US Army Corps of Engineers
Japan District

JAPAN EDITED SPECIFICATIONS (JES) Version 1.5

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SECTION 01 11 00

STATEMENT OF WORK

PART 1 GENERAL

1.1 General

The Contractor shall design and construct [Description of Project] at [Location of Project] resulting in complete and usable facility.

The intent of this section is to specify the minimum design and construction requirements for quality, function, materials, and types of construction in sufficient detail for Contract completion.

Basis of design, design submittal requirements, construction document drawings, and specifications shall be prepared to comply with this section and Section 01 33 16 DESIGN AFTER AWARD. No deviations from these sections shall be allowed unless prior approval is obtained from the Contracting Officer. All questions or problems encountered by the Contractor in following the requirements in this section shall be promptly submitted with recommendations to the Contracting Officer for resolution.

Coordinate with U.S. Army Corps of Engineers, Japan District regarding the following sections during design:

[a. Section 01 45 35 SPECIAL INSPECTIONS

b. Section 01 91 00.15 TOTAL BUILDING COMMISSIONING]

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 ATTACHMENTS

Information provided in the attachments is intended to provide design requirements and information.

3.1.1 01 11 00-A

Design Criteria: Design and construction for this project shall comply with Attachment 01 11 00-A. Secure any necessary reference at Contractor's own expense and resources.

3.1.2 01 11 00-B

Concept Drawings: Provided for design and coordination purposes. Information depicted in the Concept Drawings serves as a guide only. Further development shall require coordination with the using agency and base personnel.

3.1.3 01 11 00-C

Room Data Sheets.

3.1.4 01 11 00-D

Existing Utilities Information.

3.1.5 01 11 00-E

Geotechnical Report.

3.1.6 01 11 00-F

Environmental/Hazardous Materials Survey Report.

3.2 DESIGN COORDINATION, SUBMITTALS, AND OTHER REQUIREMENTS

Refer to Section 01 33 16 DESIGN AFTER AWARD.

-- End of Section --

SECTION 01 11 00.00 10

GENERAL CONTRACT REQUIREMENTS

PART 1 GENERAL

1.1 DEFINITIONS

The term "Government" refers to "United States Government" whenever the term "Government" appears in this Contract, unless otherwise indicated within the Contract.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 189.1	(2017) Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
ASHRAE 52.2	(2017) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

ASTM INTERNATIONAL (ASTM)

ASTM D6245	(2021) Using Indoor Carbon Dioxide Concentrations to Evaluate Indoor Air Quality and Ventilation
ASTM D6345	(2010) Selection of Methods for Active, Integrative Sampling of Volatile Organic Compounds in Air

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2022) Standard for Portable Fire Extinguishers
NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

ANSI/SMACNA 008	(2007) IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements

Manual

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

NAVFAC P-307	(2016) Weight Handling Program Management
CFAS Instruction 5532.2D	Base Access Control
NAF Atsugi Instruction 5532.2D	Base Access Control

U.S. ARMY GARRISON JAPAN (USAG-J)

Regulation 190-13	(2013) Installation Access and Control Procedures

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information onlysubmittals not having a "G" designation are for Contractor Quality Control or Designer of Record approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Initial Site Conditions Photos
Key Personnel Qualifications; G
[Conformed Drawings Submittal]
[INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN; G]

SD-07 Certificates

Monthly Progress Photos;

SD-11 Closeout Submittals

[Construction Completion Photos;]

1.4 ACCEPTABLE ALTERNATIVE JAPANESE STANDARDS

Where indicated in the technical specifications REFERENCES paragraphs, acceptable Japanese standards are listed which are considered acceptable alternatives to the US Standards within the Contract Specifications. Contract specifications authorize the use of specified acceptable alternative Japanese standards. A limited set of modified UFGS incorporating previously identified and accepted Japanese standards and methods (also known as Japan Edited Specifications, or JES) can be found at https://www.poj.usace.army.mil/Business-With-Us/References/. Other portions of the specifications also authorize the use of specified acceptable alternative Japanese standards. The use of products not meeting the applicable US standards of the Contract or alternative Japanese standards specifically authorized by the Contract is prohibited unless authorized by the Contracting Officer. Japanese standards not identified in these specifications as being acceptable alternatives to US standards may be submitted to the Contracting Officer for consideration as acceptable alternatives after award using the variation request process set forth in Section 01 33 00 SUBMITTAL PROCEDURES. Prior to the use of such proposed additional alternative Japanese standards, written approval by the Contracting Officer is required. Incorporation of methods,

materials, and equipment that will promote cost-effective and timely maintenance, and that are otherwise authorized by the contract, is highly encouraged.

[1.5 GOVERNMENT FURNISHED CONTRACTOR INSTALLED ITEMS

Attachment 01 11 00.00 10-A "Government Furnished Property" provides the items that shall be Government Furnished, Contractor Installed (GFCI).

]1.6 MANDATORY U.S. TESTED PRODUCTS

The following items shall meet U.S. testing methods (e.g. UL listed, FM approved, ASTM, etc.) and shall be labeled as required. These items shall not be substituted with Japanese testing methods (e.g. JIS, JASS, etc.) for certification:

a. Fire suppression systems, including valves, alarm valves, sprinklers (pipes and fittings of Japanese manufacturer may meet the function requirements). Fire suppression systems includes wet chemical, dry chemical, mist, deluge, pre-action, foam, and clean agent, in addition to standard sprinkler systems.

b. Fire pumps, including motors, controllers, drives, and valves.

c. Fire alarm and mass notification systems, including panels, initiating devices, notification appliances, smoke alarms (conductors and conduits of Japanese manufacturer may meet the functional requirements).

d. Engineering technician requirements for development of fire suppression systems and alarm system shop drawings, calculations, and material submittals.

e. Fire doors, smoke doors, and frames.

f. Fire dampers and smoke dampers.

g. Interior finishes with flame spread and smoke development ratings required for installation of rated assemblies.

h. Insulation with flame spread and smoke development ratings.

i. Fire proofing and fire stopping materials.

j. Plenum rated cables.

k. Domestic water supply piping in the building and plumbing fixtures that directly dispense potable drinking water (NSF stamped and/or labeled). Japanese plumbing fixtures that do not directly dispense potable drinking water are allowed, such as urinals and water closets.

1.7 KEY PERSONNEL QUALIFICATIONS

The Contractor's Project Key personnel shall not be assigned duties to any other Contracts (excluding the project manager) without approval from the Contracting Officer. [The Project Superintendent, CQC System Manager, and Site Safety Health Officer shall all be separate persons, and shall not have other duties assigned.] [One person may be assigned the duties of Project Superintendent and CQC System Manager provided they meet all

qualification requirements and maintain presence on site as required for the various duties. The Site Safety Health Officer shall not be assigned other duties.] Within five (5) working days after receipt of the Notice to Proceed, the Contractor shall submit in writing to the Contracting Officer an organizational chart, the qualifications and background history of the proposed Key Personnel for approval. The Contracting Officer shall have the explicit right to determine acceptability (or rejection) of the proposed individuals. In addition, the Contractor shall be responsible to replace said individuals upon notification by the Government should performance become inadequate during the Contract period. Key Personnel shall attend the Preconstruction conference.

[1.7.1 Program Manager

The Program Manager is responsible for the overall management of the Contract. The Program Manager shall have a minimum of [five (5)] years experience in the administration of construction Contracts on construction projects similar in size and scope to this Contract, and shall have a thorough knowledge of the duties of key management personnel assigned to this Contract.

]1.7.2 Project Manager

The Project Manager shall have a minimum of [five (5)] years experience as a Project Manager on construction projects [containing [___] components]similar in size and scope to this Contract. The Project Manager shall maintain oversight of Contract proposals prepared by the Contractor staff and be authorized to negotiate Contract terms and sign Contract documents on behalf of the Contractor. The project manager does not need to be present on the site daily, but shall attend weekly progress meetings and be available on site within 24 hours upon request. Project Manager [shall not have other duties assigned][Project Manager may have other duties assigned].

1.7.3 Project Superintendent (Supervisor)

The Project Superintendent shall be on the work site when on-site work is being performed and shall be available to the Contracting Officer or his representatives upon request. The Project Superintendent shall have overall responsibility for all operations at the job site and be authorized to make decisions, negotiate Contract terms and sign Contract documents on behalf of the Contractor. The Project Superintendent shall have a minimum of [five (5)] years experience as a superintendent on construction projects [containing [___] components]similar in size and scope to this Contract[.][, and have at least one the following qualifications:]

[a. U.S. Registered Structural Engineer or U.S. Registered Architect or 1 Kyu Kenchikushi (1st Class Qualified Architect).

][b. U.S. Registered Civil Engineer or 1 Kyu Doboku Sekou Kanrigishi (1st Class Civil Engineering Works Management Engineer).

][c. U.S. Registered Mechanical or Electrical Engineer or 1 Kyu Kankouji Sekou Kanrigishi (1st Class Building Mechanical and Electrical Engineer).

][d. U.S. Registered Electrical Engineer or 1 Kyu Denkikouji Sekou Kanrigishi (1st Class Electric Construction Management Engineer).

][e. U.S. Bachelors Degree in Construction Management or 1 Kyu Kenchiku Sekou Kanrigishi (1st Class Building Construction Management Engineer)

][f. U.S. Bachelors Degree in Construction Management or AI*DD Sougoushu (AI*DD Construction Engineer).

][g. U.S. Registered Fire Protection Engineer.

]1.7.4 English Speaking Representative (Interpreter)

At all times during the Contract period the Contractor shall have an employee capable of fluent bilingual speech in the Japanese and English languages at the job site. The bilingual interpreter shall have the capability to receive and issue concise and technical explanation and instructions between the Government representative(s) and Contractor supervisory personnel concerning all aspects of Contract administration and construction. Within fifteen (15) days after receipt of the Notice to Proceed, the Contractor shall submit in writing to the Contracting Officer's Representative the qualifications and background history of the proposed interpreter for approval. The Contracting Officer's Representative shall have the explicit right to determine acceptability or rejection of the proposed individual. In addition, the Contractor shall be responsible to replace said individual upon notification by the Government should performance become inadequate during the Contract period. The interpreter shall attend the preconstruction conference.

1.7.5 Contractor Quality Control

1.7.5.1 Contractor Quality Control System Manager (CQCSM)

The CQC System Manager is required to be a graduate of an accredited college with an engineering, architecture, or construction management degree, with a minimum of [5] years construction experience on construction of similar size and scope to this Contract. Refer to Section 01 45 00.00 10 QUALITY CONTROL, Paragraph "CQC System Manager" for additional requirements.

1.7.5.2 Contractor Quality Control Personnel

The following Contractor Quality Control (CQC) Personnel are required:[Civil,][Mechanical,][Electrical,][Structural,][Architectural,][Fire Protection,][Communications,][Environmental,][Submittals,][Occupied Family Housing,][Concrete, Pavements, and Soils,][Testing, Adjusting, and Balancing,][Design Quality Control Manager]. All other specialties in section 01 45 00.00 10 not identified in this paragraph does not apply to this project.

See Section 01 45 00.00 10 QUALITY CONTROL for qualification requirements for CQC personnel. These individuals or specialized technical companies [must be directly employed by the prime Contractor and can not be employed by a supplier or subcontractor on this project][may be employed by the prime contractor or a subcontractor on this project]. These individuals [shall have no other duties other than quality control] [can perform other duties but need to be allowed sufficient time to perform the specialized personnel's assigned quality control duties as described in the Quality Control Plan]. [A single person can cover more than one area provided that the single person is qualified to perform quality control activities in each designated and that workload allows.][A single person cannot cover

more than one area].

1.7.6 Site Safety and Health Officer (SSHO)

See Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

[1.7.7 [SUSTAINABILITY REPRESENTATIVE][TPC SUSTAINABILITY PROFESSIONAL]

See Section 01 33 29 SUSTAINABILITY REPORTING.

]1.7.8 Pass Coordinator

A person on the contractor's staff who is familiar with the requirements of USAG-J Regulation 190-13, Individual and Vehicle Access Pass Procedures, and USAG-J vehicle security inspection procedures. The Pass Coordinator must be able to obtain a DBIDS access pass with escort privileges and may be required to escort other contract personnel. Although a TOEIC score is not required, the Pass Coordinator must be able to understand pass requirements and complete pass application forms in the English language.

1.8 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

a. This paragraph specifies the procedure for determination of time extensions for unusually severe weather in accordance with the Contract clause entitled "DEFAULT (FIXED-PRICE CONSTRUCTION)". In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

(1) The weather experienced at the project site during the Contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

(2) The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

b. The listing below defines the monthly anticipated adverse weather days for the Contract period and is based upon 20th Weather Squadron (MAC), U.S. Air Force; Iwakuni U.S. Marine Corps Air Station, Weather Service; Sasebo Naval Pacific Meteorology and Oceanography Detachment; JASDF (Japan Air Self Defense Force), or similar data for the geographic location of the project. (More specific information may be obtained as specified under Special Contract Requirements Clause entitled "Physical Data.")

MONTHLY ANTICIPATED ADVERSE WEATHER DELAYS
WORK DAYS BASED ON (5) DAY WORK WEEK

	Misawa-area	Kanto Plain	Iwakuni	Okinawa	Sasebo	Osaka
JAN	8	1	2	5	7	4
FEB	9	3	4	7	6	4
MAR	6	6	7	8	7	5
APR	3	6	6	6	7	4
MAY	4	4	6	6	6	4
JUN	5	9	8	6	12	5
JUL	6	6	6	6	9	4

AUG	6	6	5	9	9	3
SEP	6	7	6	7	9	4
OCT	4	5	4	4	8	4
NOV	6	4	4	4	5	3
DEC	7	1	3	5	5	3

The above schedule of anticipated adverse weather days shall constitute the base line for monthly (or portion thereof) weather time evaluations.

c. Upon acknowledgment of the Notice-to-Proceed (NTP) and continuing throughout the Contract, the Contractor shall record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day.

d. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph (b), above, the Contracting Officer shall convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the Contract clause entitled "DEFAULT (FIXED PRICE CONSTRUCTION)".

e. For all work under this Contract, adverse weather is defined as:

(1) Rainfall - Number of occurrences of precipitation greater than or equal to 0.10 inches (2.54mm).

(2) Snowfall - Number of occurrences of precipitation greater than or equal to 1.00 inches (25.4mm). (Not applicable to Okinawa Area)

(3) Cold Temperature - Number of occurrences when daily maximum temperature does not exceed the monthly mean low temperature or 32 degrees Fahrenheit (0 degrees Celsius), whichever is lower. (Not applicable to Okinawa Area)

(4) Concurrence between snowfall and cold temperature is 80 percent, i.e. 80 percent of the time snow falls, the temperature is "cold".

(5) Wind - Number of occurrences when the wind is gusting 30 knots (56 kilometers/hour) or greater.

f. The Contractor's schedule must reflect the above anticipated adverse weather delays on all weather-dependent activities.

1.9 PERMITS AND RESPONSIBILITIES

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any laws, codes, and regulations (including the requirements of material, prefectural, and local Government of Japan, and associated military installation) applicable to the performance of work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. These damages shall be repaired or replaced by the Contractor at no cost

to the Government. The Contractor shall take proper safety and health precautions to protect all work and workers.

Submit a schedule of planned road closures to the Contracting Officer with the initial project schedule. Notification of specific road closures shall be in writing to the Contracting Officer not less than thirty (30) calendar days in advance of the intended closure. The road closure request shall include the planned traffic control measures as well as the general information about the closure. All road closures shall be coordinated with base officials and are subject to base requirements. No road closure shall be permitted until the Contractor receives written approval from the Contracting Officer. Full road closures is generally not permitted (at least one way traffic shall always be provided).

1.9.1 Naha Port Authority (NPA) Work Permit

The Contractor shall obtain a Harbor Facility Usage Permission Application (Form Number 5), also known as the "Kowan Shisetsu Shiyou Kyoka Shinseisho" permit form addressed to the Naha Port Authority Administrator.

The submission shall include basic information regarding the Contractor's point of contact information, project title, description of work, and usage area information, as well as a work plan (to include scheduling), emergency contact plan, and protection plans. Application shall be hand delivered to:

Naha Port Authority
General Affairs Division
2-1 Tondocho (2nd Floor)
Naha City, Okinawa Prefecture
900-0035

The NPA will require scheduling coordination and due consideration to all Naha Commercial Port end users and coordination with other stakeholders, such as the Local Fisheries Association, to ensure that stakeholder operations are not negatively impacted by the proposed activity and ensure that appropriate coordination is performed by the construction activity proponent. The final Harbor Facility Usage Permit Application will be authorized by the Okinawa Prefectural Governor's office.

1.9.2 Work Application Package

In accordance with Article 31 of the GOJ Act on Port Regulations "Kou Sokuhou", the Contractor shall submit a Work Application Package known as a "Koji Sagyou Kyoka Shinseisho" for review and approval by the Maritime Traffic Division Office of the Japan Coast Guard (JCG) at Naha. A physical printed out copy shall be hand delivered to the following address:

Japan Coast Guard
Naha Coast Guard Office
Maritime Traffic Division
2-11-1 Minatomachi
Naha City, Okinawa Prefecture
900-8548

This application shall contain project safety information, work planning and scheduling, emergency management information as well as copies of all pertinent certifications and licenses (e.g. boat licenses, commercial diver's certifications, etc.) The minimum application review period is 30

days, although in the case of complicated work sites, review of work permit application packages by the JCG may take longer.

The Naha Coast Guard Office normally does not accept a work permit package from a Contractor until approval of work is formalized first with the NPA. Therefore, ample time must be secured for the dredging Contractor to clear both NPA and JCG Naha Coast Guard Office work permitting processes during the pre-construction phase of the dredging project.

1.9.3 Safety Panel and Committee (SPC)

As part of the work permitting process, the Contractor shall also participate in a Safety Panel and Committee (SPC). This SPC is required by the Japan Coast Guard, and shall be facilitated by a consultant hired by the Okinawa Defense Bureau. Intent of the SPC is to provide a forum under which all stakeholder and port operator concerns can be identified and addressed. The Contractor shall attend and present proposed safety, environmental, and operational plans at the forum.

1.10 SPECIAL CONTRACT REQUIREMENTS

1.10.1 Meetings

a. Predesign Conference. A predesign conference per FAR 42.503 shall be held. The chairperson shall be the Contracting Officer or his/her designee. The chairperson shall be responsible for providing minutes of the meeting.

a. Preconstruction Conference. A Preconstruction Conference per FAR 42.503 shall be held. The chairperson shall be the Contracting Officer or his/her designee. The chairperson shall be responsible for providing minutes of the meeting.

a. Post Award Orientation. A post award orientation (often referred to as a Preconstruction Conference) per FAR 42.503 shall be held. The chairperson shall be the Contracting Officer or his/her designee. The chairperson shall be responsible for providing minutes of the meeting.

b. Weekly Progress Meetings. A weekly progress meeting shall be conducted, with the day, time, and location to be determined at the Preconstruction Conference. The Contractor's Project Manager, Superintendent, Interpreter, and Quality Control Manager shall attend. Representatives from the Government may include, but are not limited to, Director of Public Works/Facilities Engineering personnel, Project's Resident Office personnel, and Project Manager. The Contractor shall be prepared to discuss work completed during the previous week, work currently in progress, and work forecasted for the following week, as well as the status of any construction issues and open action items. Provide the meeting agenda for review 24 hours prior to the meeting, take notes during the meeting, and provide electronic copies of the meeting minutes in English within 24 hours of the progress meeting for review.

c. Red Zone Meeting. A Red Zone meeting shall be conducted for Contracts with a value in excess of 55,000,000 JPY or those deemed sufficiently complex by the Contracting Officer to warrant one. The purpose of the Red Zone meeting is to discuss closeout requirements for the contract and to establish a timeline to get those items completed (see Section 01 78 00 CLOSEOUT SUBMITTALS for typical closeout requirements). The

meeting is a good time for the Contractor to gain approval on format for items such as Operations and Maintenance manuals, the equipment-in-place list, the warranty plan, and any other items. The Initial Red Zone is typically scheduled when project reached 75 percent completion milestone. Provide the meeting agenda for review 24 hours prior to the meeting, take notes during the meeting, and provide electronic copies of the meeting minutes in English within 24 hours of the Red Zone meeting.

d. Safety and Quality Control Meetings. Safety and quality control meetings shall be held as needed and determined by the Contractor. See Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS and Section 01 45 00.00 10 USACE QUALITY CONTROL for specific requirements.

e. Construction Waste Management Meetings. See Section 01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT for requirements.

f. [Weekly][Monthly] Design Progress Meetings. A [weekly][monthly] design progress meeting shall be conducted, with the day, time, and location to be determined at the project kickoff meeting. The Contractor's Design team, Interpreter, and Design Quality Control manager shall attend. Representatives from the Government may include, but are not limited to, Client, Project Manager, and POJ Engineering personnel. The Contractor shall be prepared to discuss work completed during the previous week, work currently in progress, and work forecasted for the following week, as well as the status of any design issues and open action items. Provide the meeting agenda for review 24 hours prior to the meeting, take notes during the meeting, and provide electronic copies of the meeting minutes in English within 24 hours of the progress meeting for review.

[1.10.2 Conformed Drawings Submittal

Contractor shall submit one (1) hard copy Japanese-style folded and bound set of conformed A3 size drawings. Submittal shall be provided to the Resident Office at the Pre-Construction meeting. Conformed drawings are defined as the original advertised drawings with amended drawing sheets replaced in-kind with the corresponding original sheet number. If applicable, add new sheets and remove deleted sheets in accordance with amendment instructions. If multiple amendments are issued, supersede any previously amended drawing so that only the highest numbered amendment drawing is included.

]1.10.3 CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

Submit an IAQ Management Plan within 15 days after Notice to Proceed and not less than 10 days before the preconstruction meeting. The Plan shall include IAQ management practices implemented during construction and preoccupancy phases and describe how each requirement in ANSI/SMACNA 008 [and TPC requirements]will be met, addressed, and managed on the job site. The plan shall cover the following additional items:

a. Identify the key players and person(s) responsible for implementing the plan.

b. Specify procedures for protecting stored and installed absorptive materials from moisture damage.

c. Prohibit the use of tobacco products inside the building and within

7.5 meters (50 feet) of the building entrance at all times during construction. Consider prohibiting smoking on the entire job site. If smoking will be allowed, locate on a site plan the designated locations and signage. Comply with the tobacco use policy of the local jurisdiction.

d. Indicate whether air handlers will be operated during construction, and specify compliant filtration procedures for permanent equipment that will be used.

e. Take photographs of each IAQ measure for documentation. Annotate photographs to indicate each IAQ measure depicted and its general location. Provide photographs of the methods employed to protect stored and installed absorptive materials from moisture damage during construction and preoccupancy.

Revise and resubmit the Plan as required by the Contracting Officer. Make copies of the final plan available to all workers on site. Include provisions in the Plan to meet the requirements specified below and to ensure safe, healthy air for construction workers and building occupants.

1.10.3.1 Requirements During Construction

Provide for evaluation of indoor Carbon Dioxide concentrations in accordance with ASTM D6245. Provide for evaluation of volatile organic compounds (VOCs) in indoor air in accordance with ASTM D6345. Use filters with a Minimum Efficiency Reporting Value (MERV) of 8 in permanently installed air handlers during construction.

1.10.3.1.1 Control Measures

Meet or exceed the requirements of ANSI/SMACNA 008, Chapter 3, to help minimize contamination of the building from construction activities. The five requirements of this manual which must be adhered to are described below:

a. HVAC protection: Isolate return side of HVAC system from surrounding environment to prevent construction dust and debris from entering the duct work and spaces.

b. Source control: Use low emitting paints and other finishes, sealants, adhesives, and other materials as specified. When available, cleaning products must have a low VOC content and be non-toxic to minimize building contamination. Utilize cleaning techniques that minimize dust generation. Cycle equipment off when not needed. Prohibit idling motor vehicles where emissions could be drawn into building. Designate receiving/storage areas for incoming material that minimize IAQ impacts.

c. Pathway interruption: When pollutants are generated use strategies such as 100 percent outside air ventilation or erection of physical barriers between work and non-work areas to prevent contamination.

d. Housekeeping: Clean frequently to remove construction dust and debris. Promptly clean up spills. Remove accumulated water and keep work areas dry to discourage the growth of mold and bacteria. Take extra measures when hazardous materials are involved.

e. Scheduling: Control the sequence of construction to minimize the

absorption of VOCs by other building materials.

1.10.3.1.2 Moisture Contamination

a. Remove accumulated water and keep work dry.

b. Use dehumidification to remove moist, humid air from a work area.

c. Do not use combustion heaters or generators inside the building.

d. Protect porous materials from exposure to moisture.

e. Remove and replace items which remain damp for more than a few hours.

1.10.3.2 Requirements after Construction

After construction ends and prior to occupancy, conduct IAQ testing in accordance with ASHRAE 189.1 Section 10.3.1.4.

In the event that IAQ testing fails, conduct a building flush-out in accordance with ASHRAE 189.1 Section 10.3.1.3[and TPC requirements]. The space shall be ventilated at a minimum rate of 1.5 Liters per second per square meter of outdoor air while maintaining an internal temperature of at least 15 degrees C (60 degrees F) and no higher than 27 degrees C (80 degrees F) and relative humidity no higher than 60%. Total air volume of outdoor air will be determined by ASHRAE 189.1 Section 10.3.1.4 Equation 10-1. Total volume of outdoor air shall be approved by the Contracting Office prior to building flush-out

Air contamination testing must be consistent with EPA's current Compendium of Methods for the Determination of Air Pollutants in Ambient Air. After building flush-out or testing and prior to occupancy, replace filtration media. Filtration media must have a MERV of 13 as determined by ASHRAE 52.2.

1.11 PROGRESS AND COMPLETION PHOTOGRAPHS

Photographically document site conditions prior to start of construction operations. Provide monthly, and within one month of the completion of work, digital photographs, 1600 by 1200 by 24 bit true color 300 DPI minimum resolution in JPEG file format showing the sequence and progress of work. Take a minimum of [20] digital photographs each week throughout the entire project[and [20] digital photographs at completion of project]. Submit the Initial Site Conditions Photos, Monthly Progress Photos[, and Construction Completion Photos]. Indicate photographs demonstrating environmental procedures. Provide photographs for each month in a separate monthly directory and name each file to indicate its location on the view location sketch. Include a date designator in file names. Cross reference submittals in the appropriate daily report. Photographs provided are for unrestricted use by the Government.

1.11.1 Photography Aboard Marine Corps Air Station Iwakuni

Contractor shall request authorization for photography events prior to taking any photographs. For unrestricted areas, the approval process will take five (5) business days. For restricted areas the approval process will take a minimum of two (2) weeks.

1.12 BASE REGULATIONS

The Contractor and Subcontractor(s) shall become familiar with and obey all base regulations, including fire, traffic, safety, and security regulations. All Contractors shall keep within the limits of the work (and avenues of ingress and egress), and shall not enter any restricted areas unless required to do so and are cleared for such entry. The Contractor's equipment shall be conspicuously marked for identification.

1.12.1 Request for Contractor's Employee Passes and Vehicle Passes

No employee or representative of the Contractor shall be admitted to the work site without a Contracting Officer's furnished authorized admittance. Refer to CFAS Instruction 5532.2D Base Access Control. Refer to NAF Atsugi Instruction 5532.2D Base Access Control. Refer to USAG-J Regulation 190-13. Prior to the start of on-site work, submit applications for base passes to the Contracting Officer for key employees (project manager, site supervisor, interpreter, etc.) for long term DBIDS passes. The Contractor (through the employment of a Pass Coordinator), with assistance from the Resident Office, is responsible for securing sufficient passes for other workers, including subcontractor's employees and vehicles, required to access the base for the project duration. Additional personnel data shall also be furnished.

The Contractor shall use the USAG-J Form 1529 "EZ Pass" as the primary means of obtaining passes for all personnel who do not qualify for DBIDS passes. The USAG-J Form 1529 "EZ Pass" One Time/Multiple Access Roster must be complete and submitted to the Provost Marshall Pass and Vehicle Registration Office a minimum of three (3) U.S. workdays prior to access. The use of the USAG-J "one day" pass (AJ Form 47) should be avoided, and used only for urgent situations. Applicants for a "one day" pass may be required to wait for several hours for their pass to be issued. Contractor personnel applying for more than one (1) "one-day" pass within any 15-day period will not be issued multiple one-day passes, and will instead be required to apply for access via the USAG-J Form 1529, and wait three or more days for approval.

Provide all information required for background checks to meet base access requirements to be accomplished by Base Provost Marshal Office, Director of Emergency Services or Security Office. Contractor workforce must comply with all personal identity verification requirements as directed by DOD, HQDA and/or local policy. The Government reserves the right to make changes to the Contractor security requirements or processes due to a change in the Force Protection Condition (FPCON).

In addition to security requirements, cranes, delivery "unic" trucks, forklifts, backhoes, and other equipment capable of vertical lift operations must comply with NAVFAC rules for access to the base. Refer to NAVFAC P-307. The operator must submit a P-1 Pass request and submit the equipment, its records, and operator records for inspection by Public Works prior to the initial entry onto base property. Vehicle passes for vertical lift equipment must be renewed monthly with Public Works as long as the equipment remains on base property.

Upon completion of this Contract, return all employee and vehicle passes to the base, and obtain a certification of receipt. Final payment shall be withheld until all passes have been returned.

1.12.2 No Smoking Policy

Smoking is prohibited on installations except in designated smoking areas. This applies to existing buildings, buildings under construction, and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer shall identify designated smoking areas.

1.12.3 Munitions and Explosives of Concern (MEC)

Munitions and Explosives of Concern (MEC): Unexploded Ordnance (UXO), Material Presenting a Potential Explosive Hazard (MPPEH), Chemical Agents (CA), or Discarded Military Munitions (DMM) on jobsites shall be treated as extremely dangerous and must be reported immediately. Follow the 3Rs: RECOGNIZE, RETREAT, and REPORT. In the event MEC are discovered or uncovered, immediately stop work in that area and immediately inform the Contracting Officer's Representative. Contractor shall provide dispatch and Contracting Officer's Representative with specific location of the item. Contractor personnel shall stop work in the immediate vicinity of the discovery and maintain a minimum distance of 300 meters from the item. Contractor shall maintain flexibility in redirecting personnel and work effort in the event that items possessing an explosive hazard are discovered and construction personnel are excluded from areas during the destruction/removal process.

1.12.3.1 Additional Requirements for Camp Foster

All workers on site involved in the earthwork, in any manner, must attend a UXO brief on Marine Camp Foster. Upon completion of the brief, the worker will receive a laminated card verifying that they attended the brief. The card does not expire and is valid for all USACE construction contracts on Okinawa, but is non-transferrable between workers. The USACE team will help coordinate the training and assist with processing base access requests for Marine Camp Foster as needed. The brief is free of charge, but the contractor is responsible for all other costs associated with transport, labor, and all other costs related to the training. The expected duration of this training is two hours.

1.12.4 Unexploded Ordnance (UXO) Procedures on Kadena Air Base

Kadena Air Base 718 CES/CEN assesses the area as UXO unlikely with a low probability of uncovering UXO's on the site. However, since there is always a possibility of encountering UXOs anywhere on Okinawa, albeit unlikely at this location, excavations and other construction activities related earth work on the project site, require a measure of caution. The Ground Penetrating Radar (GPR) survey specified in 01 35 26 paragraph "Utilities Within and Under Concrete, Bituminous Asphalt, and Other Impervious Surfaces" for the identification of underground utilities will identify anomalies. Best practices of conducting GPR surveys are to repeat them in areas greater than the used method's level of detection (LOD), down to a depth of 2 meters, to ensure no utility lines or other suspicious objects are present. If suspected UXOs are identified, the construction team needs to follow the standard UXO notification procedures per the Kadena policies identified in attachment 01 11 00.00 10-[B] "UXO Emergency Mitigation Steps and Survey Policies." The contact number for the Emergency Dispatch Center for Kadena Air Base is 098-934-5911. See the following website for additional information: www.kadena.af.mil/About-Us/Emergency-Actions/.

1.13 ORDER OF WORK

1.13.1 Schedule

Schedule all work to cause the least amount of interference with activity operations. Permission to interrupt any activity or roads shall be requested in writing a minimum of 30 calendar days prior to the desired date of interruption. Interruptions of activities, roads, and utility services shall be allowed only when they will not cause interference with the operations of the activity. The Contractor shall remove and dispose off Government property all Contractor generated debris at the end of each shift, or more frequently if required, to keep the space usable. Upon award of this Contract, the Contractor shall begin and complete all required work; ready for use and including cleanup, within the time period specified on this Contract. All work scheduled in occupied areas shall be accomplished in such a manner as to cause the least possible inconvenience to the occupants.

1.13.2 Working Hours

Normal Working Hours and Days are Monday through Friday, 0800 hours through 1700 hours. Saturday work is allowed on this contract and does not require additional approvals. Notify the Contracting Officer at least three days in advance when scheduling Saturday work.

1.13.3 Noise and Vibration

Noise greater than 70 decibels and vibration producing work in occupied buildings shall be conducted outside core school/business hours (0700 - 1430) unless written permission is given by the Contracting Officer.

1.13.4 Work Outside of Regular Hours

If the Contractor desires to carry on work outside the regular hours, on Sundays, or holidays, a written application shall be submitted to the Contracting Officer or his representative for approval. The Contractor shall allow three working days notice to enable satisfactory arrangements to be made by the Government for inspecting the work in progress. If work is to be accomplished after daylight hours, the Contractor shall illuminate the area in a manner approved by the Contracting Officer or their representative and in accordance with EM 385-1-1. Unless directed by a Contracting Officer, work accomplished outside regular working hours shall be at no additional cost to the Government.

1.14 NUCLEAR DENSOMETER TESTING

Nuclear densometer testing and all forms of radiography are not permitted on U.S. Navy installations in Japan because such testing may interfere with Government of Japan monitoring activities.

1.15 FIRE PREVENTION DURING CONSTRUCTION

1.15.1 General

Comply with all pertinent fire prevention provisions of the US Army Corps of Engineers Manual EM 385-1-1, NFPA 241 and shall follow the Installation fire regulations. Prior to commencement of welding or other hot work operations, obtain approval from the Installation Fire Chief.

1.15.2 Supply

No more than one day's supply of paint, paint materials, or compounds shall be allowed within the area of the building, and shall be removed from the job site after each working day. No gasoline or similar low flash point flammable liquid shall be allowed within the building area. After proper coordination with the Facility's Emergency Services (to confirm the maximum allowable quantities and location of storage), storage of additional product may be authorized.

1.15.3 Fire Extinguishers

Provide, as a minimum, the number, size, and type of fire extinguishers in accordance with the latest NFPA 10. The Contractor shall comply with the Installation Fire Chief's policies if they are more stringent than NFPA 10. Fire extinguishers shall remain the property of the Contractor and shall be removed upon completion of the project.

1.15.4 Housekeeping

Accumulations of combustible material shall be removed from the building area on a daily basis.

1.15.5 Handling of Gasoline

Gasoline shall be stored in industry standard approved safety containers. Adequate ventilation shall be provided to safely dispose of flammable vapors where flammable liquids are utilized. Gasoline powered equipment shall be refueled a minimum 6 meters away from the building area.

1.15.6 Notification of Fire

Be familiar with methods for notifying the Installation Fire Department. The Installation's fire poster shall be posted in conspicuous locations and at telephones in construction shacks.

1.16 CONTRACTOR FURNISHED MATERIAL AND WORKMANSHIP

The Contractor shall furnish all materials necessary for performance of the work of this contract unless otherwise specified. Materials procured shall be new and shall meet any specifications and standards listed in these specifications. If no specification for a material needed to perform this contract are stated, the material shall be new, of acceptable industrial grade and quality, equal to or better than the manufacturer's original equipment for equipment being repaired or replaced, and will be compatible with existing materials and systems. All materials provided under this contract shall be free of asbestos, lead in paint, and PCB. The Contracting Officer reserves the right to request submittal of any material being provided under this contract. The Contracting Officer shall make the final determination of the acceptability of any material used on this contract.

1.17 CORRESPONDENCE

All correspondence addressed to the Government shall be made through serialized letters furnished with one original and two copies. Serialized letters shall begin with the number S-0001 and shall be continuous without a break in numbering. Serialized letters shall include the contract title and number, date, subject, and shall be signed by an authorized

representative of the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

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Reset Form

Government Furnished Property

Validate

Attachment Number

Attachment File | of

Attachment Date

Government Contracting Officer

Name	Email	Phone

○ Contract Award ○ Contract Modification **OR** ○ Solicitation ○ Amendment

Modification Number

Amendment Number

Reference Procurement Instrument Number

Custodial Procurement Instrument Identification

Solicitation, Contract or Uniform PIID Number			
Issuing Office DoDAAC	Issue Year (YY)	Contract Type	Sequence Number

Order Number (PIID Format FY16+)			
Issuing Office DoDAAC	Issue Year (YY)	Contract Type	Sequence Number

OR

Old Order Format

Japan Edited Specifications

ATTACHMENT 01 11 00.00 1-A Page 1

JES

Government Furnished Property

ADD	SERIALLY MANAGED ITEMS LIST											
Line Number	Item Name	Item Description	NSN	CAGE	Part Number	Model Number	Serial Number	UII	QTY	Unit of Measure	Unit Cost	Use As Is
Remove	Delivery Date (On or Before)	Duration	Time Unit	Delivery Event	Notes							

ADD	NON-SERIALLY MANAGED ITEMS LIST									
Line Number	Item Name	Item Description	NSN	CAGE	Part Number	Model Number	QTY	Unit of Measure	Unit Cost	Use As Is
Remove	Delivery Date (On or Before)	Duration	Time Unit	Delivery Event	Notes					

Items Authorized to be Requisitioned by the Contractor and Paid for by DoD

ADD	Line Number	Item Name	Item Description	NSN	CAGE	Part Number	QTY	Unit of Measure	Unit Cost	Use As Is
Remove										

Consolidated GFP Attachment V.M.1.1

DEPARTMENT OF THE AIR FORCE
PACIFIC AIR FORCES

11 May 17

MEMORANDUM FOR RECORD

FROM: 718 CES/CEN

SUBJECT: UXO Emergency Mitigation Steps on Kadena AB, Okinawa, Japan

1. The purpose of this memorandum is to provide steps for handling unexploded ordnance (UXO) discoveries on Kadena AB, Japan. As an island with a history involving beach invasions during WWII, it is important to properly adhere to the following procedures in order to achieve the highest level of safety during construction.

2. When working on Kadena AB and a UXO is discovered, the following steps shall be followed:

a. Cease all construction immediately.

b. If Fire Protection (FP)/Explosive Ordnance Disposal (EOD) are not already present, call the Emergency Dispatch Center at (098) 911-1911.

c. If possible, safely place a marker near the UXO. Do not mark on the UXO itself or place a marker that will pierce into the ground near the UXO. Instead, place a distinguishing item nearby such as a colored ribbon or flag.

d. Remain at least 300 feet clear of the UXO, and direct others to remain clear, until directed further by EOD/FP staff.

3. For questions or more information, please contact 2d Lt Evan Fortney at evan.fortney.1@us.af.mil or DSN 634-3789.

JOEL C. HEARN, Maj, USAF
Engineering Flight Commander
718th Civil Engineer Squadron

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SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 GENERAL

Payment items for the work of this Contract for which payments shall be made are listed in the CONTRACT LINE ITEM NUMBER (CLIN) SCHEDULE and described below. All costs for items of work, which are not specifically mentioned to be included in a particular job or unit price payment item, are included in the listed job item most closely associated with the work involved. The price and payment made for each item listed constitutes full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, topographic surveys, cost of bond premiums, and for performing all work required by drawings and specifications for which separate payment is not otherwise provided. Work paid for under one item shall not be paid for under any other item. No separate payment shall be made for the work, services, or operations required by the Contractor, as specified in DIVISION 01, GENERAL REQUIREMENTS, to complete the project in accordance with these specifications; all costs thereof shall be considered as incidental to the work.

1.2 Submittals

Government approval is required for submittals with a "G" designation; DESIGN-BID-BUILD:submittals not haveing a "G" designation are for information only; DESIGN-BUILD: submittals not having a "G" designation are for Contractor Quality Control or Designer of Record appproval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Bill Of Lading; G

1.3 LINE ITEMS

1.3.1 CLIN 0001, Construction of Primary Facility

1.3.1.1 Payment

Payment shall be made at the Contract job price for CLIN 0001 "Construction of Primary Facility" for work completed including, but not limited to []. Payment for work completed shall constitute full compensation of CLIN 0001, complete.

1.3.1.2 Unit of Measure

Unit of measure: job.

1.3.2 CLIN 0002, Construction of Supporting Facilities, 1.5 meters outside of Buildings

1.3.2.1 Payment

Payment shall be made at the Contract job price for CLIN 0002 "Construction of Supporting Facilities, 1.5 meters outside of buildings" for work completed including, but not limited to, construction of Supporting Facilities including special construction features [Pile Foundations], canopies, electrical utilities, communication utilities, water/sewer/utilities, site preparation, roads, sidewalks and parking, site improvements, AT/FP, demolition, low impact development, and environmental mitigation as shown on the drawings and specifications 1.5 meter outside of buildings, complete. Payment for work completed shall constitute full compensation of CLIN 0002, complete.

1.3.2.2 Unit of Measure

Unit of measure: job.

1.3.3 CLIN 0003, Excavation

1.3.3.1 Payment

Payment will be made for costs associated with excavation for the channel and for the structure, which includes performing required excavation and other operations incidental thereto, Contractor-furnished disposal area(s) and disposition of excess excavated material and unsuitable and frozen materials.

1.3.3.2 Measurement

The total quantity of excavated material for which payment will be made will be the theoretical quantity between the ground surface as determined by a survey and the grade and slope of the theoretical cross sections indicated. No allowance will be made for overdepth excavation or for the removal of any material outside the required slope lines unless authorized.

1.3.3.3 Unit of Measure

Unit of measure: cubic yard (CY).

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PROGRESS PAYMENT INVOICE

Requests for payment shall be submitted in accordance with Federal Acquisition Regulations (FAR) Subpart 32.9, entitled "PROMPT PAYMENT", and Paragraphs 52.232-5 and 52.232-27, entitled "Payments Under Fixed-Price Construction Contracts", and "Prompt Payment for Construction Contracts", respectively. In addition each request shall be submitted in the number of copies and to the designated billing office as shown in the Contract.

When submitting payment requests, the Contractor shall complete Blocks 1 through 12 of the "PROGRESS PAYMENT INVOICE" Form as directed by the Contracting Officer (provided in RMS CM). The completed form shall then become the cover document to which all other support data shall be

attached.

One additional copy of the entire request for payment, to include the "PROGRESS PAYMENT INVOICE" cover document, shall be forwarded to a separate address as designated by the Contracting Officer.

The Contractor shall submit with each pay request, a list of subcontractors that have worked during that pay period. The listing shall be broken down into weeks, identifying each subcontractor that has worked during a particular week, and indicate the total number of employees that have worked on site for each subcontractor for each week. The prime Contractor shall also indicate the total number of employees for its on site staff for each week.

Formal invoices shall be submitted every month between the first and the tenth of the month. Any invoice received after the tenth will be considered as not meeting the contract requirements and rejected. It may be resubmitted on the first of the following month.

3.2 TRANSPORTATION OF SUPPLIES BY SEA, BILL OF LADING

The Contractor shall, within 30 days after each shipment covered by Defense Federal Acquisition Regulation (DFAR) Subpart 252.247-7023, provide the Contracting Officer and the Maritime Administration (MARAD) one copy of the rated on board vessel operating carrier's ocean Bill of Lading. See DFAR 252.247-7023 for information required in the bill of lading. MARAD contact information: usarmy.scott.sddc.mbx.g3-ffw-team@mail.mil and msc.n101.ffw@navy.mil.

The Contractor shall use U.S.-flag vessels when transporting any supplies by sea under this contract. If U.S.-flag vessels are not available, the Contractor may submit a request for use of foreign-flag vessels in writing to the Contracting Officer at least 45 days prior to the sailing date necessary to meet its delivery schedules. Refer to DFAR 252.247-7023 for required documentation when making this request. The Contracting Officer will process requests submitted as expeditiously as possible, but the Contracting Officer's failure to grant approvals to meet the shipper's sailing date will not of itself constitute a compensable delay. Failure to get approval prior to the use of foreign-flag vessels may result in monetary penalty.

3.3 CONTRACT COST BREAKDOWN

The Contractor must furnish within 30 days after the date of Notice to Proceed, and prior to the submission of its first partial payment estimate, a breakdown of its single job pay item or items which will be reviewed by the Contracting Officer as to propriety of distribution of the total cost to the various accounts. Any unbalanced items as between early and late payment items or other discrepancies will be revised by the Contracting Officer to agree with a reasonable cost of the work included in the various items. This contract cost breakdown will then be utilized as the basis for progress payments to the Contractor.

3.4 CONTRACT ADMINISTRATION

3.4.1 Contracting Officer (KO)

This Contract shall be administered by a Contracting Officer (KO) assigned to the U.S. Army Corps of Engineers, Japan Engineer District, APO AP

96338-5010.

3.4.2 Administrative Contracting Officer (ACO)

In accordance with the USACE Acquisition Instruction (UAI) 5101.603-3-100, Appointment, Administrative Contracting Officer(s) (ACO's) may be delegated a part of the Contracting Officer's authority to modify this Contract and perform Contract administration functions under Federal Acquisition Regulation (FAR) Section 42.302, subject to the authority and limitations set forth in the appointment and delegation letter.

3.4.3 Contracting Officer's Representative (COR)

The Contracting Officer may designate one or more individuals as his/her authorized representatives in administering this Contract. Refer to the clause in Section 00 70 00 CONDITIONS OF THE CONTRACT entitled CONTRACTING OFFICER'S REPRESENTATIVE (DFARS 252.201-7000) for the definition and limited authority of CORs.

3.5 DESIGNATED BILLING OFFICE

The designated billing office for this Contract is:

Resident Engineer, Zukeran Resident Office
U.S. Army Corps of Engineers, Japan Engineer District
Unit 35132
APO AP 96376-5132

The designated billing office for this Contract is:

Resident Engineer, Yokosuka Resident Office
U.S. Army Corps of Engineers, Japan Engineer District
PSC 473, Box 1571
FPO AP 96349-0016

USAED-J
Box 1571, Bldg. 4328, 3F
Yokosuka Naval Base
2381 Tomari-Cho
Yokosuka-City, Kanagawa
238-0001 JAPAN

The designated billing office for this Contract is:

Iwakuni Resident Office
U.S. Army Corps of Engineers, Japan Engineer District
PSC 561, Box 1860
FPO AP 96310-0019

USAED-J
Bldg. 53
MCAS Iwakuni
Misumi-Cho
Iwakuni-City, Yamaguchi
740-0025 JAPAN

The designated billing office for this Contract is:

Kanagawa Resident Office
U.S. Army Corps of Engineers, Japan Engineer District
Unit 45010
APO AP 96343-5010

USAED-J
Bldg. 250
Camp Zama
Zama-City, Kanagawa
252-8511 JAPAN

The designated billing office for this Contract is:

Misawa Resident Office
U.S. Army Corps of Engineers, Japan Engineer District
Unit 5254
APO AP 96319-5254

USAED-J
Bldg. 793
Misawa Air Base
64 Hirahata
Misawa-City, Aomori
033-0012 JAPAN

The designated billing office for this Contract is:

Sasebo Resident Office
U.S. Army Corps of Engineers, Japan Engineer District
PSC 476, Box 83
FPO AP 96322-0001

USAED-J
Bldg. 200, Rm. 212
Sasebo Naval Base
Hirase-Cho
Sasebo City, Nagasaki
857-0056 JAPAN

The designated billing office for this Contract is:

Yokota Resident Office
U.S. Army Corps of Engineers, Japan Engineer District
Unit 5101
APO AP 96328-5101

USAED-J
Unit 5101, Bldg 445
Yokota Air Base
Fussa-City, Tokyo
197-0001 JAPAN

-- End of Section --

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SECTION 01 32 01.00 10

PROJECT SCHEDULE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AACE INTERNATIONAL (AACE)

AACE 29R-03	(2011) Forensic Schedule Analysis
AACE 52R-06	(2006) Time Impact Analysis - As Applied in Construction

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11	(1995) Administration -- Progress, Schedules, and Network Analysis Systems

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information onlysubmittals not having a "G" designation are for Contractor Quality Control or Designer of Record approval.Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Project Scheduler Qualifications; G

Preliminary Project Schedule; G

Initial Project Schedule; G

Periodic Schedule Update; G

1.3 PROJECT SCHEDULER QUALIFICATIONS

Designate an authorized representative to be responsible for the preparation of the schedule and all required updating and production of reports. The authorized representative must have a minimum of 2-years experience scheduling construction projects similar in size and nature to this project with scheduling software that meets the requirements of this specification. Representative must have a comprehensive knowledge of CPM scheduling principles and application.

PART 2 PRODUCTS

2.1 SOFTWARE

The scheduling software utilized to produce and update the schedules required herein must be capable of meeting all requirements of this specification.

2.1.1 Government Default Software

The Government intends to use Primavera P6.

2.1.2 Contractor Software

Scheduling software used by the contractor must be commercially available from the software vendor for purchase with vendor software support agreements available. The software routine used to create the required sdef file must be created and supported by the software manufacturer.

2.1.2.1 Primavera

If Primavera P6 is selected for use, provide the "xer" export file in a version of P6 importable by the Government system.

2.1.2.2 Other Than Primavera

If the contractor chooses software other than Primavera P6, that is compliant with this specification, provide for the Government's use two licenses, two computers, and training for two Government employees in the use of the software. These computers will be stand-alone and not connected to Government network. Computers and licenses will be returned at project completion.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Prepare for approval a Project Schedule, as specified herein, pursuant to FAR Clause 52.236-15 Schedules for Construction Contracts. Show in the schedule the proposed sequence to perform the work and dates contemplated for starting and completing all schedule activities. The scheduling of the entire project is required. The scheduling of design (when required by the contract) and construction is the responsibility of the Contractor. Contractor management personnel must actively participate in its development. Designers, Subcontractors and suppliers working on the project must also contribute in developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool. Use the Critical Path Method (CPM) of network calculation to generate all Project Schedules. Prepare each Project Schedule using the Precedence Diagram Method (PDM).

3.2 BASIS FOR PAYMENT AND COST LOADING

The schedule is the basis for determining contract earnings during each update period and therefore the amount of each progress payment. The aggregate value of all activities coded to a contract CLIN must equal the value of the CLIN.

3.2.1 Activity Cost Loading

Activity cost loading must be reasonable and without front-end loading. Provide additional documentation to demonstrate reasonableness if requested by the Contracting Officer.

3.2.2 Withholdings / Payment Rejection

Failure to meet the requirements of this specification may result in the disapproval of the preliminary, initial or periodic schedule updates and subsequent rejection of payment requests until compliance is met.

In the event that the Contracting Officer directs schedule revisions and those revisions have not been included in subsequent Project Schedule revisions or updates, the Contracting Officer may withhold 10 percent of pay request amount from each payment period until such revisions to the project schedule have been made.

3.3 PROJECT SCHEDULE DETAILED REQUIREMENTS

3.3.1 Level of Detail Required

Develop the Project Schedule to the appropriate level of detail to address major milestones and to allow for satisfactory project planning and execution. Failure to develop the Project Schedule to an appropriate level of detail will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

3.3.2 Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities may have Original Durations (OD) greater than 20 work days or 30 calendar days.

3.3.3 Design and Permit Activities

Include design and permit activities with the necessary conferences and follow-up actions and design package submission dates. Include the design schedule in the project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific contract period. Provide at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. Also include review and correction periods associated with each item.

3.3.4 Procurement Activities

Include activities associated with the critical submittals and their approvals, procurement, fabrication, and delivery of long lead materials, equipment, fabricated assemblies, and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days.

3.3.5 Mandatory Tasks

Include the following activities/tasks in the initial project schedule (as applicable to the project) and all updates.

a. Submission, review and acceptance of SD-01 Preconstruction Submittals (individual activity for each).

b. (When required by the contract) Submission, review and acceptance of features require design completion Submission, review and acceptance of design packages.

c. Submission of mechanical/electrical/information systems layout drawings.

d. Long procurement activities

e. Submission and approval of O & M manuals.

f. Submission and approval of as-built drawings.

g. Submission and approval of DD1354 data and installed equipment lists.

h. Submission and approval of testing and air balance (TAB).

i. Submission of TAB specialist design review report.

j. Submission and approval of fire protection specialist.

k. Submission and approval of Building Commissioning Plan, test data, and reports: Develop the schedule logic associated with testing and commissioning of mechanical systems to a level of detail consistent with the contract commissioning requirements. All tasks associated with all building testing and commissioning will be completed prior to submission of building commissioning report and subsequent contract completion.

l. Air and water balancing.

m. Building commissioning - Functional Performance Testing.

n. Controls testing plan submission.

o. Controls testing.

p. Performance Verification testing.

q. Other systems testing, if required.

r. Contractor's pre-final inspection.

s. Correction of punch list from Contractor's pre-final inspection.

t. Government's pre-final inspection.

u. Correction of punch list from Government's pre-final inspection.

v. Final inspection.

w. Planned Utility Outages (electrical, water, gas, etc.).

3.3.6 Government Activities

Show Government and other agency activities that could impact progress. These activities include, but are not limited to: approvals,acceptance, design reviews, environmental permit approvals by State regulators, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

3.3.7 Standard Activity Coding Dictionary

Use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11. This exact structure is mandatory. Develop and assign all Activity Codes to activities as detailed herein. A template SDEF compatible schedule backup file is available on the QCS web site: http://rms.usace.army.mil.

The SDEF format is as follows:

Field	Activity Code	Length	Description
1	WRKP	3	Workers per day
2	RESP	4	Responsible party
3	AREA	4	Area of work
4	MODF	6	Modification Number
5	BIDI	6	Bid Item (CLIN)
6	PHAS	2	Phase of work
7	CATW	1	Category of work
8	FOW	20	Feature of work*

*Some systems require that FEATURE OF WORK values be placed in several activity code fields. The notation shown is for Primavera P6. Refer to the specific software guidelines with respect to the FEATURE OF WORK field requirements.

3.3.7.1 Workers Per Day (WRKP)

Assign Workers per Day for all field construction or direct work activities, if directed by the Contracting Officer. Workers per day is based on the average number of workers expected each day to perform a task for the duration of that activity.

3.3.7.2 Responsible Party Coding (RESP)

Assign responsibility code for all activities to the Prime Contractor, Subcontractor(s) or Government agency(ies) responsible for performing the activity.

a. Activities coded with a Government Responsibility code include, but

are not limited to: Government approvals, Government design reviews, environmental permit approvals by State regulators, Government Furnished Property/Equipment (GFP) and Notice to Proceed (NTP) for phasing requirements.

b. Activities cannot have more than one Responsibility Code. Examples of acceptable activity code values are: DOR (for the designer of record); ELEC (for the electrical subcontractor); MECH (for the mechanical subcontractor); and GOVT (for USACE).

3.3.7.3 Area of Work Coding (AREA)

Assign Work Area code to activities based upon the work area in which the activity occurs. Define work areas based on resource constraints or space constraints that would preclude a resource, such as a particular trade or craft work crew from working in more than one work area at a time due to restraints on resources or space. Examples of Work Area Coding include different areas within a floor of a building, different floors within a building, and different buildings within a complex of buildings. Activities cannot have more than one Work Area Code.

Not all activities are required to be Work Area coded. A lack of Work Area coding indicates the activity is not resource or space constrained.

3.3.7.4 Modification Number (MODF)

Assign a Modification Number Code to any activity or sequence of activities added to the schedule as a result of a Contract Modification, when approved by Contracting Officer. Key all Code values to the Government's modification numbering system. An activity can have only one Modification Number Code.

3.3.7.5 Bid Item Coding (BIDI)

Assign a Bid Item Code to all activities using the Contract Line Item Schedule (CLIN) to which the activity belongs, even when an activity is not cost loaded. An activity can have only one BIDI Code.

3.3.7.6 Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities. Examples of phase of work are design phase, procurement phase and construction phase. Each activity can have only one Phase of Work code.

a. Code proposed fast track design and construction phases proposed to allow filtering and organizing the schedule by fast track design and construction packages.

b. If the contract specifies phasing with separately defined performance periods, identify a Phase Code to allow filtering and organizing the schedule accordingly.

3.3.7.7 Category of Work Coding (CATW)

Assign a Category of Work Code to all activities. Category of Work Codes include, but are not limited to design, design submittal, design reviews, review conferences, permits, construction submittal, procurement, fabrication, weather sensitive installation, non-weather sensitive installation, start-up, and testing activities. Each activity can have no

more than one Category of Work Code.

3.3.7.8 Feature of Work Coding (FOW)

Assign a Feature of Work Code to appropriate activities based on the Definable Feature of Work to which the activity belongs based on the approved QC plan.

Definable Feature of Work is defined in Section 01 45 00.00 10 QUALITY CONTROL. An activity can have only one Feature of Work Code.

3.3.8 Contract Milestones and Constraints

Milestone activities are to be used for significant project events including, but not limited to, project phasing, project start and end activities, or interim completion dates. The use of artificial float constraints such as "zero free float" or "zero total float" are prohibited.

Mandatory constraints that ignore or effect network logic are prohibited. No constrained dates are allowed in the schedule other than those specified herein. Submit additional constraints to the Contracting Officer for approval on a case by case basis.

3.3.8.1 Project Start Date Milestone and Constraint

The first activity in the project schedule must be a start milestone titled "NTP Acknowledged," which must have a "Start On" constraint date equal to the date that the NTP is acknowledged.

3.3.8.2 End Project Finish Milestone and Constraint

The last activity in the schedule must be a finish milestone titled "End Project."

Constrain the project schedule to the Contract Completion Date in such a way that if the schedule calculates an early finish, then the float calculation for "End Project" milestone reflects positive float on the longest path. If the project schedule calculates a late finish, then the "End Project" milestone float calculation reflects negative float on the longest path. The Government is under no obligation to accelerate Government activities to support a Contractor's early completion.

3.3.8.3 Interim Completion Dates and Constraints

Constrain contractually specified interim completion dates to show negative float when the calculated late finish date of the last activity in that phase is later than the specified interim completion date.

3.3.8.3.1 Start Phase

Use a start milestone as the first activity for a project phase. Call the start milestone "Start Phase X" where "X" refers to the phase of work.

3.3.8.3.2 End Phase

Use a finish milestone as the last activity for a project phase. Call the finish milestone "End Phase X" where "X" refers to the phase of work.

3.3.9 Calendars

Schedule activities on a Calendar to which the activity logically belongs. Develop calendars to accommodate any contract defined work period such as a 7-day calendar for Government Acceptance activities, concrete cure times, etc. Develop the default Calendar to match the physical work plan with non-work periods identified including weekends and holidays. Develop Seasonal Calendar(s) and assign to seasonally affected activities as applicable.

If an activity is weather sensitive it should be assigned to a calendar showing non-work days on a monthly basis, with the non-work days selected at random across the weeks of the calendar, using the anticipated adverse weather delay work days provided in the paragraph titled TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER in Section 01 11 00.00 10 GENERAL CONTRACT REQUIREMENTS. Assign non-work days over a seven-day week as weather records are compiled on seven-day weeks, which may cause some of the weather related non-work days to fall on weekends.

3.3.10 Open Ended Logic

Only two open ended activities are allowed: the first activity "NTP Acknowledged" may have no predecessor logic, and the last activity -"End Project" may have no successor logic.

Predecessor open ended logic may be allowed in a time impact analyses upon the Contracting Officer's approval.

3.3.11 Default Progress Data Disallowed

Actual Start and Finish dates must not automatically update with default mechanisms included in the scheduling software. Updating of the percent complete and the remaining duration of any activity must be independent functions. Disable program features that calculate one of these parameters from the other. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process must match those dates provided in the Contractor Quality Control Reports. Failure to document the AS and AF dates in the Daily Quality Control report will result in disapproval of the Contractor's schedule.

3.3.12 Out-of-Sequence Progress

Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case basis subject to approval by the Contracting Officer. Propose logic corrections to eliminate out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule. Address out of sequence progress or logic changes in the Narrative Report and in the periodic schedule update meetings.

3.3.13 Added and Deleted Activities

Do not delete activities from the project schedule or add new activities to the schedule without approval from the Contracting Officer. Activity ID and description changes are considered new activities and cannot be changed without Contracting Officer approval.

3.3.14 Original Durations

Activity Original Durations (OD) must be reasonable to perform the work item. OD changes are prohibited unless justification is provided and approved by the Contracting Officer.

3.3.15 Leads, Lags, and Start to Finish Relationships

Lags must be reasonable as determined by the Government and not used in place of realistic original durations, must not be in place to artificially absorb float, or to replace proper schedule logic.

a. Leads (negative lags) are prohibited.

b. Start to Finish (SF) relationships are prohibited.

3.3.16 Retained Logic

Schedule calculations must retain the logic between predecessors and successors ("retained logic" mode) even when the successor activity(s) starts and the predecessor activity(s) has not finished (out-of-sequence progress). Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") are not be allowed.

3.3.17 Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be declared 100 percent complete to allow for proper schedule management.

3.3.18 Remaining Duration

Update the remaining duration for each activity based on the number of estimated work days it will take to complete the activity. Remaining duration may not mathematically correlate with percentage found under paragraph entitled Percent Complete.

3.3.19 Cost Loading of Closeout Activities

Cost load the "Correction of punch list from Government pre-final inspection" activity(ies) not less than 1 percent of the present contract value. Activity(ies) may be declared 100 percent complete upon the Government's verification of completion and correction of all punch list work identified during Government pre-final inspection(s).

3.3.19.1 As-Built Drawings

If there is no separate contract line item (CLIN) for as-built drawings, cost load the "Submission and approval of as-built drawings" activity not less than $35,000 or 1 percent of the present contract value, which ever is greater, up to $200,000. Activity will be declared 100 percent complete upon the Government's approval.

3.3.19.2 O & M Manuals

Cost load the "Submission and approval of O & M manuals" activity not less than $20,000. Activity will be declared 100 percent complete upon the Government's approval of all O & M manuals.

3.3.20 Early Completion Schedule and the Right to Finish Early

An Early Completion Schedule is an Initial Project Schedule (IPS) that indicates all scope of the required contract work will be completed before the contractually required completion date.

a. No IPS indicating an Early Completion will be accepted without being fully resource-loaded (including crew sizes and manhours) and the Government agreeing that the schedule is reasonable and achievable.

b. The Government is under no obligation to accelerate work items it is responsible for to ensure that the early completion is met nor is it responsible to modify incremental funding (if applicable) for the project to meet the contractor's accelerated work.

3.4 PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. Include the submittal register with project schedule submissions. The data CD/DVD, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS. If the Contractor fails or refuses to furnish the information and schedule updates as set forth herein, then the Contractor will be deemed not to have provided an estimate upon which a progress payment can be made.

Review comments made by the Government on the schedule(s) do not relieve the Contractor from compliance with requirements of the Contract Documents.

3.4.1 Preliminary Project Schedule Submission

Within 15 calendar days after the NTP is acknowledged submit the Preliminary Project Schedule defining the planned operations detailed for the first 90 calendar days for approval. The approved Preliminary Project Schedule will be used for payment purposes not to exceed 90 calendar days after NTP. Completely cost load the Preliminary Project Schedule to balance the contract award CLINS shown on the Price Schedule. The Preliminary Project Schedule may be summary in nature for the remaining performance period. It must be early start and late finish constrained and logically tied as specified. The Preliminary Project Schedule forms the basis for the Initial Project Schedule specified herein and must include all of the required plan and program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as design activities, planned submissions of all early design packages, permitting activities, design review conference activities, and other non-construction activities intended to occur within the first 90 calendar days. Government acceptance of the associated design package(s) and all other specified Program and Plan approvals must occur prior to any planned construction activities. Activity code any activities that are summary in nature after the first 90 calendar days with Bid Item (CLIN) code (BIDI), Responsibility Code (RESP) and Feature of Work code (FOW).

3.4.2 Initial Project Schedule Submission

Submit the Initial Project Schedule for approval within 42 calendar days after notice to proceed is issued. The schedule must demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period. Include in the design-build schedule detailed design and permitting activities, including but not limited to identification of individual design packages, design submission, reviews and conferences; permit submissions and any required Government actions; and long lead item acquisition prior to design completion (when approved by the contracting officer). Also cover in the initial design-build schedule the entire construction effort with as much detail as is known at the time but, as a minimum, include all construction start and completion milestones, and detailed construction activities through the dry-in milestone, including all activity coding and cost loading. Include the remaining construction, including cost loading, but it may be scheduled summary in nature. As the design proceeds and design packages are developed, fully detail the remaining construction activities concurrent with the monthly schedule updating process. Constrain construction activities by Government acceptance of associated designs. When the design is complete, incorporate into the approved schedule update all remaining detailed construction activities that are planned to occur after the dry-in milestone. No payment will be made for work items not fully detailed in the Project Schedule.

3.4.2.1 Design Package Schedule Submission

With each design package submitted to the Government, submit a fragnet schedule extracted from the current Preliminary, Initial or Updated schedule which covers the activities associated with that Design Package including construction, procurement and permitting activities.

3.4.3 Periodic Schedule Updates

Update the Project Schedule on a regular basis, monthly at a minimum. Provide a draft Periodic Schedule Update for review at the schedule update meetings as prescribed in the paragraph PERIODIC SCHEDULE UPDATE MEETINGS. These updates will enable the Government to assess Contractor's progress. Update the schedule to include detailed construction activities as the design progresses, but not later than the submission of the final un-reviewed design submission for each separate design package. The Contracting Officer may require submission of detailed schedule activities for any distinct construction that is started prior to submission of a final design submission if such activity is authorized.

a. Update information including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD), and Percent Complete is subject to the approval of the Government at the meeting.

b. AS and AF dates must match the date(s) reported on the Contractor's Quality Control Report for an activity start or finish.

3.5 SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Update throughout the life of the project:

3.5.1 Data in Electronic Format

Provide two sets of data in electronic format containing the current project schedule and all previously submitted schedules in the format of the scheduling software (e.g. .xer). Also include the Narrative Report and all required Schedule Reports. Label each electronic submission indicating the type of schedule (Preliminary, Initial, Update), full contract number, Data Date and file name. Each schedule must have a unique file name and use project specific settings.

3.5.2 Narrative Report

Provide a Narrative Report with each schedule submission. The Narrative Report is expected to communicate to the Government the thorough analysis of the schedule output and the plans to compensate for any problems, either current or potential, which are revealed through that analysis. Include the following information as minimum in the Narrative Report:

a. Identify and discuss the work scheduled to start in the next update period.

b. A description of activities along the two most critical paths where the total float is less than or equal to 20 work days.

c. A description of current and anticipated problem areas or delaying factors and their impact and an explanation of corrective actions taken or required to be taken.

d. Identify and explain why activities based on their calculated late dates should have either started or finished during the update period but did not.

e. Identify and discuss all schedule changes by activity ID and activity name including what specifically was changed and why the change was needed. Include at a minimum new and deleted activities, logic changes, duration changes, calendar changes, lag changes, resource changes, and actual start and finish date changes.

f. Identify and discuss out-of-sequence work.

3.5.3 Schedule Reports

The format, filtering, organizing and sorting for each schedule report will be as directed by the Contracting Officer. Typically, reports contain Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float, Actual Start Date, Actual Finish Date, and Percent Complete. Provide the reports electronically in .pdf format. The following lists typical reports that will be requested:

3.5.3.1 Activity Report

List of all activities sorted according to activity number.

3.5.3.2 Logic Report

List of detailed predecessor and successor activities for every activity in ascending order by activity number.

3.5.3.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. List activities which have the same amount of total float in ascending order of Early Start Dates. Do not show completed activities on this report.

3.5.3.4 Earnings Report by CLIN

A compilation of the Total Earnings on the project from the NTP to the data date, which reflects the earnings of activities based on the agreements made in the schedule update meeting defined herein. Provided a complete schedule update has been furnished, this report serves as the basis of determining progress payments. Group activities by CLIN number and sort by activity number. Provide a total CLIN percent earned value, CLIN percent complete, and project percent complete. The printed report must contain the following for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Earnings to Date, Earnings this period, Total Quantity, Quantity to Date, and Percent Complete (based on cost).

3.5.3.5 Schedule Log

Provide a Scheduling/Leveling Report generated from the current project schedule being submitted.

3.5.4 Network Diagram

The Network Diagram is required for the Preliminary, Initial and Periodic Updates. Depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.4.1 Continuous Flow

Show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, duration, and estimated earned value on the diagram.

3.5.4.2 Project Milestone Dates

Show dates on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.4.3 Critical Path

Show all activities on the critical path. The critical path is defined as the longest path.

3.5.4.4 Banding

Organize activities using the WBS or as otherwise directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by major elements of work, category of work, work area and/or responsibility.

3.5.4.5 Cash Flow / Schedule Variance Control (SVC) Diagram

With each schedule submission, provide a SVC diagram showing 1) Cash Flow S-Curves indicating planned project cost based on projected early and late activity finish dates, and 2) Earned Value to-date.

3.6 PERIODIC SCHEDULE UPDATE

3.6.1 Periodic Schedule Update Meetings

Conduct periodic schedule update meetings for the purpose of reviewing the proposed Periodic Schedule Update, Narrative Report, Schedule Reports, and progress payment. Conduct meetings at least monthly within five days of the proposed schedule data date. Provide a computer with the scheduling software loaded and a projector which allows all meeting participants to view the proposed schedule during the meeting. The Contractor's authorized scheduler must organize, group, sort, filter, perform schedule revisions as needed and review functions as requested by the Contractor and/or Government. The meeting is a working interactive exchange which allows the Government and Contractor the opportunity to review the updated schedule on a real time and interactive basis. The meeting will last no longer than 8 hours. Provide a draft of the proposed narrative report and schedule data file to the Government a minimum of two workdays in advance of the meeting. The Contractor's Project Manager and scheduler must attend the meeting with the authorized representative of the Contracting Officer. Superintendents, foremen and major subcontractors must attend the meeting as required to discuss the project schedule and work. Following the periodic schedule update meeting, make corrections to the draft submission. Include only those changes approved by the Government in the submission and invoice for payment.

3.6.2 Update Submission Following Progress Meeting

Submit the complete Periodic Schedule Update of the Project Schedule containing all approved progress, revisions, and adjustments, pursuant to paragraph SUBMISSION REQUIREMENTS not later than 4 work days after the periodic schedule update meeting.

3.7 WEEKLY PROGRESS MEETINGS

Conduct a weekly meeting with the Government (or as otherwise mutually agreed to) between the meetings described in paragraph entitled PERIODIC SCHEDULE UPDATE MEETINGS for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming two weeks. Use the current approved schedule update for the purposes of this meeting and for the production and review of reports. At the weekly progress meeting, address the status of RFIs, RFPs and Submittals.

3.8 REQUESTS FOR TIME EXTENSIONS

Provide a justification of delay to the Contracting Officer in accordance with the contract provisions and clauses for approval within 10 days of a delay occurring. Also prepare a time impact analysis for each Government request for proposal (RFP) to justify time extensions.

3.8.1 Justification of Delay

Provide a description of the event(s) that caused the delay and/or impact

to the work. As part of the description, identify all schedule activities impacted. Show that the event that caused the delay/impact was the responsibility of the Government. Provide a time impact analysis that demonstrates the effects of the delay or impact on the project completion date or interim completion date(s). Evaluate multiple impacts chronologically; each with its own justification of delay. With multiple impacts consider any concurrency of delay. A time extension and the schedule fragnet becomes part of the project schedule and all future schedule updates upon approval by the Contracting Officer.

3.8.2 Time Impact Analysis (Prospective Analysis)

Prepare a time impact analysis for approval by the Contracting Officer based on industry standard AACE 52R-06. Utilize a copy of the last approved schedule prior to the first day of the impact or delay for the time impact analysis. If the Contracting Officer determines the time frame between the last approved schedule and the first day of impact is too great, prepare an interim updated schedule to perform the time impact analysis. Unless approved by the Contracting Officer, no other changes may be incorporated into the schedule being used to justify the time impact.

3.8.3 Forensic Schedule Analysis (Retrospective Analysis)

Prepare an analysis for approval by the Contracting Officer based on industry standard AACE 29R-03.

3.8.4 Fragmentary Network (Fragnet)

Prepare a proposed fragnet for time impact analysis consisting of a sequence of new activities that are proposed to be added to the project schedule to demonstrate the influence of the delay or impact to the project's contractual dates. Clearly show how the proposed fragnet is to be tied into the project schedule including all predecessors and successors to the fragnet activities. The proposed fragnet must be approved by the Contracting Officer prior to incorporation into the project schedule.

3.8.5 Time Extension

The Contracting Officer must approve the Justification of Delay including the time impact analysis before a time extension will be granted. No time extension will be granted unless the delay consumes all available Project Float and extends the projected finish date ("End Project" milestone) beyond the Contract Completion Date. The time extension will be in calendar days.

Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay will not be a cause for an extension to the performance period, completion date, or any interim milestone date.

3.8.6 Impact to Early Completion Schedule

No extended overhead will be paid for delay prior to the original Contract Completion Date for an Early Completion IPS unless the Contractor actually performed work in accordance with that Early Completion Schedule. The Contractor must show that an early completion was achievable had it not been for the impact.

3.9 FAILURE TO ACHIEVE PROGRESS

Should the progress fall behind the approved project schedule for reasons other than those that are excusable within the terms of the contract, the Contracting Officer may require provision of a written recovery plan for approval. The plan must detail how progress will be made-up to include which activities will be accelerated by adding additional crews, longer work hours, extra work days, etc.

3.9.1 Artificially Improving Progress

Artificially improving progress by means such as, but not limited to, revising the schedule logic, modifying or adding constraints, shortening activity durations, or changing calendars in the project schedule is prohibited. Indicate assumptions made and the basis for any logic, constraint, duration and calendar changes used in the creation of the recovery plan. Any additional resources, manpower, or daily and weekly work hour changes proposed in the recovery plan must be evident at the work site and documented in the daily report along with the Schedule Narrative Report.

3.9.2 Failure to Perform

Failure to perform work and maintain progress in accordance with the supplemental recovery plan may result in an interim and final unsatisfactory performance rating and may result in corrective action directed by the Contracting Officer pursuant to FAR 52.236-15 Schedules for Construction Contracts, FAR 52.249-10 Default (Fixed-Price Construction), and other contract provisions.

3.9.3 Recovery Schedule

Should the Contracting Officer find it necessary, submit a recovery schedule pursuant to FAR 52.236-15 Schedules for Construction Contracts.

3.10 OWNERSHIP OF FLOAT

Except for the provision given in the paragraph IMPACT TO EARLY COMPLETION SCHEDULE, float available in the schedule, at any time, may not be considered for the exclusive use of either the Government or the Contractor including activity and/or project float. Activity float is the number of work days that an activity can be delayed without causing a delay to the "End Project" finish milestone. Project float (if applicable) is the number of work days between the projected early finish and the contract completion date milestone.

3.11 TRANSFER OF SCHEDULE DATA INTO RMS CM

Import the schedule data into the Resident Management System Contractor Mode (RMS CM). This data is considered to be additional supporting data in a form and detail required by the Contracting Officer pursuant to FAR 52.232-5 Payments under Fixed-Price Construction Contracts. The receipt of a proper payment request pursuant to FAR 52.232-27 Prompt Payment for Construction Contracts is contingent upon the Government receiving both acceptable and approvable hard copies and matching application for progress payment in RMS CM.

3.12 PRIMAVERA P6 MANDATORY REQUIREMENTS

If Primavera P6 is being used, request a backup file template (.xer) from the Government, if one is available, prior to building the schedule. The following settings are mandatory and required in all schedule submissions to the Government:

a. Activity Codes must be Project Level, not Global or EPS level.

b. Calendars must be Project Level, not Global or Resource level.

c. Activity Duration Types must be set to "Fixed Duration & Units".

d. Percent Complete Types must be set to "Physical".

e. Set time periods for P6 for Hours/Day, Hours/Week, Hours/Month and Hours/Year based on Section 01 11 00.00 10 Paragraph "WORKING HOURS".

f. Set Schedule Option for defining Critical Activities to "Longest Path".

g. Set Schedule Option for defining progressed activities to "Retained Logic".

h. Set up cost loading using a single lump sum labor resource. The Price/Unit must be $1/hr, Default Units/Time must be "8h/d", and settings "Auto Compute Actuals" and "Calculate costs from units" selected.

i. Activity ID's must not exceed 10 characters.

j. Activity Names must have the most defining and detailed description within the first 30 characters.

-- End of Section --

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SECTION 01 32 16.00 20

SMALL PROJECT CONSTRUCTION PROGRESS SCHEDULES

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information onlysubmittals not having a "G" designation are for Contractor Quality Control or Designer of Record approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Baseline Construction Schedule; G

Baseline Design Schedule; G

Monthly Updates; G

1.2 PRE-CONSTRUCTION SCHEDULE REQUIREMENT

Prior to the start of work, prepare and submit to the Contracting Officer a Baseline Design Schedule and Baseline Construction Schedule in the form of a Network Analysis Schedule (NAS)or Bar Chart Schedule in accordance with the terms in Contract Clause FAR 52.236-15 Schedules for Construction Contracts, except as modified in this contract.
Prior to the start of work, prepare and submit to the Contracting Officer a Baseline Construction Schedule in the form of a Network Analysis Schedule (NAS) or Bar Chart Schedule in accordance with the terms in Contract Clause FAR 52.236-15 Schedules for Construction Contracts, except as modified in this contract.

The approval of a Baseline Construction Schedule is a condition precedent to:

a. The Contractor starting demolition work or construction stage(s) of the contract.

b. Processing Contractor's invoice(s) for construction activities/items of work.

c. Review of any schedule updates.

Submittal of the Baseline Design and Construction Schedule, and subsequent schedule updates, is understood to be the Contractor's certification that the submitted schedule meets the requirements of the Contract Documents, represents the Contractor's plan on how the work will be accomplished, and accurately reflects the work that has been accomplished and how it was sequenced (as-built logic).

1.3 SCHEDULE FORMAT

Provide schedule in either NAS or Bar Chart format as specified in the task order.

1.3.1 Network Analysis Schedule (NAS)

Use the critical path method (CPM) to schedule and control project activities. Prepare and maintain project schedules using Primavera P6 or Microsoft Project 2010.

Within 15 calendar days after approval of the Initial Schedule or approval of the final design for a design build project, submit to the Contracting Officer a final NAS schedule.

1.3.1.1 Activity Requirements

a. At a minimum, identify the following in the schedule:

(1) Design and Construction time for major systems and components

(2) Each activity assigned with its appropriate Responsibility Code

(3) Each activity assigned with its appropriate Phase and Area Codes

(4) Major submittals and submittal processing time

(5) Major equipment lead time

b. Build the Schedule as follows:

(1) Show design periods, submittals, Government review periods, material/equipment delivery, utility outages, on-site construction, inspection, testing, and closeout activities.

(2) With the exception of the Contract Award and End Contract milestone activities, use of open-ended activities is not allowed; each activity must have predecessor and successor ties. No activity must have open start or open finish (dangling) logic. Minimize redundant logic ties. Once an activity exists on the schedule it must not be deleted or renamed to change the scope of the activity and must not be removed from the schedule logic without approval from the Contracting Officer. While an activity cannot be deleted, where said activity is no longer applicable to the schedule but must remain within the logic stream for historical record, it can be changed to a milestone. Document any such change in the milestone's "Notebook," including a date and explanation for the change. The ID number for a deleted activity must not be re-used for another activity.

(3) Assign each activity its appropriate Responsibility Code and Area Code, indicating location and responsibility to accomplish the work indicated by the activity, Phase Code, and Work Location Code. Include anticipated tasks to be assigned Government responsibility.

(4) Date/time constraints or lags, other than those required by the contract, are not allowed unless approved by the Contracting Officer. Include as the last activity in the contract schedule, a milestone activity named "Contract Completion Date".

(5) Include the following Contract Milestones:

(a) Include as the first activity on the schedule a start

milestone titled "Contract Award", which must have a Mandatory Start constraint equal to the Contract Award Date;

(b) Include Interim or Phased Completion Milestones required by the Contract or as approved by the Contracting Officer;

(c) Include Facility Turnover Planning Meeting Milestones;

(d) Include an unconstrained finish milestone on the schedule titled "Substantial Completion". Substantial Completion is defined as the point in time the Government would consider the project ready for beneficial occupancy wherein by mutual agreement of the Government and Contractor. Government use of the facility is allowed while construction access continues in order to complete remaining items (e.g. punch list and other close out submittals).

(e) Include an unconstrained finish milestone on the schedule titled "Projected Completion". Projected Completion is defined as the point in time the Government would consider the project complete. This milestone must have the Contract Completion Date (CCD) milestone as its only successor.

(f) Include as the last activity on the schedule a finish milestone titled "Contract Completion (CCD)" with constraint type "Must Finish No Later Than". Calculation of schedule updates must be such that if the finish of the "Projected Completion" milestone falls after the contract completion date, then negative float will be calculated on the longest path and if the finish of the "Projected Completion" milestone falls before the contract completion date, the float calculation must reflect positive float on the longest path. This milestone must be set to 5:00 pm.

(6) Provide lead time for major equipment.

1.3.1.2 Anticipated Weather Lost Work Days

Refer to Section 01 11 00.00 10 GENERAL CONTRACT REQUIREMENTS, paragraph TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER.

Assign the Weather Calendar to any activity that could be impacted by adverse weather. The Contracting Officer will issue a modification in accordance with the contract clauses, giving the Contractor a time extension for the difference of days between the anticipated and actual adverse weather delay if the number of actual adverse weather delay days exceeds the number of days anticipated for the month in which the delay occurs and the adverse weather delayed activities are critical to contract completion. A lost workday due to weather conditions is defined as a day in which the Contractor cannot work at least 50 percent of the day on the impacted activity.

1.3.1.3 Activity Identification

a. Identify Government, Construction Quality Management (CQM), Construction activities planned for the project and other activities that could impact project completion if delayed.

b. Identify administrative type activity/milestones including pre-construction submittal and permit requirements prior to demolition

or construction stage.

c. Create separate activities for each Phase, Area, Floor Level, and Location the activity is occurring.

d. Do not use construction category activity to represent non-work type reference (Such as, Serial Letter or Request for Information) in NAS.

e. Place non-work reference within P6 activity details notebook. Activity categories included in the schedule are specified below.

1.3.1.4 Responsibility Code

Assign each activity its appropriate Responsibility Code indicating responsibility to accomplish the work indicated by the activity, Phase Code and Work Location Code.

1.3.1.5 Primavera P6 Settings and Parameters

Use the following Primavera P6 settings and parameters in preparing the Baseline Schedule. Deviation from these settings and parameters, without prior consent of the Contracting Officer, is cause for rejection of schedule submission.

a. General: Define or establish Calendars and Activity Codes at the "Project" level, not the "Global" level.

b. Admin Drop-Down Menu, Admin Preferences, Time Periods Tab:

(1) Set time periods for P6 for Hours/Day, Hours/Week, Hours/Month and Hours/Year based on Section 01 11 00.00 10 Paragraph "WORKING HOURS".

(2) Use assigned calendar to specify the number of work hours for each time period: Must be checked.

c. Admin Drop-Down Menu, Admin Preferences, Earned Value Tab: Earned Value Calculation: Use "Budgeted values with current dates".

d. Project Level, Dates Tab: Set "Must Finish By" date to "Contract Completion Date", and set "Must Finish By" time to 05:00pm.

e. Project Level, Defaults Tab:

(1) Duration Type: Set to "Fixed Duration & Units".

(2) Percent Complete Type: Set to "Physical".

(3) Activity Type: Set to "Task Dependent".

(4) Calendar: Set to "Standard 5 Day Workweek". Calendar must reflect Saturday, Sunday and all Federal holidays as non-work days. Alternative calendars may be used with Contracting Officer approval.

f. Project Level, Calculations Tab:

(1) Activity percent complete based on activity steps: Must be Checked.

(2) Reset Remaining Duration and Units to Original: Must be Checked.

(3) Subtract Actual from At Completion: Must be Checked.

(4) Recalculate Actual units and Cost when duration percent (%) complete changes: Must be Checked.

(5) Link Actual to Date and Actual This Period Units and Cost: Must be Checked.

(6) Price/Unit: Set to "$1/h".

(7) Update units when costs change on resource assignments: Must be Unchecked.

g. Project Level, Settings Tab:

(1) Define Critical Activities: Check "Longest Path".

h. The NAS must have a minimum of 30 construction activities. No on-site construction activity may have durations in excess of 20 working days.

1.3.1.6 Microsoft Project 2010 Settings and Parameters

Use the following MS Project 2010 settings and parameters in preparing the Baseline Schedule:

a. The Network must have a minimum of 30 construction activities. In general, all definable features of work identified in the Quality Control Plan should be represented by construction activites where practicable or sensible.

b. No on-site construction activity may have durations in excess of 20 working days.

c. Critical is defined as having zero days of Total Slack. Within the Baseline Schedule no more than 20 percent of the activities shall be critical.

d. Logic: include the following setting: File, Options, Schedule tab - Split in-progress tasks - must be selected.

e. Status Date gridline is displayed in the Gantt Chart view.

f. Task Type is set to Fixed Work for "boots-on-the-ground" construction activities.

g. Task Type is set to Fixed Duration for design activities, submittals, Government reviews, procurement, material/equipment delivery, and utility outages.

h. "Effort Driven" is turned ON for Fixed Duration tasks.

i. Set time periods for the project for Hrs/Day, Hrs/Week, and days/month based on Section 01 11 00.00 10 Paragraph "WORKING HOURS.

1.3.1.7 Cost Loading Microsoft Project 2010 Schedules

Assign material, labor and equipment costs to their respective

Construction Activities. Assign material and equipment costs, for which payment will be requested in advance of installation, to their respective procurement activity (i.e. the material/equipment on-site activity). Evenly disperse overhead and profit to each activity over the duration of the project. Cost loading must total to 100 percent of the value of the contract.

1.3.1.7.1 Software Settings

a. Resource Sheet

(1) Resource Name: Enter each code and resource for the project
(2) Type: Set to "Material"
(3) Material Label: Enter units of measurement for each resource
(4) Std. Rate: Enter unit cost for each resource
(5) Accrue at: Set to "Prorated"

b. Assigning Resources to Each Activity

(1) Select each activity in Gantt Chart
(2) Assign resources, Resource Tab
(3) Select each resource and enter the quantity of the units; then, assign the resource(s) to the activity

c. Baseline for Earned Value Calculation, File Tab, Options, Advanced, Default task Earned Value method: Set to "Physical % Complete" or as directed by the Contracting Officer

1.3.1.7.2 Tabular Reports

1.3.1.7.2.1 Tracking Gantt Schedule with Cost Table

Submit a Tracking Gantt Schedule with each schedule update showing activity baseline cost, cost percent complete, and Budgeted Cost of Work Performed (BCWP), as directed by the Contracting Officer.

1.3.1.7.2.2 Earned Value Over Time Report

a. With each schedule submission, submit Earned Value Over Time Report S-Curves indicating Planned Value to the contract completion date based on projected early and late activity finish dates and Earned Value.

b. Revise Earned Value Over Time Report S-Curves when the contract is modified, or as directed by the Contracting Officer.

1.3.1.7.3 Pay Activity Data

Manually enter pay activity data in the RMS 3 database according to the requirements of Section 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM). Tha pay activity schedule shall be identical to the activities in the NAS.

1.3.2 Bar Chart Schedule

The Bar Chart must, as a minimum, show work activities, submittals, Government review periods, material/equipment delivery, utility outages, on-site construction, inspection, testing, and closeout activities. The Bar Chart must be time scaled and generated using an electronic

spreadsheet program.

1.3.2.1 Schedule of Prices

Within 15 calendar days after the NTP is acknowledged, prepare and deliver to the Contracting Officer a Schedule of Prices. Provide a detailed breakdown of the task order price that assigns costs to activities shown on the Bar Chart Schedule.

Costs may be considered for Bonding, Design Submittals, and on-site construction activities only. Cost may not be considered for activities that do not result in tangible work in place including mobilization, temporary construction, Environmental Protection, Quality Control, Safety, submittals, pre-constructionplanning, or similar.

Overhead and profit costs shall be evenly dispersed over each pay activity and over the entire duration of the project. Cost loadings must total 100 percent of the task order value. The Schedule of Prices shall be manually entered in the RMS 3 database as pay activities according to the requirements of Section 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM).

1.3.3 Schedule Submittals and Procedures

Submit Schedules and updates in hard copy and on electronic media that is acceptable to the Contracting Officer. Submit an electronic back-up of the project schedule in an import format compatible with the Government's scheduling program.

1.4 PAYMENTS FOR STORED MATERIALS

Per FAR 52.232-5(B)(2), Payments Under Fix-Price Construction: "In preparation of estimates, the Contracting Office may authorize material delivered on the site and preparatory work done to be taken into consideration." Material costs for which payment will be requested in advance of installation must be assigned to their respective on-site construction activity. These Stored Materials payments requie evidence of paymnet, proper storage on site, and inspection for compliance.

1.5 COST LOADING OF CLOSEOUT ACTIVITES

Cost load the "Correction of punch list from Government pre-final inspection" activity(ies) not less than 5 percent of the present task order value. Activity(ies) may be declared 100 percent complete upon the Government's verification of completion and correction of all punch list work identified during Government pre-final inspection(s).

1.6 SCHEDULE MONTHLY UPDATES

Update the Design and Construction Schedule at monthly intervals. The updated schedule must be kept current, reflecting actual activity progress and plan for completing the remaining work. Submit copies of purchase orders and confirmation of delivery dates as directed by the Contracting Officer.

a. Narrative Report: Identify and justify the following:

(1) Progress made in each area of the project;

(2) Critical Path

(3) Date/time constraint(s), other than those required by the contract;

(4) Listing of changes made between the previous schedule and current updated schedule including: added or removed activities, original and remaining durations for activities that have not started, logic (sequence, constraint, lag/lead), milestones, planned sequence of operations, longest path, calendars or calendar assignments, and cost loading.

(5) Status of any long lead materials/equipment

(6) Status of critical testing requirements, (i.e. TAB (testing, adjusting and balancing), sewer line testing, commissioning).

(7) Status of Contract Completion Date and interim milestones;

(8) Current and anticipated delays (describe cause of delay and corrective actions(s) and mitigation measures to minimize);

(9) Description of current and future schedule problem areas.

For each entry in the narrative report, cite the respective Activity ID and Activity Name, the date and reason for the change, and description of the change.

1.7 CONTRACT MODIFICATION (applicable when use of NAS is specified)

Submit a Time Impact Analysis (TIA) with each cost and time proposal for a proposed change. TIA must illustrate the influence of each change or delay on the Contract Completion Date or milestones. No time extensions will be granted nor delay damages paid unless a delay occurs which consumes all available Project Float, and extends the Projected Finish beyond the Contract Completion Date.

a. Each TIA must be in both narrative and schedule form. The narrative must define the scope and conditions of the change; provide start and finish dates of impact, successor and predecessor activity to impact period, responsible party, describe how it originated, and how it impacts the schedule. The schedule submission must consist of three native files:

(1) Schedule Sub-network - Model the scope of the change condition by showing only the schedule activites to be added as a result of the change, their immediate predecessor and successor activities in the existing schedule, and how the change activities are to be logically tied together.

(2) Update Schedule - Provide the most recently accepted update schedule in effect at the time of the change. This update schedule shall not contain any revisions or additions to the existing logice or activities.

(3) Revised Update Schedule - Provide a schedule that models the effects of the disruption on the update schedule in effect at the time of the change. The revised udate shall have the Schedule Sub-network inserted into the Update Schedule to show how the project and scheduled completion date was impacted as a result of

the disruption.

b. TIAs must include any mitigation, and must determine the apportionment of the overall delay assignable to each individual delay. Apportionment must provide identification of delay type and classification of delay by compensable and non-compensable events. The associated narrative must clearly describe analysis methodology used, and the findings in a chronological listing beginning with the earliest delay event.

(1) Identify and classify types of delays as follows:

(a) Force majeure delay (e.g. weather delay): Any delay event caused by something or someone other than the Government (including its agents) or the Contractor, or the risk of which has not been assigned solely to the Government or the Contractor. If the force majeure delay is on the critical path, in absence of other types of concurrent delays, the Contractor is granted an extension of contract time, classified as a non-compensable event.

(b) A Contractor-delay: Any delay event caused by the Contractor, or the risk of which has been assigned solely to the Contractor. If the contractor-delay is on the critical path, in absence of other types of concurrent delays, Contractor is not granted extension of contract time, and classified as a non-compensable event. Where absent other types of delays, and having impact to project completion, provide a Corrective Action Plan, identifying plan to mitigate delay, to the Contracting Officer.

(c) A Government-delay: Any delay event caused by the Government, or the risk of which has been assigned solely to the Government. If the Government-delay is on the longest path, in absence of other types of concurrent delays, the Contractor is granted an extension of contract time, and classified as a compensable event.

(2) Use functional theory to analyze concurrent delays, where: Separate delay issues delay project completion, do not necessarily occur at same time, rather occur within same monthly schedule update period at minimum, or within same as-built period under review. If a combination of functionally concurrent delay types occurs, it is considered Concurrent Delay, which is defined in the following combinations:

(a) Government-delay concurrent with Contractor-delay: Excusable time extension, classified non-compensable event.

(b) Government-delay concurrent with force majeure delay: Excusable time extension, classified non-compensable event.

(c) Contractor-delay concurrent with force majeure delay: Excusable time extension, classified non-compensable event.

(3) A pacing delay, reacting to another delay (parent delay) equally or more critical than paced activity, must be identified prior to pacing. Contracting Officer will notify Contractor prior to pacing. Contractor must notify Contracting Officer prior to pacing. Notification must include identification of parent delay issue, estimated parent delay time period, paced activity(s) identity, and pacing reason(s). Pacing Concurrency is defined as

follows:

(a) Government-delay concurrent with Contractor-pacing: Excusable time extension, classified compensable event.

(b) Contractor-delay concurrent with Government-pacing: Inexcusable time extension, classified non-compensable event.

c. Submit data containing the narrative and native schedule files.

d. Unless the Contracting Office request otherwise, only confirmed task order modifications must be added into the Construction Schedule.

1.8 3-WEEK LOOK AHEAD SCHEDULE

Prepare and issue a 3-Week Look Ahead schedule to provide a more detailed day-to-day plan of upcoming work identified on the Construction Schedule. Key the work plans to activity numbers when a NAS is required and update each week to show the planned work for the current and following two-week period. Additionally, include upcoming outages, closures, preparatory meetings, and initial meetings. Identify critical path activities on the Three-Week Look Ahead Schedule. The detail work plans are to be bar chart type schedules, maintained separately from the Construction Schedule. Activities must not exceed 5 working days in duration and have sufficient level of detail to assign crews, tools and equipment required to complete the work.

1.9 CORRESPONDENCE AND TEST REPORTS:

All correspondence (e.g., letters, Requests for Information (RFIs), e-mails, meeting minute items, Production and QC Daily Reports, material delivery tickets, photographs) must reference Schedule Activities that are being addressed. All test reports (e.g., concrete, soil compaction, weld, pressure) must reference Schedule Activities that are being addressed.

1.10 ADDITIONAL SCHEDULING REQUIREMENTS

Any references to additional scheduling requirements, including systems to be inspected, tested and commissioned, that are located throughout the remainder of the Contract Documents, are subject to all requirements of this section.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Submittal Information

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

Each submittal is to be in English, complete, and in sufficient detail to allow ready determination of compliance with Contract requirements. All product information and documents provided in Japanese shall be translated to sufficient detail so native English readers shall be able to understand the major points of the documents provided.

1.1.2 Project Type

The Contractor's Quality Control (CQC) System Manager is to check and approve all items before submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.
The Contractor and the Designer of Record (DOR), if applicable, are to check and approve all items before submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

1.1.3 Submission of Submittals

Schedule and provide submittals requiring Government approval before acquiring the material or equipment covered thereby. Pick up and dispose of samples not incorporated into the work in accordance with manufacturer's Safety Data Sheets (SDS) and in compliance with existing laws and regulations.

1.2 DEFINITIONS

1.2.1 Submittal Descriptions (SD)

Submittal requirements are specified in the technical sections. Submittals are identified by Submittal Description (SD) numbers and titles as follows:

SD-01 Preconstruction Submittals

Submittals which are required prior to start of construction (work) or the start of the next major phase of the construction on a multi-phase Contract, includes schedules, tabular list of data, or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

Certificates of insurance

Surety bonds

List of proposed Subcontractors

List of proposed products

Construction progress schedule

Network Analysis Schedule (NAS)

Submittal register

Schedule of prices or Earned Value Report

Accident Prevention Plan

Work plan

Quality Control(QC) plan

Environmental protection plan

SD-02 Shop Drawings

Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems, or equipment for some portion of the work.

Samples of warranty language when the Contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment, or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses, or other data pertaining to a part of work.

Design submittals, design substantiation submittals, and extensions of design submittals.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product, or system to be provided has been tested in accord with specified requirements. Unless specified in another section, testing must have been within three years of date of Contract award for the project.

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system, or material attesting that product, system or material meets specification requirements. Must be dated after award of project Contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer, or Subcontractor through Contractor. The document purpose

is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and (MSDS) concerning impedances, hazards, and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and state the test results, and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to maintain and install equipment. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance, and repair of the item.

This data is intended to be incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements, or to establish an administrative mechanism.

Submittals required for Guiding Principle Validation (GPV) or Third Party Certification (TPC).

Special requirements necessary to properly close out a construction Contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase Contract.

1.2.2 Approving Authority

Office or designated person authorized to approve submittal.

1.2.3 Work

As used in this section, on- and off-site construction required by

Contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that shall review the submittal for the Government. Submit the following in accordance with this section.

SD-01 Preconstruction Submittals

Submittal Register; G

Submittal Register Monthly Update; G

1.4 SUBMITTAL CLASSIFICATION

1.4.1 Government Approved (G)

Government approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Government approval is required for any deviations from the Solicitation or Accepted Proposal and other items as designated by the Contracting Officer. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are considered to be "shop drawings."

1.4.2 Designer of Record Approved (DA)

Designer of Record (DOR) approval is required for extensions of design, critical materials, any deviations from the solicitation, the accepted proposal, or the completed design, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are considered to be "shop drawings." Contractor to provide the Government with the number of copies designated hereinafter of all DOR approved submittals. The Government may review any or all Designer of Record approved submittals for conformance to the Solicitation, Accepted Proposal and the completed design. The Government will review all submittals designated as deviating from the Solicitation or Accepted Proposal, as described below. Design submittals to be in accordance with Section 01 33 16 DESIGN AFTER AWARD. Generally, design submittals should be identified as SD-05 Design Data submittals.

1.4.3 Government Conformance Review of Design (CR)

The Government will review all intermediate and final design submittals for conformance with the technical requirements of the solicitation. Section 01 33 16 DESIGN AFTER AWARD covers the design submittal and review process in detail. Review will be only for conformance with the applicable codes, standards and contract requirements. Design data includes the design documents described in Section 01 33 16 DESIGN AFTER AWARD. Generally, design submittals should be identified as SD-05 Design Data submittals.

1.4.4 Designer of Record Approved/Government Conformance Review (DA/CR)

1.4.4.1 Deviations to the Accepted Design

Designer of Record approval and the Government's concurrence are required for any proposed deviation from the accepted design which still complies with the contract before the Contractor is authorized to proceed with material acquisition or installation. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are considered to be "shop drawings." If necessary to facilitate the project schedule, the Contractor and the DOR may discuss a submittal proposing a deviation with the Contracting Officer's Representative prior to officially submitting it to the Government. However, the Government reserves the right to review the submittal before providing an opinion, if deemed necessary. In any case, the Government will not formally agree to or provide a preliminary opinion on any deviation without the DOR's approval or recommended approval. The Government reserves the right to non-concur with any deviation from the design, which may impact furniture, furnishings, equipment selections or operations decisions that were made, based on the reviewed and concurred design.

1.4.4.2 Substitutions

Unless prohibited or provided for otherwise elsewhere in the Contract, where the accepted contract proposal named products, systems, materials or equipment by manufacturer, brand name and/or by model number or other specific identification, and the Contractor desires to substitute manufacturer or model after award, submit a requested substitution for Government concurrence. Include substantiation, identifying information and the DOR's approval, as meeting the contract requirements and that it is equal in function, performance, quality and salient features to that in the accepted contract proposal. If the Contract otherwise prohibits substitutions of equal named products, systems, materials or equipment by manufacturer, brand name and/or by model number or other specific identification, the request is considered a "variation" to the Contract. Variations are discussed below in paragraphs DESIGNER OF RECORD APPROVED/GOVERNMENT APPROVED (DA/GA) and VARIATIONS/SUBSTITUTION REQUESTS.

1.4.5 Designer of Record Approved/Government Approved (DA/GA)

In addition to the above stated requirements for proposed deviations to the accepted design, both Designer of Record and Government Approval and, where applicable, a Contract modification are required before the Contractor is authorized to proceed with material acquisition or installation for any proposed variation to the Contract (the solicitation and/or the accepted proposal), which constitutes a change to the contract terms. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are considered to be "shop drawings." The Government reserves the right to accept or reject any such proposed deviation at its discretion.

1.4.6 For Information Only

Submittals not requiring Government approval shall be for information only. For Design-build construction all submittals not requiring DOR or Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.4.7 Sustainability Reporting Submittals (S)

Submittals for Guiding Principle Validation (GPV) or Third Party Certification (TPC) are indicated with an "S" designation. These submittals are for information only and for use as specified in Section 01 33 29 SUSTAINABILITY REPORTING.

Schedule submittals for these items throughout the course of construction as provided; do not wait until closeout.

1.5 PREPARATION

1.5.1 Transmittal Form

Use the attached sample transmittal form in Attachment 01 33 00-A ENG FORM 4025-R for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms are included in the QCS software that the Contractor is required to use for this Contract. Properly complete this form by filling out all the heading blank spaces and identifying each item submitted. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the Contract drawings pertinent to the data submitted for each item.

1.5.2 Identifying Submittals

When submittals are provided by a Subcontractor, the Prime Contractor is to prepare, review and stamp with Contractor's approval all specified submittals prior to submitting for Government approval.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

a. Project title and location.

b. Construction Contract number.

c. Date of the drawings and revisions.

d. Name, address, and telephone number of Subcontractor, supplier, manufacturer and any other Subcontractor associated with the submittal.

e. Section number of the specification section by which submittal is required.

f. Submittal description (SD) number of each component of submittal.

g. When a resubmission, add alphabetic suffix on submittal description, for example, submittal 18 would become 18A, to indicate resubmission.

h. Product identification and location in project.

1.5.3 Format of SD-01 Preconstruction Submittals

When the submittal includes a document that is to be used in the project, or is to become part of the project record, other than as a submittal, do

not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

1.5.4 Format for SD-02 Shop Drawings

Provide shop drawings not less than 210 by 297 mm A4 nor more than 1189 by 841 mm, except for full size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless another form is required. Ensure drawings are suitable for reproduction and of a quality to produce clear, distinct lines and letters, with dark lines on a white background.

a. Include the nameplate data, size, and capacity on drawings. Also include applicable federal, military, industry, and technical society publication references.

b. Dimension drawings, except diagrams and schematic drawings. Prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Present 210 by 297 mm shop drawings sized as part of the bound volume for submittals. Present larger drawings in sets.

1.5.4.1 Drawing Identification

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph IDENTIFYING SUBMITTALS.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location next to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space, no smaller than 50 mm on the right-hand side of each sheet for the Government disposition stamp.

1.5.5 Format of SD-03 Product Data

Present product data submittals for each section and as a complete, bound volume. Include a table of contents, listing the page and catalog item numbers for product data.

Indicate, by prominent notation, each product that is being submitted; indicate the specification section number and paragraph number to which it pertains.

1.5.5.1 Product Information

Supplement product data with material prepared for the project to satisfy the submittal requirements where product data does not exist. Identify this material as developed specifically for the project, with information and format as required for submission of SD-07 Certificates.

Provide product data in metric dimensions. Where product data are included in preprinted catalogs with English units only, submit metric dimensions on separate sheet.

1.5.5.2 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.5.3 Data Submission

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal that is marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of the construction effort.

Submit the manufacturer's instructions before installation.

1.5.6 Format of SD-04 Samples

1.5.6.1 Sample Characteristics

Furnish samples in the following sizes, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:

a. Sample of Equipment or Device: Full size.

b. Sample of Materials Less Than 50 by 75 mm: Built up to 210 by 297 mm A4 mm.

c. Sample of Materials Exceeding 210 by 297 mm A4: Cut down to 210 by 297 mm A4 and adequate to indicate color, texture, and material variations.

d. Sample of Linear Devices or Materials: 250 mm length or length to be supplied, if less than 250 mm. Examples of linear devices or materials are conduit and handrails.

e. Sample Volume of Nonsolid Materials: 750 mL. Examples of nonsolid materials are sand and paint.

f. Color Selection Samples:50 by 100 mm. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

g. Sample Panel: 1200 by 1200 mm.

h. Sample Installation: 10 sq m.

1.5.6.2 Sample Incorporation

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at the time of use.

Recording of Sample Installation: Note and preserve the notation of any area constituting a sample installation, but remove the notation at the final clean-up of the project.

1.5.6.3 Comparison Sample

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.7 Format of SD-05 Design Data

Provide design data and certificates on 210 by 297 mm A4 paper in a bound volume for submittals containing numerous pages.

1.5.8 Format of SD-06 Test Reports

Provide reports on 210 by 297 mm A4 paper in a complete bound volume.

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

1.5.9 Format of SD-07 Certificates

Provide design data and certificates on 210 by 297 mm A4 paper in a bound volume for submittals containing numerous pages.

1.5.10 Format of SD-08 Manufacturer's Instructions

Present manufacturer's instructions submittals for each section as a complete, bound volume. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry, and technical-society publication references. If supplemental information is needed to clarify the manufacturer's data, submit it as specified for SD-07 Certificates.

Submit the manufacturer's instructions before installation.

1.5.10.1 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC),

submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.11 Format of SD-09 Manufacturer's Field Reports

Provide reports in electronic PDF format. Provide reports on 210 by 297 mm A4 paper in a complete bound volume.

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

1.5.12 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.

1.5.13 Format of SD-11 Closeout Submittals

When the submittal includes a document that is to be used in the project or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

Provide all dimensions in administrative submittals in metric. Where data are included in preprinted material with English units only, submit metric dimensions on separate sheet.

1.5.14 Source Drawings for Shop Drawings

1.5.14.1 Source Drawings

The entire set of source drawing files (DWG) will not be provided to the Contractor. Request the specific Drawing Number for the preparation of shop drawings. Only those drawings requested to prepare shop drawings will be provided. These drawings are provided only after award.

1.5.14.2 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim, and waives to the fullest extent permitted by law any claim or cause of action of any nature against the Government, its agents, or its subconsultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities, or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic source drawing files are not construction documents. Differences may exist between the source drawing files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic source drawing files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. The Contractor is responsible for determining if any conflict exists. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished source drawing files, the signed and sealed construction documents govern. Use of these source drawing files does not relieve the Contractor of the duty to fully comply with the contract documents, including and without limitation the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indication of ownership (seals, logos, signatures, initials and dates).

1.5.15 Electronic File Format

Provide all submittals in electronic format, with the exception of material samples required for SD-04 Samples items. In addition to the electronic submittal, see paragraph titled QUANTITY OF SUBMITTALS for number of hard copies required. Compile the submittal file as a single, complete document, to include the Transmittal Form described within. Name the electronic submittal file specifically according to its contents, and coordinate the file naming convention with the Contracting Officer. Electronic files must be of sufficient quality that all information is legible. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer. Generate PDF files from original documents with bookmarks so that the text included in the PDF file is searchable and can be copied. If documents are scanned, optical character resolution (OCR) routines are required. Index and bookmark files exceeding 30 pages to allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature or a scan of a signature.

Electronic submittal documents shall all be attached in RMS CM.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of SD-01 Preconstruction Submittal Copies

Unless otherwise specified, submit two sets of administrative submittals.

1.6.2 Number of SD-02 Shop Drawing Copies

Submit two copies of submittals of shop drawings requiring review and approval by a QC organization. Submit two copies of shop drawings requiring review and approval by the Contracting Officer.

1.6.3 Number of SD-03 Product Data Copies

Submit in compliance with quantity requirements specified for shop drawings.

1.6.4 Number of SD-04 Samples

a. Submit two samples, or two sets of samples showing the range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in the technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of nonsolid materials.

1.6.5 Number of SD-05 Design Data Copies

Submit in compliance with quantity requirements specified for shop drawings.

1.6.6 Number of SD-06 Test Report Copies

Submit in compliance with quantity and quality requirements specified for shop drawings, other than field test results that will be submitted with QC reports.

1.6.7 Number of SD-07 Certificate Copies

Submit in compliance with quantity requirements specified for shop drawings.

1.6.8 Number of SD-08 Manufacturer's Instructions Copies

Submit in compliance with quantity requirements specified for shop drawings.

1.6.9 Number of SD-09 Manufacturer's Field Report Copies

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

1.6.10 Number of SD-10 Operation and Maintenance Data Copies

Submit five copies of O&M data to the Contracting Officer for review and approval.

1.6.11 Number of SD-11 Closeout Submittals Copies

Unless otherwise specified, submit two sets of administrative submittals.

1.7 INFORMATION ONLY SUBMITTALS

Submittals without a "G" designation must be certified by the QC manager and submitted to the Contracting Officer for information-only. Approval of the Contracting Officer is not required on information only submittals. The Contracting Officer will mark "receipt acknowledged" on submittals for information and will return only the transmittal cover sheet to the Contractor. Normally, submittals for information only will

not be returned. However, the Government reserves the right to return unsatisfactory submittals and require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.8 PROJECT SUBMITTAL REGISTER

1.8.1 Submittal Management

Prepare and maintain a submittal register, as the work progresses. One copy of the submittal register monthly update shall be submitted together with the monthly progress payment requests. Do not change data that is output in columns (c), (d), (e), and (f) as delivered by Government; retain data that is output in columns (a), (g), (h), and (i) as approved. As an attachment, provide a submittal register showing items of equipment and materials for which submittals are required by the specifications. This list may not be all-inclusive and additional submittals may be required. Maintain a submittal register for the project in accordance with Section 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM). The Government will provide the initial submittal register in electronic format with the following fields completed, to the extent that will be required by the Government during subsequent usage.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD Number. and type, e.g., SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in each specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting the project requirements.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns and all dates on which submittals are received by and returned by the Government.

1.8.2 Design-Build Submittal Register

The Designer of Record develops a complete list of submittals during design and identify required submittals in the specifications, and use the list to prepare the Submittal Register. The list may not be all inclusive and additional submittals may be required by other parts of the contract. Complete the submittal register and submit it to the Contracting Officer for approval within 30 calendar days after Notice to Proceed. The approved submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period. Coordinate the submit dates and need dates with dates in the Contractor prepared progress schedule. Submit monthly or until all

submittals have been satisfactorily completed, updates to the submittal register showing the Contractor action codes and actual dates with Government action codes. Revise the submittal register when the progress schedule is revised and submit both for approval.

1.8.3 Preconstruction Use of Submittal Register

Submit the submittal register. Include the QC plan and the project schedule. Verify that all submittals required for the project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for the approving authority to receive submittals.

Column (h) Contractor Approval Date: Date that Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

1.8.4 Contractor Use of Submittal Register

Update the following fields in the Government-furnished submittal register program or equivalent fields in the program used by the Contractor with each submittal throughout the contract.

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) Date submittal transmitted.

Column (q) Date approval was received.

1.8.5 Approving Authority Use of Submittal Register

Update the following fields:

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (l) Date submittal was received.

Column (m) through (p) Dates of review actions.

Column (q) Date of return to Contractor.

1.8.6 Action Codes

1.8.6.1 Government Review Action Codes

"A" - "Approved as submitted"; "Completed"

"B" - "Approved, except as noted on drawings"; "Completed"

"C" - "Approved, except as noted on drawings; resubmission required"; "Resubmit"

"D" - "Returned by separate correspondence"; "Completed"

"E" - "Disapproved (See attached)"; "Resubmit"

"F" - "Receipt acknowledged"; "Completed"

"G" - "Other (Specify)"; "Resubmit"

"K" - "Government concurs with intermediate design"

"R" - "Design submittal is acceptable for release for construction"

"X" - "Receipt acknowledged, does not comply with contract requirements"; "Resubmit"

1.8.6.2 Contractor Action Codes

DESIGN BID BUILD SUBMITTALS			
Submittal Classifications shown in UFGS Sections	Submittal Classification	Corresponding SpecsIntact Submittal Register Code which is populated in the SI Submittal Register. Software Limitations: (The software shows one character delineation in the SpecsIntact Submittal Register)	RMS – The following Submittal Classifications are populated in RMS when the SpecsIntact Submittal Data File is pulled into RMS)
G	Submittal requires Government Approval	G	GA
BLANK	Submittal is For Information Only (FIO)	BLANK	FIO
S	Submittal is for documentation of Sustainable requirements	S	S/FIO

1.8.6.3 Contractor Action Codes

DESIGN BUILD SUBMITTALS			
Submittal Classifications shown in UFGS Sections	Submittal Classification	Corresponding SpecsIntact Submittal Register Code which is populated in the SI Submittal Register. Software Limitations: (The software shows one character delineation in the SpecsIntact Submittal Register)	RMS – The following Submittal Classifications are populated in RMS when the SpecsIntact Submittal Data File is pulled into RMS)
G	Submittal requires Government Approval	G	GA
BLANK	Submittal is For Information Only(FIO)	BLANK	FIO
DA	Submittal requires Designer of Record Approval	D	DA
CR	Submittal requires Government Conformance Review	C	CR
DA/CR	Submittal requires Designer of Record Approval and Government Conformance Review	R	DA/CR
DA/GA	Submittal requires Designer of Record Approval and Government Approval	A	DA/GA

1.8.7 Delivery of Copies

Submit an updated electronic copy of the submittal register to the Contracting Officer with each invoice request. Provide an updated Submittal Register monthly regardless of whether an invoice is submitted.

1.9 VARIATIONS

Variations from contract requirements require Contracting Officer approval pursuant to contract Clause FAR 52.236-21 Specifications and Drawings for

Construction, and will be considered where advantageous to the Government.

1.9.1 Considering Variations

Discussion of variations with the Contracting Officer before submission will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. When contemplating a variation that results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in transmittal letters. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

1.9.2 Proposing Variations

When proposing variation, deliver a written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government. Include the DOR's written analysis and approval. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

Check the column "variation" of ENG Form 4025 for submittals that include variations proposed by the Contractor. Set forth in writing the reason for any variations and note such variations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted variations.

1.9.3 Warranting that Variations are Compatible

When delivering a variation for approval, the Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.9.4 Review Schedule Extension

In addition to the normal submittal review period, a period of 14 additional calendar days will be allowed for the Government to consider submittals with variations.

1.10 SCHEDULING

Schedule and submit concurrently product data and shop drawings covering component items forming a system or items that are interrelated. Submit pertinent certifications at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

a. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. The Contractor is responsible for additional time required for Government reviews resulting from required resubmittals. The review period for each resubmittal is the same as for the initial submittal.

b. Submittals required by the contract documents are listed on the submittal register. If a submittal is listed in the submittal

register but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but that have been omitted from the register or marked "N/A."

c. Resubmit the submittal register and annotate it monthly with actual submission and approval dates. When all items on the register have been fully approved, no further resubmittal is required.

d. Except as specified otherwise, allow a review period, beginning with receipt by the approving authority, that includes at least 10 working days for submittals for QC manager approval, and 30 calendar days for submittals where the Contracting Officer is the approving authority. The period of review for submittals with the Contracting Officer approval begins when the Government receives the submittal from the QC organization.

1.10.1 Government Reviewed Design

The Government will review design submittals for conformance with the technical requirements of the Solicitation. Section 01 33 16 DESIGN AFTER AWARD covers the design submittal and review process in detail. Government review is required for variations from the completed design. Review will be only for conformance with the contract requirements. Included are only those construction submittals for which the DOR's design documents do not include enough detail to ascertain contract compliance. The Government may, but is not required to, review extensions of design such as structural steel or reinforcement shop drawings.

1.11 GOVERNMENT APPROVING AUTHORITY

When approving authority is the Contracting Officer, the Government shall:

a. Note date on which submittal was received.

b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with Contract documents.

c. Identify returned submittals with one of the actions defined in paragraph REVIEW NOTATIONS and with markings appropriate for action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date submittals. Two copies of the submittal shall be retained by the Contracting Officer and one copy of the submittal shall be returned to the Contractor. If the Government performs a conformance review of other Designer of Record approved submittals, the submittals will be so identified and returned, as described above.

1.11.1 Review Notations

Contracting Officer review shall be completed within 30 calendar days after receipt of submission by the Government. Submittals shall be returned to the Contractor with the following notations:

a. Submittals marked "approved" or "accepted" authorize the Contractor to

proceed with the work covered.

b. Submittals marked "approved as noted" "or approved, except as noted, resubmittal not required," authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.

c. Submittals marked "not approved" or "disapproved," or "revise and resubmit," indicate noncompliance with the Contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.

d. Submittals marked "not reviewed" shall indicate submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" shall be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

1.12 DISAPPROVED OR REJECTED SUBMITTALS

Contractor shall make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the Contract drawings or specifications; notice as required under the Contract clause CHANGES, is to be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.13 APPROVED/ACCEPTED SUBMITTALS

The Contracting Officer's approval or acceptance of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing and other information are satisfactory. design, general method of construction, materials, detailing and other information appear to meet the Solicitation and Accepted Proposal.

Approval or acceptance shall not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this Contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work design, dimensions, all design extensions, such as the design of adequate connections and details, etc., and the satisfactory construction of all work.

After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment shall be considered unless accompanied by an explanation of why a substitution is necessary.

1.14 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any Contract requirements. Before submitting samples, assure that the materials or equipment shall be available in quantities required in the project. No change or substitution shall be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those which may be damaged in testing, shall be returned to the Contractor, at his expense, upon completion of the Contract. Samples not approved shall also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests shall be sufficient cause for refusal to consider, under this Contract, any further samples of the same brand or make of that material. Government reserves the right to disapprove any material or equipment which previously has proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet Contract requirements shall automatically void previous approvals. Replace such materials or equipment to meet Contract requirements.

Approval of the Contractor's samples by the Contracting Officer does not relieve the Contractor of his responsibilities under the Contract.

1.15 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work shall not be made if required approvals have not been obtained.No payment for materials incorporated in the work will be made if all required Designer of Record or required Government approvals have not been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

1.16 STATUS REPORT ON MATERIALS ORDERS

Within 15 calendar days after notice to proceed, submit, for approval by the Contracting Officer, an initial material status report on all materials orders. This report shall be updated and re-submitted every 30 calendar days as the status on material orders changes.

Report to include list, in chronological order by need date, materials orders necessary for completion of the Contract. The following information shall be required for each material order listed:

a. Material name, supplier, and invoice number.

b. Bar chart line item or CPM activity number affected by the order.

c. Delivery date needed to allow directly and indirectly related work to be completed within the Contract performance period.

d. Current delivery date agreed on by supplier.

e. When item d exceeds item c, the effect that delayed delivery date will have on Contract completion date.

f. When item d exceeds item c, a summary of efforts made by the Contractor to expedite the delayed delivery date to bring it in line with the needed delivery date, including efforts made to place the order (or Subcontract) with other suppliers.

1.17 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets Contract requirements shall be similar to the following:

CONTRACTOR
(Firm Name)
_____ Approved
_____ Approved with corrections as noted on submittal data and/or attached sheets(s)
SIGNATURE: _____
TITLE: _____
DATE: _____

For design-build construction, both the Contractor Quality Control System Manager and the Designer of Record are to stamp and sign to certify that the submittal meets contract requirements.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

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U.S. Army Corps of Engineers (USACE)

TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE

For use of this form, see ER 415-1-10; the proponent agency is CECW-CE.

DATE	TRANSMITTAL NO.

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (*This section will be initiated by the contractor*)

TO:	FROM:	CONTRACT NO.	CHECK ONE: ☐ THIS IS A NEW TRANSMITTAL ☐ THIS IS A RESUBMITTAL OF TRANSMITTAL _____

SPECIFICATION SEC. NO. (*Cover only one section with each transmittal*)	PROJECT TITLE AND LOCATION	THIS TRANSMITTAL IS FOR: (*Check one*) ☐ FIO ☐ GA ☐ DA ☐ CR ☐ DA/CR ☐ DA/GA

ITEM NO. (*See Note 3*) a.	**DESCRIPTION OF SUBMITTAL ITEM** (*Type size, model number/etc.*) b.	**SUBMITTAL TYPE CODE** (*See Note 8*) c.	**NO. OF COPIES** d.	**CONTRACT DOCUMENT REFERENCE**		**CONTRACTOR REVIEW CODE** g.	**VARIATION** Enter "Y" if requesting a variation (*See Note 6*) h.	**USACE ACTION CODE** (*Note 9*) i.
				SPEC. PARA. NO. e.	**DRAWING SHEET NO.** f.			

REMARKS	I certify that the above submitted items had been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.	
	NAME OF CONTRACTOR	SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED (*List by item No.*)	NAME AND TITLE OF APPROVING AUTHORITY	SIGNATURE OF APPROVING AUTHORITY	DATE

INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.

2. Each Transmittal shall be numbered consecutively. The Transmittal Number typically includes two parts separated by a dash (-). The first part is the specification section number. The second part is a sequential number for the submittals under that spec section. If the Transmittal is a resubmittal, then add a decimal point to the end of the original Transmittal Number and begin numbering the resubmittal packages sequentially after the decimal.

3. The "Item No." for each entry on this form will be the same "Item No." as indicated on ENG FORM 4288-R.

4. Submittals requiring expeditious handling will be submitted on a separate ENG Form 4025-R.

5. Items transmitted on each transmittal form will be from the same specification section. Do not combine submittal information from different specification sections in a single transmittal.

6. If the data submitted are intentionally in variance with the contract requirements, indicate a variation in column h, and enter a statement in the Remarks block describing he detailed reason for the variation.

7. ENG Form 4025-R is self-transmitting - a letter of transmittal is not required.

8. When submittal items are transmitted, indicate the "Submittal Type" (*SD-01 through SD-11*) in column c of Section I.
   Submittal types are the following:
   SD-01 - Preconstruction SD-02 - Shop Drawings SD-03 - Product Data SD-04 - Samples SD-05 - Design Data SD-06 - Test Reports
   SD-07 - Certificates SD-08 - Manufacturer's Instructions SD-09 - Manufacturer's Field Reports SD-10 - O&M Data SD-11 - Closeout

9. For each submittal item, the Contractor will assign Submittal Action Codes in column g of Section I. The U.S. Army Corps of Engineers approving authority will assign Submittal Action Codes in column i of Section I. The Submittal Action Codes are:

   A -- Approved as submitted.
   B -- Approved, except as noted on drawings. Resubmission not required.
   C -- Approved, except as noted on drawings. Refer to attached comments. Resubmission required.
   D -- Will be returned by separate correspondence.
   E -- Disapproved. Refer to attached comments.
   F -- Receipt acknowledged.
   X -- Receipt acknowledged, does not comply with contract requirements, as noted.
   G -- Other action required *(Specify)*
   K -- Government concurs with intermediate design. (*For D-B contracts*)
   R -- Design submittal is acceptable for release for construction. (*For D-B contracts*)

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract.

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		01 11 00.00 10	SD-01 Preconstruction Submittals															
			Initial Site Conditions Photos	1.11														
			Key Personnel Qualifications	1.7	G													
			Conformed Drawings Submittal	1.10.2														
			INDOOR AIR QUALITY (IAQ)	1.10.3	G													
			MANAGEMENT PLAN															
			SD-07 Certificates															
			Monthly Progress Photos	1.11														
			SD-11 Closeout Submittals															
			Construction Completion Photos	1.11														
		01 20 00	SD-07 Certificates															
			Bill Of Lading	3.2	G													
			Bill Of Lading	3.2	G													
		01 32 01.00 10	SD-01 Preconstruction Submittals															
			Project Scheduler Qualifications	1.3	G													
			Preliminary Project Schedule	3.4.1	G													
			Initial Project Schedule	3.4.2	G													
			Periodic Schedule Update	3.6.2	G													
		01 32 16.00 20	SD-01 Preconstruction Submittals															
			Baseline Construction Schedule	1.2	G													
			Baseline Construction Schedule	1.2	G													
			Baseline Design Schedule	1.2	G													
			Monthly Updates	1.6	G													
		01 33 00	SD-01 Preconstruction Submittals															
			Submittal Register	1.8	G													

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		01 33 00	Submittal Register Monthly	1.8.1	G													
			Update															
		01 33 29	SD-01 Preconstruction Submittals															
			Sustainability Action Plan	1.4.1	G													
			SD-11 Closeout Submittals															
			High Performance and	1.5.2.2	G													
			Sustainable Building Checklist															
			Final Sustainability eNotebook	1.5.2.2	G													
			Amended Final Sustainability	1.5.2.2	G													
			eNotebook															
			Third Party Certification	3.2	G													
			Certificate, Assessment, or															
			Validation and Compliance Report															
			Amended Final High	1.5.2.2	G													
			Performance And Sustainable															
			Building Checklist															
		01 35 26	SD-01 Preconstruction Submittals															
			Standard Lift Plan	1.7.2.2	G													
			Accident Prevention Plan (APP)	1.7	G													
			Critical Lift Plan	1.7.2.3	G													
			SD-06 Test Reports															
			Monthly Exposure Reports	1.4														
			Notifications and Reports	1.12														
			Accident Reports	1.12.2	G													
			LHE Inspection Reports	1.12.3														
			SD-07 Certificates															

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		01 35 26	Crane Operators/Riggers	1.6.1.4	G														
			Naval Architecture Analysis	1.7.2.3	G														
			Activity Hazard Analysis (AHA)	1.8	G														
			Confined Space Entry Permit	1.9.1															
			Hot Work Permit	1.9.1															
			Certificate of Compliance	1.12.4															
		01 45 00.00 10	SD-01 Preconstruction Submittals																
			Contractor Quality Control (CQC)	3.2	G														
			Plan																
			Design Quality Control (DQC)	3.2.2															
			Plan																
			SD-05 Design Data																
			Discipline-Specific Checklists	3.2.2															
			Design Quality Control	3.9.1															
			SD-06 Test Reports																
			Verification Statement	3.9.2															
		01 45 35	SD-01 Preconstruction Submittals																
			SIOR Letter of Acceptance	3.1.1	G														
			Project Manual	3.1.1	G														
			Written Practices	3.1.1															
			NDT Procedures and Equipment	3.1.1															
			Calibration Records																
			SD-06 Test Reports																
			Daily Reports	3.1.1															
			Biweekly Reports	3.1.1															
			SD-07 Certificates																

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		01 45 35	Fabrication Plant	2.1														
			Certificate of Compliance	2.1														
			Special Inspector of Record	1.5.20	G													
			Special Inspector	1.5	G													
			Qualification Records	3.1.1														
			SD-11 Closeout Submittals															
			Interim Final Report	3.1.1														
			Comprehensive Final Report	3.1.3	G													
		01 50 00	SD-01 Preconstruction Submittals															
			Construction Site Plan	1.3	G													
			Traffic Control Plan	3.4.1	G													
			Temporary Utility Connections	3.3.2	G													
			Plan															
		01 57 19	SD-01 Preconstruction Submittals															
			Environmental Protection Plan	1.9	G													
			Environmental Manager	1.8.3	G													
			Qualifications															
			Qualifications	1.8.3														
			Training Program	1.6.2.2														
			Written Assessment Of Friable	3.11														
			Asbestos Disturbance															
			SD-06 Test Reports															
			Solid Waste Management Report	3.8.2.2	G													
			Nonhazardous Solid Waste	3.7.3														
			Diversion Report															
			Disposal Requirements	3.5.7.2.1	G													

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		01 57 19	SD-07 Certificates															
			ECATTS Certificate Of	1.6.1.2	G													
			Completion															
			Certificate of Competency	1.8.4.1														
			Asbestos Certification	1.7.1														
			Lead Certification	1.7.2														
			SD-11 Closeout Submittals															
			Disposal Documentation for	3.8.3.8	G													
			Hazardous and Regulated Waste															
			Assembled Employee Training	1.8.4	G													
			Records															
			Solid Waste Management Report	3.8.2.2	G													
			Hazardous Waste/Debris	3.8.3.1	G													
			Management															
			Environmental Records Binder	1.11														
		01 57 19.01	SD-01 Preconstruction Submittals															
			Preconstruction Survey	1.8.1														
			Regulatory Notifications	1.8.2														
			Environmental Protection Plan	1.9	G													
			Environmental Protection Plan	3.8.2.1	G													
			Environmental Manager	1.8.4	G													
			Qualifications															
			Temporary Fuel Storage Tank	3.15.3	G													
			Approval Request															
			Underground Fuel Storage Tank	3.15.5	G													
			Approval Request															

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		01 57 19.01	Licenses/Permits/Notifications	1.8.3	G													
			General Use Permitted	1.10														
			Equipment															
			Fuel Storage Tank	1.9.13.2	G													
			Installation/Removal Report															
			Written Assessment Of Friable	3.11														
			Asbestos Disturbance															
			SD-06 Test Reports															
			Laboratory Analysis	3.8.1.1.2														
			Nonhazardous Solid Waste	3.7.2														
			Diversion Report															
			SD-07 Certificates															
			EMS Certificate of Completion	1.6.1.1	G													
			Asbestos Certification	1.7.1														
			Lead Certification	1.7.2														
			SD-11 Closeout Submittals															
			Environmental Records Binder	1.8.5														
			Environmental Records Binder	1.8.5														
			Environmental Records Binder	1.11														
			Environmental Records Binder	3.2.2														
			Environmental Records Binder	3.8.1														
			Environmental Records Binder	3.8.3.5														
		01 74 19	SD-01 Preconstruction Submittals															
			Waste Management Plan	1.6	G													
			SD-11 Closeout Submittals															
			Records	1.7														

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		01 78 00	SD-03 Product Data														
			Warranty Management Plan	1.7.1	G												
			Warranty Tags	1.7.5													
			Final Cleaning	3.8													
			Spare Parts Data	1.5													
			SD-08 Manufacturer's Instructions														
			Instructions	1.7.1													
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	3.7	G												
			Manuals														
			SD-11 Closeout Submittals														
			As-Built Drawings	3.1	G												
			Record Drawings	3.3	G												
			As-Built Record of Equipment	1.7.1	G												
			and Materials														
			As-Built Record of Equipment	3.6	G												
			and Materials														
			Final Approved Shop Drawings	3.4	G												
			Construction Contract	3.5	G												
			Specifications														
			Interim DD FORM 1354	3.9	G												
			Checklist for DD FORM 1354	3.9	G												
		01 78 23	SD-10 Operation and Maintenance														
			Data														
			O&M Database	1.4	G												

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		01 78 23	Training Plan	3.1.1	G													
			Training Outline	3.1.3	G													
			Training Content	3.1.2	G													
			SD-11 Closeout Submittals															
			Training Video Recording	3.1.4	G													
			Validation of Training Completion	3.1.6	G													
		01 91 00.15 10	SD-01 Preconstruction Submittals															
			Commissioning Firm	1.7	G													
			Lead Commissioning Specialist	1.7.1														
			Technical Commissioning	1.7.2														
			Specialists															
			Commissioning Firm's Contract	1.7														
			SD-06 Test Reports															
			Design Review Report	3.1.3	G													
			Interim Construction Phase	3.1.2.1	G													
			Commissioning Plan															
			Final Construction Phase	3.1.2.2	G													
			Commissioning Plan															
			Building Envelope Inspection	3.1.5.2	G													
			Checklists															
			Pre-Functional Checklists	3.1.5.3	G													
			Issues Log	1.9														
			Commissioning Report	3.2	G													
			Post-Construction Trend Log	3.3.1	G													
			Report															
			SD-07 Certificates															

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		01 91 00.15 10	Certificate of Readiness	1.10	G													
			SD-10 Operation and Maintenance Data															
			Training Plan	3.1.6	G													
			Training Attendance Rosters	3.1.6														
			Systems Manual	3.1.7	G													
			Maintenance and Service Life Plans	3.1.8														
			SD-11 Closeout Submittals															
			Construction Phase Commissioning Plan	3.1.2.1	G													
			Final Commissioning Report	3.2	G													
		02 61 13	SD-01 Preconstruction Submittals															
			Work Plan	1.2	G													
			Sampling And Analysis Plan	3.7	G													
			SD-02 Shop Drawings															
			Surveys	3.1														
			SD-06 Test Reports															
			Compaction	3.9.2														
			Analytical Results	3.7	G													
			Closure Report	3.11	G													
		02 65 00	SD-01 Preconstruction Submittals															
			Work Plan	1.4.4	G													
			Site Safety and Health Plan	1.4.4.1	G													
			Excavation and Material Handling Plan	1.4.4.2	G													

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		02 65 00	Field Sampling and Laboratory	1.4.4.3	G														
			Testing Plan																
			Tank and Piping Removal And	1.4.4.4	G														
			Disposal Plan																
			Spill and Discharge Control Plan	1.4.4.5	G														
			Qualifications	1.4.1	G														
			Laboratory Services	1.4.2	G														
			State Licensed Waste	3.12.3															
			Transporter																
			SD-06 Test Reports																
			Laboratory and Field Testing	3.15															
			Reports																
			Tank Contents Verification	3.2															
			Contaminated Water Disposal	3.5.2															
			Soil Examination, Testing, and	3.10															
			Analysis																
			Backfilling	3.11	G														
			SD-11 Closeout Submittals																
			Salvage Rights	3.12.4	G														
			Tank Closure Report	3.15															
		02 81 00	SD-01 Preconstruction Submittals																
			Waste Management And	3.1	G														
			Disposal Plan																
			SD-06 Test Reports																
			Spill Response	3.4															
			SD-07 Certificates																

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		02 81 00	Shipping Documents and	3.2.2	G														
			Packagings Certification																
			Certificates Of Disposal/	3.3	G														
			Destruction																
			SD-11 Closeout Submittals																
			AFFF Disposal Accountability	3.3.5	G														
			Report																
		02 82 00	SD-03 Product Data																
			Amended Water	1.2.2	G														
			Safety Data Sheets (SDS) for All	1.3.9	G														
			Materials																
			Encapsulants	2.1	G														
			Respirators	3.1.2.1	G														
			Local Exhaust Equipment	3.1.7	G														
			Pressure Differential Automatic	3.1.7	G														
			Recording Instrument																
			Vacuums	3.1.8	G														
			Glovebags	3.1.10	G														
			SD-06 Test Reports																
			Air Sampling Results	1.5.6	G														
			Pressure Differential Recordings	1.5.7	G														
			for Local Exhaust System																
			Encapsulation Test Patches	3.2.12.2	G														
			Clearance Sampling	3.2.14.5	G														
			Asbestos Disposal Quantity	3.3.3.2	G														
			Report																

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		02 82 00	SD-07 Certificates															
			Employee Training	1.3.4	G													
			Notifications	1.3.5	G													
			Respiratory Protection Program	1.3.7	G													
			Asbestos Hazard Abatement Plan	1.3.10	G													
			Testing Laboratory	1.3.11	G													
			Landfill Approval	1.3.12	G													
			Delivery Tickets	1.3.12	G													
			Waste Shipment Records	1.3.12	G													
			Transporter Certification	1.3.13	G													
			Medical Certification	1.3.14	G													
			Private Qualified Person	1.5.2	G													
			Documentation															
			Competent Person	1.5.3	G													
			Worker's License	1.5.4	G													
			Contractor's License	1.5.5	G													
			Encapsulants	2.1	G													
			Equipment Used to Contain	3.1	G													
			Airborne Asbestos Fibers															
			Water Filtration Equipment	3.1.3.3	G													
			Vacuums	3.1.8	G													
			Ventilation Systems	3.1.8	G													
			SD-11 Closeout Submittals															
			Permits[and Licenses]	1.3.5	G													
			Notifications	1.3.5	G													
			Respirator Program Records	1.3.7.1	G													

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		02 82 00	Protective Clothing	1.5.9	G														
			Decontamination Facility																
			Notification																
			Rental Equipment	1.7.1	G														
			Records	1.3.12.1															
		02 83 00	SD-01 Preconstruction Submittals																
			Occupational and Environmental	1.5.2.3	G														
			Assessment Data Report																
			Medical Examinations	1.5.2.4	G														
			Lead, Cadmium, Chromium	1.5.2.8	G														
			Waste Management Plan																
			Licenses, Permits and	1.5.4	G														
			Notifications																
			Occupant Protection Plan	1.5.5	G														
			Initial Sample Results	3.4.1.1	G														
			Written Evidence of TSD	3.5.2.1	G														
			Approval																
			Lead, Cadmium, Chromium	1.5.2.2	G														
			Compliance Plan																
			Lead, Cadmium, Chromium	3.1.1.6	G														
			Compliance Plan																
			SD-03 Product Data																
			Respirators	1.6.1	G														
			Vacuum Filters	1.6.4	G														
			Negative Air Pressure System	1.6.7	G														
			Materials and Equipment	2.1	G														

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		02 83 00	Expendable Supplies	2.1.1	G												
			Local Exhaust Equipment	3.1.1.5	G												
			Pressure Differential Automatic	3.1.1.5	G												
			Recording Instrument														
			Pressure Differential Log	3.1.1.6	G												
			SD-06 Test Reports														
			Occupational and Environmental	1.5.2.3	G												
			Assessment Data Report														
			Sampling Results	1.5.2.3	G												
			Pressure Differential Recordings	1.5.3	G												
			For Local Exhaust System														
			SD-07 Certificates														
			Occupant Notification	3.1.1.1	G												
			Notification of the	3.1.1.1	G												
			Commencement of [LBP] Hazard														
			Abatement														
			Clearance Certification	3.5.1.1	G												
			SD-11 Closeout Submittals														
			Hazardous Waste Manifest	3.5.2.1	G												
			Turn-In Documents or Weight	3.5.2.1	G												
			Tickets														
		02 84 16	SD-01 Preconstruction Submittals														
			Notification	1.4.7													
			PCB and Lamp Management and	1.4.1.1	G												
			Disposal Plan														
			SD-11 Closeout Submittals														

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		02 84 16	Transporter certification	3.5.5	G													
			Certification of Decontamination	3.2.4														
			Copy E of the Japan Hazardous	3.5.3														
			Waste Manifest															
			Disposal Request Form	3.5.6.2														
			Signed Ballast Turn-in (at Bldg	3.3.1														
			3625) Sheet															
		02 84 33	SD-01 Preconstruction Submittals															
			PCB and Lamp Removal and	1.4.6	G													
			Disposal Work Plan															
			PCB and Lamp Disposal Plan	1.4.7	G													
			PCB And Lamp Management	1.4.1	G													
			And Disposal Plan															
			SD-07 Certificates															
			Qualifications of IH/PQP	1.4.5	G													
			Qualifications of IH/PQP	1.4.5	G													
			Training certification	1.4.8														
			Japan Specially Controlled	3.9														
			Hazardous Waste Disposal Permit															
			Japan Industrial Waste Collection	3.10														
			And Transport Permit															
			Copy E of the Japanese	3.11														
			Hazardous Waste Manifest															
			Notification	1.4.9														
			Certification of Decontamination	3.4.4														
			Post cleanup sampling	3.4.5														

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		03 30 00	SD-01 Preconstruction Submittals																
			Concrete Curing Plan	1.6.3.1															
			Quality Control Plan	1.6.6	G														
			Laboratory Accreditation	1.6.9	G														
			SD-02 Shop Drawings																
			Formwork	2.1															
			Reinforcing Steel	1.6.2.1	G														
			SD-03 Product Data																
			Formwork Materials	2.1															
			Reinforcement	2.6															
			Liquid Chemical Floor Hardeners	2.4.3.1															
			and Sealers																
			Mechanical Reinforcing Bar	2.6.2															
			Connectors																
			Pumping Concrete	1.6.3.2															
			Finishing Plan	1.6.3.3															
			SD-04 Samples																
			Slab Finish Sample	1.6.5.1															
			Surface Finish Samples	1.6.5.2															
			SD-05 Design Data																
			Concrete Mix Design	1.6.1.1	G														
			SD-06 Test Reports																
			Concrete Mix Design	1.6.1.1	G														
			Fly Ash	1.6.4.1															
			Pozzolan	1.6.4.1															
			Slag Cement	1.6.4.2															

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		03 30 00	Aggregates	1.6.4.3													
			Tolerance Report	3.10.2.1													
			Compressive Strength Tests	3.14.2.3	G												
			Unit Weight of Structural	3.14.2.5													
			Concrete														
			Chloride Ion Concentration	3.14.2.6													
			Air Content	3.14.2.4													
			Slump Tests	3.14.2.1													
			Water	2.3.2													
			SD-07 Certificates														
			Reinforcing Bars	2.6.1													
			Welder Qualifications	1.8													
			VOC Content for Form Release	1.6.3.4													
			Agents, Curing Compounds, and														
			Concrete Penetrating Sealers														
			Safety Data Sheets	1.6.3.5													
			Field Testing Technician and	1.6.7.2													
			Testing Agency														
			SD-08 Manufacturer's Instructions														
			Liquid Chemical Floor Hardeners	2.4.3.1													
			and Sealers														
			Joint Sealants	2.4.5													
			Curing Compound	2.4.1													
		05 05 23.13 10	SD-01 Preconstruction Submittals														
			Personnel Qualification	1.4.1	G												
			Procedure description	2.1.1	G												

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		05 05 23.13 10	SD-03 Product Data																
			Equipment and accessories	2.1.1															
			SD-06 Test Reports																
			Equipment Qualifications	1.4.5															
			Inspection Test Reports	3.4.1															
		05 05 23.16	SD-01 Preconstruction Submittals																
			Welding Quality Assurance Plan	3.2	G														
			SD-03 Product Data																
			Welding Procedure Qualifications	1.3	G														
			Welder, Welding Operator, and	1.3.4															
			Tacker Qualification																
			Previous Qualifications	1.3.2															
			Pre-Qualified Procedures	1.3.3	G														
			Welding Electrodes and Rods	2.2															
			SD-06 Test Reports																
			Nondestructive Testing	3.3															
			Weld Inspection Log	3.2															
			SD-07 Certificates																
			Certified Welding Inspector	1.3.5															
			Nondestructive Testing Personnel	1.3.5															
		05 12 00	SD-01 Preconstruction Submittals																
			Erection and Erection Bracing	1.5.1.1	G														
			Drawings																
			SD-02 Shop Drawings																
			Fabrication Drawings	1.5.2	G														
			SD-03 Product Data																

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		05 12 00	Shop Primer	2.6.2														
			Welding Electrodes and Rods	2.4.1														
			Direct Tension Indicator Washers	2.3.2.3														
			Non-Shrink Grout	2.4.2														
			Tension Control Bolts	2.3.3														
			SD-05 Design Data															
			Shoring and Temporary Bracing	1.5.2	G													
			SD-06 Test Reports															
			Class B Coating	2.6.2														
			Weld Inspection Reports	3.7.1.2														
			Direct Tension Indicator Washer	3.7.2.1														
			Inspection Reports															
			Bolt Testing Reports	3.7.3.1														
			Embrittlement Test Reports	3.7.4														
			SD-07 Certificates															
			MLIT Structural Steel Fabricator	1.3														
			Quality Certification															
			MLIT Structural Steel Erector	1.3														
			Quality Certification															
			Welding Procedure Specifications	3.4														
			(WPS)															
			Overhead, Top Running Crane	1.5.3.2														
			Rail Beam															
		05 30 00	SD-02 Shop Drawings															
			Fabrication Drawings	1.3.4	G													
			SD-04 Samples															

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		05 30 00	Metal Roof Deck Units	2.1.1														
			Cellular Metal Floor Deck Units	2.1.3														
			Acoustical Material	2.2.16														
			SD-05 Design Data															
			Deck Units	2.1	G													
			SD-07 Certificates															
			Welder Qualifications	1.3.2														
			Welding Procedures	1.3.2														
			Fire Safety	1.3.3.1														
			Wind Storm Resistance	1.3.3.2														
			Manufacturer's Certificate	1.3.1														
			Stud Manufacture's Certification	2.2.11														
			Stud Manufacture's Test Reports	2.2.11														
		05 50 13	SD-02 Shop Drawings															
			Structural Steel Door Frames	2.13	G													
			Cover Plates and Frames	2.4	G													
			Expansion Joint Covers	2.5	G													
			Floor Gratings	2.6														
			Roof Walkways	2.6														
			Bollards/Pipe Guards	2.7	G													
			Wheel Guards	2.14	G													
			Window[and Door] Guards	2.16														
			Angles and Plates	2.9	G													
			Roof Hatches	2.15	G													
			SD-03 Product Data															
			Corner Guards	2.3														

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		05 50 13	Cover Plates and Frames	2.4													
			Expansion Joint Covers	2.5													
			Floor Gratings	2.6													
			Roof Walkways	2.6													
			Structural Steel Door Frames	2.13													
			Wheel Guards	2.14													
			Window[and Door] Guards	2.16													
			Roof Hatches	2.15													
			SD-04 Samples														
			Expansion Joint Covers	2.5													
			SD-07 Certificates														
			Certified Mill	2.1	G												
		05 51 00	SD-02 Shop Drawings														
			Iron and Steel Hardware	2.1	G												
			Steel Shapes, Plates, Bars, and Strips	2.1	G												
			Metal Stair System	2.2.1	G												
			SD-03 Product Data														
			Structural Steel Plates, Shapes, and Bars	2.4.1	G												
			Structural Steel Tubing	2.4.2	G												
			Hot-Rolled Carbon Steel Sheets and Strips	2.4.5	G												
			Cold-Finished Steel Bars	2.4.4	G												
			Hot-Rolled Carbon Steel Bars	2.4.3	G												
			Cold-Rolled Carbon Steel Sheets	2.4.6	G												

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		05 51 00	Galvanized Carbon Steel Sheets	2.4.7	G													
			Cold-Drawn Steel Tubing	2.4.8	G													
			Gray Iron Castings	2.4.9	G													
			Malleable Iron Castings	2.4.10	G													
			Concrete Inserts	2.3.4	G													
			Masonry Anchorage Devices	2.3.5	G													
			Protective Coating	2.2.4	G													
			Steel Pan Stairs	2.2.2	G													
			Steel Stairs	2.3.1	G													
			Steel Stairs, Circular	2.3.2	G													
			SD-07 Certificates															
			Welding Procedures	1.3.1	G													
			Welder Qualification	1.3.1	G													
			SD-08 Manufacturer's Instructions															
			Structural Steel Plates, Shapes, and Bars	2.4.1	G													
			Structural Steel Tubing	2.4.2	G													
			Hot-Rolled Carbon Steel Sheets and Strips	2.4.5	G													
			Cold-Finished Steel Bars	2.4.4	G													
			Hot-Rolled Carbon Steel Bars	2.4.3	G													
			Cold-Rolled Carbon Steel Sheets	2.4.6	G													
			Galvanized Carbon Steel Sheets	2.4.7	G													
			Cold-Drawn Steel Tubing	2.4.8	G													
			Gray Iron Castings	2.4.9	G													
			Malleable Iron Castings	2.4.10	G													

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		05 51 00	Protective Coating	2.2.4	G														
			Masonry Anchorage Devices	2.3.5	G														
		05 51 33	SD-02 Shop Drawings																
			Ladders	2.3															
			Ship's Ladder	2.3.3															
			SD-03 Product Data																
			Ladders	2.3															
			Ship's Ladder	2.3.3															
			Ladder Safety Devices	2.3.2															
			SD-07 Certificates																
			Fabricator Certification for Ladder	1.3															
			Assembly																
			Fabricator Certification for Ships	1.3															
			Ladder Assembly																
		05 52 00	SD-02 Shop Drawings																
			Fabrication Drawings	1.2.1	G														
			Iron and Steel Hardware	3.2															
			Steel Shapes, Plates, Bars and	3.2															
			Strips																
			SD-07 Certificates																
			Welding Procedures	1.4.1	G														
			Welder Qualification	1.4.2	G														
			SD-08 Manufacturer's Instructions																
			Installation Instructions	3.2															
		06 10 00	SD-02 Shop Drawings																
			Structural Glued Laminated	2.2.3	G														

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		06 10 00	Trussed Rafters	2.5.7	G													
			Trussed Joists	2.5.8	G													
			Fabricated Structural Members	1.9.1	G													
			Modifications of Structural	1.9.2	G													
			Members															
			Nailing Strips	2.2.2	G													
			SD-03 Product Data															
			Salvaged Lumber	2.1.2														
			Recovered Lumber	2.1.3														
			Underlayment	2.4														
			Plastic Lumber	2.1.5														
			Fiberboard Wall Sheathing	2.5.2														
			Cellulose Honeycomb Panels	2.5.5														
			Fire-retardant Treatment	1.8														
			Structural-use and OSB Panels	1.4.4														
			Structural-use and OSB Panels	2.3.3.2														
			Oriented Strand Board	2.3														
			Adhesives	2.5.11														
			Biobased Content for Strawboard	2.4.6	S													
			Panels															
			Biobased Content for Cork	2.4.7	S													
			Underlayment															
			Recycled Content for Plastic	2.1.5	S													
			Lumber															
			Recycled Content for Fiberboard	2.4.5	S													
			Underlayment															

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		06 10 00	Recycled Content for Cork	2.4.7	S														
			Underlayment																
			Recycled Content for Fiberboard	2.5.2	S														
			Wall Sheathing																
			Recycled Content for Cellulose	2.5.5	S														
			Honeycomb Panels																
			SD-05 Design Data																
			Modifications of Structural	1.9.2	G														
			Members																
			SD-06 Test Reports																
			Preservative-treated	1.4.5															
			SD-07 Certificates																
			Certificates of Grade	1.11.1															
			Certified Sustainably Harvested	2.1.1	S														
			Virgin Lumber																
			Certified Sustainably Harvested	2.1.4	S														
			Natural-decay and Insect-resistant																
			Wood																
			Certified Sustainably Harvested	2.2.2	S														
			Framing Lumber																
			Certified Sustainably Harvested	2.2.3	S														
			Structural Glued Laminated Timber																
			Certified Sustainably Harvested	2.3.1.1	S														
			Plywood Subflooring																

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		06 10 00	Certified Sustainably Harvested	2.3.1.2	S													
			Structural-use and OSB Panel															
			Subfloor Sheathing															
			Certified Sustainably Harvested	2.3.2.1	S													
			Plywood Combination Subfloor															
			Underlayment															
			Certified Sustainably Harvested	2.3.3.1	S													
			Plywood Wall Sheathing															
			Certified Sustainably Harvested	2.3.3.2	S													
			Structural-use and OSB Panel															
			Wall Sheathing															
			Certified Sustainably Harvested	2.3.4.1	S													
			Plywood Roof Sheathing															
			Certified Sustainably Harvested	2.3.5.1	S													
			Plywood Diaphragm															
			Certified Sustainably Harvested	2.3.5.2	S													
			Structural-use and OSB Panel															
			Diaphragm															
			Certified Sustainably Harvested	2.3.6.1	S													
			Plywood Shear Wall															
			Certified Sustainably Harvested	2.3.6.2	S													
			Structural-use and OSB Panel															
			Shear Wall															
			Certified Sustainably Harvested	2.3.7.1	S													
			Plywood for Other Uses															

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		06 10 00	Certified Sustainably Harvested	2.3.7.2	S													
			Structural-use and OSB Panels for															
			Other Uses															
			Certified Sustainably Harvested	2.4.3	S													
			Plywood Underlayment															
			Preservative Treatment	1.7														
			Indoor Air Quality for	2.4.2	S													
			Particleboard Underlayment															
			Indoor Air Quality for Fiberboard	2.4.5	S													
			Underlayment															
			Indoor Air Quality for Strawboard	2.4.6	S													
			Panels															
			Indoor Air Quality for Fiberboard	2.5.2	S													
			Wall Sheathing															
			Indoor Air Quality for Aerosol	2.5.11	S													
			Adhesives															
			Indoor Air Quality for Non-aerosol	2.5.11	S													
			Adhesives															
			SD-10 Operation and Maintenance															
			Data															
			Plastic	1.4.8														
			Take-back Program	3.6														
		06 41 16.00 10	SD-02 Shop Drawings															
			Shop Drawings	2.11														
			Installation	3.1														
			SD-03 Product Data															

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		06 41 16.00 10	Finish Schedule	2.11.9.3														
			SD-04 Samples															
			Plastic Laminates	2.3														
			Cabinet Hardware	2.6														
		07 05 23	SD-01 Preconstruction Submittals															
			Work Plan	1.4	G													
			SD-03 Product Data															
			Thermal Imaging Camera	2.2	G													
			SD-05 Design Data															
			Envelope Surface Area	3.2	G													
			Calculations															
			SD-07 Certificates															
			Pressure Test Agency	1.6.2.1														
			Thermographer Qualifications	1.6.2.2														
			Test Instruments	1.6.3														
			Date Of Last Calibration	1.6.3														
			SD-06 Test Reports															
			Pressure Test Procedures	3.5	G													
			Air Leakage Test Report	1.6.4	G													
			Air Leakage Test Report	3.5.8	G													
			Diagnostic Test Report	1.6.4	G													
			Diagnostic Test Report	3.6.5	G													
		07 14 00	SD-03 Product Data															
			Fluid-Applied Membrane	2.1														
			Membrane Primer	2.2														
			Bond Breaker	2.7														

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		07 14 00	SD-11 Closeout Submittals															
			Warranty	1.6														
			Information Card	3.6														
			Instructions To Government	3.5														
			Personnel															
		07 21 16	SD-03 Product Data															
			Blanket Insulation	2.1														
			Recycled Content for Insulation	2.1.2	S													
			Materials															
			Sill Sealer Insulation	2.2														
			Vapor Retarder	2.4														
			Pressure Sensitive Tape	2.5														
			Accessories	2.6														
			SD-07 Certificates															
			Indoor Air Quality for Insulation	2.1.4	S													
			Materials															
			Indoor Air Quality for Adhesives	2.6.1	S													
			SD-08 Manufacturer's Instructions															
			Insulation	3.3.1														
		07 27 10.00 10	SD-02 Shop Drawings															
			Air Barrier System Shop	2.1	G													
			Drawings															
			SD-03 Product Data															
			Air Barrier System Product Data	2.1	G													
			SD-04 Samples															
			Mock-Up	3.1.2	G													

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		07 27 10.00 10	Material Samples For Air Barrier	2.1	G												
			System														
			SD-05 Design Data														
			Design Data And Calculations	1.8	G												
			For The Air Barrier System														
			SD-06 Test Reports														
			Design Review Report	1.8	G												
			Testing and Inspection	3.1.3	G												
			SD-07 Certificates														
			Air Barrier Inspector	1.7	G RO												
		07 27 36	SD-01 Preconstruction Submittals														
			Qualification of Manufacturer	1.10.1	G												
			Qualification of Installer	1.10.2	G												
			Quality Control Plan	1.11	G												
			Safety Plan	1.11	G												
			Fire Prevention Plan	1.9.1	G												
			Respirator Plan	1.9.2	G												
			SD-02 Shop Drawings														
			Spray Foam Air Barrier	1.5													
			Foam Air Barrier System	1.11	G												
			Fire-Rated Assemblies	1.5.1	G												
			SD-03 Product Data														
			Closed Cell	2.1.2													
			Open Cell	2.1.2	G												
			Transition Membrane	2.2	G												
			Primers, Adhesives, and Mastics	2.3	G												

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		07 27 36	Sealants	2.5	G													
			Safety Data Sheets	1.5.2	G													
			Thermal Barrier Materials	2.1.1	G													
			Ignition Barrier Coatings	2.1.1	G													
			Accessories	2.1.6	G													
			Recycled Content for Closed Cell Spray Foam Air Barrier	2.1.2	S													
			Recycled Content for Open Cell Spray Foam Air Barrier	2.1.2	S													
			SD-04 Samples															
			Spray Foam Air Barrier	1.5	G													
			SD-06 Test Reports															
			Field Peel Adhesion Test	1.5.4	G													
			Thermographic Test	3.4.5.1	G													
			Air Barrier Test	1.8	G													
			Primers	1.5.3	G													
			Fire-Ratings Of [Thermal][Ignition] Barrier Materials	1.5.4	G													
			Flame Spread And Smoke Developed Index Ratings Of SPF Products	1.5.4	G													
			Flame Propagation Of Wall Assemblies	1.5.4	G													
			Site Inspections	3.4.1	G													
			SD-07 Certificates															

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		07 27 36	Closed cell	2.1.2															
			Open cell	2.1.2	G														
			Transition Membrane	2.2	G														
			Indoor Air Quality for Spray Foam	2.1.5	S														
			Air Barrier																
			SD-08 Manufacturer's Instructions																
			SPF Handling, Storage, and	1.6.1	G														
			Spray Procedures																
			Substrate Preparation	3.2.1	G														
			Thermal Barrier	1.5.1	G														
			Ignition Barrier	1.5.1	G														
			Transition Membrane	2.2	G														
			Primers, Adhesives, and Mastics	2.3	G														
			SD-09 Manufacturer's Field																
			Reports																
			Core Samples	1.11															
			Daily Work Record	3.3.3															
			Visual Inspection and Thermal	3.4.5															
			Scanning																
		07 52 00	SD-02 Shop Drawings																
			Roof plan	1.4.7	G														
			SD-07 Certificates																
			Fire Resistance	1.4.5	G														
			SD-11 Closeout Submittals																
			Warranty	1.9															
			Information Card	3.8															

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		07 52 00	Instructions To	3.7															
			[Government][Contractor]																
			Personnel																
		07 60 00	SD-02 Shop Drawings																
			Exposed Sheet Metal	2.2.1	G														
			Gutters	3.1.17	G														
			Downspouts	3.1.18	G														
			Expansion Joints	3.1.26	G														
			Gravel Stops and fascia	2.2.1	G														
			Splash Pans	3.1.22	G														
			Flashing for Roof Drains	3.1.19	G														
			Base Flashing	3.1.11	G														
			Counterflashing	3.1.12	G														
			Flashing at Roof Penetrations	3.1.27	G														
			and Equipment Supports																
			Scuppers	3.1.20	G														
			Copings	3.1.30	G														
			Drip Edges	3.1.16	G														
			Conductor Heads	3.1.21	G														
			Open Valley Flashing	3.1.23	G														
			Eave Flashing	3.1.24	G														
			SD-08 Manufacturer's Instructions																
			Instructions for Installation	1.4.3	G														
			Quality Control Plan	3.5	G														
			SD-10 Operation and Maintenance																
			Data																

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		07 60 00	Cleaning and Maintenance	1.4.3	G												
		08 11 13	SD-02 Shop Drawings														
			Doors	2.1	G												
			Doors	2.1	G												
			Frames	2.7	G												
			Frames	2.7	G												
		08 11 16	SD-02 Shop Drawings														
			Door and Frame Assembly	1.5.1	G												
			SD-04 Samples														
			Finish Samples	1.5.2	G												
			SD-05 Design Data														
			Calculations	1.2.1	G												
			SD-06 Test Reports														
			Air Infiltration	1.2.3	G												
			Water Penetration	1.2.4	G												
			SD-10 Operation and Maintenance														
			Data														
			Adjustments, Cleaning, and	1.5.3	G												
			Maintenance														
		08 14 00	SD-02 Shop Drawings														
			Doors	2.1	G												
			SD-04 Samples														
			Doors	2.1													
			Door Finish Colors	2.3.6.4													
			SD-11 Closeout Submittals														
			Warranty	1.5													

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		08 31 00	SD-02 Shop Drawings																
			Access Doors And Panels	1.3	G														
			SD-03 Product Data																
			Access Doors And Panels	1.3	G														
			Hardware	1.3.2	G														
			Accessories	2.2.8	G														
			Power Transfer Components	1.3.1	G														
			Recycled Content	2.1	S														
			SD-04 Samples																
			Finishes	2.5	G														
			SD-06 Test Reports																
			Fire-rating(s) of Assemblies	1.3.1	G														
			Acoustical Ratings of Assemblies	1.3.1	G														
		08 32 13	SD-02 Shop Drawings																
			Aluminum sliding glass doors	2.1															
			SD-10 Operation and Maintenance																
			Data																
			Aluminum sliding glass doors	2.1	G														
		08 51 13	SD-02 Shop Drawings																
			Windows	2.1	G														
			Fabrication Drawings	1.6															
			SD-06 Test Reports																
			Windborne-Debris-Impact	1.7.7															
			Performance																
			SD-10 Operation and Maintenance																
			Data																

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		08 51 13	Windows	2.1	G												
		08 51 23	SD-02 Shop Drawings														
			Windows	2.2													
			SD-03 Product Data														
			Steel Framing Materials	2.1.1													
			Recycled Content for Steel	2.1.1	S												
			Framing Materials														
			Mullions	2.5													
			Hardware	2.7.3													
			Hardware Materials	2.7.3.1													
			Fasteners	2.7.4													
			Accessories	2.7													
			Operators	2.10.1.1													
			Screens	2.11													
			SD-04 Samples														
			Color Coating	2.9.2	G												
			Windows	2.2													
			SD-05 Design Data														
			Structural Calculations for	1.3.5	G												
			Deflection														
			Design Analysis	1.3.5	G												
			SD-06 Test Reports														
			Air Infiltration	1.4.1													
			Water Infiltration	1.4.1													
			Mullion and Transom Bar Wind	1.4.2													
			Load														

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		08 51 23	Minimum Condensation	1.4.3															
			Resistance Factor																
			Resistance to Forced Entry	1.4.3															
			Standard Airblast Test	1.4.3	G														
			Windborne-Debris-Impact	1.5.3															
			Performance																
			SD-07 Certificates																
			Engineer's Qualifications	1.3.4															
			SD-10 Operation and Maintenance																
			Data																
			Windows	2.2	G														
		08 71 00	SD-02 Shop Drawings																
			Manufacturer's Detail Drawings	1.3	G														
			Verification of Existing Conditions	1.3	G														
			Hardware Schedule	1.5	G														
			Keying System	2.3.11	G														
			SD-08 Manufacturer’s Instructions																
			Installation	3.1															
			SD-10 Operation and Maintenance																
			Data																
			Hardware Schedule	1.5	G														
			SD-11 Closeout Submittals																
			Key Bitting	1.6.1															
		08 81 00	SD-03 Product Data																
			Insulating Glass	1.7.1															
			Sealants	2.5.3.1															

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		08 81 00	Joint Backer	2.5.4													
			SD-08 Manufacturer's Instructions														
			Setting and Sealing Materials	2.5													
			Glass Setting	3.2													
			SD-11 Closeout Submittals														
			Insulated Glass Units	1.7.1													
			Warranty for Polycarbonate	1.7.2													
			Sheet														
			Monolithic Reflective Glass	1.7.3													
			Monolithic Opacified Spandrel	1.7.4													
		08 91 00	SD-02 Shop Drawings														
			Wall Louvers	1.4													
			SD-03 Product Data														
			Metal Wall Louvers	2.2													
			Door Louvers	2.3													
			SD-04 Samples														
			Wall Louver Samples	1.5	G												
			Door Louver Samples	1.5	G												
		09 22 00	SD-02 Shop Drawings														
			Metal Support Systems	2.1	G												
			SD-03 Product Data														
			Metal Support Systems	2.1													
		09 29 00	SD-08 Manufacturer's Instructions														
			Safety Data Sheets	2.1													
			SD-10 Operation and Maintenance														
			Data														

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		09 29 00	Manufacturer Maintenance	2.1															
			Instructions																
		09 30 10	SD-02 Shop Drawings																
			Detail Drawings	3.2	G														
			SD-10 Operation and Maintenance																
			Data																
			Installation	3.2	G														
		09 51 00	SD-02 Shop Drawings																
			Approved Detail Drawings	2.1	G														
		09 65 00	SD-02 Shop Drawings																
			Resilient Flooring and	2.13	G														
			Accessories																
			SD-10 Operation and Maintenance																
			Data																
			Resilient Flooring and	2.13	G														
			Accessories																
		09 68 00	SD-02 Shop Drawings																
			Installation Drawings	3.4	G														
			SD-10 Operation and Maintenance																
			Data																
			Cleaning and Protection	3.5															
			Maintenance Service	3.7.2															
			SD-11 Closeout Submittals																
			Warranty	1.6															
		09 90 00	SD-02 Shop Drawings																
			Piping Identification	3.12															

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		09 90 00	SD-08 Manufacturer's Instructions																
			Application Instructions	3.4.1															
			Mixing	3.8.2															
			SD-10 Operation and Maintenance																
			Data																
			Coatings	1.3.1.1															
		10 14 00.10	SD-02 Shop Drawings																
			Approved Detail Drawings	3.1	G														
			SD-10 Operation and Maintenance																
			Data																
			Protection and Cleaning	3.1.2	G														
		10 14 00.20	SD-02 Shop Drawings																
			Detail Drawings	1.4.2	G														
			SD-10 Operation and Maintenance																
			Data																
			Approved Manufacturer's	3.2	G														
			Instructions																
			Protection and Cleaning	3.2.2	G														
		10 21 13	SD-02 Shop Drawings																
			Fabrication Drawings	2.1															
			Installation Drawings	3.3	G														
			SD-07 Certificates																
			Warranty	1.5															
			SD-10 Operation and Maintenance																
			Data																
			Plastic Identification	2.1.1	G														

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		10 26 00	SD-02 Shop Drawings															
			Corner Guards	2.2	G													
			Wall Guards (Bumper Guards)	2.3	G													
			Door Protectors	2.4	G													
			Wall Covering/Panels	2.5	G													
			SD-03 Product Data															
			Corner Guards	2.2	G													
			Wall Guards (Bumper Guards)	2.3	G													
			Door Protectors	2.4	G													
			Wall Covering/Panels	2.5	G													
			Recycled content for aluminum	2.2.1	S													
			component of corner guards															
			Recycled content for steel	2.2.2	S													
			component of corner guards															
			Recycled content for aluminum	2.3.1	S													
			component of wall guards,															
			Combination Handrail/Wall guard															
			and handrails															
			Recycled content for aluminum	2.3.2	S													
			component of wall guards/bed															
			locators															
			Recycled content for aluminum	2.3.3	S													
			component of combination															
			handrail/wall guards															
			Recycled content for aluminum	2.3.4	S													
			component of handrails															

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		10 26 00	SD-04 Samples																
			Finish	2.7	G														
			SD-06 Test Reports																
			Corner Guards	2.2															
			Wall Guards (Bumper Guards)	2.3															
			Door Protectors	2.4															
			Wall Covering/Panels	2.5															
			SD-07 Certificates																
			Corner Guards	2.2															
			Wall Guards (Bumper Guards)	2.3															
			Door Protectors	2.4															
			Indoor air quality for wall	2.5	S														
			covering/panels																
			Indoor air quality for adhesives	2.8	S														
		10 28 13	SD-04 Samples																
			Finishes	2.1.2	G														
			Accessory Items	2.2															
			SD-10 Operation and Maintenance																
			Data																
			Electric Hand Dryer	2.2.27	G														
		12 21 00	SD-02 Shop Drawings																
			Installation	3.3															
			SD-10 Operation and Maintenance																
			Data																
			Window Blinds	2.1	G														
		21 13 13	SD-01 Preconstruction Submittals																

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		21 13 13	Qualified Fire Protection Engineer	1.2.3	G												
			(QFPE)														
			Sprinkler System Designer	1.4.2.1	G												
			Sprinkler System Installer	1.4.2.2	G												
			SD-02 Shop Drawings														
			Shop Drawing	1.2.1.1	G												
			SD-03 Product Data														
			Pipe	2.2.1	G												
			Fittings	2.3.1.2	G												
			Valves	2.3.4	G												
			Alarm Valves	2.3.5	G												
			Relief Valves	2.8.5	G												
			Sprinklers	2.7	G												
			Pipe Hangers and Supports	2.3.3	G												
			Sprinkler Alarm Switch	2.4.1	G												
			Valve Supervisory (Tamper)	2.4.2	G												
			Switch														
			Fire Department Connection	2.6	G												
			Backflow Prevention Assembly	2.5	G												
			Air Vent	2.8.6	G												
			Hose Valve	2.5.1	G												
			Seismic Bracing	2.3.3	G												
			Nameplates	2.1.2	G												
			SD-05 Design Data														
			Seismic Bracing	2.3.3	G												
			Hydraulic Calculations	1.2.1.2	G												

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		21 13 13	SD-06 Test Reports															
			Test Procedures	3.7.1	G													
			SD-07 Certificates															
			Verification of Compliant Installation	3.7.2.1	G													
			Request for Government Final Test	3.7.2.2	G													
			SD-10 Operation and Maintenance Data															
			Operating and Maintenance (O&M) Instructions	3.9	G													
			Spare Parts	1.6	G													
			SD-11 Closeout Submittals															
			As-built drawings	3.9														
		21 30 00	SD-01 Preconstruction Submittals															
			Fire Pump Installation Related Submittals	1.3														
			Fire Protection Specialist	1.7.2	G													
			SD-02 Shop Drawings															
			Installation Drawings	3.3.1	G													
			As-Built Drawings	3.11.2	G													
			Piping Layout	3.3.2	G													
			Pump Room	3.3.2	G													
			SD-03 Product Data															
			Catalog Data	2.1	G													
			Spare Parts	1.6														

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		21 30 00	Preliminary Tests	3.8.2													
			Field Tests	3.8	G												
			Manufacturer's Representative	1.7.7	G												
			Field Training	3.11.1	G												
			Final Acceptance Test	3.8.3													
			SD-06 Test Reports														
			Preliminary Tests	3.8.2													
			SD-07 Certificates														
			Fire Protection Specialist	1.7.2													
			Qualifications of Welders	1.7.3													
			Qualifications of Installer	1.7.4													
			Preliminary Test Certification	1.7.5													
			Final Test Certification	1.7.6													
			SD-10 Operation and Maintenance														
			Data														
			Operating and Maintenance	3.11.1	G												
			Instructions														
			Flow Meter	2.17													
		22 00 00	SD-02 Shop Drawings														
			Plumbing System	3.9.1	G												
			SD-03 Product Data														
			Water Heaters	2.10													
			Pumps	2.12													
			Backflow Prevention Assemblies	3.9.1.1													
			Swimming Pool [and Spa]Suction	2.6.9	G												
			Fittings														

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		22 00 00	SD-06 Test Reports																
			Tests, Flushing and Disinfection	3.9															
			Test of Backflow Prevention	3.9.1.1	G														
			Assemblies																
			SD-10 Operation and Maintenance																
			Data																
			Plumbing System	3.9.1															
		23 05 15	SD-01 Preconstruction Submittals																
			Material, Equipment, and Fixture	1.2	G														
			Lists																
			SD-02 Shop Drawings																
			Record Drawings	1.2	G														
			Coordination Drawings	1.2	G														
			SD-10 Operation and Maintenance																
			Data																
			Operation and Maintenance	3.11															
			Manuals																
		23 05 48.19	SD-02 Shop Drawings																
			Coupling and Bracing	3.1															
			Flexible Couplings or Joints	3.3															
			Equipment Restraint	2.2															
			Contractor Designed Bracing	1.2.4	G														
			SD-03 Product Data																
			Coupling and Bracing	3.1	G														
			Flexible Couplings Or Joints	3.3	G														
			Equipment Restraint	2.2	G														

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		23 05 48.19	Contractor Designed Bracing	1.2.4	G													
			Snubbers	2.6														
			Anchor Bolts	3.9														
			Vibration Isolators	2.2.2														
			SD-05 Design Data															
			Design Calculations	1.2.4														
			SD-06 Test Reports															
			Anchor Bolts	3.9	G													
		23 07 00	SD-02 Shop Drawings															
			Pipe Insulation Systems	2.3														
			Duct Insulation Systems	3.3														
			Equipment Insulation Systems	3.4														
		23 23 00	SD-02 Shop Drawings															
			Refrigerant Piping System	2.3	G													
			SD-06 Test Reports															
			Refrigerant Piping Tests	3.5														
			SD-10 Operation and Maintenance															
			Data															
			Maintenance	1.5														
			Operation and Maintenance	3.4														
			Manuals															
			Demonstrations	3.4														
		23 30 00	SD-02 Shop Drawings															
			Detail Drawings	1.4.4	G													
			SD-03 Product Data															
			Fire Dampers	2.9.3														

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		23 30 00	Automatic Smoke-Fire Dampers	2.9.7														
			Automatic Smoke Dampers	2.9.8														
			Air Handling Units	2.11	G													
			Room Fan-Coil Units	2.12.1	G													
			Coil Induction Units	2.12.2	G													
			Constant Volume, Single Duct Terminal Units	2.12.3.1	G													
			Variable Volume, Single Duct Terminal Units	2.12.3.2	G													
			Variable Volume, Single Duct, Fan-Powered Terminal Units	2.12.3.3	G													
			Dual Duct Terminal Units	2.12.3.4	G													
			Reheat Units	2.12.3.5	G													
			Energy Recovery Devices	2.13	G													
			Test Procedures	1.4.5														
			Diagrams	1.2.1.2	G													
			SD-06 Test Reports															
			Performance Tests	3.13														
			Damper Acceptance Test	3.11	G													
			SD-10 Operation and Maintenance Data															
			Operation and Maintenance Manuals	3.16.1														
			Fire Dampers	2.9.3														
			Manual Balancing Dampers	2.9.4														
			Automatic Smoke-Fire Dampers	2.9.7														

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		23 30 00	Automatic Smoke Dampers	2.9.8															
			Centrifugal Fans	2.10.1.1															
			In-Line Centrifugal Fans	2.10.1.2															
			Axial Flow Fans	2.10.1.3															
			Centrifugal Type Power Wall	2.10.1.4															
			Ventilators																
			Centrifugal Type Power Roof	2.10.1.5															
			Ventilators																
			Propeller Type Power Roof	2.10.1.6															
			Ventilators																
			Air-Curtain Fans	2.10.1.7															
			Ceiling Exhaust Fans	2.10.1.8															
			Air Handling Units	2.11															
			Room Fan-Coil Units	2.12.1															
			Coil Induction Units	2.12.2															
			Constant Volume, Single Duct	2.12.3.1															
			Terminal Units																
			Variable Volume, Single Duct	2.12.3.2															
			Terminal Units																
			Variable Volume, Single Duct,	2.12.3.3															
			Fan-Powered Terminal Units																
			Dual Duct Terminal Units	2.12.3.4															
			Reheat Units	2.12.3.5															
			Unit Ventilators	2.12.4															
			Energy Recovery Devices	2.13															
			Hydronic Modular Panels	2.16.1															

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		23 30 00	Prefabricated Radiant-Heating	2.16.3															
			Electric Panels																
		23 64 10	SD-03 Product Data																
			Water Chiller	2.5	G														
			Water Chiller - Field Acceptance	3.4.1															
			Test Plan																
			SD-06 Test Reports																
			Field Acceptance Testing	3.4															
			Water Chiller - Field Acceptance	3.4.2															
			Test Report																
			System Performance Tests	3.5															
			SD-07 Certificates																
			Refrigeration System	3.1.9															
			SD-10 Operation and Maintenance																
			Data																
			Operation and Maintenance	3.6															
			Manuals																
		23 64 26	SD-03 Product Data																
			Pumps	2.8	G														
			SD-06 Test Reports																
			Piping Welds NDE Report	3.1.1.3															
			Pressure Tests Reports	3.4.2	G														
			Condenser Water Quality Test	3.4.3	G														
			Reports																
			One-Year Inspection Report For	3.6	G														
			Cooling Water																

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		23 64 26	SD-10 Operation and Maintenance															
			Data															
			Water Treatment Systems	2.11														
			Calibrated Balancing Valves	2.6.8														
			Automatic Flow Control Valves	2.6.9														
			Pump Discharge Valve	2.6.10														
			Water Temperature Mixing Valve	2.6.11														
			Water Temperature Regulating	2.6.12														
			Valves															
			Water Pressure Reducing Valve	2.6.13														
			Pressure Relief Valve	2.6.14														
			Combination Pressure and	2.6.15														
			Temperature Relief Valves															
			Expansion Joints	2.7.8														
			Pumps	2.8	G													
			Combination Strainer and Pump	2.7.2														
			Suction Diffuser															
			Expansion Tanks	2.9	G													
			Air Separator Tanks	2.10	G													
		23 65 00	SD-03 Product Data															
			Cooling Towers	2.5	G													
			Remote Evaporatively-Cooled	2.6														
			Condensers															
			Packaged Cooling Tower - Field	3.3.1	G													
			Acceptance Test Plan															

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		23 65 00	Field-Erected Cooling Tower -	3.3.1	G														
			Field Acceptance Test Plan																
			Packaged Cooling Tower - Field	3.4	G														
			Acceptance Test Report																
			Field-Erected Cooling Tower -	3.4	G														
			Field Acceptance Test Report																
			SD-07 Certificates																
			Cooling Tower	2.5.1.12															
			Remote Evaporatively-Cooled	2.6															
			Condensers																
			SD-10 Operation and Maintenance																
			Data																
			Operation and Maintenance	3.1															
			Manuals																
			Remote Evaporatively-Cooled	2.6															
			Condensers																
		23 81 00	SD-02 Shop Drawings																
			Field-Assembled Refrigerant	2.8.2															
			Piping																
			Control System Wiring Diagrams	1.4.2															
			SD-03 Product Data																
			Room Air Conditioners	2.1															
			Packaged Terminal Units	2.2															
			Heat Pumps	2.3															
			Air Conditioners	2.4															
			SD-06 Test Reports																

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		23 81 00	Start-Up and Initial Operational	3.8.3													
			Tests														
			SD-10 Operation and Maintenance														
			Data														
			Room Air Conditioners	2.1													
			Packaged Terminal Units	2.2													
			Heat Pumps	2.3													
			Air Conditioners	2.4													
			Filters	2.5													
			Thermostats	2.4.12													
		25 05 11	SD-01 Preconstruction Submittals														
			Wireless Communication	3.1.5.3	G												
			Request														
			Device Account Lock Exception	3.1.2.2	G												
			Request														
			Multiple IP Connection Device	3.9	G												
			Request														
			Contractor Computer	1.5.1.4	G												
			Cybersecurity Compliance														
			Statements														
			Contractor Temporary Network	1.5.6	G												
			Cybersecurity Compliance														
			Statements														
			SD-02 Shop Drawings														
			User Interface Banner Schedule	3.1.3.1	G												
			Network Communication Report	1.3.2	G												

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		25 05 11	Cybersecurity Riser Diagram	1.3.4	G														
			Control System Inventory Report	1.3.3	G														
			Cybersecurity Interconnection	1.3.1	G														
			Schedule																
			SD-03 Product Data																
			Control System Cybersecurity	1.5	G														
			SD-11 Closeout Submittals																
			Password Summary Report	3.5.2.2.5	G														
			Device Audit Record Upload	3.2.2.1	G														
			Software																
		26 05 48.00 10	SD-02 Shop Drawings																
			Lighting Fixtures in Buildings	3.2															
			Equipment Requirements	1.3															
			SD-03 Product Data																
			Lighting Fixtures in Buildings	3.2	G														
			Equipment Requirements	1.3	G														
			Contractor Designed Bracing	1.2.4	G														
		26 11 16.00 33	SD-02 Shop Drawings																
			Cubicle Type Unit Substation	2.3															
			Distribution	2.7															
			Cubicle type unit switching station	2.5															
			Switchgear	2.6															
			SD-03 Product Data																
			Transformers	2.4	G														
			Transformers	3.8.3.6	G														
			Primary Cutout	2.6.1.1	G														

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		26 11 16.00 33	Disconnecting Switches (DS)	2.6.1.2	G													
			Load Disconnecting Switches	2.6.2.2	G													
			(LDS)															
			Vacuum Circuit Breaker (VCB)	2.6.1.3	G													
			Load Break Switches (LBS)	2.6.2.3	G													
			Load Break Switches (LBS) with	2.6.2.4	G													
			tripping device															
			Load Break Switches (LBS) with	2.6.2.5	G													
			fuse															
			Circuit breaker	2.7.4.1	G													
			Circuit Breaker with GFCI	2.7.4.2	G													
			Automatic Transfer Switch (ATS)	2.7.5	G													
			Power Fuses (PF)	2.6.2.5	G													
			Instruments	2.7.7.1	G													
			Instrument Control Switches	2.7.7.2	G													
			Buzzer	2.7.7.3														
			Test Terminal	2.7.7.4														
			Lightning Arrester	2.7.7.6	G													
			SD-06 Test Reports															
			Acceptance Checks and Tests	3.8.2														
			SD-10 Operation and Maintenance															
			Data															
			Data Package 5	1.5.1	G													
		26 12 19.10	SD-02 Shop Drawings															
			Pad-mounted Transformer	1.5.1	G													
			Drawings															

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		26 12 19.10	SD-03 Product Data														
			Pad-mounted Transformers	2.2	G												
			SD-06 Test Reports														
			Acceptance Checks and Tests	3.7.1													
			SD-07 Certificates														
			Transformer Efficiencies	2.2.2.1													
			SD-10 Operation and Maintenance														
			Data														
			Transformer(s)	1.6.1													
		26 20 00	SD-02 Shop Drawings														
			Panelboards	2.15	G												
			Transformers	2.20	G												
			Busway	2.4	G												
			Cable trays	2.5	G												
			Motor control centers	2.24	G												
			Wireways	2.34	G												
			Load centers for housing units	2.17	G												
			Marking strips	3.1.14.1	G												
			SD-03 Product Data														
			Receptacles	2.14													
			Circuit breakers	2.15.3	G												
			Switches	2.12	G												
			Transformers	2.20	G												
			Enclosed circuit breakers	2.18	G												
			Motor controllers	2.22	G												
			Combination motor controllers	2.24.2	G												

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		26 20 00	Load centers for housing units	2.17	G												
			Manual motor starters	2.23	G												
			Residential load centers	2.16	G												
			Metering	2.35	G												
			Meter base only	2.36	G												
			CATV outlets	2.27.1	G												
			Surge protective devices	2.37	G												
			SD-06 Test Reports														
			600-volt wiring test	3.5.2													
			Grounding system test	3.5.5													
			Transformer tests	3.5.3													
			Ground-fault receptacle test	3.5.4													
			SD-10 Operation and Maintenance														
			Data														
			Electrical Systems	1.5.1													
			Metering	2.35													
		26 23 00	SD-02 Shop Drawings														
			Switchgear Drawings	1.5.2	G												
			SD-03 Product Data														
			Switchgear	2.2	G												
			SD-06 Test Reports														
			Acceptance Checks and Tests	3.5.1													
			SD-10 Operation and Maintenance														
			Data														
			Switchgear Operation and	1.6.1													
			Maintenance														

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		26 23 00	SD-11 Closeout Submittals														
			Assembled Operation and	1.6.2													
			Maintenance Manuals														
			Equipment Test Schedule	2.5.1													
			Request for Settings	3.5													
			Required Settings	3.5													
			Service Entrance Available Fault	2.8													
			Current Label														
		26 24 13	SD-02 Shop Drawings														
			Switchboard Drawings	1.5.2	G												
			SD-03 Product Data														
			Switchboard	2.2	G												
			SD-06 Test Reports														
			Switchboard Design Tests	2.5.2													
			SD-10 Operation and Maintenance														
			Data														
			Switchboard Operation and	1.6.1													
			Maintenance														
			SD-11 Closeout Submittals														
			Assembled Operation and	1.6.2													
			Maintenance Manuals														
			Equipment Test Schedule	2.5.1													
			Request for Settings	3.5													
			Required Settings	3.5													
			Service Entrance Available Fault	2.8													
			Current Label														

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		26 41 00	SD-02 Shop Drawings																
			Overall lightning protection	1.4.1.1	G														
			system																
			Each major component	1.4.1.2	G														
			SD-06 Test Reports																
			Lightning Protection and	1.4.3	G														
			Grounding System Test Plan																
			Lightning Protection and	3.5.1	G														
			Grounding System Test																
			SD-07 Certificates																
			Lightning Protection System	1.2.3	G														
			Installers Documentation																
			Component UL or JIS Listed and	1.4.2	G														
			Labeled																
			Lightning protection system	1.4.4	G														
			inspection certificate																
			Roof manufacturer's warranty	3.1.1	G														
		26 51 00	SD-02 Shop Drawings																
			Occupancy/Vacancy Sensor	1.5.2															
			Coverage Layout																
			SD-03 Product Data																
			Luminaires	2.2	G														
			Light Sources	2.4	G														
			Drivers, Ballasts and Generators	2.3	G														
			LED Luminaire Warranty	1.6.1															
			Vacancy Sensors	2.5.3.2	G														

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		26 51 00	Dimming Controllers (Dimmers)	2.5.2	G														
			Lighting Contactor	2.5.4	G														
			Timeswitch	2.5.5	G														
			Power Hook Luminaire Hangers	2.8	G														
			Exit Signs	2.6.1	G														
			Emergency Lighting Unit (EBU)	2.6.2	G														
			LED Emergency Drivers	2.6.3	G														
			Fluorescent Emergency Ballasts	2.6.4	G														
			Occupancy Sensors	2.5.3.1	G														
			Ambient Light Level Sensor	3.1.8	G														
			Lighting Control Panel	2.5.6	G														
			SD-06 Test Reports																
			Occupancy/Vacancy Sensor	1.5.7															
			Verification Tests																
			Energy Efficiency	1.5.10.3															
		26 56 00	SD-01 Preconstruction Submittals																
			Photometric Plan	1.5.2	G														
			LED Luminaire Warranty	1.7.1															
			SD-02 Shop Drawings																
			Luminaire Drawings	1.5.1.1															
			Poles	1.5.1.2															
			SD-03 Product Data																
			[LED,]Luminaires	2.2	G														
			Luminaire Light Sources	2.2.2	G														
			Luminaire[Power Supply Units	2.2.3	G														
			(Drivers)]																

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		26 56 00	Lighting Contactor	2.4.3	G												
			Time Switch	2.4.2	G												
			Lighting Control Relay Panel	2.4.4	G												
			Motion Sensor	2.4.5	G												
			Photocell	2.4.1	G												
			Concrete Poles	2.5.1	G												
			Aluminum Poles	2.5.2	G												
			Steel Poles	2.5.3	G												
			Fiberglass Poles	2.5.4	G												
			Obstruction Marker Luminaires	2.3	G												
			SD-06 Test Reports														
			Operating Test	3.2													
			SD-10 Operation and Maintenance														
			Data														
			Operational Service	1.8													
		27 10 00	SD-02 Shop Drawings														
			Telecommunications drawings	1.6.1.1	G												
			Telecommunications Space	1.6.1.2	G												
			Drawings														
			SD-03 Product Data														
			Telecommunications cabling	2.3	G												
			Patch panels	2.4.5	G												
			Telecommunications	2.5	G												
			outlet/connector assemblies														
			Equipment support frame	2.4.2	G												
			Connector blocks	2.4.3	G												

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		27 10 00	SD-06 Test Reports																
			Telecommunications cabling	3.5.1															
			testing																
			SD-10 Operation and Maintenance																
			Data																
			Telecommunications cabling and	1.10.1															
			pathway system																
			SD-11 Closeout Submittals																
			Record Documentation	1.10.2															
		31 00 00	SD-01 Preconstruction Submittals																
			Shoring	3.5	G														
			Dewatering Work Plan	1.6.2	G														
			SD-06 Test Reports																
			Testing	3.18															
			Borrow Site Testing	2.1															
		31 21 13	SD-03 Product Data																
			Respirators	1.8.3.1	G														
			Radon Mitigation Systems	2.1.2															
			Components																
			Radon Mitigation Systems	2.2															
			Enclosure Components																
			Radon Mitigation Systems	2.2															
			Enclosure Components																
			SD-06 Test Reports																
			Post Mitigation Testing	3.4.2	G														
			SD-07 Certificates																

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		31 21 13	Worker Protection Plan	1.7	G														
			Medical Certification	1.7.3	G														
			Worker Notification	1.7.4	G														
			Respiratory Protection Program	1.8	G														
			Contractor Qualifications	1.9.1.1	G														
			Contractor Experience	1.9.1.2	G														
			Testing Laboratory Certification	1.9.2	G														
			Proof Of Current Calibration For	1.9.3	G														
			Testing Devices																
			Radon Mitigation System	3.4.1	G														
			Inspection																
			SD-08 Manufacturer's Instructions																
			Radon Mitigation Systems	2.1.2															
			Components																
			Radon Mitigation Systems	2.2															
			Enclosure Components																
			Radon Mitigation Systems	2.2															
			Enclosure Components																
			SD-10 Operation and Maintenance																
			Data																
			Radon Mitigation Systems	2.1	G														
			SD-11 Closeout Submittals																
			Radon Detector Location Log	1.6	G														
			Respirator Program Records	1.8.1	G														
		31 62 13.20	SD-01 Preconstruction Submittals																
			Installation Procedures	1.7.3	G														

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		31 62 13.20	Geotechnical Consultant	1.7.4	G												
			Documentation														
			Wave Equation Analysis	3.2.1	G												
			Order List	3.2.2	G												
			quality control procedures	1.7.2	G												
			SD-02 Shop Drawings														
			Piles	1.7.1	G												
			SD-03 Product Data														
			Pile Driving Equipment	3.1	G												
			SD-05 Design Data														
			Concrete mix design	1.7.5	G												
			Cement milk mix design	3.6	G												
			SD-06 Test Reports														
			Silica Fume	2.2													
			Compressive Strength	2.2	G												
			Cement milk Compressive	3.6	G												
			Strength														
			Test piles	3.4.1	G												
			Load tests	3.4.3	G												
			Dynamic Pile Analysis	3.4.2	G												
			SD-11 Closeout Submittals														
			Pile records	3.4.6	G												
		32 11 20	SD-03 Product Data														
			Plant, Equipment, and Tools	1.4													
			SD-06 Test Reports														
			Initial Tests	2.2.1	G												

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		32 11 20	In-Place Tests	3.12.1	G														
		32 11 23	SD-03 Product Data																
			Plant, Equipment, and Tools	1.4															
			SD-06 Test Reports																
			Initial Tests	2.3.1	G														
			In-Place Tests	3.12.1	G														
		32 12 13	SD-06 Test Reports																
			Sampling and Testing	3.7	G														
		32 12 16.16	SD-03 Product Data																
			Mix Design	2.4	G														
			Quality Control	3.11	G														
			Material Acceptance	3.12	G														
			SD-06 Test Reports																
			Aggregates	2.2	G														
			QC Monitoring	3.11.3.2															
		32 15 00	SD-03 Product Data																
			Plant, Equipment, and Tools	1.4															
			SD-06 Test Reports																
			Initial Tests	2.3.1	G														
			In-Place Tests	3.9.1	G														
		32 16 19	SD-03 Product Data																
			Concrete	2.1	G														
			SD-06 Test Reports																
			Field Quality Control	3.8															
		32 31 13	SD-02 Shop Drawings																
			Fence Assembly	2.1	G														

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		32 31 13	Location of Gate, Corner, End,	3.2.2.1	G													
			and Pull Posts															
			Gate Assembly	2.2.10.1	G													
			Gate Hardware and Accessories	2.2.10.3	G													
			Erection/Installation Drawings	Part 3	G													
			SD-03 Product Data															
			Fence Assembly	2.1	G													
			Gate Assembly	2.2.10.1	G													
			Gate Hardware and Accessories	2.2.10.3	G													
			Zinc Coating	2.3.1	G													
			PVC Coating	2.1	G													
			Fabric	2.2.1	G													
			Stretcher Bars	2.2.6	G													
			Barbed Wire	2.2.4	G													
			Precast Concrete Posts	2.2.2.1	G													
			Padlocks	2.2.13	G													
			Turnbuckles	2.2.10.4	G													
			Truss Rod	2.2.10.5	G													
			Tension Wires	2.2.10.6	G													
			Wire Ties	2.2.11	G													
			Concrete	2.3.2	G													
			SD-07 Certificates															
			Certificates of Compliance	1.3.1														
			SD-08 Manufacturer's Instructions															
			Fence Assembly	2.1														
			Gate Assembly	2.2.10.1														

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		32 31 13	Hardware Assembly	2.1															
			Accessories	2.1															
			SD-11 Closeout Submittals																
			Recycled Material Content	3.3															
		33 11 00	SD-03 Product Data																
			Fire Hydrants	2.1.4.1															
			Meters	2.1.5															
			Backflow Preventer	2.1.6															
			Disinfection Procedures	3.2.5	G														
			SD-06 Test Reports																
			Backflow Preventer Tests	3.3.1.5	G														
			Bacteriological Samples	3.3.1.4	G														
			Hydrostatic Sewer Test	3.2.1.1.6	G														
			Leakage Test	3.3.1.3	G														
			Hydrostatic Test	3.3.1.1	G														
			SD-07 Certificates																
			Fire Hydrants	2.1.4.1															
			Backflow Certificate	2.1.6															
			SD-08 Manufacturer's Instructions																
			Ductile Iron Piping	2.1.1.1															
			PVC Piping	2.1.1.2.1	1														
			PVCO Piping	2.1.1.2.1	2														
			Polyethylene (PE) Pipe	2.1.1.2.3															
			PVC Piping For Service Lines	2.1.1.2.2															
		33 30 00	SD-02 Shop Drawings																
			Installation Drawings	3.1.1	G														

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		33 30 00	SD-03 Product Data															
			Pressure Pipe	2.2.2	G													
			Sewage Treatment Tanks	2.2.9	G													
			SD-06 Test Reports															
			Hydrostatic Sewer Test	3.3.1.1														
			Infiltration Tests or Exfiltration	3.3.1.2														
			Tests															
			Tests For Pressure Lines	3.3.1.3	G													
			Deflection Testing	3.3.1.4														
			SD-07 Certificates															
			Gaskets	2.2.1.1.2														
			Pre-Installation Inspection	3.3.3.1	G													
			Request															
			Post-Installation Inspection	3.3.3.2	G													
		33 40 00	SD-07 Certificates															
			Crushed Stone for Perforated	2.4.7														
			Pipes															
			Geotextile Filter Fabric for	2.7														
			Perforated Pipes															
			Leakage Test	3.10.1.1	G													
			Determination of Density	3.10.1.2														
			Post-Installation Inspection	3.10.2.1.3	G													
			Report															
			Placing Pipe	3.3														
		33 71 02	SD-02 Shop Drawings															
			Precast underground structures	1.6.1	G													

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		33 71 02	SD-03 Product Data															
			[High][Extra-High] voltage cable	2.5	G													
			[High][Extra-High] voltage cable joints	2.7	G													
			[High][Extra-High] voltage cable terminations	2.6	G													
			Live end caps	2.9	G													
			Precast concrete structures	2.14.2.1	G													
			Sealing Material	2.14.2.4														
			Pulling-In Irons	3.5.3														
			Manhole frames and covers	2.14.3	G													
			Handhole frames and covers	2.14.4	G													
			Frames and Covers for Airfield Facilities	2.14.5	G													
			Ductile Iron Frames and Covers for Airfield Facilities	2.14.6	G													
			Composite/fiberglass handholes	2.14.8	G													
			Cable supports	2.15	G													
			Protective Devices and Coordination	2.19	G													
			SD-06 Test Reports															
			Field Acceptance Checks and Tests	3.20.1														
		33 82 00	SD-02 Shop Drawings															
			Telecommunications Outside Plant	1.6.1.1	G													

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		33 82 00	Telecommunications Entrance	1.6.1.2	G														
			Facility Drawings																
			SD-03 Product Data																
			Wire and cable	2.8	G														
			Cable splices, and connectors	2.5	G														
			Closures	2.3	G														
			Building protector assemblies	2.2.1	G														
			Protector modules	2.2.2	G														
			Cross-connect terminal cabinets	2.4	G														
			SD-06 Test Reports																
			Pre-installation tests	3.5.1															
			Acceptance tests	3.5.2															
			SD-10 Operation and Maintenance																
			Data																
			Telecommunications Outside	1.6.1.1															
			plant (OSP)																
			SD-11 Closeout Submittals																
			Record Documentation	1.8.1															

SECTION 01 33 16

DESIGN AFTER AWARD

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD 3007	Standard Practice For Unified Facilities Criteria And Unified Facilities Guide Specifications
UFC 1-200-01	(2020) DoD Building Code
UFC 3-301-01	(2019) Structural Engineering
UFC 3-600-01	(2016; Change 4) Fire Protection Engineering for Facilities
UFC 4-010-01	(2018; Change 1) DoD Minimum Antiterrorism Standards for Buildings

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1110-345-700	(1997) Design Analysis, Drawings and Specifications
PDC TR 12-08	(2013) Standoff Distances for Japanese Conventional Construction

1.2 GENERAL DESCRIPTION

This section lists items that must be submitted for review at various milestones following award of a Design-Build Contract.

Design submittals are required at the [Concept stage,][Intermediate stage,][Final stage,][and Final Backcheck stage]. The requirements for each design stage are listed hereinafter.

1.3 DESIGNER

1.3.1 Designer Of Record (DOR) Identification

Identify a DOR for each design area. Minimum requirements of the DORs shall be as indicated in following experience matrix. Submit a list of DORs to the Contracting Officer's Representative.

[

Experience Matrix	
Area	Qualifications
Civil	Graduate of an accredited university with a Civil Engineering degree. Two years of work experience as either a U.S. Licensed Professional Civil Engineer or 1 Kyu Doboku Sekou Kanrigishi (1st Class Civil Engineering Works Management Engineer).
Mechanical	Graduate of an accredited university with a Mechanical Engineering degree. Two years of work experience as either a U.S. Licensed Professional Mechanical Engineer or 1 Kyu Kankouji Sekou Kanrigishi (1st Class Building Mechanical and Electrical Engineer).
Electrical	Graduate of an accredited university with an Electrical Engineering degree. Two years of work experience as either a U.S. Licensed Professional Electrical Engineer or 1 Kyu Kankouji Sekou Kanrigishi (1st Class Building Mechanical and Electrical Engineer).
Structural	Graduate of an accredited university with a Structural Engineering degree. Two years of work experience as either a U.S. Licensed Professional Structural Engineer or 1 Kyu Kenchikushi (1st Class Qualified Architect).
Architectural	Graduate of an accredited university with an Architectural degree. Two years of work experience as either a U.S. Licensed Architect or 1 Kyu Kenchikushi (1st Class Qualified Architect).
Fire Protection	Registered U.S. Professional Engineer who has passed the fire protection engineering written examination administered by the National Council of Examiners and Surveying (NCEES) and has a minimum of four (4) years of relevant fire protection engineering experience.
Communications	Graduate of an accredited university with a Communications or Electrical Engineering degree. Two years of work experience designing communication systems for buildings or facilities. Either a U.S. Licensed Registered Communications Distribution Designer (RCDD) or Type 3 Denki Shunin Gijutsusha.
Environmental	Graduate of an accredited university with an Environmental Engineering degree. Two years of experience working with JEGS compliance.

Experience Matrix	
Area	Qualifications
Geotechnical	Graduate of an accredited university with a Civil or related Engineering degree. Two years of work experience as either a U.S. Licensed Professional Engineer or Registered Civil Engineering Consulting Manager (RCCM) with Geotechnical Certification.
Surveying	Graduate of an accredited university with a Civil or related Engineering degree. Two years of work experience as either a U.S. Licensed Professional Engineer or Sokuryo shi Japanese Professional Registration.

For Architecture and Structural Engineering, the highest level of qualification is specified. For Mechanical Engineering, qualification of Kenchiku Setsubishi is higher than 1st class Kankouji Sekou Kanrigishi, and therefore acceptable. For Civil and Geotechnical Engineering, Gijutsushi is higher in qualifications than RCCM, and therefore acceptable.
]

1.3.2 DOR Responsibilities

Each DOR shall be responsible for ensuring integrity of their design and design integration in all construction submittals and extensions to design developed by others, such as the Contractor, subcontractors, or suppliers.

All construction drawings and design calculations of the Contractor and any changes to these documents shall be affixed with the registration stamp (seal) of the DOR and that of all consultants, as appropriate, (i.e. structural, civil, mechanical and fire protection engineers) before submittal for review. Approval shall be indicated on all documents by having the professional stamp/seal of the architect or engineer with personal signature over same appearing on all sheets as applicable to their specialties.

Each DOR shall review and approve all construction submittals and extensions to design, in accordance with the procedures described in Section 01 33 00 SUBMITTAL PROCEDURES. Each DOR shall be responsible for reviewing Requests for Information (RFI), applicable to their area of design responsibility, prior to submission to the Government.

1.4 SEQUENCE OF DESIGN AND CONSTRUCTION

a. After receipt of the Contract Notice to Proceed (NTP) the Contractor shall initiate design, comply with all design submission requirements as covered under Division 01 General Requirements, and obtain Government review of each submission. No construction shall be started until the Government reviews the Final Backcheck Design submission and determines it satisfactory for purposes of beginning construction. The COR shall notify the Contractor when the design is cleared for construction. The Government shall not grant any time extension for any design resubmittal required when, in the opinion of the ACO or COR, the initial submission failed to meet the minimum

quality requirements as set forth in the Contract.

b. If the Government allows the Contractor to proceed with limited construction based on pending minor revisions to the reviewed Final Backcheck Design submission, no payment shall be made for any in-place construction related to the pending revisions until they are completed, resubmitted and are satisfactory to the Government.

c. No payment shall be made for any in-place construction until all required submittals have been made, reviewed and are satisfactory to the Government.

1.5 CONTRACTOR'S ROLE DURING DESIGN

The Contractor's construction management key personnel shall be actively involved during the design process to effectively integrate the design and construction requirements of this Contract. In addition to the typical required construction activities, the Contractor's involvement includes, but is not limited to actions such as: integrating the design schedule into the Master Schedule to maximize the effectiveness of fast-tracking design and construction (within the limits allowed in the contract), ensuring constructability and economy of the design, integrating the shop drawing and installation drawing process into the design, executing the material and equipment acquisition programs to meet critical schedules, effectively interfacing the construction QC program with the design QC program, and maintaining and providing the design team with accurate, up-to-date redline and as-built documentation. The Contractor shall require and manage the active involvement of key trade subcontractors in the above activities.

1.6 DESIGN TIMELINE

As indicated in Section [01 32 01.00 10 PROJECT SCHEDULE][01 32 16.00 20 SMALL PROJECT CONSTRUCTION SCHEDULES], the Contractor shall submit for approval, a complete design schedule with all submittals and review times indicated in calendar dates. Update this schedule in accordance with [01 32 01.00 10 PROJECT SCHEDULE][01 32 16.00 20 SMALL PROJECT CONSTRUCTION SCHEDULES]. No design submittals shall be reviewed or evaluated until after receipt and acceptance of the proposed design/review schedule.

1.7 DEVIATING FROM THE ACCEPTED DESIGN

The Contractor must obtain the approval of the Designer of Record and the Government's concurrence for any Contractor proposed revision to the professionally stamped and sealed and Government reviewed and concurred design, before proceeding with the revision.

a. The Government reserves the right to non-concur with any revisions to the design, which may impact furniture, furnishings or equipment selections or operations decisions that were made, based on the reviewed and concurred design.

b. Any revisions to the design, which deviates from the Contract requirements (i.e., the RFP and the accepted proposal), will require a modification, pursuant to the Changes clause, in addition to Government concurrence. The Government reserves the right to disapprove such a revision.

c. Unless the Government initiates a change to the Contract requirements,

or the Government determines that the Government furnished design criteria are incorrect and must be revised, any Contractor initiated proposed change to the Contract requirements, resulting in additional cost, shall strictly be at the Contractor's expense.

d. The Contractor shall track all approved revisions to the reviewed and accepted design and shall incorporate them into the as-built design documentation, in accordance with agreed procedures. The Designer of Record shall document its professional concurrence on the as-builts for any revisions to the stamped and sealed drawings and specifications.

1.8 DESIGN CONFERENCES

1.8.1 Pre-Performance

As part of the Pre-Performance Conference conducted after the Contract award, key representatives of the Government and the Contractor shall review the design submission and review procedures specified herein, discuss the preliminary design schedule and provisions for phase completion of the D-B documents with construction activities (fast tracking), as appropriate, meet with Corps of Engineers Design Review personnel and key Using Agency points of contact and any other appropriate pre-design discussion items.

1.8.2 Design Charrette

After award of the Contract, the Contractor shall visit the site and conduct extensive interviews, and problem solving discussions with the individual users, base personnel, Corps of Engineers personnel to acquire all necessary site information, review user options, and discuss user needs. The Contractor shall document all discussions. Additionally, the Contractor shall schedule and perform a Design Charrette which is a condensed design meeting with all stakeholders present, if required by the Contract SOW. The design scope shall be finalized as direct result of these meetings.

1.8.3 Design Review Conferences

Review conferences shall be held either on-base or Corps of Engineer's Office for each design submittal. The Contractor shall bring the personnel that developed the design submittal to the review conference. The conferences shall take place approximately one week after the review is complete.

1.9 POST REVIEW CONFERENCE ACTION

Copies of comments, annotated with comment action agreed on, shall be made available to all parties before the conference adjourns. Unresolved problems shall be resolved by immediate follow-on action at the end of conferences. Valid comments shall be incorporated. After receipt of Final Backcheck design documents upon incorporation of backcheck comments, the Contractor may proceed with site and building development activities within the parameters set forth in the Contract and accepted design submittal. The Government, however, reserves the right to reject design document submittals if comments are significant (in the opinion of the Government, it does not comply with the Contract documents nor the level of quality implied).

1.10 CONFERENCE RECORDS

The Contractor shall within three (3) working days after each conference or discussion, prepare a written record of the meeting and/or discussions and submit to the Japan Engineer District Resident Engineer/Contracting Officer Representative identified in the Contract. The written report shall include the project name, Contract number, subject, the name of the participants, an outline of discussions, the recommendations, and conclusions. All meetings, site visits, review conferences, and telephonic discussions require written records. The Contractor shall also provide copies of conference records to the designated Administrative Contracting Officer identified for the Contract. Number each written record for the particular project under design in consecutive order.

1.11 DESIGN SUBMITTALS

The Contractor shall follow the requirements outlined below for all submittals.

1.11.1 Guidance, References, and Precedence

The design shall comply with Department of Defense Uniform Facilities Criteria (UFC), Component Service (Air Force, Army, Navy) Design Standards, the appropriate Installation Design Guide, and the US Army Corps of Engineers planning, design, and construction directive. In the event of conflict between documents and references, precedence shall be given to the following in descending order.

a. Unified Facilities Criteria (UFC) system prescribed by MIL-STD 3007, which provides planning, design, construction, operations, and maintenance criteria, and applies to all Department of Defense (DoD) commands. UFC are distributed in electronic media from the Whole Building Design Guide (WBDG) website: http://www.wbdg.org/ccb/browse_cat.php?c=4. UFC 1-200-01 provides guidance for the use of model building codes for design and construction of DoD facilities. Public Law 104-113, National Technology Transfer and Advancement Act of 1995, requires federal use of private sector consensus standards wherever practicable. The goal of the law is to reduce reliance on Federal standards by using industry standards when there is potential to simplify contracting, increase timeliness and cost effectiveness, and promote the safety and welfare of users.

b. The Service Component Design Standards provide common facility and infrastructure standards for the relevant Service Component installations. The appropriate installation design standards in conjunction with mission requirements and technical designs and specifications, define requirements for installation maintenance, repair, and construction projects. The Installation Design Standards and Installation Design Guides improve the functional and visual aspects of the installation. The Installation Design Standards follow the concept established in the Joint Service Unified Facilities Criteria Installation Design Manual.

c. Federal and Industry Standards. All applicable Federal and local industry standards referenced in the scope of work, including those not referenced or listed, constitute criteria for the design of this project, unless otherwise indicated. Applicable Japanese standards may apply.

1.11.2 Quantity of Design Submittals

Submit the documents listed and generally described hereinafter to the Government. Each submittal shall be accompanied by two (2) electronic copies of all documentation and drawings to be provided. The electronic copies shall consist of standard type word processing, spreadsheet, and CAD (AutoCAD or MicroStation) files. The delivery address, quantity and type of the required hardcopy submittals are identified in the table below.

[

Activity and Address	Drawing set (Size A1)	Design Analysis	Specs	Other Documents
Sasebo Resident Office (SRO) Attn: Donald L. George PSC 476 Box 83 FPO, AP 96322-0001 DSN: 315-252-3251 Comm: 81-95-650-3251 Email: donald.l.george.civ@usace.army.mil				
NAVFAC Far East Attn: Richard Owen, AREJ PSC 473 Box 13				

]

1.11.3 Delivery of Design Submittals

Mail or hand deliver all design submittals to the Government during design and construction. For mail delivery use an overnight mailing service. The Government shall furnish the Contractor addresses where each copy shall be delivered after Contract award.

1.11.4 Transmittal Letter

Each design submittal shall have a transmittal letter accompanying it indicating the date, design percentage, type of submittal, list of items submitted, transmittal number, and point of contact with telephone number.

1.11.5 Late Design Submittal

If a design submittal is over one (1) day late in accordance with the latest design schedule, the Government review period may be extended 7 calendar days. The review conference shall be held the week after the new period. Submittal date revisions must be made in writing at least one (1) week prior to the affected submittal schedules.

1.12 GOVERNMENT REVIEW

After receipt of submittals, the Government shall be allowed twenty-one (21) calendar days to review and comment on each Intermediate and Final Design submittal, except as noted below. The Final Backcheck design submittal shall permit the Government fourteen (14) calendar days to review and ensure the Final Design submittal was updated. For each design submittal, the COR shall furnish the Contractor comments from the various design sections and from other concerned agencies involved in the review process. The review shall be for conformance with the technical requirements of the Contract RFP and the Contractor's proposal. If the Contractor disagrees technically with any comment or comments and does not intend to comply with the comment, he must clearly outline, with ample justification, the reasons for noncompliance within five (5) working days after receipt of these comments in order that the comment can be resolved. All comments must be mutually resolved by the Government and the Contractor. The Contractor shall furnish disposition of all comments, in writing, with the next scheduled submittal. The Contractor is cautioned in that if he believes the action required by any comment exceeds the requirements of this Contract, that he should take no action and notify the COR in writing immediately. Review conferences shall be held for each design submittal at the project's location. The Contractor shall bring the personnel that developed the design submittal to the review conference. These conferences shall take place approximately one week after the twenty-one (21) day review period.

1.12.1 ProjNet (DrChecks)

Although the Contractor may use its own internal system for overall design configuration management, the Government and the Contractor shall use the DrChecks Design Review and Checking System to initiate, respond to, resolve and track Government design compliance review comments. This system may be useful for other data which needs to be interactive or otherwise available for shared use and retrieval. The Contractor shall check the Design Quality Lessons learned (DQLL) through DrChecks and incorporate any applicable Lessons Learned into the design of this project.

1.12.1.1 Tracking Comments in DrChecks

Throughout the design process, the DB Contractor shall enter, track, and back-check comments using the DrChecks system. DOR shall annotate their own discipline specific comments timely to indicate exactly what action will be taken or why the action is not required. Merely stating “concur” or “will comply” or is not considered a satisfactory response. Comments considered critical by the conference participants shall be flagged as such.

1.12.1.2 DrChecks Review Comments

The DB Contractor shall monitor DrChecks to assure all comments are

annotated and agreed to by the designers and reviewers prior to the next submittal. The DrChecks comments and responses shall be printed and included in the design analysis for record.

Conference participants (reviewers) will expect coordination between Design Analysis calculations and the submitted design. Reviewers will also focus on the design submittal's satisfaction of the contract requirements.

The DOR shall answer each comment in DrChecks with a formal response prior to the next submittal, clearly indicating what action will be taken and what drawing/spec will change. DOR are encouraged to directly contact reviewers to discuss and agree to the formal comment responses rather than relying only on DrChecks and review meetings to discuss comments. With the next design conference, reviewers will back-check answers to the comments against the submittal, in addition to reviewing additional design work.

Comments that, in the DB Contractor's opinion, require effort outside the scope of the contract shall be clearly indicated as such in DrChecks. The DB Contractor shall not proceed with work outside the contract until a modification to the contract is properly executed, if one is necessary.

1.12.1.3 DrChecks Initial Account Set-Up

To initialize an office's use of DrChecks, choose a contact person within the office to call the DrChecks Help Desk at 800-428-4357, M-F, 8AM-5PM, Central time. This POC will be given an office password to distribute to others in the office. Individuals can then go to the hyperlink at {http://www.projnet.org} and register as a first time user. Upon registration, each user will be given a personal password to the DrChecks system.

Once the office and individuals are registered, the US Army Corps of Engineers’s project manager or lead reviewer will assign the individuals and/or offices to the specific project for review. At this point, persons assigned can make comments, annotate comments, and close comments, depending on their particular assignment.

1.12.1.4 DrChecks Comment Evaluation

The role of the DOR is to evaluate and respond to the comments entered by the reviewer. To respond to comments:

1. Log into DrChecks.

2. Click on the appropriate project.

3. Under “Evaluate” click on the number under “Pending”.

4. Locate the comments that require your evaluation. (Note: If you know the comment number you can use the Jump to ID on the left hand side in DrChecks; enter the number and click on go.)

5. Select the appropriate evaluation (concur, non-concur, for information only, or check and resolve) and add the response.

6. Click on the Add button. The evaluation will be added to the database and a fresh screen will appear with the next comment.

7. Once evaluations are all entered, exit DrChecks by choosing "My Account" and then Logout.

1.12.2 Contractor Actions

The disposition of each Government review comment must be clearly annotated. Merely stating "concur" or "will comply" is not considered an adequate indication of actions taken. Not-in-scope comments annotated by the Contractor must be discussed with the Government within five (5) working days.

1.12.3 Design Responsibility and Compliance

Regardless of Government review and comment on design submittals, the Contractor shall be responsible for compliance with all requirements of the RFP and accepted Proposal. Should any non-compliance be discovered during design and/or construction, the Contractor shall be responsible for providing corrective action at no additional cost and/or time impact to the Government in order to comply with the requirements of the Contract.

PART 2 PRODUCTS

2.1 DESIGN ANALYSIS

2.1.1 General

Design Analysis format shall follow guidance from ER 1110-345-700, Appendix B located on Corps of Engineers website: http://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_1110-345-700.pdf.
This shall exclude part 6 "Exceptions to Appendix B, Requirements."

2.1.2 Format

Use standard A4 size or 8.5 inch by 11 inch paper except that larger sheets may be used when required for graphs or other special calculation forms. All sheets shall be in reproducible form. The material may be typewritten, hand lettered, handwritten, or a combination thereof, provided it is legible. Side margins shall be 1 inch minimum to permit side binding and head to head printing. Bottom margins shall be a minimum of 1 inch with page numbers centered.

2.1.3 Organization

The design analysis shall be sequentially numbered and bound under a cover indicating the name of the facility and project number. The design analysis shall be further classified by the submittal stage. All portions of the design analysis shall be organized and bound by relevant topics.

2.1.4 Design Computations

Calculations are a part of the design analysis. When they are voluminous, bind them separately from the narrative part of the design analysis. Present the design calculations in a clean and legible form incorporating a title page and index for each volume. Furnish a table of contents which shall be an index of the indices, when there is more than one volume. Identify the source of loading conditions, supplementary sketches, graphs, formulae, and references. Explain all assumptions and conclusions.

Calculation sheets shall carry the names or initials of the computer and the checker and the dates of calculations and checking. As part of the Contractor's Quality Control System, no portion of the calculations shall be computed and checked by the same person.

When ADPS are used to perform design calculations, the design analysis shall include descriptions of the computer programs used and copies of the ADPS input data and output summaries. When the computer output is large, it may be divided into volumes at logical division points. Precede each set of computer printouts by an index and by a description of the computation performed. If several sets of computations are submitted; they shall be accompanied by a general table of contents in addition to the individual indices. Include the following in the description accompanying each set of ADPS printouts:

a. Explain the design method, including assumptions, theories and formulae.

b. Include applicable diagrams, adequately identified.

c. State exactly the computation performed by the computer.

d. Provide all necessary explanations of the computer printout format, symbols and abbreviations.

e. Use adequate and consistent notation.

f. Provide sufficient information to permit manual checks of the results.

2.2 DRAWINGS

2.2.1 General

Prepare all drawings utilizing Computer-Aided Design and Drafting (CADD) software so that they are well arranged, placed for ready reference and they present complete information. The Contractor shall prepare all CADD files drawings in compliance with the A/E/C CADD Standards (rel 6.0) dated August 2015 (referred to as the "CADD standard") unless otherwise specified. Drawings shall be complete, unnecessary work such as duplicate views, notes and lettering, and repetition of details shall not be permitted. Do not show standard details that are not applicable to the project, and minimize unnecessary wasted space. Do not include details of standard products or items, which are adequately covered by specifications on the drawings. The cover sheet shall be signed and stamped by a principal of the firm who is a registered professional engineer/architect. Each design discipline shall provide a complete list of abbreviations and symbols used in their respective drawings. Do not use shop drawings as design drawings. The design documents shall consist of drawings utilizing metric drawing sheets A1 (594 x 841 mm) or A2 (420 x 594 mm) format unless otherwise specified. The Contractor shall use standard Corps of Engineers title blocks and borders on all drawings. The Contractor shall submit all CADD files for A/E/C compliance verification and a description of all drawings and drawing file names with each required design submittal.

2.2.2 Methods and Format

Create all drawings utilizing metric units. All CADD files shall utilize one of the following software applications and the version specified (or

the latest version):

a. AutoCAD 2013 (.dwg)

b. MicroStation V8 (.dgn)

2.2.3 Use of Records Management Directory Structure

a. The main (root) folder shall be named after the P2 number of the project.

b. The folder names (under the root folder) are shown on table 2-1, page 13 of the CADD standard. CADD files shall then be properly organized in the applicable folder structure as described. Table 2-1 shall also serve as the sequence or order of drawings.

c. Model files shall be organized in a sub-folder (in each applicable discipline) called "resource".

d. Sheet files shall be organized in the applicable discipline folder.

e. A subfolder called "PDF" shall be created under each applicable discipline folder to store design .pdf files of each submittal percentage phase.

f. Only English language characters shall be used in the folder names.

g. The Contractor at their prerogative may delete folders that are not applicable to the design.

2.2.4 Use of A/E/C CADD File Naming System

For the purposes of simplicity model files and sheet files shall be named as described below:

a. Model files names shall have a minimum of ten characters (reference the CADD standard, figure 2-4, page 12). The first six characters shall be the project P2 number, followed by two characters for the discipline designator, and the last two characters the model file type. The last four characters of the model file name is user definable and may be used at the Contractor's prerogative. Only English alphabet and numerical characters shall be used in file names (no kanji).

b. The sheet file name shall have a minimum of ten characters (reference the CADD Standard, figure 2-5, page 18). The first six characters shall be the project P2 number, followed by one character for the discipline designator (the level 2 designator shall be used only when more than 99 sheets are needed to subdivide the applicable discipline), and the last two characters the sheet sequence number. The last three characters of the sheet file name is user definable and shall be used in the event of an amendment or modification.

2.2.5 Use of Reference or Xref Files

The use of reference or xrefs files during the design stage is at the discretion of the designers.

2.2.6 Drawing Sheet Assembly

CADD drawings shall utilize model and sheet files (modelspace and paperspace) and shall be drawn in real world units. The drawings shall be Xref'd or referenced to a scale (see table 3-7, page 35 of the CADD standard) that fits into the Government provided border sheet. The Contractor shall utilize "Option 1" of a drawing sheet assembly (see figure 2-2, page 10 of the CADD standard). The border sheet shall remain at its original scale and only one bordersheet (paperspace) per design file is allowed.

2.2.7 Use of True Type Fonts and Sizes

For file conversion purposes the standard font shall be Arial.ttf and simplex.ttf. Fonts created by third parties or the designers are not permitted. Standard text sizes that may be used are 1.5 mm, 3 mm, 6 mm and 12 mm (text height and width).

2.2.8 Use of Standard Dimensioning and Terminator Symbols

All dimensioning shall be in millimeters (see figure 3-7 through 3-10, pages 38 and 39 of the CADD standard). The preferred terminator for dimensioning shall be the architectural slash. In the event that filled arrowheads are selected ensure that the size of the arrowheads are at a ratio of 3:1 (see page 37 of the CADD standard).

2.2.9 Use of Standard Abbreviations

The use of abbreviations are for use when space is limited within a drawing sheet, otherwise it is recommended the all the words are spelled out versus using abbreviations. Approved abbreviations are available from the National CADD Standard (NCS version 3.1)

2.2.10 Use of Standard Symbols, Patterns, and Line Styles

General symbols such as a two part detail, section and elevation bubbles are to be used. Other approved symbols, patterns, and line styles are located in Appendix D of the CADD Standards.

2.2.11 Government Provided Files

The use of these files is free. The U.S. Army Corps of Engineers (USACE) makes no warranty, impressed or implied, with regards to the use of these files. USACE shall not be liable for any errors or for incidental or consequential damages in connection with the furnishing and performance of these files. The COR shall furnish the Contractor with the following:

a. A/E/C CADD Standards rel. 6.0 (Main text, Appendix A in pdf format)

b. Japan Engineer District Title and border sheets (Size A1 and A2 in .dgn and .dwg format)

c. AutoCAD drawing template and MicroStation library files (.dwt and .dgnlib)

d. A/E/C Cell and Block Libraries (.cel and .dwg)

e. A/E/C Line Style Libraries (.rsc and .shx)

f. A/E/C Pattern Libraries (.cel and .pat)

2.2.12 Submittal Delivery Media and Format

Submit all Design Complete CADD files on the following media.

a. Before a CADD file is copied on the delivery digital media, the following procedures shall be performed:

(1) Remove all extraneous graphics outside the border area of the sheet file. Set the active parameters to a standard setting or those in the Government-furnished template or seed file.

(2) Include all files, both graphic and non-graphic, required for the project (i.e., color tables, pen tables, font libraries, cell libraries, user command files, plot files, etc.). All cells/blocks not provided as Government-furnished materials must be provided to the Government as a part of the electronic digital deliverables.

(3) Make sure that all support files such as those listed above are in the resource directory and that model files do not include device or directory specifications.

(4) Document any fonts, tables, etc., developed by the Contractor or not provided among the Government-furnished materials. The Contractor shall obtain Government approval before using anything other than the Government's standard fonts, line styles, patterns, cells/blocks.

b. A copy of all CADD data and files developed under this Contract shall be submitted to the Government on electronic digital CAD media for approval by the Government at the Intermediate Design submittal phase, the Final Design submittal stage, and at the Final Backcheck Design submittal phase as required unless otherwise directed by the Contracting Officer.

c. The external label for each electronic digital media shall contain, as a minimum, the following information:

(1) The Project title, design submittal stage, and date.

(2) The format and version of operating system software.

(3) The name and version of utility software used for preparation (e.g., compression/decompression) and copying files to the media.

(4) The A/E name and address.

2.3 SPECIFICATIONS

2.3.1 General

The latest version of Unified Facilities Guide Specifications (UFGS), as established by CSI Manual of Practice, shall be utilized, and can be obtained from the Whole Building Design Guide website http://www.wbdg.org/ccb/browse_cat.php?c=3.

SpecsIntact is an automated specification processing system for use in preparing construction project specifications from the UFGS. The use of

SpecsIntact is mandatory. SpecsIntact can be downloaded at http://specsintact.ksc.nasa.gov/. The Contractor shall submit SpecsIntact (.sec) files for marked-up and final specifications as required in the Contract.

Federal Specs and MIL Specs have been phased out with a few exceptions. Only those Federal and MIL specs in the current editions of the UFGS may be used. Industry standards (e.g. ASTM, ANSI) shall be used to the greatest extent practicable for description of materials. Japanese Industry Standards (e.g. JIS, JAS) are acceptable, provided that the A-E can provide adequate documentation for COR's approval proving that the Japanese Industry Standards are equivalent to the US Industry Standards. A limited set of modified UFGS incorporating previously identified and accepted Japanese standards and methods (also known as Japan Edited Specifications, or JES) can be found at https://www.poj.usace.army.mil/Business-With-Us/References/. When standards are not available for an item, specify by performance criteria instead. Proprietary items are not allowed.

At the Intermediate and Final Design submittal stages, submit edited specifications in marked-up or redlined format. At the Final Backcheck Design submittal stage, execute all previous revisions.

2.3.2 Submittal Register

A Submittal Register indicating the submittal requirements during the construction phase must be prepared by the A-E using SpecsIntact during the design phase of the Contract. The A-E shall be responsible for listing all required submittals necessary to insure the project requirements are complied with. The Register shall identify submittal items such as shop drawings, manufacturer's literature, certificates of compliance, material samples, guarantees, test results, etc. that the Contractor shall submit for review and/or approval action during the life of the construction Contract. The A-E shall include the Submittal Register as an attachment to Section 01 33 00 SUBMITTAL PROCEDURES with the specifications.

PART 3 EXECUTION

3.1 CONCEPT (35%) DESIGN SUBMITTAL

The A-E shall prepare the Concept Design based on the discussions and decisions made at the design charrette.

The Concept Design goal is to demonstrate that the A-E has a thorough understanding of the scope of the project and the owner's requirements, as discussed at the design charrette. At the Concept Design stage, the A-E shall confirm all CADD requirements (i.e.: sheet numbering, sheet size, A/E/C CADD & USACE standards) with the POJ CADD center.

Concept Design submittal shall consist of, but not limited to, the following:

3.1.1 Design Drawings

a. Title and general sheets with preliminary haul route.

b. Project site plan & area site plan.

c. Construction notes and legend pages (all disciplines); Phasing plan, if required.

d. Preliminary Building Life Safety Code Analysis.

e. Civil

(1) Project site plan, including required standoff setbacks.

(2) Area site plan.

(3) General Preliminary Exterior Utility Plans.

(4) Complete subsurface investigation and analysis.

f. Architectural

(1) Architectural Plans that consider functional relationships, work area use, security requirements and traffic flow patterns.

(2) General Preliminary Building code/life safety code analysis diagrams.

(3) Exterior elevations showing principal shapes, fenestrations and exterior finishes.

(4) Building sections.

(5) General interior finish selections.

g. Structural

(1) General Preliminary Blast Requirements for Exterior Windows and Doors.

h. Mechanical/Plumbing

(1) General Preliminary HVAC, plumbing layouts, including equipment capacities and sizes.

i. Electrical and Telecommunication

(1) General Preliminary electrical, and information systems layout, including equipment capacities and sizes.

j. Fire Protection

(1) Fire Alarm Control Panel configuration, Riser configuration, pipe size and configuration.

3.1.2 Specifications

List of Technical Specification sections that will be included in the intermediate submittal.

3.1.3 Design Analysis

a. Concept Design Analysis

(1) Include a discussion of existing conditions and project goals.

(2) List design assumptions, design calculations referenced criteria, and show initial calculations.

(3) Include placeholder sections for topics not required in the concept submittal, but needed for the intermediate submittal.

(4) Narrative description of the approach used and basis for AT measures, and a narrative description of those measures in accordance with UFC 4-010-01.

(5) Life Safety & Fire protection analysis in accordance with UFC 3-600-01.

(6) Discussion of types and capacities of HVAC systems, including a description of the selected system.

(7) Discussion of types and capacities of primary electrical power, conduit, information systems, lighting, and other systems considered, including a description of the selected systems.

(8) Description of the foundation, including any special requirements such as drilled piers, pilings, and support facilities.

(9) Site analysis that discusses the opportunities and constraints of the site and include the recommendations from the IDG/Installation.

(10) Hazard analysis (lead based paint, asbestos, etc., if required).

(11) Preliminary erosion control analysis.

(12) Preliminary plant material analysis that reflects the selection of plant material native to the project area, if required.

(13) Life cycle cost analysis.

(14) Building energy simulations, energy conservation studies, and design energy use calculations.

(15) Corrosion mitigation plan, if required.

(16) Site specific traffic analysis.

(17) List of materials and methods of construction to be used.

3.1.4 Cost Estimate

Current working estimate.

3.2 INTERMEDIATE (65%) DESIGN SUBMITTAL

Prepare the Intermediate Design and technical specifications based on Concept Design, project criteria and general instructions.

The Intermediate Design effort shall be a continuation of the Concept Design. The Intermediate Design goals are to show the project is on schedule and at an acceptable level of quality and completeness and demonstrate that A-E's QC process is functioning properly. Submit all QC

documentation with the Intermediate Design submittal. Complete coordination amongst design disciplines shall be conducted to review and resolve design conflicts.

Intermediate Design shall consist of, but not limited to, the following:

3.2.1 Design Drawings

a. Title and general sheets with haul route.

b. Project site plan & area site plan.

c. Construction notes and legend pages (all disciplines); Phasing plan, if required.

d. Building Life Safety Code & Fire Protection Plans including Building Code and Occupancy Analysis.

e. Complete Discipline coordination of the design.

f. Civil

(1) Existing conditions (topography).

(2) Demolition plan.

(3) Site plan.

(4) Grading plan.

(5) Road sections, plans, and profiles.

(6) Utility plans and profiles.

(7) Civil and site profiles.

(8) Geotechnical boring logs.

g. Architectural

(1) Architectural Floor Plans.

(2) Reflected Ceiling Plans.

(3) Roof Plans.

(4) Furniture/Equipment Floor Plans and Schedules.

(5) Exterior elevations.

(6) Building sections.

(7) Wall sections.

(8) Partition Types.

(9) Air barrier plans and details.

(10)Interior elevations.

(11)Door & window types/schedules and details.

(12)Blast requirements for Exterior Windows and Doors, details.

(13)Room Finish Materials and Schedule.

(14)Miscellaneous Details.

(15)Signage Plans and Schedules.

h. Structural

(1) Foundation plans.

(2) Floor framing plans.

(3) Roof framing plans.

(4) Foundation Schedule and details.

(5) Wall sections and details.

(6) Column Schedules and details.

(7) Beam/Girder Schedules and details.

(8) Slab Schedules and details.

(9) Building sections.

i. Mechanical

(1) Site Plans.

(2) HVAC Plans.

(3) Piping Plans.

(4) Sections.

(5) Equipment Control Sequences.

(6) DDC points list.

(7) Equipment Schedules.

(8) Isometrics.

(9) Riser Diagrams.

(10)Schematics.

(11)Details.

j. Plumbing

(1) Site Plans.

(2) Plumbing Plans.

(3) Sections.

(4) Equipment Control Sequences.

(5) Fixture Schedules.

(6) Isometrics/Riser Diagrams.

(7) Details.

k. Electrical

(1) Electrical Legend.

(2) Existing Electrical Site plan, indicating power, lighting.

(3) Exterior Demolition Plan.

(4) Plan view, indicating the interior electrical power plan, including receptacles, HVAC equipment, and specialty items needing power.

(5) Plan view, indicating the interior light fixture layout.

(6) Preliminary Light fixture schedule.

(7) Preliminary Electrical one line diagram.

(8) Preliminary one line diagram for any auxiliary systems.

l. Telecommunication

(1) Existing Telecommunication Site plan.

(2) Exterior Demolition Plan.

(3) Interior Telecommunication Plan.

(4) Preliminary Telecommunication one-line diagrams.

m. Fire Protection

(1) Fire Suppression general notes and legend.

(2) Fire Alarm & Mass Notification general notes and legend.

(3) Fire Protection site plans.

(4) Fire Suppression details.

(5) Fire alarm plans and details.

n. Food Service (as required)

(1) Equipment Plans and Schedules.

(2) Details.

o. Audio/Video (as required)

(1) AV Plans and Schedules.

(2) Details.

3.2.2 Technical Specifications

a. Interm set of Technical Specifications.

(1) Technical specifications shall incorporate all comments and revisions from the previous submission.

b. Specifications shall include the submittal register (ENG Form 4288) in .csv and .pdf format in this and all subsequent submittals.

c. Draft 1354 property form shall be submitted for review.

3.2.3 Design Analysis

a. Intermediate Design Analysis

(1) Include a discussion of existing conditions and project goals.

(2) List design assumptions, design calculations referenced criteria, and show initial calculations and manufacturer's material and equipment information.

(3) Narrative description of the approach used and basis for AT measures, and a narrative description of those measures in accordance with UFC 4-010-01 and PDC TR 12-08.

(4) Life Safety & Fire protection analysis including hydraulic calculations in accordance with UFC 3-600-01.

(5) Designed HVAC systems types and capacities, including a description of the selected system.

(6) Designed primary electrical power types and capacities, conduit, information systems, lighting, and other systems considered, including a description of the selected systems.

(7) Designed information systems requirements.

(8) Designed food service requirements (as required).

(9) Designed audio/visual requirements (as required).

(10) Designed foundation, including any special requirements such as drilled piers, pilings, and support facilities.

(11) Site analysis that discusses the opportunities and constraints of the site and include the recommendations from the IDG/Installation.

(12) Hazard analysis, if required.

(13) Erosion control analysis.

(14)Landscaping planting plan and a plant material analysis that reflects the selection of plant material native to the project area, if required.

(15)Life cycle cost analysis.

(16)Building energy simulations, energy conservation studies, and design energy use calculations.

(17)Corrosion mitigation plan (as required).

(18)Economic analyses.

(19)Justification for use of all U.S. materials/equipment specified in the design to be used in construction when local materials/equipment are excluded.

[b. Provide completed LEED Checklist.]

c. Provide a copy of the project's DD Form 1391.

d. For Renovation Projects: Discussion on property replacement values versus plant replacement values of the existing building(s) and associated implementation triggers for Seismic (UFC 3-301-01) and Anti-Terrorism (UFC 4-010-01) requirements.

3.2.4 Cost Estimate

Current working estimate for budget purposes and back-up cost data and price quotes.

3.2.5 Quality Control

Submit completed Detail Check Review (DCR) and Independent Technical Review (ITR) documents to include: Completed DCR checklists, completed ITR annotated comment sheets in accordance with the project's Scope of Work.

3.3 FINAL (95%) DESIGN SUBMITTAL

The A-E shall prepare the Final Design based on the Intermediate Design, project criteria and general instructions.

The Final Design effort shall be a complete design incorporating and resolving all previous review comments. Complete coordination amongst design disciplines shall be conducted to review and resolve any and all design conflicts. A-E shall conduct a full Quality Control review prior to the submittal of the Final Design. A-E QC review shall consist of a full Detail Check and Independent Technical Review. The Final Design submittal is the last full review of the Contract documents by the Government. Any significant new information included in this submittal that is not a direct result of a review comment shall be brought to the attention of the reviewer(s) and USACE Project Manager. Provide a brief description of the new information. The design shall be within the project's programmed amount.

All disciplines and specialty systems shall be designed and detailed to provide clear design intent. Design analysis shall include representative sample manufacturer's product information.

Final Design shall consist of, but not limited, to the following:

3.3.1 Design Drawings

a. Title and general sheets with haul route.

b. Project site plan & area site plan.

c. Construction notes and legend pages (all disciplines); Phasing plan (as required).

d. Building Life Safety Code & Fire Protection Plans including Occupancy Analysis.

e. Complete Discipline Coordinate of the design.

f. Civil

(1) Completed set of Civil drawings.

g. Architectural

(1) Completed set of Architectural drawings.

h. Structural

(1) Completed set of Structural drawings.

i. Mechanical & Plumbing

(1) Completed set of Mechanical and Plumbing drawings.

j. Electrical & Telecommunication

(1) Completed set of Electrical and Telecommunication drawings.

k. Fire Protection

(1) Completed set of Fire Protection drawings.

l. Food Service (as required)

(1) Completed set of Food Service drawings.

m. Audio/Video (as required)

(1) Completed set of Audio/Visual drawings.

3.3.2 Technical Specifications

a. Completed set of Technical Specifications.

(1) Technical specifications shall incorporate all comments and revisions from the previous submission.

b. Specifications shall include the submittal register (ENG Form 4288) in .csv and .pdf format in this and all subsequent submittals.

c. Draft 1354 property form shall be submitted for review.

3.3.3 Design Analysis

a. Final Design Analysis

(1) Completed Design Analysis incorporating all comments and revisions from the previous submission.

[b. Provide completed LEED Checklist.]

c. Provide a copy of the project DD Form 1391.

d. For Renovation Projects: Discussion on Property Replacement Values versus plant replacement values of the existing building(s) and associated implementation triggers for Seismic (UFC 3-301-01) and Anti-Terrorism (UFC 4-010-01) requirements.

3.3.4 Cost Estimate

a. Final working cost estimate with all back-up data, vendor estimates, etc.

3.3.5 Quality Control

a. Submit Detail Check Review (DCR) and Independent Technical Review (ITR) documents to include: Completed DCR checklists, completed ITR annotated comment sheets in accordance with the project Scope of Work.

3.4 FINAL BACKCHECK (100%) DESIGN SUBMITTAL

The A-E shall prepare the Final Backcheck Design submittal based on the Final Design, project criteria and general instructions.

The Final Backcheck Design submittal shall be complete in every respect, from the Government's perspective. The drawings shall show the name of the reviewer and signature of the Principal of the firm responsible for the design as testimony that this submittal has been reviewed. The submittal shall incorporate all previous review comments. A-E shall provide a response indicating the reason for not incorporating any non-concurred comments. The A-E shall submit a complete response to all previous review comments in DrChecks with the submission.

Final Backcheck Design shall consist of, but not limited to, the following:

3.4.1 Design Drawings

Complete final design construction drawings.

3.4.2 Technical Specifications

Completed set of final technical specifications.

3.4.3 Design Analysis

Complete final design analysis.

3.4.4 Cost Estimate

Complete final working cost estimate.

3.5 "CLEARED FOR CONSTRUCTION" SUBMITTAL

DOR shall submit one (1) hard copy Japanese-style folded and bound sets of A3 size drawings and A4 specifications. Submittal shall be provided to the Resident Office at the Pre-Construction meeting. "Cleared For Construction" Submittal is defined as the complete, government-approved set of drawings and specifications that can be used by the Contractor to build and complete the project.

-- End of Section --

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SECTION 01 33 29

SUSTAINABILITY REQUIREMENTS AND REPORTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

COUNCIL ON ENVIRONMENTAL QUALITY (CEQ) (WHITE HOUSE)

HPSB Guiding Principles	(2016) Guiding Principles for Sustainable Federal Buildings and Determining Compliance with the Guiding Principles for Sustainable Federal Buildings

GREEN BUSINESS CERTIFICATION INC. (GBCI)

GP Assessment (DOD)	Guiding Principles Assessment for Department of Defense

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-200-02	(2020) High Performance and Sustainable Building Requirements

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED v4 BD+C	LEED v4 Building Design and Construction

1.2 SUMMARY

This section includes requirements for Sustainability documentation and reporting submittals per the federally mandated High Performance and Sustainable Building (HPSB) or HPSB "Guiding Principles" (GP),[and Third Party Certification (TPC) requirements,] in accordance with UFC 1-200-02 High Performance and Sustainable Building Requirements.

1.3 SUBMITTALS

[Government approval is required for submittals with a "G" classification. Submittals not having a "G" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals
Sustainability Action Plan; G

SD-11 Closeout Submittals

High Performance and Sustainable Building Checklist; G
Final Sustainability eNotebook; G
Amended Final Sustainability eNotebook; G
[Third Party Certification Certificate, Assessment, or Validation and Compliance Report; G
Amended Final High Performance And Sustainable Building Checklist; G
]1.4 GUIDING PRINCIPLES VALIDATION (GPV)

Provide the following sustainability activities and documentation to verify achievement of HPSB Guiding Principles Validation (GPV):

1.4.1 Sustainability Action Plan

Include the following information in the Sustainability Action Plan:

a. Analysis of each HPSB Guiding Principles and how project will comply. Final government approved narrative(s) must be included in the HPSB Checklist submittal.
b. Name and contact information for: Contractor's Point of Contact (POC) ensuring sustainability goals are accomplished and documentation is assembled. For TPC that include on-site visit by third party representative, provide list of required attendees.
b. HPSB Checklist. No changes to the HPSB Checklist are allowed without approval from the Contracting Officer, in accordance with Section 01 33 00 SUBMITTAL REQUIREMENTS. Immediately bring to the attention of the Contracting Officer any project changes that impact meeting the approved HPSB Guiding Principles for this project. Demonstrate the change will not increase the life-cycle cost and maintains or improves the building performance.
c. Documentation of all work required to incorporate the applicable HPSB Guiding Principles requirements indicated on the HPSB Checklist and in this contract.
c. Indoor Air Quality plan.

1.5 SUSTAINABILITY SUBMITTALS

1.5.1 High Performance Sustainable Building (HPSB) Checklist

Provide construction documentation that provides proof of, and supports compliance with, the completed HPSB Checklist. Submit updated HPSB Checklist with each Sustainability eNotebook submittal. Include the final HPSB Checklist(s) with the interim DD1354 Real Property Record Submittal.

1.5.2 Sustainability eNotebook

The Sustainability eNotebook is an electronic organizational file that serves as a repository for all required sustainability submittals. To support documentation of compliance with an approved HPSB[and TPC] checklist, provide and maintain a comprehensive and current Sustainability eNotebook. Include all required data in Sustainability eNotebook, to support full compliance with the HPSB Guiding Principles Requirements, including:

a. HPSB checklist
b. Sustainability Action Plan
c. Calculations
d. Labels
e. Sustainability submittals

[f. Certifications, assessments, or validations and compliance report
][g. TPC documentation required in paragraph THIRD PARTY CERTIFICATION (TPC).

]1.5.2.1 Sustainability eNotebook Format

Provide Sustainability eNotebook in the form of an Adobe PDF file; bookmark each HPSB Guiding Principles Requirement[, TPC requirement,] and sub-bookmark at each document. Match format to HPSB Guiding Principles numbering system indicated herein. Maintain up-to-date information, such as spreadsheets, templates, with each current submittals.[For TPC projects, provide a second Table of Contents using TPC numbering system, for maintaining documentation unique to TPC.]

Contracting Officer may deduct from the monthly progress payment accordingly if Sustainability eNotebook information is not current and on track per project goals.

1.5.2.2 Sustainability eNotebook Submittal Schedule

Provide Sustainability eNotebook Submittals at the following milestones of the project:

a. Final Sustainability eNotebook
Submit updated Sustainability eNotebook with updated High Performance and Sustainable Building Checklist[with TPC Checklist] at Beneficial Occupancy Date (BOD). Final progress payment retainage may be held by Contracting Officer until Final Sustainability construction phase documentation is complete.

[b. Amended Final Sustainability eNotebook
Amend and resubmit the Amended Final Sustainability eNotebook with Amended Final High Performance and Sustainable Building Checklist[and amended TPC Checklist], to include post-occupancy corrections, updates, and requirements. Final progress payment retainage may be held by Contracting Officer until amended final sustainability documentation is complete. Submit the Amended Final Sustainability eNotebook Submittal on DVDs to the Contracting Officer no later than 30 days after final GP[, TPC] determination.

]1.6 DOCUMENTATION REQUIREMENTS

a. Incorporate each of the applicable UFC 1-200-02 HPSB Guiding Principles requirements into project and provide documentation that proves compliance with each listed requirement. For life-cycle cost analysis requirements, one document with all analyses is acceptable, with Contracting Officer approval.

b. For the following items, Japanese acceptable alternatives are listed. For all other items, see UFC 1-200-02.

1.6.1 Energy Efficient Products

Products do not have to have the Energy Star label, but they shall have Federal Energy Management Program (FEMP) recommended efficiencies. Energy efficient products can be referenced at: https://www.energy.gov/eere/femp/federal-energy-management-program and http://www.energystar.gov/.

1.6.2 Indoor Water Use

Products do not have to have the EPA WaterSense label, but they shall comply with WaterSense efficiency requirements.

1.6.3 Reduce Volatile Organic Compounds (VOC) (Low-Emitting Materials)

F 4-Star and 4VOC combined ratings are acceptable Japanese alternatives for low-VOC materials. For Construction submittal documentation, provide certifications or labels that demonstrate compliance with cited requirements.

[1.6.4 Additional Sustainability Requirements

Provide the additional sustainability requirements cited in this paragraph.

[1.6.4.1 Third Party Certification (TPC) Documentation

Third Party Certification certificate, assessment, or validation, and compliance report requirements are in addition to all requirements under header above GUIDING PRINCIPLES VALIDATION (GPV).

1.6.4.1.1 TPC Registration

This project has been designed for, and must be constructed to achieve [LEED v4 BD+C][GP Assessment (DOD)]. Project is already registered with the TPC Organization. Provide construction related sustainability documentation, in the format required by the TPC Organization, to the Contracting Officer for approval, and for final approval by the TPC organization. Third Party Certification is met when Government receives TPC organization certificate, assessment, or validation and compliance report. Execute the following:

a. Refer to TPC Checklist at the end of this specification section. (Multiple checklists indicate multiple buildings that require TPC.)

b. Immediately bring to the attention of the Contracting Officer any project changes that impact meeting the approved TPC Requirements for this project. Demonstrate the change will not increase the life-cycle cost and maintains or improves the building performance.

c. Complete all work required to incorporate the applicable TPC Requirements.

d. Maintain the construction related information in the Sustainability eNotebook pertaining to additions and changes to the approved sustainability requirements. Maintain the Sustainability eNotebook in electronic format. For more explanation, refer to paragraph SUSTAINABILITY eNOTEBOOK. Provide the following components in the Sustainability eNotebook, in addition to the GPV components above:

(1) TPC Checklist
(2) Provide construction documentation required to achieve third party certification

e. Provide the following information in the Sustainability Action Plan. Provide this TPC information in addition to the GPV Action Plan items above:

(1) Planned method to achieve each TPC requirement.

(2) For each TPC requirement that is attempted but not achieved, provide narrative explaining how mission or activity precludes achieving specific sustainability requirement or goal. Provide analysis of particular requirement and level to which project is able to comply.

(3) Provide name and contact information for: Sustainability Point of Contact (POC) and other names of sustainability professionals responsible for ensuring TPC sustainability goals are accomplished and documentation is assembled. Sustainability POCs are also responsible for ensuring GPV required in paragraph GUIDING PRINCIPLES VALIDATION (GPV) above.

f. Bear all costs associated with construction changes that affect sustainability design requirements, constructing, demonstrating, and documenting that project complies with approved TPC requirements, including but not limited to:

(1) TPC coordination with Government's AE and other consultants, TPC website requirements, and management for construction related documentation.

(2) Construction work required to incorporate TPC requirements.

(3) Submittals required to demonstrate compliance with Government approved TPC checklists.

(4) Documentation illustrating compliance with TPC requirements and additional documentation required by the TPC.

g. Provide all calculations, product data, and certifications, assessments, or validations required in this contract to demonstrate compliance with the TPC Requirements of this section.

][1.6.4.2 Third Party Certification (TPC) Documentation

Third Party Certification certificate, assessment, or validation, and compliance report requirements are in addition to all requirements under header above GUIDING PRINCIPLES VALIDATION (GPV).

[1.6.4.2.1 TPC Registration Required

Pay all fees associated with registration and achievement of Third Party Certification (TPC), by meeting all TPC and project requirements to achieve [LEED v4 BD+C [GP Assessment (DOD)] sustainability certification, assessment, or validation. Third Party Certification is met when Government receives TPC organization certificate, assessment, or validation and compliance report

Register project with TPC organization using the following format and content:

a. Project Title First Line: Building Owner (US Army, US Air Force, US Navy or US Marine Corps), Building Name (if known)

b. Project Title Second Line: MILCON P#, DD1391 Project Name

c. Project Address: UIC (Installation code), Category code, RPUID (Real Property Unique Identifier) Number

d. Project Owner Organization: US Army, US Air Force, US Navy or US Marine Corps

e. Primary Contact, Project Owner: Component Project Manager

f. Building Owner Organization: US Army, US Air Force, US Navy or US Marine Corps

g. Building Owner Organization Project Number

h. Additional Contact, Building Owner: Department of Public Works, Public Works Officer, Base Civil Engineer, or Designee

][1.6.4.2.2 TPC Already Registered

Project is already registered with TPC organization to achieve [LEED v4 BD+C] [GP Assessment (DOD)]. When applicable, request TPC online access turnover from Government. Manage and provide all documentation for requirements of TPC and obtain Final Certification or validation. Third Party Certification is met when Government receives TPC organization certificate, assessment, or validation and compliance report.

]1.6.4.2.3 TPC Management and Certification

Execute the following TPC Certification, assessment, or validation requirements:

a. Refer to TPC Checklist at the end of this specification section. (Multiple checklists indicate multiple buildings that require TPC.)

b. Immediately bring to the attention of the Contracting Officer any project changes that impact meeting the approved TPC Requirements for this project. Demonstrate the change will not increase the life-cycle cost and maintains or improves the building performance.

c. Complete all work required to incorporate the applicable TPC Requirements.

d. Maintain the construction related information in the Sustainability eNotebook pertaining to additions and changes to the approved sustainability requirements. When construction changes are made that affect design sustainability requirements, provide all required updates to affected design requirements and update in the Sustainability eNotebook. Maintain the Sustainability eNotebook in electronic format. For more explanation, refer to paragraph SUSTAINABILITY eNOTEBOOK. Provide the following components in the Sustainability eNotebook, in addition to the GPV components above:

(1) TPC Checklist

(2) Completed TPC forms. Transmit by the method required by the TPC organization.

(3) Copy of all correspondence with the TPC organization including proof of TPC registration

(4) Documentation illustrating compliance with TPC requirements and additional documentation as requested by the TPC

(5) TPC Award Certificate, assessment, or validation and compliance report.

e. Provide the following information in the Sustainability Action Plan. Provide this TPC information in addition to the Sustainability Action Plan items above:

(1) Planned method to achieve each TPC requirement.

(2) For each TPC requirement that is attempted but not achieved, provide narrative explaining how mission or activity precludes achieving specific sustainability requirement or goal. Provide analysis of particular requirement and level to which project is able to comply.

(3) Provide name and contact information for: Sustainability point of contact (POC) and other names of sustainability professionals responsible for ensuring TPC sustainability goals are accomplished and documentation is assembled. Sustainability POCs are also responsible for ensuring GPV required in paragraph GUIDING PRINCIPLES VALIDATION (GPV) above.

f. Bear all costs associated with construction changes that affect sustainability design requirements, constructing, demonstrating, and documenting that project complies with approved TPC requirements, including but not limited to:

(1) Final TPC review, certification, assessment, or validation fees.

(2) Online (or offline with secure facilities) TPC management and documentation.

(3) Obtaining TPC certification or validation based on Government-approved sustainability goals.

(4) Construction work required to incorporate TPC requirements.

(5) Submittals required to demonstrate compliance with Government approved TPC checklists.

g. Provide all calculations, product data, and certifications, assessments, or validations required in this specification to demonstrate compliance with the TPC Requirements.

h. Provide all TPC management and documentation. Transmit TPC requirements by the method required by TPC organization.

i. Provide all required responses to third party organization.

[j. Facilitate and participate in required TPC site visit. Coordinate with the Contract Officer to determine participating team members. Include Commissioning provider on applicable projects.

][k. Provide TPC Certificate, assessment, or validation. Provide TPC compliance report that includes level achieved and reasons for non-compliance or not applicable elements. Use format below to create the Certificate, assessment or validation, compliance report, and

Letter of Congratulations (when provided). Forward to parties designated by Contracting Officer:

(1) Certificate, Assessment or Validation:

Project Title, first line: P-(X); Form DD1391 Project Name).
Project Title, second line: UIC (Installation code)

(2) Letter Congratulations (when provided): Address letter to Facility's Installation Commander Name. Address the letter to an individual person.

(3) Compliance Report: Title page must cite Project title: P-(X); (1391 Project Name); Final Building Name if known; UIC (installation code); Owner Service; User organization if known; date of compliance. Include TPC scoresheet if applicable.

]

l. Once Final Certification is achieved, turn over Administrative rights to online TPC to the [Base Civil Engineer] [Department of Public Works] [Public Works Office] or designee, contact information provided by the Contracting Officer.

]][1.6.5 Additional Sustainability Requirements

The following requirements are included, as required by the project scope or the applied sustainability Third Party Certification program:

[_____]

]PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 SUSTAINABILITY COORDINATION

Provide sustainability focus and coordination at all meetings to achieve sustainability goals. Coordinate meeting requirements with other UFGS Sections meeting requirements in this project. Ensure the designated [TPC accredited]sustainability professional responsible for GP [and TPC]documentation participates in these meetings to coordinate documentation completion. Review GP[and TPC] sustainability requirements, HPSB Checklist[and TPC] documentation, Sustainability Action Plan, and completeness status of Sustainability eNotebook[, and TPC status] at the following meetings:

a. Pre-Construction Conference

b. Construction Quality Control Meetings

c. Facility Turnover Meetings

Conduct review no later than 60 days before final turnover and identify any outstanding issues that affect correct completion of all documentation[and final TPC certification, assessment or validation], and actions that will achieve requirements. Conduct corrective actions prior to turnover, to ensure all requirements are achieved.

[3.2 THIRD PARTY CERTIFICATION CERTIFICATE, ASSESSMENT, OR VALIDATION AND COMPLIANCE REPORT

Finalize the process requirements and obtain the TPC Certificate, assessment, or validation, and compliance report, indicating completion of the project's sustainability goals. Include TPC compliance report with final TPC scoresheet as applicable.

[Provide one original framed copy of the certificate, assessment, or validation, mounted in 25 mm deep metal frames, with double matt, and wire hangers, in location approved by Contracting Officer.]Deliver [one][_____] original certificate, assessment, or validation, and compliance report to Contractor Officer, unless otherwise instructed.

-- End of Section --

SECTION 01 35 26

GOVERNMENTAL SAFETY REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.34	(2021) Protection of the Public on or Adjacent to Construction Sites
ASSP Z359	(2018) Fall Protection Code

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B30.20	(2021) Below-the-Hook Lifting Devices
ASME B30.22	(2016) Articulating Boom Cranes
ASME B30.26	(2015; R 2020) Rigging Hardware
ASME B30.3	(2019) Tower Cranes
ASME B30.5	(2021) Mobile and Locomotive Cranes
ASME B30.8	(2020) Floating Cranes and Floating Derricks
ASME B30.9	(2021) Slings

ASTM INTERNATIONAL (ASTM)

ASTM F855	(2020) Standard Specifications for Temporary Protective Grounds to be Used on De-energized Electric Power Lines and Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1048	(2016) IEEE Guide for Protective Grounding of Power Lines
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

MINISTRY OF HEALTH, LABOUR AND WELFARE, GOVERNMENT OF JAPAN (MHLW)

MHLW Laws	(1972; Amendment No. 57 - 2006) Industrial Safety and Health Law

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	((2022) Standard for Portable Fire Extinguishers
NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 306	(2019) Standard for Control of Gas Hazards on Vessels
NFPA 51B	(2019) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2022) National Electrical Code
NFPA 70E	(2021) Standard for Electrical Safety in the Workplace

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.147	Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1910.333	Selection and Use of Work Practices
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1915.89	Control of Hazardous Energy (Lockout/Tags-Plus)

1.2 DEFINITIONS

1.2.1 Competent Person (CP)

The CP is a person designated in writing, who, through training, knowledge and experience, is capable of identifying, evaluating, and addressing existing and predictable hazards in the working environment or working conditions that are dangerous to personnel, and who has authorization to take prompt corrective measures with regards to such hazards.

1.2.2 Competent Person, Confined Space

The CP, Confined Space, is a person meeting the competent person requirements as defined EM 385-1-1 Appendix Q, with thorough knowledge of the USACE Confined Space Standard, EM 385-1-1, Section 34, and designated in writing to be responsible for the immediate supervision, implementation and monitoring of the confined space program, who through training, knowledge and experience in confined space entry is capable of identifying, evaluating and addressing existing and potential confined space hazards and, who has the authority to take prompt corrective

measures with regard to such hazards.

1.2.3 Competent Person, Cranes and Rigging

The CP, Cranes and Rigging, as defined in EM 385-1-1 Appendix Q, is a person meeting the competent person, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the Crane and Rigging Program, who through training, knowledge and experience in crane and rigging is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

1.2.4 Competent Person, Excavation/Trenching

A CP, Excavation/Trenching, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the excavation/trenching program, who through training, knowledge and experience in excavation/trenching is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

1.2.5 Competent Person, Fall Protection

The CP, Fall Protection, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q, who has been designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

1.2.6 Competent Person, Scaffolding

The CP, Scaffolding is a person meeting the competent person requirements in EM 385-1-1 Appendix Q, and designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the scaffolding program. The CP for Scaffolding has enough training, knowledge and experience in scaffolding to correctly identify, evaluate and address existing and potential hazards and also has the authority to take prompt corrective measures with regard to these hazards. CP qualifications must be documented and include experience on the specific scaffolding systems/types being used, assessment of the base material that the scaffold will be erected upon, load calculations for materials and personnel, and erection and dismantling. The CP for scaffolding must have a documented, minimum of 8-hours of scaffold training to include training on the specific type of scaffold being used (e.g. mast-climbing, adjustable, tubular frame), in accordance with EM 385-1-1 Section 22.B.02.

1.2.7 Competent Person (CP) Trainer

A competent person trainer as defined in EM 385-1-1 Appendix Q, who is qualified in the material presented, and who possesses a working knowledge of applicable technical regulations, standards, equipment and systems related to the subject matter on which they are training Competent Persons. A competent person trainer must be familiar with the typical hazards and the equipment used in the industry they are instructing. The

training provided by the competent person trainer must be appropriate to that specific industry. The competent person trainer must evaluate the knowledge and skills of the competent persons as part of the training process.

1.2.8 High Risk Activities

High Risk Activities are activities that involve work at heights, crane and rigging, excavations and trenching, scaffolding, electrical work, and confined space entry.

1.2.9 High Visibility Accident

A High Visibility Accident is any mishap which may generate publicity or high visibility.

1.2.10 Load Handling Equipment (LHE)

LHE is a term used to describe cranes, hoists and all other hoisting equipment (hoisting equipment means equipment, including crane, derricks, hoists and power operated equipment used with rigging to raise, lower or horizontally move a load).

1.2.11 Medical Treatment

Medical Treatment is treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

1.2.12 Near Miss

A Near Miss is a mishap resulting in no personal injury and zero property damage, but given a shift in time or position, damage or injury may have occurred (e.g., a worker falls off a scaffold and is not injured; a crane swings around to move the load and narrowly misses a parked vehicle).

1.2.13 Operating Envelope

The Operating Envelope is the area surrounding any crane or load handling equipment. Inside this "envelope" is the crane, the operator, riggers and crane walkers, other personnel involved in the operation, rigging gear between the hook, the load, the crane's supporting structure (i.e. ground or rail), the load's rigging path, the lift and rigging procedure.

1.2.14 Qualified Person (QP)

The QP is a person designated in writing, who, by possession of a recognized degree, certificate, or professional standing, or extensive knowledge, training, and experience, has successfully demonstrated their ability to solve or resolve problems related to the subject matter, the work, or the project.

1.2.15 Qualified Person, Fall Protection (QP for FP)

A QP for FP is a person meeting the requirements of EM 385-1-1 Appendix Q, and ASSP Z359, with a recognized degree or professional certificate and with extensive knowledge, training and experience in the fall protection and rescue field who is capable of designing, analyzing, and evaluating

and specifying fall protection and rescue systems.

1.2.16 Recordable Injuries or Illnesses

Recordable Injuries or Illnesses are any work-related injury or illness that results in:

a. Death, regardless of the time between the injury and death, or the length of the illness.

b. Days away from work (any time lost after day of injury/illness onset).

c. Restricted work.

d. Transfer to another job.

e. Medical treatment beyond first aid.

f. Loss of consciousness.

g. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (a) through (f) above.

1.2.17 USACE Property and Equipment

Interpret "USACE" property and equipment specified in USACE EM 385-1-1 as Government property and equipment.

1.2.18 Load Handling Equipment (LHE) Accident or Load Handling Equipment Mishap

A LHE accident occurs when any one or more of the eight elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; or collision, including unplanned contact between the load, crane, or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents, even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, or roll over). Document any mishap that meets the criteria described using the Crane High Hazard working group mishap reporting form.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information onlysubmittals not having a "G" designation are for Contractor Quality Control or Designer of Record approval. Submit the following in accordance with Section 01 33 00SUBMITTAL PROCEDURES:

Government acceptance, as defined in EM 385-1-1, is required for submittals with a "G designation.

SD-01 Preconstruction Submittals

Standard Lift Plan; G

Accident Prevention Plan (APP); G

Critical Lift Plan; G

SD-06 Test Reports

Monthly Exposure Reports

Notifications and Reports

Accident Reports; G

LHE Inspection Reports

SD-07 Certificates

Crane Operators/Riggers; G

[Naval Architecture Analysis; G

] Activity Hazard Analysis (AHA); G

Confined Space Entry Permit

Hot Work Permit

Certificate of Compliance

1.4 MONTHLY EXPOSURE REPORTS

Provide a Monthly Exposure Report and attach to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both Prime and subcontractor. Failure to submit the report may result in retention of up to 10 percent of the voucher. Monthly exposure reports are to be tracked and generated through RMS.

1.5 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this Contract, comply with USACE EM 385-1-1, MHLW Laws, and Host Nation laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern.

1.6 SITE QUALIFICATIONS, DUTIES, AND MEETINGS

1.6.1 Personnel Qualifications

1.6.1.1 Site Safety and Health Officer (SSHO)

Provide an SSHO that meets the requirements of EM 385-1-1 Section 1. Provide a Safety oversight team that includes a minimum of one (1) person at each project site to function as the Site Safety and Health Officer (SSHO). The SSHO or an equally-qualified Alternate SSHO must be at the work site at all times to implement and administer the Contractor's safety

program and government-accepted Accident Prevention Plan. The SSHO and Alternate SSHO must have the required training, experience, and qualifications in accordance with EM 385-1-1 Section 01.A.17, and all associated sub-paragraphs.

If the SSHO is off-site for a period longer than 24 hours, an equally-qualified alternate SSHO must be provided and must fulfill the same roles and responsibilities as the primary SSHO. When the SSHO is temporarily (up to 24 hours) off-site, a Designated Representative (DR), as identified in EM 385-1-1 and the AHA may be used in lieu of an Alternate SSHO, and must be on the project site at all times when work is being performed. Note that the DR is a collateral duty safety position, with safety duties in addition to their full time occupation.

The SSHO shall meet the following additional requirements:

a. A minimum of 5 years safety work on similar projects.

b. 30-hour OSHA construction safety class or equivalent within the last 5 years. Completion of OSHA construction safety class or equivalent shall be submitted as part of the APP submittal.

   Host Nation safety training is considered to meet the equivalent of the 30-hour OSHA construction safety course. The Japan Construction Occupational Safety and Health Association (JCOSHA) provides the construction safety course "Kouji Shunin" Course, or "Shocho" Course for Construction Site Managers" as an equivalent to the 30-hour OSHA construction safety course. The training can be viewed at the JCOSHA website: http://www.kensaibou.or.jp.

c. SSHOs shall maintain competency through having taken 8 hours of documented formal, on-line, or self-study safety and health related coursework every year for the past 5 years. Examples of continuing education activities that meet this requirement are: writing an article, teaching a class, reading/writing professional articles, attendance/participation in professional societies/meetings, etc.

   Competency training can be obtained from Japan Construction Occupational Safety and Health Association (JCOSHA) or equivalent. Copies of the competent person training shall be part of the APP submittal.

   The completion of the NAVFAC 24-hour EM 385-1-1 Awareness Course for Contractors cannot be used as credit for formal safety training required by EM 385-1-1, para 01.A.17.

1.6.1.2 Competent Person Qualifications

Provide Competent Persons in accordance with EM 385-1-1, Appendix Q and herein. Competent Persons for high risk activities include confined space, cranes and rigging, excavation/trenching, fall protection, and electrical work. The CP for these activities must be designated in writing, and meet the requirements for the specific activity (i.e. competent person, fall protection).

The Competent Person identified in the Contractor's Safety and Health Program and accepted Accident Prevention Plan, must be on-site at all times when the work that presents the hazards associated with their professional expertise is being performed. Provide the credentials of the

Competent Persons(s) to the Contracting Officer for information in consultation with the Safety Office.

1.6.1.2.1 Competent Person for Confined Space Entry

Provide a Confined Space (CP) Competent Person who meets the requirements of EM 385-1-1, Appendix Q, and herein. The CP for Confined Space Entry must supervise the entry into each confined space.

[Since this work involves marine operations that handle combustible or hazardous materials, this person must have the ability to understand and follow through on the air sampling, Personal Protective Equipment (PPE), and instructions of a Marine Chemist, Coast Guard authorized persons, or Certified Industrial Hygienist. Confined space and enclosed space work must comply with NFPA 306, OSHA 29 CFR 1915, Subpart B, "Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment," or as applicable, 29 CFR 1910.147 for general industry.

]1.6.1.2.2 Competent Person for Scaffolding

Provide a Competent Person for Scaffolding who meets the requirements of EM 385-1-1, Section 22.B.02 and herein.

1.6.1.2.3 Competent Person for Fall Protection

Provide a Competent Person for Fall Protection who meets the requirements of EM 385-1-1, Section 21.C.04 and herein.

[1.6.1.3 Dredging Contract Requirements

1.6.1.3.1 Dredging Safety Personnel Requirements

a. Provide a minimum of one full time SSHO assigned per project site for the primary working shift.

b. For a project involving multiple work shifts, provide one full-time SSHO for each additional shift.

c. For individual dredging projects or sites with a dredge crew and fill crew on watch of 8 employees or less, a CDSO must be appointed, instead of an SSHO. The CDSO assumes the same responsibilities as a full-time SSHO.

d. An example of one dredging project site is reflected in each of the following:

(1) a mechanical dredge, tug(s) and scow(s), scow route, and material placement site; or

(2) a hydraulic pipeline dredge, attendant plant, and material placement site; or,

(3) a hopper dredge (include land-based material placement site - if applicable.)

e. For Hopper Dredges with the U.S. Coast Guard, documented crews may designate an officer as a Collateral Duty Safety Officer (CDSO) instead of having a full-time SSHO onboard if the officer meets the SSHO training and experience requirements.

1.6.1.3.2 SSHO Requirements for Dredging

a. In addition to requirements stated elsewhere in this specification, an individual serving as a SSHO must be present at the project site, located so that they have full mobility and reasonable access to all major work operations, for at least one shift in each 24 hour period when work is being performed. The SSHO must be available during their shift for immediate verbal consultation and notification, either by phone or radio.

b. The SSHO is a full-time, dedicated position, except as noted above, who must report to a senior project (or corporate) official. When the SSHO is permitted to be a collateral duty, the SSHO is not permitted to be in another position requiring continuous mechanical or equipment operations, such as equipment operators.

c. The SSHO must inspect all work areas and operations during initial setup and at least monthly observe and provide personal oversight on each shift during dredging operations for projects with many work sites, more often for those with less work sites.

d. If the SSHO is off-site for a period longer than 24 hours, another qualified SSHO must be provided and fulfill the same roles and responsibilities as the SSHO during their absence.

1.6.1.3.3 Collateral Duty Safety Officer (CDSO) Requirements for Dredging

a. A CDSO is an individual who is assigned collateral duty safety responsibilities in addition to their full-time occupation, and who supports and supplements the SSHO efforts in managing, implementing and enforcing the Contractor's Safety and Health Program. The assigned CDSO must be an individual(s) with work oversight responsibilities, such as master, mate, fill foreman, or superintendent. A CDSO must not be an employee responsible for continuous mechanical or equipment operations, such as an equipment operator.

b. A CDSO performs safety program tasks as assigned by the SSHO and must report safety findings to the SSHO. The SSHO must document results of safety findings and provide information for inclusion in the CQC reports to the Contracting Officer.

1.6.1.3.4 Safety Personnel Training Requirements for Dredging

A SSHO and a CDSO for dredging contracts must take either a formal classroom or online OSHA 30-hour Construction Safety Course, or an equivalent 30 hours of formal classroom or online safety and health training covering the subjects of the OSHA 30-hour Course in accordance with EM 385-1-1 Appendix A, paragraph 3.d.(3), applicable to dredging work, and given by qualified instructors. In exception to EM 385-1-1, Section 01.A.17, comply with the following:

a. The SSHO must maintain competency through having taken 8 hours of formal classroom or online safety and health related coursework every year for the past 5 years. Hours spent as an instructor in such courses will be considered the same as attending them, but each course only gets credit once (for example, instructing a 1-hour asbestos awareness course 5 times in a year provides one hour credit for

training).

b. The SSHO and a CDSO must have a minimum of three years of experience within the past five years in one of the following:

(1) Supervising/managing dredging activities

(2) Supervising/managing marine construction activities

(3) Supervising/managing land-based construction activities

(4) Work managing safety programs or processes

(5) Conducting hazard analyses and developing controls in activities or environments with similar hazards

]1.6.1.4 Crane Operators/Riggers

Provide Operators meeting the requirements in EM 385-1-1, Section 15.B for Riggers and Section 16.B for Crane Operators. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacities of 22,680 kg or greater, designate crane operators qualified by a source that qualifies crane operators (i.e., union, a Government agency, or an organization that tests and qualifies crane operators). Provide proof of current qualification.

1.6.1.5 Load Handling Equipment Operator Accepted Alterative

The Commander, POJ, has determined that there are adequate provisions provided under the Government of Japan (GOJ) Ordinance to achieve the required protections for crane operator licensing and practical training requirements employed as part of contracted activities provided for USACE within the locality of Japan. Reference POJ-SO decision memorandum, subject, Alternate Requirement Analysis - Load Handling Equipment, Qualifications, dated 8 January 2020.

Provisions within the JOISH Articles 223-228 provide sufficient confirmation of an operator's certification/qualification and practical training to achieve the intent of EM 385-1-1, Section 16, and paragraph 16.B.03.

JIOSH Articles 223 establishes the Director of the Prefectural Labour Bureau as the licensing authority. Based upon this Article the Ministry of Labour is the recognized auditor, established for local accreditation of certification and training programs.

1.6.2 Personnel Duties

1.6.2.1 Duties of the Site Safety and Health Officer (SSHO)

The SSHO shall:

a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Attach safety inspection logs to the Contractors' daily production report.

b. Conduct mishap investigations and complete required reports. Report

mishaps and near misses.

c. Use OSHA's Form 300 to log work-related injuries and illnesses occurring on the project site for Contractors and Subcontractors. Post and maintain the Form 300 on the site Safety Bulletin Board.

d. Maintain applicable safety reference material on the job site.

e. Attend the pre-construction conference, pre-work meetings including preparatory meetings, and periodic in-progress meetings.

f. Review the APP and AHAs for compliance with EM 385-1-1, and approve, sign, implement and enforce them.

g. Establish a Safety and Occupational Health (SOH) Deficiency Tracking System that lists and monitors outstanding deficiencies until resolution.

h. Ensure Subcontractor compliance with safety and health requirements.

i. Maintain a list of hazardous chemicals on site and their material Safety Data Sheets (SDS).

j. Maintain a weekly list of high hazard activities involving energy, equipment, excavation, entry into confined space, and elevation, and be prepared to discuss details during QC Meetings.

k. Provide and keep a record of site safety orientation and indoctrination for Contractor employees, Subcontractor employees, and site visitors.

Failure to perform the above duties shall result in dismissal of the superintendent, QC Manager, and/or SSHO, and a project work stoppage. Project work stoppage shall remain in effect pending approval of a suitable replacement.

1.6.3 Meetings

1.6.3.1 Preconstruction Conference

a. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).

b. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that shall be developed and implemented during the performance of the Contract. This list of proposed AHAs shall be reviewed at the conference and an agreement shall be reached between the Contractor and the Contracting Officer's Representative as to which phases shall require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.

c. Deficiencies in the submitted APP, identified during the Contracting

Officer's review, must be corrected, and the APP re-submitted for review prior to the start of construction. Work is not permitted to begin work until an APP is established that is acceptable to the Contracting Officer.

1.6.3.2 Safety Meetings

Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors on the project location. The SSHO, supervisors, foremen, or CDSOs must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer of all scheduled meetings 7 calendar days in advance.

1.7 ACCIDENT PREVENTION PLAN (APP)

A qualified person must prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of EM 385-1-1, Appendix A, and as supplemented herein. Cover all paragraph and subparagraph elements in EM 385-1-1, Appendix A. The APP must be job-specific and address any unusual or unique aspects of the project or activity for which it is written. The APP must interface with the Contractor's overall safety and health program referenced in the APP in the applicable APP element, and made site-specific. Describe the methods to evaluate past safety performance of potential Subcontractors in the selection process. Also, describe innovative methods used to ensure and monitor safe work practices of Subcontractors. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the Subcontractors. Contractors are responsible for informing their Subcontractors of the safety provisions under the terms of the Contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting Subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP must be signed by an officer of the firm (Prime Contractor senior person), the individual preparing the APP, the on-site superintendent, the designated SSHO, the Contractor Quality Control Manager. The SSHO must provide and maintain the APP and a log of signatures by each Subcontractor foreman, attesting that they have read and understand the APP, and make the APP and log available on-site to the Contracting Officer. If English is not the foreman's primary language, the Prime Contractor must provide an interpreter.

Submit the APP to the Contracting Officer including attachment 01 35 26-A "Form A-02 Accident Prevention Plan Checklist" 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP. Once reviewed and accepted by the Contracting Officer, the APP and attachments shall be enforced as part of the Contract. Disregarding the provisions of this Contract or the accepted APP is cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified. Continuously review and amend the APP, as necessary, throughout the life of the Contract. Changes to the accepted APP must be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and

Quality Control Manager. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered. Should any severe hazard exposure (i.e. imminent danger) become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate and remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSP A10.34), and the environment.

Copies of the accepted APP shall be maintained at the resident engineer's office and at the job site. Continuously review and amend the APP, as necessary, throughout the life of the contract. Incorporate unusual or high-hazard activities not identified in the original APP as discovered.

1.7.1 Names and Qualifications

Provide plans in accordance with the requirements outlined in Appendix A of EM 385-1-1, including the following:

a. Names and qualifications (resumes including education, training, experience and certifications) of site safety and health personnel designated to perform work on this project to include the designated Site Safety and Health Officer and other competent and qualified personnel to be used. Specify the duties of each position.

b. Qualifications of competent and of qualified persons. As a minimum, designate and submit qualifications of competent persons for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; and personal protective equipment and clothing to include selection, use and maintenance.

1.7.2 Plans

Provide plans in the APP in accordance with the requirements outlined in Appendix A of EM 385-1-1, including the following:

1.7.2.1 Confined Space Entry Plan

Develop a confined or enclosed space entry plan in accordance with EM 385-1-1 and any other installation specific procedures, Host Nation, and local regulatory requirements identified in this Contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by Contractor personnel and the coordination with emergency responders. (If there is no confined space work, include a statement that no confined space work exists and none shall be created.)

1.7.2.2 Standard Lift Plan (SLP)

Plan lifts to avoid situations where the operator cannot maintain safe control of the lift. Prepare a written SLP in accordance with EM 385-1-1, Section 16.A.03, using Form 16-2 for every lift or series of lifts (if duty cycle or routine lifts are being performed). The SLP must be developed, reviewed and accepted by all personnel involved in the lift in conjunction with the associated AHA. Signature on the AHA constitutes

acceptance of the plan. Maintain the SLP on the LHE for the current lift(s) being made. Maintain historical SLPs for a minimum of three months.

1.7.2.3 Critical Lift Plan - Crane or Load Handling Equipment

Provide a Critical Lift Plan as required by EM 385-1-1, Section 16.H.01, using Form 16-3. Critical lifts require detailed planning and additional or unusual safety precautions. Develop and submit a critical lift plan to the Contracting Officer 30 calendar days prior to critical lift. Comply with load testing requirements in accordance with EM 385-1-1, Section 16.F.03.

In addition to the requirements of EM 385-1-1, Section 16.H.02, the critical lift plan must include the following:

a. For lifts of personnel, demonstrate compliance with the requirements of EM 385-1-1, Section 16.T.

b. [For barge mounted mobile cranes, provide a Naval Architecture Analysis and include an LHE Manufacturer's Floating Service Load Chart in accordance with the criteria from the selected standard in EM 385-1-1, Section 16.L.02. The Floating Service Load Chart must provide a table of rated load versus boom angle and radius. The Floating Service Load Chart must also provide the maximum allowable machine list and trim associated with the tabular loads and radii provided. If the Manufacturer's Floating Service Load Chart is not available, a floating service load chart may be developed and provided by a qualified Registered Professional Engineer (RPE), competent in the field of floating cranes. The Load Chart must be in accordance with the criteria from the selected standard in EM 385-1-1, Section 16.L; provide a table of rated load versus boom angle and radius; provide the maximum allowable machine list and machine trim associated with the tabular loads and radii provided; and be stamped by a RPE qualified and competent in the field of floating cranes. The RPE, competent in the field of floating cranes must stamp and certify (sign) that the Naval Architectural Analysis (NAA) meets the requirements of EM 385-1-1, Section 16.L.03.][Reserved.]

c. Multi-purpose machines, material handling equipment, and construction equipment used to lift loads that are suspended by rigging gear, require proof of authorization from the machine OEM that the machine is capable of making lifts of loads suspended by rigging equipment. Demonstrate that the operator is properly trained and that the equipment is properly configured to make such lifts and is equipped with a load chart.

1.7.2.4 Fall Protection and Prevention (FP&P) Plan

The plan must comply with the requirements of EM 385-1-1, Section 21.D, be site specific, and address all fall hazards in the work place and during different phases of construction. Address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 1.8 m. A competent person or qualified person for fall protection must prepare and sign the plan documentation. Include fall protection and prevention systems, equipment and methods employed for every phase of work, roles and responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Review and revise, as necessary, the Fall Protection and Prevention Plan

documentation as conditions change, but at a minimum every six months, for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. Keep and maintain the accepted Fall Protection and Prevention Plan documentation at the job site for the duration of the project. Include the Fall Protection and Prevention Plan documentation in the Accident Prevention Plan (APP).

1.7.2.5 Rescue and Evacuation Plan

Provide a Rescue and Evacuation Plan in accordance with EM 385-1-1 Section 21.N and include in the FP&P Plan and as part of the APP. Include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility.

1.7.2.6 Hazardous Energy Control Program (HECP)

Develop a HECP in accordance with EM 385-1-1 Section 12. Submit this HECP as part of the Accident Prevention Plan (APP). Conduct a preparatory meeting and inspection with all effected personnel to coordinate all HECP activities. Document this meeting and inspection in accordance with EM 385-1-1, Section 12.A.02. Ensure that each employee is familiar with and complies with these procedures.

1.7.2.7 Excavation Plan

Identify the safety and health aspects of excavation, and provide and prepare the plan in accordance with EM 385-1-1, Section 25.A and Section 31 00 00 EARTHWORK.

[1.7.2.8 Occupant Protection Plan

Identify the safety and health aspects of lead-based paint removal, prepared in accordance with Section 02 83 13.00 20 and Section 6, USACE EM 385-1-1 for LEAD IN CONSTRUCTION.

][1.7.2.9 Asbestos Hazard Abatement Plan

Identify the safety and health aspects of asbestos work, and prepare in accordance with Section 02 82 13.00 10 and Section 6, USACE EM 385-1-1 for ASBESTOS ABATEMENT.

][1.7.2.10 Site Safety and Health Plan

Identify the safety and health aspects, and prepare in accordance with Section 01 35 29.13 HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES.

][1.7.2.11 PCB and Mercury Plan

Identify the safety and health aspects of Polychlorinated Biphenyls and mercury work, and prepare in accordance with Sections 02 84 16 and Section 33, USACE EM 385-1-1 for HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBs AND MERCURY.

][1.7.2.12 Site Demolition Plan

Identify the safety and health aspects, and prepare in accordance with

Section 02 41 00 DEMOLITION and referenced sources.

]1.8 ACTIVITY HAZARD ANALYSIS (AHA)

Before beginning each activity, task or Definable Feature of Work (DFOW) involving a type of work presenting hazards not experienced in previous project operations, or where a new work crew or Subcontractor is to perform the work, the Contractor(s) performing that work activity must prepare an AHA. AHAs must be developed by the Prime Contractor, Subcontractor, or supplier performing the work, and provided for Prime Contractor review and approval before submitting to the Contracting Officer. AHAs must be signed by the SSHO, Superintendent, QC Manager and the Subcontractor Foreman performing the work. Format the AHA in accordance with EM 385-1-1, Section 1 or as directed by the Contracting Officer. Submit the AHA for review at least 15 working days prior to the start of each activity task, or DFOW. The Government reserves the right to require the Contractor to revise and resubmit the AHA if it fails to effectively identify the work sequences, specific anticipated hazards, site conditions, equipment, materials, personnel and the control measures to be implemented.

AHAs must identify competent persons required for phases involving high risk activities, including confined entry, crane and rigging, excavations, trenching, electrical work, fall protection, and scaffolding.

1.8.1 AHA Management

Review the AHA list periodically (at least monthly) at the Contractor supervisory safety meeting, and update as necessary when procedures, scheduling, or hazards change. Use the AHA during daily inspections by the SSHO to ensure the implementation and effectiveness of the required safety and health controls for that work activity.

1.8.2 AHA Signature Log

Each employee performing work as part of an activity, task or DFOW must review the AHA for that work and sign a signature log specifically maintained for that AHA prior to starting work on that activity. The SSHO must maintain a signature log on site for every AHA. Provide employees whose primary language is other than English, with an interpreter to ensure a clear understanding of the AHA and its contents.

1.9 DISPLAY OF SAFETY INFORMATION

1.9.1 Safety Bulletin Board

Within one calendar day after commencement of work, erect a safety bulletin board at the job site. Where size, duration, or logistics of project do not facilitate a bulletin board, an alternative method, acceptable to the Contracting Officer, that is accessible and includes all mandatory information for employee and visitor review, shall be deemed as meeting the requirement for a bulletin board. Include and maintain information on safety bulletin board as required by EM 385-1-1. Additional items required to be posted include:

a. Confined space entry permit.

b. Hot work permit.

1.9.2 Safety and Occupational Health (SOH) Deficiency Tracking System

Establish a SOH deficiency tracking system that lists and monitors the status of SOH deficiencies in chronological order. Use the tracking system to evaluate the effectiveness of the APP. A monthly evaluation of the data must be discussed in the QC or SOH meeting with everyone on the project. The list must be posted on the project bulletin board and updated daily, and provide the following information:

a. Date deficiency identified;

b. Description of deficiency;

c. Name of person responsible for correcting deficiency;

d. Projected resolution date;

e. Date actually resolved.

Deficiencies and resolutions are to be tracked through RMS.

1.10 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in the paragraph REFERENCES. Maintain applicable equipment manufacturer's manuals.

1.11 EMERGENCY MEDICAL TREATMENT

Contractors shall arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment. Verify and coordinate for on post/installation emergency medical treatment response.

1.12 NOTIFICATIONS AND REPORTS

1.12.1 Mishap Notification

Notify the Contracting Officer as soon as practical, but no more than twenty-four hours, after any mishaps, including recordable accidents, incidents, and near misses, as defined in EM 385-1-1 Appendix Q, any report of injury, illness, load handling equipment (LHE) or rigging mishaps, or any property damage. The Contractor is responsible for obtaining appropriate medical and emergency assistance and for notifying fire, law enforcement, and regulatory agencies. Immediate reporting is required for electrical mishaps, to include Arc Flash; shock; uncontrolled release of hazardous energy (includes electrical and non-electrical); load handling equipment or rigging; fall from height (any level other than same surface); and underwater diving in accordance with EM 385-1-1, para 01.D.05 for High Hazard mishaps. These mishaps must be investigated in depth to identify all causes and to recommend hazard control measures.

Within notification include Contractor's name; Contract title; type of Contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government

investigation is conducted. Assist and cooperate fully with the Government's investigation(s) of any mishap.Notifications are to be tracked in RMS.

1.12.2 Accident Reports

a. Conduct an accident investigation for recordable injuries and illnesses, property damage, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. Complete the applicable Pacific Ocean Division 265-Series form for Immediate Notification of Accident within 24 hours for all mishaps beyond first aid, property damage, and near miss. The USACE Accident Report ENG 3394 and Preliminary Accident Notification (PAN) forms shall be submitted within 24 hours for Class A or B mishaps or for High Hazard type mishaps in accordance with EM 385-1-1, para 01.D.05 or within 72 hours and provide the required reports to the Contracting Officer. The Contracting Officer shall provide copies of any required or special forms.

b. Near Misses: Report all "Near Misses" to the Government Designated Authority (GDA), using local mishap reporting procedures, within 24 hrs. The Contracting Officer shall provide the Contractor the required forms. Near miss reports are considered positive and proactive Contractor safety management actions.

c. Conduct an accident investigation for any load handling equipment accident (including rigging gear accidents) to establish the root cause(s) of the accident, complete the LHE Accident Report (Crane and Rigging Gear) form, and provide the report to the Contracting Officer within 30 calendar days of the accident. Do not proceed with crane operations until cause is determined and corrective actions have been implemented to the satisfaction of the Contracting Officer. The Contracting Officer shall provide a blank copy of the accident report form.

1.12.3 LHE Inspection Reports

Submit LHE inspection reports required in accordance with EM 385-1-1 and as specified herein with Daily Reports of Inspections.

1.12.4 Certificate of Compliance and Pre-lift Plan/Checklist for LHE and Rigging

Provide a FORM 16-1 Certificate of Compliance for LHE entering an activity under this contract and in accordance with EM 385-1-1. Post certifications on the crane.

Develop a Standard Lift Plan (SLP) in accordance with EM 385-1-1, Section 16.H.03 using Form 16-2 Standard Pre-Lift Crane Plan/Checklist for each lift planned. Submit SLP to the Contracting Officer for approval within 15 calendar days in advance of planned lift.

1.13 HOT WORK

1.13.1 Permit and Personnel Requirements

Submit and obtain a written permit prior to performing "Hot Work" (i.e. welding or cutting) or operating other flame-producing/spark producing devices, from the Installation Fire Department. Contractors are required

to meet all criteria before a permit is issued. Provide at least two (2) 9kg 4A:20 BC rated extinguishers for normal "Hot Work". Extinguishers shall be current inspection tagged, and have approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch shall be trained in accordance with NFPA 51B and remain on-site for a minimum of one hour after completion of the task or as specified on the hot work permit.

When starting work in the facility, require personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Base Fire Department phone number. Report any fire, no matter how small, to the responsible Base Fire Department immediately.

1.13.2 Work Around Flammable Materials

Obtain services from a NFPA Certified Marine Chemist or qualified Certified Industrial Hygienist who has extensive knowledge and experience for "HOT WORK" within or around flammable materials (such as fuel systems or welding/cutting on fuel pipes) or confined spaces (such as sewer wet wells, manholes, or vaults) that have the potential for flammable or explosive atmospheres.

Whenever these materials, except beryllium and chromium (VI), are encountered in indoor operations, local mechanical exhaust ventilation systems that are sufficient to reduce and maintain personal exposures to within acceptable limits must be used and maintained in accordance with manufacturer's instruction and supplemented by exceptions noted in EM 385-1-1, Section 06.H.

1.14 CONFINED SPACE ENTRY REQUIREMENTS

Confined space entry must comply with Section 34 of EM 385-1-1, and any other installation specific procedures, Host Nation, and local regulatory requirements identified in this Contract. Any potential for a hazard in the confined space requires a permit system to be used. Obtain written permission from the Contracting Officer prior to confined space entry by personnel.

1.14.1 Entry Procedures

Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. Comply with EM 385-1-1, Section 34 for entry procedures. Hazards pertaining to the space must be reviewed with each employee during review of the AHA.

1.14.2 Forced Air Ventilation

Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its action level.

1.14.3 Sewer Wet Wells

Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

1.14.4 Rescue Procedures and Coordination with Local Emergency Responders

Develop and implement an on-site rescue and recovery plan and procedures. The rescue plan must not rely on local emergency responders for rescue from a confined space.

[1.15 DIVE SAFETY REQUIREMENTS

Develop a Dive Operations Plan, AHA, emergency management plan, and personnel list that includes qualifications, for each separate diving operation. Submit these documents to the District Dive Coordinator (DDC) for review and acceptance at least 15 working days prior to commencement of diving operations. These documents must be at the diving location at all times. Provide each of these documents as a part of the project file.

]1.16 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor must:

a. Secure outside equipment and materials and place materials that could be damaged in protected areas.

b. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.

c. Ensure that temporary erosion controls are adequate.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CONSTRUCTION AND OTHER WORK

Comply with EM 385-1-1, NFPA 70, NFPA 70E, NFPA 241, the APP, the AHA, OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard prevails.

PPE is governed in all areas by the nature of the work the employee is performing. Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks. Safety glasses must be carried/available on each person. Mandatory PPE includes:

a. Hard Hat.

b. Long Pants.

c. Appropriate Safety Shoes.

d. Appropriate Class Reflective Vests.

3.1.1 Worksite Communication

Employees working alone in a remote location or away from other workers must be provided an effective means of emergency communications (i.e., cellular phone, two-way radios, land-line telephones or other acceptable means). The selected communication must be readily available (easily within the immediate reach) of the employee and must be tested prior to

the start of work to verify that it effectively operates in the area/environment. An employee check-in/check-out communication procedure must be developed to ensure employee safety.

3.1.2 Radiation Safety Requirements

Notwithstanding any other hazardous material used in this Contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint, and hexavalent chromium, are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. Low mercury lamps used within fluorescent lighting fixtures are allowed as an exception without further Contracting Officer approval. The Contractor shall request approval in writing to the Contracting Officer not less than thirty (30) calendar days in advance of any request for exception. Following Contracting Officer approval of any radiation related exception, the Contractor shall coordinate with the Contracting Officer's Representative at least fifteen (15) calendar days in advance to notify the Radiation Safety Officer (RSO) prior to excepted items of radioactive material and devices being brought on base.

3.2 PRE-OUTAGE COORDINATION MEETING

Apply for utility outages at least [sixty (60)] calendar days in advance. As a minimum, the request shall include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. All utility outages shall be coordinated with Installation officials and are subject to Installation requirements. No utility outages shall be permitted (unless under emergency conditions) until the Contractor receives written approval from the Contracting Officer. Once approved, and prior to beginning work on the utility system requiring shut down, attend a pre-outage coordination meeting with the Contracting Officer and the Installation representative to review the scope of work and the lock-out/tag-out procedures for worker protection. No work shall be performed on energized electrical circuits unless proof is provided that no other means exist.

3.2.1 Okinawa Utility Outages

Outages (power, water, sewer, and communications) for the following listed dates, times, and locations shall not be permitted during the performance of this Contract, unless approved by the authorized agent of the Installation Commander and Contracting Officer's Representative:

a. DoDEA Schools: No outages from 01 September through 31 July, Monday through Friday between the hours of 0700 and 1800.

b. Family Housing Areas: No outages will be allowed on Saturdays when DoDEA schools are not in session. No more than two (2) outages for the same utility service shall be allowed in a one-month period (30 calendar days), and no more than one (1) outage in a two-week period (14 calendar days).

c. U.S. Government Holidays: No outages during the following periods:

(1) New Year's Day - to include seven (7) calendar days before and one (1) calendar day after this date (contiguous with the Christmas Day outage requirement).

(2) Martin Luther King's Birthday - to include the following Tuesday.

(3) President's Day - to include the following Tuesday.

(4) Memorial Day - to include the following Tuesday.

(5) Juneteenth - to include one (1) calendar day before and after this date.

(6) Independence Day - to include one (1) calendar day before and after this date.

(7) Labor Day - to include the following Tuesday.

(8) Columbus Day - to include the preceding Friday.

(9) Veteran's Day - to include two (2) calendar days before and after this date.

(10) Thanksgiving Day - to include one (1) calendar day before and after this date.

(11)Christmas Day - to include seven (7) calendar days before and after this date (contiguous with the New Year's Day outage requirement).

d. Child Development Centers (CDC): Outages allowed only when the CDC is closed or on Sundays.

e. Marine Corps Bases: No outages during Marine Corps Balls or Change of Commands which are normally scheduled between 20 October and 21 November. Specific dates and locations shall be provided during or subsequent to the Preconstruction Conference.

f. Kadena Air Base: No outages during Change of Commands. Specific dates and locations shall be provided during or subsequent to the Preconstruction Conference.

g. Torii Station: No outages during Change of Commands. Specific dates and locations shall be provided during or subsequent to the Preconstruction Conference.

3.2.2 Reimursement for Public Works Support of Electrical Outages

The Contractor shall reimburse the NAF Atsugi Public Works Department for its costs to prepare for, support, and recover from Contractor requested utility outages associated with this work. Public Works efforts include setting up generators, securing elevators and securing utilities before the outage, and restoring these systems after the outage. The work includes resetting steam systems, air conditioning systems, hot water systems and electrical systems. Outages during the heating and cooling season cost $1,369 to support during normal working hours, and $3,200 during overtime hours. Outages in the spring and fall, between heating

and cooling seasons, cost $1,150 to support during normal working hours, and $2,696 during overtime hours.

3.3 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Provide and operate a Hazardous Energy Control Program (HECP) in accordance with EM 385-1-1 Section 12, 29 CFR 1910.333, 29 CFR 1915.89, and paragraph HAZARDOUS ENERGY CONTROL PROGRAM (HECP).

3.4 FALL PROTECTION PROGRAM

Establish a fall protection program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify roles and responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures in accordance with EM 385-1-1, Sections 21.A and 21.D.

3.4.1 Training

Institute a fall protection training program. As part of the Fall Protection Program, provide training for each employee who might be exposed to fall hazards. Provide training by a competent person for fall protection in accordance with EM 385-1-1, Section 21.C. Document training and practical application of the competent person in accordance with EM 385-1-1, Section 21.C.04 and in the AHA.

3.4.2 Fall Protection Equipment and Systems

Enforce use of personal fall protection equipment and systems designated (to include fall arrest, restraint, and positioning) for each specific work activity in the Site Specific Fall Protection and Prevention Plan and AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1, Section 21.

Provide personal fall protection equipment, systems, subsystems, and components that comply with EM 385-1-1 Section 21.I.

3.4.2.1 Additional Personal Fall Protection

In addition to the required fall protection systems, other protection such as safety skiffs, personal floatation devices, and life rings, are required when working above or next to water in accordance with EM 385-1-1, Sections 21.O through 21.O.06. Personal fall protection systems and equipment are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall protection systems are required when operating other equipment such as scissor lifts. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, travel, or while performing work.

3.4.2.2 Personal Fall Protection Harness

Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. The use of body belts is not acceptable. Harnesses must have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Snap

hooks and carabiners must be self-closing and self-locking, capable of being opened only by at least two consecutive deliberate actions and have a minimum gate strength of 1,633 kg in all directions. Use webbing, straps, and ropes made of synthetic fiber. The maximum free fall distance when using fall arrest equipment must not exceed 1.8 m, unless the proper energy absorbing lanyard is used. Always take into consideration the total fall distance and any swinging of the worker (pendulum-like motion), that can occur during a fall, when attaching a person to a fall arrest system. All full body harnesses must be equipped with Suspension Trauma Preventers such as stirrups, relief steps, or similar in order to provide short-term relief from the effects of orthostatic intolerance in accordance with EM 385-1-1, Section 21.I.06.

3.4.3 Fall Protection for Roofing Work

Implement fall protection controls based on the type of roof being constructed and work being performed. Evaluate the roof area to be accessed for its structural integrity including weight-bearing capabilities for the projected loading.

a. Low Sloped Roofs:

(1) For work within 1.8 m of an edge, on a roof having a slope less than or equal to 4:12 (vertical to horizontal), protect personnel from falling by use of personal fall arrest/restraint systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and is not authorized.

(2) For work greater than 1.8 m from an edge, erect and install warning lines in accordance with EM 385-1-1, Section L.

b. Steep-Sloped Roofs: Work on a roof having a slope greater than 4:1 (vertical to horizontal) requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also applies to residential or housing type construction.

3.4.4 Horizontal Lifelines (HLL)

Provide HLL in accordance with EM 385-1-1, Section 21.I.08.d.2. Commercially manufactured horizontal lifelines (HLL) must be designed, installed, certified and used, under the supervision of a qualified person, for fall protection as part of a complete fall arrest system which maintains a safety factor of 2. The competent person for fall protection may (if deemed appropriate by the qualified person) supervise the assembly, disassembly, use and inspection of the HLL system under the direction of the qualified person. Locally manufactured HLLs are not acceptable unless they are custom designed for limited or site specific applications by a Registered Professional Engineer who is qualified in designing HLL systems.

3.4.5 Guardrails and Safety Nets

Design, install, and use guardrails and safety nets in accordance with EM 385-1-1, Section 21.F.01.

3.4.6 Rescue and Evacuation Procedures

When personal fall arrest systems are used, ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. Prepare a

Rescue and Evacuation Plan and include a detailed discussion of the following: methods of rescue; methods of self-rescue or assisted-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan within the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident Prevention Plan (APP). The plan must comply with the requirements of Section 21.N of EM 385-1-1.

3.5 WORK PLATFORMS

3.5.1 Scaffolding

Provide employees with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Comply with the following requirements:

a. Scaffold platforms greater than 6 m in height must be accessed by use of a scaffold stair system.

b. Ladders commonly provided by scaffold system manufacturers are prohibited for accessing scaffold platforms greater than 6 m maximum in height.

c. An adequate gate is required.

d. Employees performing scaffold erection and dismantling must be qualified.

e. Scaffold must be capable of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan.

f. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward.

g. Special care must be given to ensure scaffold systems are not overloaded.

h. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material are prohibited. The first tie-in must be at the height equal to 4 times the width of the smallest dimension of the scaffold base.

i. Scaffolding other than suspended types must bear on base plates upon wood mudsills (51 mm by 254 mm by 203 mm minimum) or other adequate firm foundation.

j. Scaffold or work platform erectors must have fall protection during the erection and dismantling of scaffolding or work platforms that are more than 1.83 m.

k. Delineate fall protection requirements when working above 1.83 m or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

3.5.2 Scaffolding Accepted Alterative

The Commander, POJ, has determined that there are adequate provisions provided under the Government of Japan Ordinance to achieve the required protections for supported metal scaffolding employed as part of contracted activities provided for U.S. Army Corps of Engineers (USACE) within the locality of Japan. Reference POJ-SO decision memorandum, subject, Alternate Requirement Analysis - Scaffolding Standards Review, dated 24 September 2019.

This determination only includes supported metal scaffolding structures and does not include other forms of scaffolding methods included in Section 22.

JOISH requirements for steel scaffolding structures to conform to the Japanese Industrial Standard (JIS) A-895l are comparable to those of ANSI A10.8, providing sufficient protection required to achieve the provisions of EM 385-1-1, Section 22, paragraph 22.A.01.

3.5.3 Elevated Aerial Work Platforms (AWPs)

Workers must be anchored to the basket or bucket in accordance with manufacturer's specifications and instructions (anchoring to the boom may only be used when allowed by the manufacturer and permitted by the CP). Lanyards used must be sufficiently short to prohibit worker from climbing out of basket. The climbing of rails is prohibited. Lanyards with built-in shock absorbers are acceptable. Self-retracting devices are not acceptable. Tying off to an adjacent pole or structure is not permitted unless a safe device for 100 percent tie-off is used for the transfer.

Use of AWPs must be operated, inspected, and maintained as specified in the operating manual for the equipment and delineated in the AHA. Operators of AWPs must be designated as qualified operators by the Prime Contractor. Maintain proof of qualifications on site for review and include in the AHA.

3.6 EQUIPMENT

3.6.1 Material Handling Equipment (MHE)

a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions. Material handling equipment fitted with personnel work platform attachments are prohibited from traveling or positioning while personnel are working on the platform.

b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.

c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA or Host Nation requirements.

3.6.2 Rigging Accepted Alterative

The Commander, POJ, has determined that there are adequate provisions provided under the Government of Japan (GOJ) Ordinance, which warrant a partial acceptance for rigging procedures and rigging equipment, employed as part of contracted activities provided for USACE within the locality of

Japan. Reference POJ-SO decision memorandum, subject, Alternate Requirement Analysis - Rigging Requirements and Procedures, dated 15 January 2020.

This acceptance excludes Multiple Lift Rigging (MLR) procedures as well as standards for all hooks used for lifting or load handling purposes. MLR and hooks used for load handling purposes will adherer to the respective sections of the EM 385-1-1, rigging standards (section 15) without exception.

Accepted standards include, Ministry of Labour Ordinance and Welfare, Ordinance on Industrial Safety and Health (JOISH) No. 57 of September 30, 1972, Chapter VIII Sling Work, Section 1 Slinging Equipment Articles 213-220. Also referenced, Japan International Center for Occupational Safety and Health (JICOSH) guidelines for sling work safety (2000).

3.6.3 Load Handling Equipment (LHE)

a. Equip cranes and derricks as specified in EM 385-1-1, Section 16.

b. Notify the Contracting Officer 15 working days in advance of any LHE entering the activity, in accordance with EM 385-1-1, Section 16.A.02, so that necessary quality assurance spot checks can be coordinated. Contractor shall provide the GDA 24-hour notice in advance of any LHE entering the site (prior to inspection/tests) so that observation of the Contractor's inspection process and spot checks may be conducted. A copy of the permitting process shall be provided at the Preconstruction Conference. Contractor's operator must remain with the crane during the spot check.

c. Comply with the LHE manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Perform erection under the supervision of a designated person (as defined in ASME B30.5). Perform all testing in accordance with the manufacturer's recommended procedures.

d. Comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, ASME B30.8 for floating cranes and floating derricks, ASME B30.9 for slings, ASME B30.20 for below the hook lifting devices and ASME B30.26 for rigging hardware.

e. Under no circumstance shall a Contractor make a lift at or above 90 percent of the cranes rated capacity in any configuration.

f. When operating in the vicinity of overhead transmission lines, operators and riggers must be alert to this special hazard and follow the requirements of EM 385-1-1 Section 11.

g. Do not use crane suspended personnel work platforms (baskets) unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Do not lift personnel with a line hoist or friction crane. Additionally, submit a specific AHA for this work to the Contracting Officer. Ensure the activity and AHA are thoroughly reviewed by all involved personnel.

h. Inspect, maintain, and recharge portable fire extinguishers as specified in NFPA 10, Standard for Portable Fire Extinguishers.

i. All employees must keep clear of loads about to be lifted and of suspended loads.

j. Use cribbing when performing lifts on outriggers.

k. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

l. A physical barricade must be positioned to prevent personnel access where accessible areas of the LHE's rotating superstructure poses a risk of striking, pinching or crushing personnel.

m. Maintain inspection records in accordance by EM 385-1-1, Section 16.D, including shift, monthly, and annual inspections, the signature of the person performing the inspection, and the serial number or other identifier of the LHE that was inspected. Records must be available for review by the Contracting Officer.

n. Maintain written reports of operational and load testing in accordance with EM 385-1-1, Section 16.F, listing the load test procedures used along with any repairs or alterations performed on the LHE. Reports must be available for review by the Contracting Officer.

o. Certify that all LHE operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

p. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. At wind speeds greater than 9 m/s, the operator, rigger and lift supervisor must cease all crane operations, evaluate conditions and determine if the lift may proceed. Base the determination to proceed or not on wind calculations per the manufacturer and a reduction in LHE rated capacity if applicable. Include this maximum wind speed determination as part of the activity hazard analysis plan for that operation.

3.6.4 Equipment and Mechanized Equipment

a. Proof of qualifications for operator shall be kept on the project site for review.

b. Manufacture specifications or owner's manual for the equipment shall be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Incorporate such additional safety precautions or requirements into the AHAs.

3.6.5 USE OF EXPLOSIVES

Explosives shall not be used or brought to the project site without prior written approval from the Contracting Officer. Such approval shall not relieve the Contractor of responsibility for injury to persons or for damage to property due to blasting operations.

Storage of explosives, when permitted on Government property, shall be only where directed and in approved storage facilities. These facilities shall be kept locked at all times except for inspection, delivery, and withdrawal of explosives.

3.7 EXCAVATIONS

Soil classification shall be performed by a competent person in accordance with EM 385-1-1.

3.7.1 Excavations and Trenching Accepted Alterative

The Commander, POJ, has determined that there are adequate provisions provided under the Government of Japan Ordinance to achieve the required protections for excavation and trenching systems including shoring, shielding, and engineered designed systems employed as part of contracted activities provided for USACE within the locality of Japan. Reference POJ-SO decision memorandum, subject, Alternate Requirement Analysis - Excavation and Trenching Review, dated 7 November 2019.

This determination only includes excavation and trenching systems including shoring, shielding, and engineered designed systems where the manufactures or a registered professional engineer's tabulated data has been employed.

Provisions within the JOISH Articles 368 -371 provide sufficient protection required to achieve the provisions of EM 385-1-1, Section 25, paragraphs 25.D. JIOSH instructions included in Articles 368 - 371 conform with the provisions for manufactured shoring/shielding and engineered designed support systems including material serviceability, structural design, and erection/installation. These provisions provided sufficient protection required to achieve the provisions of EM 385-1-1, Section 25, paragraph 25.D.

3.7.2 Utility Locations

The Contractor shall positively identify underground utilities in the work area and coordinate with the installation utility department. The Contractor shall obtain digging permits prior to start of excavation by contacting the Contracting Officer at least fifteen (15) calendar days in advance.

3.7.3 Utility Location Verification

The Contractor shall scan the construction site with electromagnetic or sonic equipment, and mark the surface of the ground where existing underground utilities are discovered. Verify the elevations of existing piping, utilities, and any type of underground or encased obstruction not indicated to be specified or removed, but indicated or discovered during scanning in locations to be traversed by piping, ducts, and other work to be conducted or installed. Verify elevations before installing new work closer than nearest manhole or other structure at which an adjustment in grade can be made. Physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within one meter of the underground system.

3.7.4 Utilities Within and Under Concrete, Bituminous Asphalt, and Other Impervious Surfaces

Utilities located within and under concrete slabs or pier structures, bridges, parking areas, and the like, are extremely difficult to identify. Whenever Contract work involves chipping, saw cutting, or core drilling through concrete, bituminous asphalt or other impervious surfaces, the

existing utility location must be coordinated with installation utility departments in addition to location and depth verification by the Contractor. The Contractor shall locate utility depth by use of Ground Penetrating Radar (GPR), X-ray, bore scope, or ultrasound prior to the start of demolition and construction. Outages to isolate utility systems must be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the Contractor from meeting this requirement.

3.7.5 Munitions and Explosives of Concern (MEC)

Munitions and Explosives of Concern (MEC): Unexploded Ordinance (UXO), Material Presenting a Potential Explosive Hazard (MPPEH), Chemical Agents (CA), or Discarded Military Munitions (DMM) on jobsites shall be treated as extremely dangerous and must be reported immediately. Follow the 3Rs: RECOGNIZE, RETREAT, and REPORT.

3.7.5.1 Identification and Notification

If you encounter or suspect you have encountered MEC, the on-site supervisor shall immediately suspend all operations put at risk due to the suspected MEC identified. STOP WORK, and DO NOT TOUCH, mark the location, keep people out of the area, and report to the Government Designated Authority. Project personnel will withdraw along cleared path upwind 300 meters from the discovery or as determined by emergency responders.

The on-site supervisor shall contact the installation emergency services who will intern contact the appropriate Explosives Ordinance Disposal (EOD) unit. EOD will determine the threat and mitigate any immediate explosives hazard(s).

Where suspected MEC are encountered during construction operations and other activities, notify the Contracting Officer's Representative/Contracting Officer immediately. If no hazard is present or poses no danger, the Government will direct the Contractor to proceed without change after given the all clear from the emergency responders. If MEC are found the condition or probability of encountering MEC may also change. The responsible government authority will conduct a new probability assessment, this determination will be used to plan the level of support required and determine further requirements. Pursuant to FAR 52.243-4, "Changes" the Government may issue a modification.

3.7.5.2 Training

All workers on site involved in the earthwork, in any manner, must attend a UXO brief. Coordinate with Contracting Officer for scheduling of this Briefing. Upon completion of the brief, the worker will receive a laminated card verifying that they attended the brief. The card does not expire and is valid for all USACE construction contracts on Okinawa, but is non-transferrable between workers. The USACE team will help coordinate the training and assist with processing base access requests as needed. The brief is free of charge, but the contractor is responsible for all other costs associated with transport to Camp Foster, labor, and all other costs related to the training. The expected duration of this training is two hours.

[3.7.5.3 Diving Operations

Compliance with USACE EM 385-1-1, Safety and Health Requirements Manual

are required for diving operations. In the event that operational conditions require, work dealing with MEC shall be performed in accordance with EM 385-1-97, Explosives Safety and Health Requirements Manual. If the Contractor investigation identifies metal anomalies as MEC, the Contractor shall mark the anomaly, evacuate the area, and coordinate with the Contracting Officer for removal and disposal. The EM 385-1-97, dated September 15, 2008 and subsequent change 1, dated April 12, 2013 contain requirements for Safety Planning and Field Operations (Section 2.p - Use of DDSEB Technical Paper 16 for Determination of Exclusion zones, Munition and Explosives of Concern (MEC) encountered during USACE Activities (Chapter III), and Explosive Safety Site Plans (ESSP) requirements (Chapter IV).

]3.8 ELECTRICAL

Perform electrical work in accordance with EM 385-1-1, Appendix A, Sections 11 and 12.

3.8.1 Conduct of Electrical Work

As delineated in EM 385-1-1, electrical work is to be conducted in a de-energized state unless there is no alternative method for accomplishing the work. In those cases obtain an energized work permit from the Contracting Officer. The energized work permit application must be accompanied by the AHA and a summary of why the equipment/circuit needs to be worked energized. Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Attach temporary grounds in accordance with ASTM F855 and IEEE 1048. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator is allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method.

When working in energized substations, only qualified electrical workers are permitted to enter. When work requires work near energized circuits as defined by NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves, and electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA. Ensure that each employee is familiar with and complies with these procedures and provisions outlined within the AHA.

3.8.2 Qualifications

Electrical work must be performed by QP personnel with verifiable credentials who are familiar with applicable code requirements. Verifiable credentials consist of State, National and Local Certifications or Licenses that a Master or Journeyman Electrician may hold, depending on work being performed, and must be identified in the appropriate AHA. Journeyman/Apprentice ratio must be in accordance with Host Nation requirements applicable to where work is being performed.

3.8.3 Arc Flash

Conduct a hazard analysis/arc flash hazard analysis whenever work on or near energized parts greater than 50 volts is necessary, in accordance with NFPA 70E.

All personnel entering the identified arc flash protection boundary must be QPs and properly trained in NFPA 70E requirements and procedures. Unless permitted by NFPA 70E, no Unqualified Person is permitted to approach nearer than the Limited Approach Boundary of energized conductors and circuit parts. Training must be administered by an electrically qualified source and documented.

3.8.4 Grounding

Ground electrical circuits, equipment, and enclosures in accordance with NFPA 70 and IEEE C2 to provide a permanent, continuous, and effective path to ground unless otherwise noted by EM 385-1-1.

Check grounding circuits to ensure that the circuit between the ground and a grounded power conductor has a resistance low enough to permit sufficient current flow to allow the fuse or circuit breaker to interrupt the current.

3.8.4.1 Ground-Fault Circuit Interrupters

Provide ground-fault circuit interrupters for all 120-volt single phase 15- and 20-ampere receptacle outlets which are not part of the permanent wiring of the building or structure in accordance with EM 385-1-1, Section 11.D.05.

3.8.5 Testing

Temporary electrical distribution systems and devices must be inspected, tested and found acceptable for Ground-Fault Circuit Interrupter (GFCI) protection, polarity, ground continuity, and ground resistance before initial use, before use after modification and at least monthly. Monthly inspections and tests must be maintained for each temporary electrical distribution system, and signed by the electrical CP or QP.

3.8.6 Portable Extension Cords

Size portable extension cords in accordance with manufacturer ratings for the tool to be powered and protected from damage. Immediately removed from service all damaged extension cords. Portable extension cords shall meet the requirements of EM 385-1-1, NFPA 70E, and OSHA electrical standards.

-- End of Section --

Form A-02
U.S. Army Corps of Engineers
Accident Prevention Plan Checklist

Date of Inspection

Location (Plant or Facility)	Contract Number
Contractor Name	Project Name
Inspector Name (Print)	Inspector Signature

This checklist serves as a guide only, it does not replace or eliminate the need to comply with the requirements set forth in Engineering Manual 385-1-1, Safety and Health Requirements Manual, dated 30 Nov 2014. The references included in this checklist correspond to the applicable sections of EM 385-1-1.

Item Description	Yes	No	N/A	Remarks (Any NO or N/A item)
a. Signature sheet				
1. Includes the name, title, signature, telephone number, and qualifications of the Plan Preparer (*Qualified person, i.e. corporate safety staff person, QC*)				
2. Includes the name, title, signature, telephone number, and qualifications of the Plan Approver (*e.g. owner, company president, regional vice president*) (HTRW activities require approval of a Certified Industrial Hygienist, a Certified Safety Professional may approve the plan for operations involving UST removal where contaminants are known to be petroleum, oils, or lubricants).				
3. Includes the name(s), title(s), signature(s), telephone number(s), and qualifications for Plan Concurrence (provide concurrence of other applicable corporate and project personnel (contractor)) (*e.g. Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional, project QC.*)				
b. Background information				
1. Includes the Contractor Name.				
2. Includes the Contract Number.				
3. Includes the Project Name.				
4a. Includes the Brief Project Description.				
4b. Includes a Discription of the Work to be Performed.				
4c. Includes the Location of the Project (map).				
4d. Includes the Equipment to be Used.				
4e. Includes the Anticipated High Risk Activities.				
5. Includes the Major Phases of Work Anticipated. *(Within these major phases of work identified, activities [includes Definable features of Work (DFOWs) and tasks] to be performed that will require an AHA shall be specifically highlighted. This information can then be used by QC, QA and Safety personnel to track AHA submittals. The AHAs for these activities, tasks of DFOWs are NOT submitted at this time (AHAs created/submitted at this time would not be activity-specific as they are intended to be). > See Sections 01.A.14 and 01.A.15.)*				

Form A-02
U.S. Army Corps of Engineers
Accident Prevention Plan Checklist (cont'd)

Date of Inspection

Item Description	Yes	No	N/A	Remarks (Any NO or N/A item)
c. Statement of Safety and Health Policy.				
1. Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. (*In addition to the corporate policy statement, a copy of the corporate safety program may provide a portion of the information required by the accident prevention plan*.)				
2. Includes Contractor's written safety program goals.				
3. Includes Contractor's written safety program objectives.				
4. Includes the Contractor Accident Experience (*Copy of OSHA 300 Forms, or equivalent documentation*).				
d. Responsibilities and Lines of Authority.				
1. Includes statement of the employer's ultimate responsibility for the implementation of his SOH program for his own employees, all sub-contractors and all others on the worksite (includes the strict enforcement of the program).				
2. Includes the identification and accountability of personnel responsible for safety and health at both the corporate and project level – including their resumes. Qualifications shall be in accordance with Section 01.A.17. *(Only official OSHA 30-Hour cards will be accepted or, if equivalent training is provided, appropriate instructor qualifications.)*				
3. Includes equivalent training to the OSHA 30-Hour classes is being presented as qualification, the training shall cover, as a minimum, the areas discussed in Appendix A, Section 3.d.3.(a-d).				
4. Includes the names of Competent (CP) and/or Qualified Person(s) (QP) and proof of competency/qualification to meet specific OSHA CP/QP requirements. *(Must include copies of proof of CP/QP).*				
5. Includes requirements and details of the employer's Risk Management Process. *(USACE uses the Activity Hazard Analysis (AHA) as part of a total risk management process. Contractors and other individual employer's may use the AHAs or their own version [Job Safety Analyses (JSAs), Job Hazard Analyses (JHAs), or similar Risk Management assessment tools]. These documents are considered equivalent to, and acceptable substitutes for, the USACE's AHA provided the data collected is the same as that required by the AHA.)*				
6. Includes requirements for initial activity-specific AHAs to be submitted and accepted at preparatory meetings, prior to work being performed;				
7. Includes requirements that no work by the Contractor shall be performed unless a designated Competent Person/SSHO is present on the job site.				
8. Includes policies and procedures regarding non-compliance with safety requirements (to include disciplinary actions for violation of safety requirements).				
9. Lines of authority.				
10. Includes written company procedures for holding managers and supervisors accountable for safety.				

Form A-02
U.S. Army Corps of Engineers
Accident Prevention Plan Checklist (cont'd)

Date of Inspection

Item Description	Yes	No	N/A	Remarks (Any NO or N/A item)
e. Subcontractors and Suppliers.				
1. Includes the list of subcontractors and suppliers. *(If not known at the time of initial APP submittal, the contractor shall include the following statement in their initial APP: "The subcontractors for the following DFOWs/activities are not known at this time, but additional information will be submitted to the APP for acceptance prior to the start of any activities listed")*				
2. Includes safety responsibilities of subcontractors and suppliers.				
f. Training				
1. Includes requirements for new hire SOH orientation training at the time of initial hire of each new employee.				
2. Includes requirements for mandatory training and certifications that are applicable to this project (*e.g., explosive actuated tools, confined space entry, crane operator, diver, vehicle operator, HAZWOPER training and certification, PPE*) and any requirements for periodic retraining / recertification.				
3. Includes procedures for periodic safety and health training for supervisors and employees.				
4. Includes the requirements for emergency response training.				
g. Safety and Health Inspections				
1. Includes specific assignment of responsibilities for a minimum daily jobsite SOH inspection during periods of work activity.				
1a. Includes the name(s) of individual(s) responsible for conducting safety inspections. (*e.g., PM, safety professional, QC, supervisors, employees*)				
1b. Includes proof of inspector's training / qualifications.				
1c. Indicates when inspections will be conducted.				
1d. Indicates procedures for documentation. *(Furnished sample forms upon which inspections will be recorded.)*				
1e. Indicates deficiency tracking system and follow-up procedures.				
2. Includes any external inspections / certifications which may be required. (*e.g., US Coast Guard*)				
h. Mishap Reporting and Investigation				
1. The plan identifies how, when, and who shall complete the Exposure data (man-hours worked).				
2a. The plan identifies how, when, and who shall complete mishap investigations, reports, and logs. *(The contractor shall report, thoroughly investigate, and analyze all mishaps occurring incidentally to an operation, project or facility for which this manual is applicable.)*				
2b. The plan identifies how, when, and who shall make immediate notification of major mishaps. *(Mishaps shall be reported as soon as possible but not more than 24 hours afterwards to the KO/COR.)*				
2c. Includes how, when, and who will provide notice to the KO/COR when corrective actions are completed. *(Implement corrective actions as soon as reasonably possible.)*				

Form A-02
U.S. Army Corps of Engineers
Accident Prevention Plan Checklist (cont'd)

Date of Inspection

Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable safety and occupational health risks and associated compliance plans. *Using the EM 385-1-1 as a guide, plans, programs, procedures (assessments and evaluations), may include but not be limited to:*

(1)Include a project-specific compliance plan, as applicable to the work being performed, and as identified below. The plans shall incorporate project-wide procedures to control hazards to which the employees of all project employers may be exposed.

(2) These procedures shall be coordinated with all project employers and shall include project-specific, project-wide emergency response and evacuation procedures, PPE requirements, recordkeeping and reporting requirements, and training requirements.

(3) The plans shall be prepared prior to the start of any work activities on the job site (as much as the information can be known at that point in time). The plans shall be updated throughout the life of the project to include changes in personnel, equipment, conditions, etc. Additional revisions shall be incorporated as necessary to reflect changing site conditions, construction methods, personnel roles and responsibilities and construction schedules.

(4) No activity (DFOW) shall be started on site until the APP is revised and submitted to the GDA for acceptance, with the site-specific plans, programs and procedures required to complete the project.

Item Description	Yes	No	N/A	Remarks (Any NO or N/A item)
i. Plans (Programs, Procedures, Assessments, and Evaluations) required by the Safety Manual				
1. Fatigue Management Plan (01.A.20)				
2. Emergency Plans (01.E):				
(a) Procedures & Test (01.E.01)				
(b) Spill Plans (01.E.01, 06.A.02)				
(c) Fire Fighting Plan (01.E.01; 19.A)				
(d) Posting of Emergency Telephone Numbers (01.E.05)				
(e) Man overboard/abandon ship (19.A.04)				
(f) Plan for prevention of alcohol and drug abuse (01.C.02 & Specs)				
3. Site Sanitation/Housekeeping Plan (02.B)				
4. Medical Support Agreement. Outline on-site medical support and off-site medical arrangements including rescue and medical duties for those employees who are to perform them, and the name(s) of on-site Contractor personnel trained in first aid and CPR. A minimum of two employees shall be certified in CPR and first-aid per shift/site (03.A.01, 03.A.03)				
5. Blood-borne Pathogen Program (03.A.05)				
6. Exposure Control Plan (03.A.05)				
7. Automatic External Defibrillator (AED) Program (03.B.04)				
8. Site Layout Plan (04.A)				
9. Access/Haul Road Plan (04.B)				
10. Hearing Conservation Program (05.C)				
11. Respiratory Protection Plan (05.G)				
12. Health Hazard Control Program (06.A)				
13. Hazard Communication Program (06.B.01)				
14. Process Safety Management Plan (06.B.04)				
15. Lead Compliance Plan (06.C.02 & Specifications)				
16. Asbestos Abatement Plan (06.C.03 & Specifications)				

Form A-02
U.S. Army Corps of Engineers
Accident Prevention Plan Checklist (cont'd)

Date of Inspection

Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational risks and compliance plans. *Using the EM 385-1-1 as a guide, plans, programs, procedures (assessments and evaluations), may include but not be limited to:*

Item Description	Yes	No	N/A	Remarks (Any NO or N/A item)
i. Plans (Programs, Procedures) continued.				
17. Radiation Safety Program (06.F)				
18. Abrasive Blasting Plan (06.I)				
19. Heat Stress Monitoring Plan (HSMP) (06.J.02)				
20. Cold Stress Monitoring Plan (CSMP) (06.J.04)				
21. Indoor Air Quality Management Plan (06.L)				
22. Mold Remediation Plan (06.L.04)				
23. Chromium (VI) Exposure Evaluation (06.M)				
24. Crystalline Silica Assessment (06.N.02)				
25. Lighting Plan for Night Operations (07.A.06)				
26. Traffic Control Plan (08.C.05)				
27. Fire Prevention Plan (09.A.01)				
28. Wild Land Fire Management Plan (09.L)				
29. Arc Flash Hazard Analysis (11.B)				
30. Assured Equipment Grounding Control Program (AEGCP), (11.D.05, Appendix E)				
31. Hazardous Energy Control Program and Procedures (12.A.01)				
32. Standard Pre-Lift Plan – LHE (16.A.03)				
33. Critical Lift Plan – LHE (16.H)				
34. Naval Architectural Analysis – LHE (Floating) (16.L)				
35. Floating Plant Inspection and Certification (19.A.01)				
36. Severe Weather Plan for Marine Activities (19.A.03)				
37. Emergency Plan for Marine Activities (19.A.04)				
38. Man Overboard/Abandon Ship Procedures (19.A.04)				
39. Float Plan for Launches, Motorboats, Skiffs (19.F.04)				
40. Fall Protection and Prevention Plan (21.D)				
41. Demolition/Renovation Plan (to include engineering survey) (23.A)				
42. Rope Access Work Plan (24.H)				
43. Excavation/Trenching Plan (25.A.01)				
44. Fire Prevention and Protection Plan for Underground Construction (26.D.01)				
45. Compressed Air Work Plan for Underground Construction (26.I.01)				
46. Erection and Removal Plan for Formwork and Shoring (27.C)				
47. Precast Concrete Plan (27.D)				

Form A-02
U.S. Army Corps of Engineers
Accident Prevention Plan Checklist (cont'd)

Date of Inspection

Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational risks and compliance plans. *Using the EM 385-1-1 as a guide, plans, programs, procedures (assessments and evaluations), may include but not be limited to:*

Item Description	Yes	No	N/A	Remarks (Any NO or N/A item)
i. Plans (Programs, Procedures) continued.				
48. Lift-slab Plans (27.E)				
49. Masonry Bracing Plan (27.F.01)				
50. Steel Erection Plan (28.B)				
51. Explosives Safety Site Plan (ESSP) (29.A)				
52. Blasting Plan (29.A; 26.J)				
53. Dive Operations Plan (30.A.14, 30.A.16)				
54. Safe Practices Manual for Diving Activities (30.A.15)				
55. Emergency Management Plan for Diving (30.A.18)				
56. Tree Felling/Maintenance Program (31.A.01)				
57. Aircraft/Airfield Construction Safety & Phasing Plan (CSPP) (32.A.02)				
58. Aircraft/Airfield Safety Plan Compliance Document (SPCD) (32.A.02)				
59. Site Safety and Health Plan (HTRW) (33.B)				
60. Confined Space Entry Procedures (34.A.05)				
61. Confined Space Program (34.A.06)				
j. Risk Management Processes (AHAs). Detailed project-specific hazards and controls shall be provided by Activity Hazard Analysis for each activity (DFOW). No work will begin on an activity (DFOW) until the initial AHA has been accepted by the GDA addressing the project-specific hazards. (01.A.14 & 01.A.15) *Note: USACE uses the Activity Hazard Analysis (AHA) as part of a total risk management process. Contractors and other individual employer's may use the AHAs or their own version [Job Safety Analyses (JSAs), Job Hazard Analyses (JHAs), or similar Risk Management assessment tools]. These documents are considered equivalent to, and acceptable substitutes for, the USACE's AHA provided the data collected is the same as that required by the AHA.*				

Remarks:

Form A-02 U.S. Army Corps of Engineers Accident Prevention Plan Checklist (cont'd)	Date of Inspection

Other Remarks:

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SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization (e.g. ASTM B564 Standard Specification for Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

AACE INTERNATIONAL (AACE)
1265 Suncrest Towne Centre Drive
Morgantown, WV 26505-1876 USA
Ph: 304-296-8444
Fax: 304-291-5728
E-mail: info@aacei.org
Internet: http://www.aacei.org

AIR BARRIER ASSOCIATION OF AMERICA (ABAA)

1600 Boston-Providence Hwy
Walpole, MA 02081
Ph: 866-956-5888
Fax: 866-956-5819
Email: abaa@airbarrier.org
Internet: https://www.airbarrier.org

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)
30 West University Drive
Arlington Heights, IL 60004-1893
Ph: 847-394-0150
Fax: 847-253-0088
E-mail: amca@amca.org
Internet: http://www.amca.org

ALUMINUM ASSOCIATION (AA)
National Headquarters
1525 Wilson Boulevard, Suite 600
Arlington, VA 22209
Ph: 703-358-2960

E-Mail: info@aluminum.org
Internet: http://www.aluminum.org

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)
1827 Walden Office Square, Suite 550
Schaumburg, IL 60173-4268
Ph: 847-303-5664
Fax: 847-303-5774
E-mail: customerservice@aamanet.org
Internet: http://www.aamanet.org

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: http://www.aashto.org

AMERICAN ASSOCIATION OF RADON SCIENTISTS AND TECHNOLOGISTS (AARST)

527 N Justice Street
Hendersonville, NC 28739
Ph: (828) 348-0185
Email: info@aarst.org
Internet: https://aarst.org/

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)
38800 Country Club Drive
Farmington Hills, MI 48331-3439
Ph: 248-848-3700
Fax: 248-848-3701
E-mail: bkstore@concrete.org
Internet: http://www.concrete.org

AMERICAN FOREST FOUNDATION (AFF)

2000 M Street, NW
Suite 550
Washington, DC 20036
Ph: 202-765-3660
Email: info@forestfoundation.org
Internet: https://www.forestfoundation.org/

AMERICAN HARDBOARD ASSOCIATION (AHA)
1210 West Northwest Highway
Palatine, IL 60067
Ph: 847-934-8800
Fax: 847-934-8803
E-mail: aha@hardboard.org
Internet: http://domensino.com/AHA/

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
One East Wacker Drive, Suite 700
Chicago, IL 60601-1802
Ph: 312-670-2400
Fax: 312-670-5403
Bookstore: 800-644-2400

E-mail: aisc@ware-pak.com
Internet: http://www.aisc.org

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)
7012 South Revere Parkway, Suite 140
Centennial, CO 80112
Ph: 503-639-0651
Fax: 503-684-8928
E-mail: info@aitc-glulam.org
Internet: http://www.aitc-glulam.org

AMERICAN IRON AND STEEL INSTITUTE (AISI)
25 Massachusetts Avenue, NW Suite 800
Washington, DC 20001
Ph: 202-452-7100
Internet: http://www.steel.org

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)
P.O. Box 210
Germantown, MD 20875-0210
Ph: 301-972-1700
Fax: 301-540-8004
E-mail: alsc@alsc.org
Internet: http://www.alsc.org

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1899 L Street, NW,11th Floor
Washington, DC 20036
Ph: 202-293-8020
Fax: 202-293-9287
E-mail: storemanager@ansi.org
Internet: http://www.ansi.org/

AMERICAN PETROLEUM INSTITUTE (API)
Internet: http://www.api.org

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)
4501 Forbes Blvd., Suite 130
Lanham, MD 20706
Ph: 301-459-3200
Fax: 301-459-8077
E-mail: bcaruso@arema.org
Internet: http://www.arema.org

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)
P.O. Box 28518
1711 Arlingate Lane
Columbus, OH 43228-0518
Ph: 800-222-2768; 614-274-6003
Fax: 614-274-6899
E-mail: tjones@asnt.org
Internet: http://www.asnt.org

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20191
Ph: 703-295-6300; 800-548-2723
E-mail: member@asce.org

Internet: http://www.asce.org

THE SOCIETY OF HEATING, AIR-CONDITIONING AND SANITARY ENGINEERS OF JAPAN (SHASE)
4 Chome-8 Kagurazaka
Shinjuku-ku, Tokyo 162-0825
Ph: 81-3-5206-3600
FAX: 81-3-5206-3603
Internet: http://www.shasej.org/

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

520 N. Northwest Highway
Park Ridge, IL 60068
Ph: 847-699-2929
E-mail: customerservice@assp.org
Internet: https://www.assp.org/

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
1791 Tullie Circle, NE
Atlanta, GA 30329
Ph: 800-527-4723 or 404-636-8400
Fax: 404-321-5478
E-mail: ashrae@ashrae.org
Internet: http://www.ashrae.org

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)
1800 East Oakton Street
Des Plaines, IL 60018
Ph: 847-699-2929
Internet: http://www.asse.org

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
18927 Hickory Creek Drive, Suite 220
Mokena, IL 60448
Ph: 708-995-3019
Fax: 708-479-6139
E-mail: staffengineer@asse-plumbing.org
Internet: http://www.asse-plumbing.org

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 West Quincy Avenue
Denver, CO 80235-3098
Ph: 303-794-7711
E-mail: distribution@awwa.org
Internet: http://www.awwa.org

AMERICAN WELDING SOCIETY (AWS)
13301 NW 47 Ave
Miami, FL 33054
Ph: 888-WELDING, 305-824-1177, 305-826-6192
Fax: 305-826-6195
E-mail: customer.service@awspubs.com
Internet: http://www.aws.org

AMERICAN WOOD COUNCIL (AWC)
222 Catoctin Circle SE, Suite 201
Leesburg, VA 20175

Ph: 800-890-7732
Fax: 412-741-0609
E-mail: publications@awc.org
Internet: http://www.awc.org

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)
P.O. Box 361784
Birmingham, AL 35236-1784
Ph: 205-733-4077
Fax: 205-733-4075
Internet: http://www.awpa.com

APA - THE ENGINEERED WOOD ASSOCIATION (APA)
7011 South 19th St.
Tacoma, WA 98466-5333
Ph: 253-565-6600
Fax: 253-565-7265
Internet: http://www.apawood.org

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
Two Park Avenue, M/S 10E
New York, NY 10016-5990
Ph: 800-843-2763
Fax: 973-882-1717
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Ph: 202-289-7800
Fax: 202-289-1092
Internet: http://www.wbdg.org/references/docs_refs.php

U.S. DEPARTMENT OF DEFENSE HEADQUARTERS, U.S. FORCES JAPAN (USFJ)
Internet: https://www.usfj.mil/

U.S. DEPARTMENT OF ENERGY (DOE)
1000 Independence Avenue Southwest
Washington, D.C. 20585
Internet: www.eere.energy.gov

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)
451 7th Street S.W.
Washington, DC 20410
Ph: 202-708-1112
Internet: https://www.hud.gov/

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20004
Ph: 202-272-0167
Internet: http://www2.epa.gov/libraries
--- Some EPA documents are available only from:
National Technical Information Service (NTIS)
5301 Shawnee Road
Alexandria, VA 22312
Ph: 703-605-6050 or 1-688-584-8332
Fax: 703-605-6900
E-mail: info@ntis.gov
Internet: http://www.ntis.gov

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)
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U.S. Government Printing Office (GPO)
710 North Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800
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Washington, DC 20591
Ph: 1-866-835-5322
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General Services Administration
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Washington, DC 20417
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Internet: http://www.gsaelibrary.gsa.gov/ElibMain/home.do
Obtain documents from:
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Internet: https://assist.dla.mil/online/start/; account registration required

U. S. GREEN BUILDING COUNCIL (USGBC)
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Washington, D.C. 20037
Ph: 800-795-1747
Internet: http://www.usgbc.org

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
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Fax: 301-837-0483
Internet: http://www.archives.gov
Order documents from:

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Washington, DC 20401
Ph: 202-512-1800
Fax: 202-512-2104
E-mail: contactcenter@gpo.gov
Internet: http://www.gpoaccess.gov

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)
1322 Patterson Ave. SE, Suite 1000
Washington Navy Yard, DC 20374-5065
Ph: 202-685-9387
Internet: http://www.navfac.navy.mil

U.S. DEPARTMENT OF THE NAVY

Chief of Information
Attn: US Navy
1200 Navy Pentagon
Washington DC 20350-1200
Internet: https://www.navy.mil/

UNDERWRITERS LABORATORIES (UL)
2600 N.W. Lake Road
Camas, WA 98607-8542
Ph: 877-854-3577
E-mail: CEC.us@us.ul.com
Internet: http://www.ul.com/
UL Directories available through IHS at http://www.ihs.com

VIBRATION ISOLATION AND SEISMIC CONTROL MANUFACTURERS ASSOCIATION (VISCMA)
994 Old Eagle School Road Suite 1019
Wayne, PA 19087-1866
Ph: 610-971-4850
Internet: http://www.viscma.com

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)
P.O. Box 23145
Portland, OR 97281
Ph: 503-639-0651
Fax: 503-684-8928
E-mail: info@wclib.org
Internet: http://www.wclib.org

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)
1500 SW First Ave., Suite 870
Portland, OR 97201
Ph: 503-224-3930
Fax: 503-224-3934
E-mail: info@wwpa.org
Internet: http://www.wwpa.org

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

SECTION 01 42 15

METRIC MEASUREMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM SI10	(2010) American National Standard for Use of the International System of Units (SI): The Modern Metric System

1.2 GENERAL

This project includes metric units of measurements. The metric units used are the International System of Units (SI) developed and maintained by the General Conference on Weights and Measures (CGPM); the name International System of Units and the international abbreviation SI were adopted by the 11th CGPM in 1960. The following criteria allow both metric and English inch-pound (I-P) measurements to be shown for a product:

a. To subsitute products that are manufactured to an industry recognized rounded metric (hard metric) dimension with I-P products.

b. To indicate industry and/or Government standards, test values or other controlling factors (such as the code requirements where I-P values are needed for clarity).

c. To trace back to the referenced standard(s), test value(s) or code(s).

1.3 USE OF MEASUREMENTS IN DRAWINGS AND SPECIFICATIONS

Measurements in drawings and specifications shall be in SI units, with I-P units in parenthesis in cases as indicated in Paragraph GENERAL and as otherwise authorized by the Contracting Officer. Procure the product in SI units unless otherwise authorized by the Contracting Officer. The Contractor is responsible for all associated labor and materials when authorized to substitute one system of units for another and for the final assembly and performance of the specified work and/or products.

1.3.1 Hard Metric

Hard metric measurements are often used for field data such as distance from one point to another or distance above the floor. Products are considered to be hard metric when they are manufactured to metric dimensions or have an industry recognized metric designation.

1.3.2 Soft Metric

a. A soft metric measurement is a non-mathematical, industry related conversion. Soft metric measurements are used for measurements

pertaining to products, test values, and other situations where the I-P units are the standard for manufacture, verification, or other controlling factor.

b. A soft metric measurement is also indicated for products that are manufactured in industry designated metric dimensions but are required by law to allow substitute I-P products.

1.3.3 Neutral

A neutral measurement is indicated by an identifier which has no expressed relation to either an SI or an I-P value (e.g., American Wire Gage (AWG) which indicates thickness but in itself is neither SI nor I-P).

1.4 COORDINATION

Bring discrepancies, such as mismatches or product unavailability, arising from use of both metric and non-metric measurements and discrepancies between the measurements in the specifications and the measurements in the drawings to the attention of the Contracting Officer for resolution.

1.5 RELATIONSHIP TO SUBMITTALS

Submittals for Government approval or for information only covers the SI products actually being furnished for the project. Submit the required drawings and calculations in the same units used in the Contract documents describing the product or requirement unless otherwise instructed or approved. Use ASTM SI10 as the basis for establishing metric measurements required to be used in submittals.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

SECTION 01 45 00.00 10

QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1110-1-12 (2006; Change 1) Engineering and Design -- Quality Management

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, all associated costs shall be included in the applicable CLIN Schedule unit or job prices.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information onlysubmittals not having a "G" designation are for Contractor Quality Control or Designer of Record approval.Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Contractor Quality Control (CQC) Plan; G

Design Quality Control (DQC) Plan

SD-05 Design Data

Discipline-Specific Checklists

Design Quality Control

SD-06 Test Reports

Verification Statement

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system that

complies with FAR 52.246-12 Inspection of Construction. QC consist of plans, procedures, and organization necessary to produce an end product which complies with the Contract requirements. The QC system covers all design and/or construction operations, both onsite and offsite, and be keyed to the proposed design and construction sequence. The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the Contract. In this context the highest level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent maintains a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

3.2 CONTRACTOR QUALITY CONTROL (CQC) PLAN

Submit no later than 15 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements FAR 52.246-12 Inspection of Construction. Include the submittal register with CQC Plan submissions. The Government will consider an interim plan for the first 14 days of operation. ConstructionDesign and/or construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional work.

3.2.1 Content of the CQC Plan

Include, as a minimum, the following to cover all design and construction-operations, both onsite and offsite, including work by subcontractors designers of record, consultants, architect/engineers (AE), fabricators, suppliers and purchasing agents:

a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff will implement the three phase control system for all aspects of the work specified. Include a CQC System Manager that reports to the project superintendent if the CQC System Manager and project superintendent are separate persons.

b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.

c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the Contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will be issued by the CQC System Manager. Furnish copies of these letters to the Contracting Officer.

d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, designers of record, consultants, architect engineers (AE), offsite fabricators, suppliers, and purchasing agents. These procedures must be in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer are required to be used.)

f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.

g. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.

h. Reporting procedures, including proposed reporting formats.

i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of the specifications can generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

[j. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections. Where the applicable Code issue by the International Code Council (ICC) calls for inspections by the Building Official, the Contractor must include the inspections in the Quality Control Plan and must perform the inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors. Include the Special Inspection Plan requirements in the QC Plan.]

3.2.2 Additional Requirements for Design Quality Control (DQC) Plan

The following additional requirements apply to the Design Quality Control (DQC) plan:

a. Submit and maintain a Design Quality Control (DQC) Plan as an effective quality control program which assures that all services required by this contract are performed and provided in a manner that meets professional architectural and engineering quality standards. As a minimum, all documents must be technically reviewed by competent, independent reviewers identified in the DQC Plan. The same element that produced the product may not perform the independent technical review (ITR). Correct errors and deficiencies in the design documents prior to submitting them to the Government.

b. Include the design schedule in the master project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific Contract period. This should be at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. Include review and correction periods associated with each item. This should be a

forward planning as well as a project monitoring tool. The schedule reflects calendar days and not dates for each activity. If the schedule is changed, submit a revised schedule reflecting the change within 7 calendar days. Include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal. Submit at each design phase as part of the project documentation these completed discipline-specific checklists. ER 1110-1-12 provides some useful information in developing checklists.

c. Implement the DQC Plan by a Design Quality Control Manager who has the responsibility of being cognizant of and assuring that all documents on the project have been coordinated. This individual must be a person who has verifiable engineering or architectural design experience and is a registered professional engineer or architect. Notify the Contracting Officer, in writing, of the name of the individual, and the name of an alternate person assigned to the position.

The Contracting Officer will notify the Contractor in writing of the acceptance of the DQC Plan. After acceptance, any changes proposed by the Contractor are subject to the acceptance of the Contracting Officer.

3.2.3 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of design and construction. Acceptance is conditional and will be predicated on satisfactory performance during the design and construction. The Government reserves the right to require the Contractor to make changes in the Contractor Quality Control(CQC) Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

3.2.4 Notification of Changes

After acceptance of the CQC Plan, notify the Contracting Officer in writing a minimum of seven (7) days prior of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

3.3 COORDINATION MEETING

After the Preconstruction Conference,Postaward Conference, before start of design or construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer and discuss the Contractor's quality control system. Submit the CQC Plan a minimum of 15 calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CQC operations, design activities, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government, signed by both the Contractor and the Contracting Officer and will become a part of the contract file. There can be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION

3.4.1 Personnel Requirements

The requirements for the CQC organization are a Site Safety and Health Officer (SSHO), CQC System Manager, a Design Quality Manager, and sufficient number of additional qualified personnel to ensure safety and Contract compliance. The SSHO reports directly to a senior project (or corporate) official independent from the CQC System Manager. The SSHO will also serve as a member of the CQC Staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff maintains a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer. Provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawing submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

3.4.2 CQC System Manager

Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. This CQC System Manager is on the site at all times during construction and is employed by the prime Contractor. Identify in the plan an alternate to serve in the event of the CQC System Manager's absence. The requirements for the alternate are the same as the CQC System Manager. The CQC System Manager shall report to the assigned Project Manager. Refer to Section 01 11 00.00 10 GENERAL CONTRACT REQUIREMENTS, Paragraph "Contractor Quality Control System Manager" for experience requirements.

3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the required areas listed in Section 01 11 00.00 10 GENERAL CONTRACT REQUIREMENTS, Paragraph "Contractor Quality Control Personnel". All personnel listed in this table may not be required on this Contract. These individuals or specialized technical companies must be responsible to the CQC System Manager; must be physically present at the construction site during work on the specialized personnel's areas of responsibility; must have the necessary education or experience in accordance with the experience matrix listed herein. The table below defines only the qualification requirements. Refer to the Section 01 11 00.00 10 GENERAL CONTRACT REQUIREMENTS, Paragraph "Contractor Quality Control Personnel" for actual required personnel.

Experience Matrix	
Area	Qualifications
Civil	Graduate of an accredited university with an Civil Engineering or Construction Manager degree with 3 years experience in the type of work being performed on this project or technician with 5 yrs related experience. Or Non-US degree plus 1 Kyu Doboku Sekou Kanrigishi (1st Class Civil Engineering Works Management Engineer).
Mechanical	Graduate of an accredited university with an Mechanical Engineer degree with 3 years experience or person with 5 years of experience supervising mechanical features of work in the field with a construction company. Or Non-US degree plus 1 Kyu Kankouji Sekou Kanrigishi (1st Class Building Mechanical and Electrical Engineer).
Electrical	Graduate of an accredited university with an Electrical Engineering degree with 3 years related experience or person 5 years of experience supervising electrical features of work in the field with a construction company. Or Non-US degree plus 1 Kyu Kankouji Sekou Kanrigishi (1st Class Building Mechanical and Electrical Engineer) or 1 Kyu Denkikouji Sekou Kanrigishi (1st Class Electric Construction Management Engineer).
Structural	Graduate of an accredited university with an Civil Engineering degree (with Structural Track or Focus) or Construction Management degree with 3 years experience or technician 5 years of experience supervising structural features of work in the field with a construction company. Or Non-US degree plus 1 Kyu Kenchikushi (1st Class Qualified Architect) or 1 Kyu Kenchiku Sekou Kanrigishi (1st Class Building Construstion Managemnet Engineer).
Architectural	Graduate of an accredited university with an Architecture degree with 3 years experience or person with 5 years related experience. Or Non-US degree plus 1 Kyu Kenchikushi (1st Class Qualified Architect) or 1 Kyu Kenchiku Sekou Kanrigishi (1st Class Building Construction Management Engineer).

Experience Matrix	
Area	Qualifications
Fire Protection	Registered U.S. Professional Engineer who has passed the fire protection engineering written examination administered by the National Council of Examiners and Surveying (NCEES) and has a minimum of four (4) years of relevant fire protection engineering experience.
Communications	Graduate of an accredited university with an Electrical Engineering degree with 3 yrs related experience or technician with 5 years of experience supervising communications features of work in the field with a construction company. Non-US degree plus AI*DD Sougoushu(AI*DD Construction Engineer).
Environmental	Refer to Section [01 57 19][01 57 19.01] ENVIRONMENTAL MANAGER.
Submittals	Submittal Clerk with 1 year experience
Occupied Family Housing	Person, customer relations type, coordinator experience
Concrete, Pavements and Soils	Materials Technician with 2 years experience for the appropriate area
Testing, Adjusting and Balancing (TAB) Personnel	Specialist must be a member of AABC or an experienced technician of the firm certified by the NEBB
Design Quality Control Manager	Registered Architect or Professional Engineer or Japanese equivalent (i.e. 1st Class License in any specific discpline, etc.) Minimum of 5 years experience as a Design Quality Control Manager.

3.4.4 Site Safety and Health Officer (SSHO)

See Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMNTS.

3.4.5 Additional Requirement

In addition to the above experience and education requirements, the Contractor Quality Control(CQC) System Manager and Alternate CQC System Manager are required to have completed the Construction Quality Management (CQM) for Contractors course. If the CQC System Manager does not have a current certification, obtain the CQM for Contractors course certification within 90 days of award. This course is periodically offered by the Naval Facilities Engineering Command and the Army Corps of Engineers. Contact the Contracting Officer for information on the next scheduled class.

The Construction Quality Management Training certificate expires after 5 years. If the CQC System Manager's certificate has expired, retake the course to remain current.

3.4.6 Organizational Changes

Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

3.5 SUBMITTALS AND DELIVERABLES

Submittals, if needed, have to comply with the requirements in Section 01 33 00 SUBMITTAL PROCEDURES. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 01 91 00.15 10 TOTAL BUILDING COMMISSIONING is included the submittals required by those sections must be coordinated with Section 01 33 00 SUBMITTAL PROCEDURES to ensure adequate time is allowed for each type of submittal required.

3.6 CONTROL

CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control are required to be conducted by the CQC System Manager for each definable feature of the construction work as follows:

3.6.1 Preparatory Phase

This phase is performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:

a. A review of each paragraph of applicable specifications, reference codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.

b. Review of the Contract drawings.

c. Check to assure that all materials and equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.

e. Review Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.

f. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.

g. Examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.

h. Review of the appropriate activity hazard analysis to assure safety requirements are met.

i. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

j. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

k. Discussion of the initial control phase.

l. The Government needs to be notified at least 72 hours in advance of beginning the preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

3.6.2 Initial Phase

This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:

a. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing are in compliance with the contract.

c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve all differences.

e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

f. The Government needs to be notified at least 24 hours in advance of beginning the initial phase for definable feature of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with follow-up phases.

g. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

h. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.

3.6.3 Follow-up Phase

Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work. Coordinate scheduled work with Special Inspections required by Section 01 45 35 SPECIAL INSPECTIONS, the Statement of Special Inspections and the Schedule of Special Inspections.

3.6.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

3.7 TESTS

3.7.1 Testing Procedure

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and acceptance tests when specified. Procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.

e. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

3.7.2 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control

testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.8 COMPLETION INSPECTION

3.8.1 Punch-Out Inspection

Conduct an inspection of the work by the CQC System Manager near the end of the work, or any increment of the work established by a time stated in FAR 52.211-10 Commencement, Prosecution, and Completion of Work. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved drawings and specifications, as required by paragraph DOCUMENTATION. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. Make a second inspection the CQC System Manager or staff to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final inspection.

3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. Ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Correct any items noted on the Pre-Final inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph need to be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative is required to be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands can also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notify the Contracting Officer at least 14 days prior to the final acceptance inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the Contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance FAR 52.246-12 Inspection of Construction.

3.9 DOCUMENTATION

3.9.1 Quality Control Activities

Maintain current records providing factual evidence that required quality control activities and tests have been performed. Include in these

records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

a. The name and area of responsibility of the Contractor/Subcontractor.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

d. Test and control activities performed with results and references to specifications/drawings requirements. Identify the control phase (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.

e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.

f. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.

g. Offsite surveillance activities, including actions taken.

h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

i. Instructions given/received and conflicts in plans and specifications.

j. Provide documentation of design quality control activities. For independent design reviews, provide, as a minimum, identification of the Independent Technical Review (ITR) team, the ITR review comments, responses and the record of resolution of the comments.

3.9.2 Verification Statement

Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract. Furnish the original and one copy of these records in report form to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, prepare and submit one report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the Contractor Quality Control(CQC) System Manager. Include copies of test reports and copies of reports prepared by all subordinate quality control personnel within the CQC System Manager Report.

3.10 SAMPLE FORMS

Sample forms can be obtained from the Resident Office or found through Contractor link of the RMS website http://rms.usace.army.mil.

3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer can issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

-- End of Section --

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SECTION 01 45 00.15 10

RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

1.2 MEASUREMENT AND PAYMENT

The work of this section is not measured for payment. The Contractor is responsible for the work of this section, without any direct compensation other than the payment received for contract items.

1.3 CONTRACT ADMINISTRATION

The Government will use the Resident Management System (RMS) to assist in its monitoring and administration of this contract. The Government accesses the system using the Government Mode of RMS (RMS GM) and the Contractor accesses the system using the Contractor Mode (RMS CM). The term RMS will be used in the remainder of this section for both RMS GM and RMS CM. The joint Government-Contractor use of RMS facilitates electronic exchange of information and overall management of the contract. The Contractor accesses RMS to record, maintain, input, track, and electronically share information with the Government throughout the contract period in the following areas:

Administration
Finances
Quality Control
Submittal Monitoring
Scheduling
Closeout
Import/Export of Data

1.3.1 Correspondence and Electronic Communications

For ease and speed of communications, exchange correspondence and other documents in electronic format to the maximum extent feasible. Some correspondence, including pay requests and payrolls, are also to be provided in paper format with original signatures. Paper documents will govern, in the event of discrepancy with the electronic version.

1.3.2 Other Factors

Other portions of this document have a direct relationship to the reporting accomplished through RMS. Particular attention is directed to

FAR 52.236-15 Schedules for Construction Contracts; FAR 52.232-27 Prompt Payment for Construction Contracts; FAR 52.232-5 Payments Under Fixed-Priced Construction Contracts; [Section 01 32 01.00 10 PROJECT SCHEDULE][Section 01 32 16.00 20 SMALL PROJECT CONSTRUCTION PROGRESS SCHEDULES]; Section 01 33 00 SUBMITTAL PROCEDURES; Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS; and Section 01 45 00.00 10 QUALITY CONTROL.

1.4 RMS SOFTWARE

RMS is a Windows-based program that can be run on a Windows-based PC meeting the requirements as specified in paragraph SYSTEM REQUIREMENTS. Download, install and be able to utilize the latest version of the RMS software within 7 calendar days of receipt of the Notice to Proceed. RMS software, user manuals, access and installation instructions, program updates and training information are available from the RMS website (https://rms.usace.army.mil). The Government and the Contractor will have different access authorities to the same contract database through RMS. The common database will be updated automatically each time a user finalizes an entry or change.

1.5 SYSTEM REQUIREMENTS

The following is the recommended system configuration to run the Contractor Mode RMS for full utilization of all features for all types and sizes of contracts. Smaller, less complicated, projects may not require the configuration levels described below. Required configuration also noted below.

Recommended RMS System Requirements	
Hardware	
Windows-based PC	1.7 GHz i3; AMD A6 3650 GHz or higher processor (REQUIRED)
RAM	8 GB
Hard drive disk	100 GB space for sole use by RMS system
Monitor	Screen resolution 1366 x 768
Mouse or other pointing device	
Windows compatible printer	Laser printer must have 4 MB+ of RAM
Connection to the Internet	minimum 4 Mbs per user
Software	
MS Windows	Windows 10 x 64 bit (RMS requires 64 bit O/S) or newer (REQUIRED)
Word Processing software	Viewer for MS Word 2013, MS Excel 2013 or newer (REQUIRED)

Recommended RMS System Requirements	
E-mail	MAPI compatible (REQUIRED)
Virus protection software	Regularly upgraded with all issued Manufacturer's updates and is able to detect most zero day viruses (REQUIRED)

1.6 CONTRACT DATABASE - GOVERNMENT

The Government will enter the basic contract award data in RMS prior to granting the Contractor access. The Government entries into RMS will generally be related to submittal reviews, correspondence status, and Quality Assurance(QA)comments, as well as other miscellaneous administrative information.

1.7 CONTRACT DATABASE - CONTRACTOR

Contractor entries into RMS establish, maintain, and update data throughout the duration of the contract. Contractor entries generally include prime and subcontractor information, daily reports, submittals, RFI's, schedule updates and payment requests. RMS includes the ability to import attachments and export reports in many of the modules, including submittals. The Contractor responsibilities for entries in RMS typically include the following items:

1.7.1 Administration

1.7.1.1 Contractor Information

Enter all current Contractor administrative data and information into RMS within 7 calendar days of receiving access to the contract in RMS. This includes, but is not limited to, Contractor's name, address, telephone numbers, management staff, and other required items.

1.7.1.2 Subcontractor Information

Enter all missing subcontractor administrative data and information into RMS CM within 7 calendar days of receiving access to the contract in RMS or within 7 calendar days of the signing of the subcontractor agreement for agreements signed at a later date. This includes name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor is listed separately for each trade to be performed.

1.7.1.3 Correspondence

Identify all Contractor correspondence to the Government with a serial number. Prefix correspondence initiated by the Contractor's site office with "S". Prefix letters initiated by the Contractor's home (main) office with "H". Letters are numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C" or "RFP".

1.7.1.4 Equipment

Enter and maintain a current list of equipment planned for use or being

used on the jobsite, including the most recent and planned equipment inspection dates.

1.7.1.5 Reports

Track the status of the project utilizing the reports available in RMS. The value of these reports is reflective of the quality of the data input. These reports include the Progress Payment Request worksheet, Quality Control (QC) comments, Submittal Register Status, and Three-Phase Control worksheets.

1.7.1.6 Request For Information (RFI)

Create and track all Requests For Information (RFI) in the RMS Administration Module for Government review and response.

1.7.2 Finances

1.7.2.1 Pay Activity Data

Develop and enter a list of pay activities in conjunction with the project schedule. The sum of pay activities equals the total contract amount, including modifications. Each pay activity must be assigned to a Contract Line Item Number (CLIN). The sum of the activities assigned to a CLIN equals the amount of each CLIN.

1.7.2.2 Payment Requests

Prepare all progress payment requests using RMS. Update the work completed under the contract at least monthly, measured as percent or as specific quantities. After the update, generate a payment request and prompt payment certification using RMS. Submit the signed prompt payment certification and payment request as well as supporting data either electronically or by hard copy. Unless waived by the Contracting Officer, a signed paper copy of the approved payment certification and request is also required and will govern in the event of discrepancy with the electronic version.

1.7.3 Quality Control (QC)

Enter and track implementation of the 3-phase QC Control System, QC testing, transferred and installed property and warranties in RMS. Prepare daily reports, identify and track deficiencies, document progress of work, and support other Contractor QC requirements in RMS. Maintain all data on a daily basis. Insure that RMS reflects all quality control methods, tests and actions contained within the Contractor Quality Control (CQC) Plan and Government review comments of same within 7 calendar days of Government acceptance of the CQC Plan.

1.7.3.1 Quality Control (QC) Reports

The Contractor's Quality Control (QC) Daily Report in RMS is the official report. The Contractor can use other supplemental formats to record QC data, but information from any supplemental formats are to be consolidated and entered into the RMS QC Daily Report. Any supplemental information may be entered into RMS as an attachment to the report. QC Daily Reports must be finalized and signed in RMS within 24 hours after the date covered by the report. Provide the Government a printed signed copy of the QC Daily Report, unless waived by the Contracting Officer.

1.7.3.2 Deficiency Tracking.

Use the QC Daily Report Module to enter and track deficiencies. Deficiencies identified and entered into RMS by the Contractor or the Government will be sequentially numbered with a QC or QA prefix for tracking purposes. Enter each deficiency into RMS the same day that the deficiency is identified. Monitor, track and resolve all QC and QA entered deficiencies. A deficiency is not considered to be corrected until the Government indicates concurrence in RMS.

1.7.3.3 Three-Phase Control Meetings

Maintain scheduled and actual dates and times of preparatory and initial control meetings in RMS. Worksheets for the three-phase control meetings are generated within RMS.

1.7.3.4 Labor and Equipment Hours

Enter labor and equipment exposure hours on a daily basis. Roll up the labor and equipment exposure data into a monthly exposure report.

1.7.3.5 Accident/Safety Reporting

Both the Contractor and the Government enter safety related comments in RMS as a deficiency. The Contractor must monitor, track and show resolution for safety issues in the QC Daily Report area of the RMS QC Module. In addition, follow all reporting requirements for accidents and incidents as required in EM 385-1-1, Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS and as required by any other applicable Federal, State or local agencies.

1.7.3.6 Definable Features of Work

Enter each feature of work, as defined in the approved CQC Plan, into the RMS QC Module. A feature of work may be associated with a single or multiple pay activities, however a pay activity is only to be linked to a single feature of work.

1.7.3.7 Activity Hazard Analysis

Import activity hazard analysis electronic document files into the RMS QC Module utilizing the document package manager.

1.7.4 Submittal Management

Enter all current submittal register data and information into RMS within 7 calendar days of receiving access to the contract in RMS. The information shown on the submittal register following the specification Section 01 33 00 SUBMITTAL PROCEDURES will already be entered into the RMS database when access is granted. Group electronic submittal documents into transmittal packages to send to the Government, except very large electronic files, samples, mock ups, color boards, or where hard copies are specifically required. Track transmittals and update the submittal register in RMS on a daily basis throughout the duration of the contract. Submit hard copies of all submittals unless waived by the Contracting Officer.

1.7.5 Schedule

Enter and update the contract project schedule in RMS by either manually entering all schedule data or by importing the Standard Data Exchange Format (SDEF) file, based on the requirements in [Section 01 32 01.00 10 PROJECT SCHEDULE][Section 01 32 16.00 20 SMALL PROJECT CONSTRUCTION PROGRESS SCHEDULES].

1.7.6 Closeout

Closeout documents, processes and forms are managed and tracked in RMS by both the Contractor and the Government. Ensure that all closeout documents are entered, completed and documented within RMS.

1.8 IMPLEMENTATION

Use of RMS as described in the preceding paragraphs is mandatory. Ensure that sufficient resources are available to maintain contract data within the RMS system. RMS is an integral part of the Contractor's required management of quality control.

1.9 MONTHLY COORDINATION MEETING

Update the RMS CM database each workday. At least monthly, generate and submit one schedule update. At least one week prior to submittal, meet with the Government representative to review the planned progress payment data submission for errors and omissions.

Make required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will not be accepted. The Government will not process progress payments until all required corrections are processed.

1.10 NOTIFICATION OF NONCOMPLIANCE

Take corrective action within 7 calendar days after receipt of notice of RMS non-compliance by the Contracting Officer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 45 35

SPECIAL INSPECTIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(2017) Minimum Design Loads for Buildings and Other Structures

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS Z2305	(2013) Non-destructive Testing - Qualification and Certification of Personnel

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 03-301-01	(2019) Structural Engineering

1.2 GENERAL REQUIREMENTS

Perform Special Inspections in accordance with the Statement of Special Inspections, Schedule of Special Inspections and Chapter 17 of ICC IBC. The Statement of Special Inspections and Schedule of Special Inspections are included as an attachment to this specification. Special Inspections are to be performed by an independent third party and are intended to ensure that the work of the prime contractor is in accordance with the Contract Documents and applicable building codes. Special inspections do not take the place of the three phases of control inspections performed by the Contractor's QC Manager or any testing and inspections required by other sections of the specifications.[

Structural observations will be performed by the Government. The contractor must provide notification to the Contracting Officer 14 days prior to the following points of construction:

a. [_____]
b. [_____]
c. [_____]]

1.3 DEFINITIONS

1.3.1 Continuous Special Inspections

Continuous Special Inspections is the constant monitoring of specific tasks by a special inspector. These inspections must be carried out continuously over the duration of the particular tasks.

1.3.2 Periodic Special Inspections

Periodic Special Inspections is Special Inspections by the special inspector who is intermittently present where the work to be inspected has been or is being performed.

1.3.3 Perform

Perform these Special Inspections tasks for each welded joint or member, bolted or fastener connection, and required verification.

1.3.4 Observe

Observe these Special Inspections items on a random daily basis. Operations need not be delayed pending these inspections.

1.3.5 Special Inspector (SI)

A qualified person retained by the contractor and approved by the Contracting Officer as having the competence necessary to inspect a particular type of construction requiring Special Inspections. The SI must be an independent third party hired directly by the Prime Contractor.

1.3.6 Associate Special Inspector (ASI)

A qualified person who assists the SI in performing Special Inspections but must perform inspection under the direct supervision of the SI and cannot perform inspections without the SI on site.

1.3.7 Third Party

A third party inspector must not be company employee of the Contractor or any Sub-Contractor performing the work to be inspected.

[1.3.8 Special Inspector of Record (SIOR)

A licensed engineer in responsible charge of supervision all special inspectors for the project and approved by the Contracting officer. The SIOR must be an independent third party hired directly by the Prime Contractor.

]1.3.9 Contracting Officer

The Government official having overall authority for administrative contracting actions. Certain contracting actions may be delegated to the Contracting Officer's Representative (COR).

1.3.10 Contractor's Quality Control (QC) Manager

An individual retained by the prime contractor and qualified in accordance with the Section [01 45 00.00 10 QUALITY CONTROL] having the overall

responsibility for the contractor's QC organization.

1.3.11 Designer of Record (DOR)

A registered design professional [employed by the Government] [contracted by the Government as an A/E] responsible for the overall design and review of submittal documents prepared by others. The DOR is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws in state in which the design professional works. The DOR is also referred to as the Engineer of Record (EOR) in design code documents.

1.3.12 Statement of Special Inspections (SSI)

A document developed by the DOR identifying the material, systems, components and work required to have Special Inspections.

1.3.13 Schedule of Special Inspections

A schedule which lists each of the required Special Inspections, the extent to which each Special Inspections is to be performed, and the required frequency for each in accordance with ICC IBC Chapter 17.

[1.3.14 Designated Seismic System

Those nonstructural components that require design in accordance with ASCE 7 Chapter 13 and for which the component importance factor, Ip, is greater than 1.0. This designation applies to systems that are required to be operational following the Design Earthquake for RC I - IV structures [and following the MCER for RC V structures. All systems in RC V facilities designated as MC-1 in accordance with UFC 03-301-01 are considered part of the Designated Seismic Systems]. [Designated Seismic Systems will be identified by Owner and will have an Importance Factor Ip = 1.5].

][1.3.15 Component Certification and O&M Manual

For any electrical or mechanical component required by ASCE 7 Section 13.2.2 to be certified, evidence demonstrating compliance with the requirement shall be maintained in a file identified as "Equipment Certification Documentation." This file shall be a part of the Operations & Maintenance Manual that is turned over to the Contracting Officer. The project specifications shall require the Operations & Maintenance Manual state that replaced or modified components need to be certified per the original certification criteria.

][1.3.16 Component Identification Nameplate

Any electrical or mechanical component required by ASCE 7 SSection 13.2.2 to be certified shall bear permanent marking or nameplates constructed of a durable heat and water resistant material. Nameplates shall be mechanically attached to such nonstructural components and placed on each component for clear identification. The nameplate shall not be less than 125 x 180 with red letters 25 in height on a white background stating "Certified Equipment." The following statement shall be on the nameplate: "This equipment/component is certified. No modifications are allowed unless authorized in advance and documented in the Equipment Certification Documentation file." The nameplate shall also contain the component identification number in accordance with the drawings/specifications and

the O&M manuals.

]1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.][information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

SIOR Letter of Acceptance; G[, [_____]]

Special Inspections Project Manual; G[, [_____]]

Special Inspections Agency's Written Practices

NDT Procedures and Equipment Calibration Records

SD-06 Test Reports

Special Inspections Daily Reports

Special Inspections Biweekly Reports

SD-07 Certificates

Fabrication Plant

Certificate of Compliance

Special Inspector of Record Qualifications; G[, [_____]]

Special Inspector Qualifications; G[, [_____]]

Qualification Records for NDT technicians

SD-11 Closeout Submittals

Interim Final Report of Special Inspections

Comprehensive Final Report of Special Inspections; G[, [_____]]

1.5 SPECIAL INSPECTOR QUALIFICATIONS

Submit qualifications for each special inspector [and the special inspector of record].

Certifying Associations	
FM	Factory Mutual
ICC	International Code Council

Certifying Associations	
JCI	Japan Concrete Institute
JSFA	Japan Steel Fabricators Association
JWES	Japan Welding Engineering Society
UL	Underwriters Laboratories
Architect Under Bldg Standard Law of Japan	First Class Architect (Kenchikushi) Registered Under Standard Law of Japan

1.5.1 Steel Construction and High Strength Bolting

1.5.1.1 Special Inspector

a. Structural Steel Work Manager (Tekkotsu Koji Kanri Sekininsha), or

b. Japan Welding Society Certified Inspector (Nihon Yosetsu Kyokai Kensa-in), or

c. Non-Destructive Test Technician (Hihakai Kensa Gijutsusha), or

d. Architectural or Civil Construction Managing Engineer (Kenchiku/ Doboku Koji Sekou Kanrigishi), or

e. JSFA Certified Architectural High Strength Bolt Joint Management Engineer

1.5.2 Welding Structural Steel

1.5.2.1 Special Inspector

a. JWES Certified Welding Management Engineer

b. JSFA Certified Architectural Structural Steel Products Inspection Engineer

1.5.3 Nondestructive Testing of Welds

1.5.3.1 Special Inspector

JIS Z2305 NDT Level III Certificate.

1.5.3.2 Associate Special Inspector

JIS Z2305 NDT Level II Certificate plus one year of related experience.

1.5.4 Cold Formed Steel Framing

1.5.4.1 Special Inspector

a. JSFA Certified Architectural Structural Steel Products Inspection Engineer, or

b. Registered Professional Engineer with related experience.

1.5.5 Concrete Construction

1.5.5.1 Special Inspector

a. Japan Concrete Institute Concrete Engineer (JCI Concrete Gishi), or

b. Registered Professional Engineer with related experience, or

c. First Class Kenchikushi with four years of related experience.

d. Architectural or Civil Construction Managing Engineer (Kenchiku/ Doboku Sekou Kanrigishi)

1.5.6 Prestressed Concrete Construction

1.5.6.1 Special Inspector

a. Registered Professional Engineer with related experience, or

b. First Class Kenchikushi with four years of related experience

1.5.7 Post-tensioned Concrete Construction

1.5.7.1 Special Inspector

a. Registered Professional Engineer with related experience, or

b. First Class Kenchikushi with four years of related experience.

1.5.8 Masonry Construction

1.5.8.1 Special Inspector

a. Registered Professional Engineer with related experience, or

b. First Class Kenchikushi with four years of related experience.

1.5.9 Wood

1.5.9.1 Special Inspector

a. Registered Professional Engineer with related experience

b. First Class Kenchikushi with four years of related experience

1.5.10 Verification of Site Soil Condition, Fill Placement and Load-Bearing Requirements

1.5.10.1 Special Inspector

a. First Class Kenchikushi, or

b. First Class Doboku Sekou Kanrigishi (1st class Civil Engineering Works Management Engineer), or

c. Geotechnical Survey Technician (Chishitsu Chosa Gishi), or

d. Soil Investigation Technician (Jiban Kensa Gishi)

1.5.11 Deep Foundations

1.5.11.1 Special Inspector

Chishitsu Chosa Gishi (Professional Geotechnical Engineer)

1.5.12 Sprayed Fire Resistant Material

1.5.12.1 Special Inspector

a. ICC Spray-applied Fireproofing Special Inspector Certificate, or

b. ICC Fire Inspector I Certificate with one year of related experience, or

c. Registered Professional Engineer with related experience, or

d. First Class Kenchikushi with four years related experience.

1.5.13 Mastic and Intumescent Fire Resistant Coatings

1.5.13.1 Special Inspector

a. ICC Spray-applied Fireproofing Special Inspector Certificate, or

b. ICC Fire Inspector I Certificate with one year of related experience, or

c. Registered Professional Engineer with related experience, or

d. First Class Kenchikushi with four years related experience

1.5.14 Exterior Insulation and Finish System (EIFS)

1.5.14.1 Special Inspector

a. Registered Professional Engineer with related experience, or

b. First Class Kenchikushi with four years related experience.

1.5.15 Fire-Resistant Penetrations and Joints

1.5.15.1 Special Inspector

a. Passed the UL Firestop Exam with one year of related experience, or

b. Passed the FM Firestop Exam with one year of related experience, or

c. Registered Professional Engineer with related experience, or

d. First Class Kenchikushi with four years related experience.

1.5.16 Smoke Control

1.5.16.1 Special Inspector

a. AABC Technician Certification with one year of related experience, or

b. Registered Professional Engineer with related experience, or

c. First Class Kenchikushi with four years related experience

1.5.17 Architectural Components

1.5.17.1 Special Inspector

a. Registered Professional Architect with related experience, or

b. Registered Professional Engineer with related experience, or

c. First Class Kenchikushi with four years related experience.

1.5.18 Mechanical, Electrical, and Plumbing Designated Seismic Systems

1.5.18.1 Special Inspector

a. Registered Professional Engineer with related experience, or

b. First Class Kenchikushi with four years related experience.

1.5.19 Verification of Electrical Systems

a. Chief Electrical Engineer (Denki Shunin Gijutusha), or

b. Electrical Construction Managing Engineer (Denki Sekou Kanrigishi), or

c. Japanese Licensed Electrician (Denki Koujishi)

[1.5.20 Special Inspector of Record (SIOR)

Registered Professional Engineer or First Class Kenchikushi with four years of related experience.

]PART 2 PRODUCTS

2.1 FABRICATOR SPECIAL INSPECTIONS

Special Inspections of fabricator's work performed in the fabricator's shop is required to be inspected in accordance with the Statement of Special Inspections and the Schedule of Special Inspections unless the fabricator is certified by the approved agency to perform such work without Special Inspections. Submit the following certification [certifications] to the Contracting Officer for information to allow work performed in the fabricator's shop to not be subjected to Special Inspections.

Minister of Land, Infrastructure and Transportation (MLIT) Certified Fabrication Plant, Category as specified

At the completion of fabrication, submit a certificate of compliance, to be included with the comprehensive final report of Special Inspections, stating that the materials supplied and work performed by the fabricator are in accordance the construction documents.

PART 3 EXECUTION

3.1 RESPONSIBILITIES

[3.1.1 Special Inspector of Record

a. Supervise all Special Inspectors required by the contract documents and the IBC.

b. Submit a SIOR Letter of Acceptance to the Contracting Officer attesting to acceptance of the duties of SIOR, signed and sealed by the SIOR.

c. Verify the qualifications of all of the Special Inspectors.

d. Verify the qualifications of fabricators.

[e. Submit Special Inspections agency's written practices for the monitoring and control of the agency's operations to include the following:

(1) The agency's procedures for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualifications and certification of inspection personnel.

(2) The agency's inspection procedures, including general inspection, material controls, and visual welding inspection.

f. Submit qualification records for nondestructive testing (NDT) technicians designated for the project.

g. Submit NDT procedures and equipment calibration records for NDT to be performed and equipment to be used for the project.]

h. Prepare a Special Inspections Project Manual, which will cover the following:

(1) Roles and responsibilities of the following individuals during Special Inspections: SIOR, SI, General Contractor, Subcontractors, QC Manager, and DOR.

(2) Organizational chart and/or communication plan, indicating lines of communication.

(3) Contractor's internal plan for scheduling inspections. Address items such as timeliness of inspection requests, who to contact for inspection requests, and availability of alternate inspectors.

(4) Indicate the government reporting procedures.

(5) Propose forms or templates to be used by SI and SIOR to document inspections.

(6) Indicate procedures for tracking nonconforming work and verification that corrective work is complete.

(7) Indicate how the SIOR and/or SI will participate in weekly QC meetings.

(8) Indicate how Special Inspections of shop fabricated items will be handled when the fabricator's shop is not certified per paragraph FABRICATOR SPECIAL INSPECTIONS.

(9) Include a section in the manual that covers each specific item requiring Special Inspections that is indicated on the Schedule of Special Inspections. Provide names and qualifications of each special inspector who will be performing the Special Inspections for each specific item. Provide detail on how the Special Inspections are to be carried out for each item so that the expectations are clear for the General Contractor and the Subcontractor performing the work.

Make a copy of the Special Inspections Project Manual available on the job site during construction. Submit a copy of the Special Inspections Project Manual for approval.

i. Attend coordination and mutual understanding meeting where the information in the Special Inspections Project Manual will be reviewed to verify that all parties have a clear understanding of the Special Inspections provisions and the individual duties and responsibilities of each party.

j. Maintain a 3- ring binder for the Special Inspector's daily and biweekly reports and the Special Inspections Project Manual. This file must be located in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the DOR.

k. Submit a copy of the Special Inspector's daily reports to the QC Manager.

l. Discrepancies that are observed during Special Inspections must be reported to the QC Manager for correction. If discrepancies are not corrected before the special inspector leaves the site the observed discrepancies must be documented in the daily report.

m. Submit a biweekly Special Inspections report until all work requiring Special Inspections is complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following:

(1) A brief summary of the work performed during the reporting time frame.

(2) Changes and/or discrepancies with the drawings, specifications [and mechanical or electrical component certification,] that were observed during the reporting period.

(3) Discrepancies which were resolved or corrected.

(4) A list of nonconforming items requiring resolution.

(5) All applicable test results including nondestructive testing reports.

[n. At the completion of each Definable Feature of Work (DFOW) requiring Special Inspections, submit an interim final report of Special Inspections that documents the Special Inspections completed for that

DFOW and corrections of all discrepancies noted in the daily reports. The interim final report of Special Inspections must be signed, dated and bear the seal of the SIOR.]

o. At the completion of the project submit a comprehensive final report of Special Inspections that documents the Special Inspections completed for the project and corrections of all discrepancies noted in the daily reports. The comprehensive final report of Special Inspections must be signed, dated and bear the seal of the SIOR.

]3.1.2 Quality Control Manager

[a. Supervise all Special Inspectors required by the contract documents and the IBC.

b. Verify the qualifications of all of the Special Inspectors.

c. Verify the qualifications of fabricators.

d. Maintain a 3- ring binder for the Special Inspector's daily and biweekly reports. This file must be located in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the DOR.

] [a.][e.] Maintain a rework items list that includes discrepancies noted on the Special Inspectors daily report.

3.1.3 Special Inspectors

a. Inspect all elements of the project for which the special inspector is qualified to inspect and are identified in the Schedule of Special Inspections.

b. Attend preparatory phase meetings related to the Definable Feature of Work (DFOW) for which the special inspector is qualified to inspect.

[c. Submit Special Inspections agency's written practices for the monitoring and control of the agency's operations to include the following:

(1) The agency's procedures for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualifications and certification of inspection personnel.

(2) The agency's inspection procedures, including general inspection, material controls, and visual welding inspection.

d. Submit qualification records for nondestructive testing (NDT) technicians designated for the project.

e. Submit NDT procedures and equipment calibration records for NDT to be performed and equipment to be used for the project.]

f. Submit a copy of the daily reports to the QC Manager.

g. Discrepancies that are observed during Special Inspections must be reported to the QC Manager for correction. If discrepancies are not corrected before the special inspector leaves the site the observed

discrepancies must be documented in the daily report.

h. Submit a biweekly Special Inspection Report until all inspections are complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following:

(1) A brief summary of the work performed during the reporting time frame.

(2) Changes and/or discrepancies with the drawings, specifications [and mechanical or electrical component certification,] that were observed during the reporting period.

(3) Discrepancies which were resolved or corrected.

(4) A list of nonconforming items requiring resolution.

5) All applicable test result including nondestructive testing reports.

[i. At the completion of each DFOW requiring Special Inspections, submit an interim final report of Special Inspections that documents the Special Inspections completed for that DFOW. Identify the inspector responsible for each item inspected and corrections of all discrepancies noted in the daily reports. The interim final report of Special Inspections must be signed, dated and indicate the certification of the special inspector qualifying them to conduct the inspection.]

j. At the completion of the project submit a comprehensive final report of Special Inspections that documents the Special Inspections completed for the project and corrections of all discrepancies noted in the daily reports. The comprehensive final report of Special Inspections must be signed, dated and indicate the certification of the special inspector qualifying them to conduct the inspection.

[k. Submit daily reports to the SIOR.

]3.2 DEFECTIVE WORK

Check work as it progresses, but failure to detect any defective work or materials must in no way prevent later rejection if defective work or materials are discovered, nor obligate the Contracting Officer to accept such work.

-- End of Section --

Project: P234 - Maintenance Hangar
Location: Anytown, VA
Project #: 12345678
Date: 4/10/2017

STATEMENT OF SPECIAL INSPECTIONS

Project Seismic Design Category: E
Project Risk Category: IV
Project Design Wind Speed (km/h): 392
Number of Stories: 2
Structure Height Above Grade (M): 21
Hazardous Occupancy or attached to such? No Group H Occupancies (2018 IBC, Section 415)

Special Inspector of Record (SIOR)

A Special Inspector of Record (SIOR) **IS** required (per UFGS 01 45 35, Section 1.3.8)

SIOR Name (Registered Professional): John Doe P.E.
Professional Registration Number: C222222
Consulting Firm Name (if any): ABC Structural Consulting
SIOR Office AND Mobile Phone Number: 1234567895 (Mobile), 123456789 (Office)

This Statement of Special Inspections is in accordance with Section 1704.3 of the 2018 IBC. It includes a Schedule of Special Inspections applicable to the above referenced project.

2018 IBC 1704.3.2 and 1704.3.3

Following is a listing of critical main wind/seismic force resisting systems for this structure. Carefully inspect these elements as part of the roles and responsibilities of the Special Inspector (reference the Schedule of Special Inspections for inspection checklists).

Vertical LFRS Elements	**Notes**
Ordinary Concentric Braced Frames	North - South Direction Only, See Plan
Special Concentric Braced Frames	Lettered Gridline only, see plan for call out
Ordinary Steel Moment resisting Frames (SMRF)	Both orthogonal Directions, See plan for call out
Ordinary Reinforced Concrete Shearwalls	See Key Notes
Concrete Grade Beams Resisting Lateral Loads	Office Portion Only, see plan key notes
Ordinary Reinforced Masonry Shear Walls	High Bay, Numbered Gridlines only, see plan
OSB Sheathed Shear Walls (nailing, sill bolting, Etc)	See schedule on plan
Shear Wall Hold Downs	Identified on Plan & in Detail Sheet X.XX
Horizontal LFRS Elements	**Notes**
Continuous Roof Ties	See Key Notes on Roof Plan
Collector Elements	Identified on plan with key notes
Concrete over metal deck	2nd floor and roof
Metal Roof Deck & Related Fastening System	See Roof Plan
Out of Plane Wall Connections	See Structural Details XX & XX
Diaphragm Cross Rod Bracing	See Roof Plan for locations
Cast in Place Concrete Floor and Roof Diaphragms	See sheet XX for details and rebar schedule
Special Force Transfer Connection	See Detail X on Sheet X.XX

Project: P234 - Maintenance Hangar
Location: Anytown, VA
Project #: 12345678
Date: 4/10/2017

Designated Seismic Systems (DSS)

(2018 IBC 1705.13.3.4) (ASCE 7-16, 13.2.2, C13.2.2) (UFC 3-301-04, 2-11.2 & 2-13.2.2)

Non-structural 'Designated Seismic Systems' (DSS) have an I_p greater than 1.0, and must be certified by the manufacturer to remain operable after a design earthquake. The Prime Contractor shall collect the manufacturers Certificates of Compliance for incorporation into the Operations and Maintenance manual per Section 01 78 23 paragraph 1.3. The SIOR shall review the Certificates of Compliance as part of the special inspection. Additionally, the below listed Designated Seismic Systems must be carefully inspected by the Special Inspector according to the requirements noted in the Schedule of Special Inspections.

ELECTRICAL Designated Seismic Systems (DSS) Requiring a Certificate of Compliance	
1.	DSS Emergency or Standby Power System
2.	DSS Lighting Inverters and Associated Conduits
3.	DSS Electrical System (including conduits) and Panels Serving Fire Pump Controller and Fire Pump
4.	DSS Light Fixture with Emergency Battery Backup
5.	DSS Component XX

If additional space is required, append an additional sheet listing the remaining DSS

MECHANICAL/PLUMBING Designated Seismic Systems (DSS) Requiring a Certificate of Compliance	
1.	DSS Gas lines and associated fittings, anchorage, & flexible Connections
2.	DSS Component XX
3.	DSS Component XX
4.	DSS Component XX
5.	DSS Component XX

If additional space is required, append an additional sheet listing the remaining DSS

OTHER Designated Seismic Systems (DSS) Requiring a Certificate of Compliance	
1.	DSS Building egress stair systems
2.	DSS Building fire sprinkler systems
3.	DSS Elevator System, see specification section 14 21 23
4.	DSS Fire pump, Fire pump controller, fire alarm control panel and mass notification
5.	DSS Component XX

Final Walk Down Inspection and Report

(UFC 3-301-01 SECTION 2-2.4.3)

Designated Seismic Systems shall receive a final walk-down inspection by the Registered Design Professional in Responsible Charge.

Final Walk Down Report, Prepared by the Registered Design Professional in Responsible Charge, Must Include:

1. Record observations of Final Walk Down Inspection
2. Document that Inspections were performed in accordance with the Schedule of Special Inspections
3. Document that all Designated Seismic Systems are installed according to construction/manufacturer document requirements, and that Compliance Certificates have been collected (UFC 3- 301-01, 01, 2-13.2.2.1).

SCHEDULE OF SPECIAL INSPECTIONS

Reference UFGS 01 45 35 for all requirements not noted as part of this schedule.

INSPECTION DEFINITIONS:

PERFORM: Perform these tasks for each weld, fastener or bolted connection, and noted verification.

OBSERVE: Observe these items randomly during the course of each work day to ensure that applicable requirements are being met. Operations need not be delayed pending these inspections at contractor's risk.

DOCUMENT: Document, with a report, that the work has been performed in accordance with the contract documents. This is in addition to any other reports required in the Special Inspections guide specification.

CONTINUOUS: Constant monitoring by a special inspector of identified tasks over the duration of performance of said tasks.

PERIODIC: Intermittent monitoring by a special inspector of identified tasks that have been or are being performed.

DESIGNER NOTES (to be deleted after reviewing):

1. This schedule contains minimum requirements. Do not delete applicable inspection tasks unless notes in blue indicate it is acceptable to do so.
2. Blue text = designers notes. The designer must review and edit all blue text in this schedule prior to inserting this schedule into the special inspections spec (UFGS 01 45 35).
3. Check section boxes with ANY inspection tasks applicable to your project. You may choose to delete unchecked sections or leave them in the scheduled unchecked.
4. Individual rows/tasks that that are not applicable to the project may be left in the section, as the inspector can determine whether they occur/apply (e.g. metal trusses in the light gauge framing section for example).
5. Design discipline sections are color coded for easier reference by designers. This schedule does NOT need to be printed in color.
6. When finished editing, delete this note box and save this schedule as a PDF and insert into the project specifications (special inspections section).

A. STRUCTURAL - STEEL – WELDING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

STEEL INSPECTION PRIOR TO WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-16: Table C-N5.4-1		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify that the welding procedures specification (WPS) is available	**PERFORM**	
2. Verify manufacturer certifications for welding consumables are available	**PERFORM**	
3. Verify material identification	**PERFORM**	Type and grade.
4. Welder Identification System	**PERFORM**	The fabricator or erector, as applicable, shall maintain a system by which a welder who has welded a joint or member can be identified. Stamps, if used, shall be the low-stress type.
5. Fit-up of groove welds (including joint geometry)	OBSERVE	✓ Joint preparation ✓ Dimensions (alignment, root opening, root face, bevel) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location) ✓ Backing type and fit (if applicable)
6. Configuration and finish of access holes	OBSERVE	
7. Fit-up of fillet welds	OBSERVE	✓ Dimensions (alignment, gaps at root) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location)
8. Check welding equipment	OBSERVE	
STEEL INSPECTION DURING WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-16: Table C-N5.4-2		
TASK	INSPECTION TYPE [2]	DESCRIPTION
9. Use of qualified welders	**PERFORM**	Welding by welders, welding operators, and tack welders who are qualified in conformance with requirements.
10. Control and handling of welding consumables	OBSERVE	✓ Packaging ✓ Electrode atmospheric exposure control
11. No welding over cracked tack welds	OBSERVE	
12. Environmental conditions	OBSERVE	✓ Wind speed within limits ✓ Precipitation and temperature
13. Welding Procedures Specification followed	OBSERVE	✓ Settings on welding equipment ✓ Travel speed ✓ Selected welding materials ✓ Shielding gas type/flow rate ✓ Preheat applied ✓ Interpass temperature maintained (min./max.)

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

[2] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

STEEL INSPECTION DURING WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-16: Table C-N5.4-2		
TASK	INSPECTION TYPE[1]	DESCRIPTION
14. Welding techniques	OBSERVE	✓ Interpass and final cleaning ✓ Each pass within profile limitations ✓ Each pass meets quality requirements
		✓ Proper position (F, V, H, OH) ✓ Intermix of filler metals avoided

CONTINUED ON FOLLOWING PAGE

A. STRUCTURAL - STEEL – WELDING SECTION (CONTINUED)

STEEL INSPECTION AFTER WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 2018 1705.2.1, AISC 360-16: Table C-N5.4-3		
TASK	INSPECTION TYPE [2]	DESCRIPTION
15. Welds cleaned	OBSERVE	
16. Size, length, and location of all welds	**PERFORM**	Size, length, and location of all welds conform to the requirements of the detail drawings.
17. Welds meet visual acceptance criteria	**PERFORM AND DOCUMENT**	✓ Crack prohibition ✓ Weld/base-metal fusion ✓ Crater cross section ✓ Weld profiles ✓ Weld size ✓ Undercut ✓ Porosity
18. Arc strikes	**PERFORM**	
19. k-area	**PERFORM**	When welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks.
20. Backing removed, weld tabs removed and finished, and fillet welds added where required	**PERFORM**	
21. Repair activities	**PERFORM AND DOCUMENT**	
22. Document acceptance or rejection of welded joint or member	**PERFORM**	
23. No prohibited welds have been added without the approval of the Contracting Officer	OBSERVE	

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

[2] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

B. STRUCTURAL - STEEL – BOLTING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

STEEL INSPECTION TASKS PRIOR TO BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-16: Table C-N5.6-1		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Manufacture's certifications available for fastener materials	**PERFORM**	
2. Fasteners marked in accordance with ASTM or JIS requirements	OBSERVE	
3. Proper fasteners selected for joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	OBSERVE	
4. Proper bolting procedure selected for joint detail	OBSERVE	
5. Connecting elements, including appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	OBSERVE	
6. Pre-installation verification testing by installation personnel observed and documented for fastener assemblies and methods used	**PERFORM**	
7. Proper storage provided for bolts, nuts, washers, and other fastener components	OBSERVE	
STEEL INSPECTION TASKS DURING BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-16: Table C-N5.6-2		
TASK	INSPECTION TYPE [1]	DESCRIPTION
8. Fastener assemblies of suitable condition, placed in all holes and washers (if required) are positioned as required	OBSERVE	
9. Joint brought to the snug-tight condition prior to pretensioning operation	OBSERVE	
10. Fastener component not turned by the wrench prevented from rotating	OBSERVE	
11. Bolts are pretensioned in accordance with RCSC Specification, progressing systematically from the most rigid point toward the free edges	OBSERVE	
STEEL INSPECTION TASKS AFTER BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-16: Table C-N5.6-3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
12. Document acceptance or rejection of all bolted connections	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

C. STRUCTURAL - STEEL - NON DESTRUCTIVE TESTING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-16: Section N5.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Use of qualified nondestructive testing personnel	**PERFORM**	Visual weld inspection and nondestructive testing (NDT) shall be conducted by personnel qualified in accordance with AWS D1.8 clause 7.2
2. CJP groove welds	OBSERVE	**[NOTE: DOR must delete this row if section D (SEISMIC PROVISIONS SECTION) is checked]** Dye penetrant testing (DT) and ultrasonic testing (UT) shall be performed on 20% of CJP groove welds for materials greater than 8mm thick. Testing rate must be increased to 100% if greater than 5% of welds tested have unacceptable defects.
3. Welded joints subject to fatigue	OBSERVE	Dye penetrant testing (DT) and Ultrasonic testing (UT) shall be performed on 100% of welded joints identified on contract drawings as being subject to fatigue.
4. Weld tab removal sites	OBSERVE	At the end of welds where weld tabs have been removed, magnetic particle testing shall be performed on the same beam-to-column joints receiving UT

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

D. STRUCTURAL - STEEL – AISC 341 REQUIREMENTS (SEISMIC PROVISIONS) SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 341-16: Section J6.2		
TASK	INSPECTION TYPE [1]	DESCRIPTION
[NOTE: DOR may uncheck this section for projects NOT designed in accordance with AISC 341 (Seismic Provisions) or for projects designed according to AISC 341, but using an R value equal to 3]		
1. CJP groove welds	OBSERVE	Dye penetrant testing (DT) and ultrasonic testing (UT) shall be performed on 100% of CJP groove welds for materials greater than 5/16" thick (8mm).
2. Beam cope and access hole.	OBSERVE	At welded splices and connections, thermally cut surfaces of beam copes and access holes shall be tested using magnetic particle testing (MT) or dye penetrant testing (DT), when the flange thickness exceeds 38mm for rolled shapes, or when the web thickness exceeds 38mm for built-up shapes.
3. K-area NDT (AISC 341)	**PERFORM**	Where welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, the web shall be tested for cracks using magnetic particle testing (MT). The MT inspection area shall include the k-area base metal within 75mm of the weld. The MT shall be performed no sooner than 48 hours following completion of the welding.
4. Placement of reinforcing or contouring fillet welds	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

E. STRUCTURAL - STEEL - COMPOSITE CONSTRUCTION [1]

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

COMPOSITE CONSTRUCTION PRIOR TO PLACING CONCRETE – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-16: Table N6.1, AISC 341-16: Table J9-1		
TASK	INSPECTION TYPE [2]	DESCRIPTION
1. Placement and installation of steel headed stud anchors	**PERFORM**	
2. Material identification of reinforcing steel (Type/Grade)	OBSERVE	
3. Determination of carbon equivalent for reinforcing steel other than ASTM A706	OBSERVE	
4. Proper reinforcing steel size, spacing, clearances, support, and orientation	OBSERVE	
5. Reinforcing steel has been tied and supported as required	OBSERVE	

END SECTION

F. STRUCTURAL - STEEL - OTHER INSPECTIONS

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

OTHER STEEL INSPECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 341-16: Tables J8-1 & J10-1		
TASK	INSPECTION TYPE [2]	DESCRIPTION
1. Anchor rods and other embedments supporting structural steel	**PERFORM**	Verify the diameter, grade, type, and length of the anchor rod or embedded item, and the extent or depth of embedment prior to placement of concrete.
2. Fabricated steel or erected steel frame	OBSERVE	Verify compliance with the details shown on the construction documents, such as braces, stiffeners, member locations and proper application of joint details at each connection.
3. Reduced beam sections (RBS) where/if occurs	**DOCUMENT**	✓ Contour and finish ✓ Dimensional tolerances
4. Protected zones	**DOCUMENT**	No holes or unapproved attachments made by fabricator or erector
5. H-piles where/if occurs	**DOCUMENT**	No holes or unapproved attachments made by the responsible contractor

END SECTION

[1] See Concrete Construction Section for all concrete related inspection of composite steel construction.

[2] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

G. STRUCTURAL - COLD-FORMED METAL DECK - PLACEMENT SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

METAL DECK INSPECTION PRIOR TO DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2017, Appendix 1, Table 1.1		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify compliance of materials (deck and all deck accessories) with construction documents, including profiles, material properties, and base metal thickness	**PERFORM**	
2. Document acceptance or rejection of deck and deck accessories	**DOCUMENT**	
METAL DECK INSPECTION DURING DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2017, Appendix 1, Table 1.2		
TASK	INSPECTION TYPE [1]	DESCRIPTION
3. Verify compliance of deck and all deck accessories installation with construction documents	**PERFORM**	
4. Verify deck materials are represented by the mill certifications that comply with the construction documents	**PERFORM**	
5. Document acceptance or rejection of installation of deck and deck accessories	**DOCUMENT**	
METAL DECK INSPECTION AFTER DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2017, Appendix 1, Table 1.3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
6. Welding procedure specification (WPS) available	**PERFORM**	
7. Manufactures certifications for welding consumables available	OBSERVE	
8. Material identification (type/grade)	OBSERVE	
9. Check welding equipment	OBSERVE	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

H. STRUCTURAL - COLD-FORMED METAL DECK – WELDING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

METAL DECK INSPECTION DURING WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2017, Appendix 1, Table 1.4 or JASS 6		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Use of qualified welders	OBSERVE	
2. Control and handling of welding consumables	OBSERVE	
3. Environmental conditions (wind speed, moisture, temperature)	OBSERVE	
4. WPS followed	OBSERVE	
METAL DECK INSPECTION AFTER WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2017, Appendix 1, Table 1.5 or JASS 6		
TASK	INSPECTION TYPE [1]	DESCRIPTION
5. Verify size and location of welds, including support, sidelap, and perimeter welds.	**PERFORM**	
6. Welds meet visual acceptance criteria	**PERFORM**	
7. Verify repair activities	**PERFORM**	
8. Document acceptance or rejection of welds	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

I. STRUCTURAL - COLD-FORMED METAL DECK – FASTENING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

METAL DECK INSPECTION BEFORE MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2017, Appendix 1, Table 1.6		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Manufacturer installation instructions available for mechanical fasteners	OBSERVE	
2. Proper tools available for fastener installation	OBSERVE	
METAL DECK INSPECTION DURING MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2017, Appendix 1, Table 1.7		
TASK	INSPECTION TYPE [1]	DESCRIPTION
3. Fasteners are positioned as required	OBSERVE	
4. Fasteners are installed in accordance with manufacturer's instructions	OBSERVE	
METAL DECK INSPECTION AFTER MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2017, Appendix 1, Table 1.8		
TASK	INSPECTION TYPE [1]	DESCRIPTION
5. Check spacing, type, and installation of support fasteners	**PERFORM**	
6. Check spacing, type, and installation of sidelap fasteners	**PERFORM**	
7. Check spacing, type, and installation of perimeter fasteners	**PERFORM**	
8. Verify repair activities	**PERFORM**	
9. Document acceptance or rejection of mechanical fasteners	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

J. STRUCTURAL - LIGHT GAUGE STEEL FRAMING AND/OR LIGHT GAUGE TRUSSES SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

LIGHT GAUGE STEEL CONSTRUCTION AND CONNECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.2, 1705.11.2, 1705.11.3, UFC 4 023 03		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Trusses spanning 18.3m or greater where/if applies	**PERFORM**	Verify that temporary and permanent truss restraint/bracing is installed in accordance with approved truss submittal package.
2. Welded connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all welds composing part of the main wind or seismic force resisting system, including shearwalls, braces, collectors (drag struts), and hold-downs. **[NOTE: DOR must identify critical wind and/or seismic force resisting welds in the contract drawings so that the special inspector can confirm compliance.]**
3. Connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all screw attachment, bolting, anchoring and other fastening of components within the main wind or seismic force resisting system, including roof deck, roof framing, exterior wall covering, wall to roof/floor connections, braces, collectors (drag struts) and hold-downs. **[NOTE: DOR must identify critical wind and/or seismic force resisting connection/fastener components in the contract drawings so that the special inspector can confirm compliance.]**
4. Cold-formed steel (progressive collapse resisting system where/if applies)	OBSERVE	Verify proper welding operations, screw attachment, bolting, anchoring and other fastening of components within the progressive collapse resisting system, including horizontal tie force elements, vertical tie force elements and bridging elements (UFC 4 023 03). **[NOTE: DOR must identify critical progressive collapse resisting connection/fastener components in the contract drawings so that the special inspector can confirm compliance.]**

END SECTION

K. STRUCTURAL - OPEN-WEB STEEL JOISTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

OPEN-WEB STEEL JOISTS AND JOIST GIRDERS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.2.3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Installation of open-web steel joists and joist girders	OBSERVE	✓ End connections – welded or bolted ✓ All Bridging – horizontal and diagonal, per Steel Joist Institute specifications listed in Section 2207.1.

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to ensure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

L. STRUCTURAL - CONCRETE CONSTRUCTION SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.3 (ACI 318 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspect reinforcement, including prestressing tendons, and verify placement.	PERIODIC	Verify prior to placing concrete that reinforcing is of specified type, grade and size; that it is free of oil, dirt and unacceptable rust; that it is located and spaced properly; that hooks, bends, ties, stirrups and supplemental reinforcement are placed correctly; that lap lengths, stagger and offsets are provided; and that all mechanical connections are installed per the manufacturer's instructions and/or evaluation report. **[NOTE: DOR must identify critical progressive collapse resisting connection/fastener components in the contract drawings so that the special inspector can confirm compliance.]**
2. Reinforcing bar welding	PERIODIC	✓ Verify weldability of reinforcing bars other than ASTM A 706 ✓ Inspect single-pass fillet welds, maximum 8mm in accordance with AWS D1.4 or JASS 6
3. All other welding	**CONTINUOUS**	Visually inspect all welds in accordance with AWS D1.4 or JASS 6
4. Gas Pressure Welding	**CONTINUOUS**	Visually inspect all welds for compliance with construction documents and workmanship and check all welds for internal flaws by ultrasonic inspection
5. Cast in place anchors and post installed drilled anchors (downward inclined)	PERIODIC	Verify prior to placing concrete that cast in place anchors and post installed drilled anchors have proper embedment, spacing and edge distance.
6. Post-installed adhesive anchors in horizontal or upward inclined orientations	**CONTINUOUS AND DOCUMENT**	✓ Inspect as required per approved ICC-ES report ✓ Verify that installer is certified for installation of horizontal and overhead installation applications ✓ Inspect proof loading as required by the contract documents
7. Verify use of required mix design	PERIODIC	Verify that all mixes used comply with the approved construction documents
8. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	**CONTINUOUS**	At the time fresh concrete is sampled to fabricate specimens for strength test verify these tests are performed by qualified technicians.

CONTINUED ON FOLLOWING PAGE

[1] **PERIODIC**: Intermittent monitoring by a special inspector of identified tasks that have been or are being performed.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

STRUCTURAL - CONCRETE CONSTRUCTION (CONTINUED)

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.3 (ACI 318 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
9. Inspect concrete and/or shotcrete placement for proper application techniques	**CONTINUOUS**	Verify proper application techniques are used during concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated.
10. Verify maintenance of specified curing temperature and technique	PERIODIC	Inspect curing, cold weather protection, and hot weather protection procedures.
11. Pre-stressed concrete	**CONTINUOUS**	Verify application of prestressing forces and grouting of bonded prestressing tendons.
12. Inspect erection of precast concrete members	PERIODIC	
13. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	PERIODIC	
14. Inspect formwork for shape, location and dimensions of the concrete member being formed.	PERIODIC	

END SECTION

[1] **PERIODIC**: Intermittent monitoring by a special inspector of identified tasks that have been or are being performed.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

M. STRUCTURAL - MASONRY CONSTRUCTION SECTION (ALL RISK CATEGORIES)

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE AT START OF CONSTRUCTION IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Compliance with approved submittals prior to start	PERIODIC	
2. Proportions of site-mixed mortar.	PERIODIC	
3. Grade and type of reinforcement, anchor bolts, and prestressing tendons and anchorages	PERIODIC	
4. Prestressing technique	PERIODIC	
5. Properties of thin bed mortar for AAC masonry	PERIODIC	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE PRIOR TO GROUTING IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
6. Grout space	PERIODIC **CONTINUOUS**	[NOTE: DOR must either delete 'OBSERVE' for Risk Category IV/V, or delete 'CONTINUOUS' for Risk Categories I/II/ III]
7. Proportions of site-prepared grout and prestressing grout for bonded tendons	PERIODIC	
8. Proportions of site-mixed grout and prestressing grout for bonded tendons	PERIODIC	
9. Placement of masonry units and mortar joints	PERIODIC	
10. Welding of reinforcement	**CONTINUOUS**	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE DURING CONSTRUCTION IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
11. Size and location of structural elements is in compliance	PERIODIC	
12. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F (4.4°c) or hot weather (temp above 90°F (32.2°C))	PERIODIC	
13. Application and measurement of prestressing force	**CONTINUOUS**	
14. Placement of grout and prestressing grout for bonded tendons	**CONTINUOUS**	
15. Placement of AAC masonry units and construction of thin bed mortar joints	**CONTINUOUS**	Continuous for first 465 square meters only.
16. Observe preparation of grout specimens, mortar specimens, and/or prisms	PERIODIC	
17. Type, size and placement of reinforcement, connectors, anchor bolts and prestressing tendons and anchorages, including details of anchorage of masonry to structural members, frames, or other construction	PERIODIC **CONTINUOUS**	[NOTE: DOR must either delete 'OBSERVE' for Risk Category IV/V, or delete 'CONTINUOUS' for Risk Categories I/II/III]

END SECTION

[1] **PERIODIC**: Intermittent monitoring by a special inspector of identified tasks that have been or are being performed.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

N. STRUCTURAL - WOOD CONSTRUCTION – SPECIALTY ITEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

WOOD CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. High-load diaphragms where applicable	PERIODIC	Verify thickness and grade of sheathing, size of framing members at panel edges, nail diameters and length, and the number of fastener lines and that fastener spacing is per approved contract documents.
2. Metal-plate connected wood trusses spanning 18.3m or greater	PERIODIC	Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package

END SECTION

O. STRUCTURAL - WOOD CONSTRUCTION - SEISMIC & WIND SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

WOOD CONSTRUCTION SEISMIC AND WIND – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
[NOTE: DOR may uncheck this section where sheathing nailing/fasteners (both shearwall and roof) are consistently greater than 100mm on center, or if the design wind speed is less than 49 meters/sec AND the seismic design category is A or B]		
1. Field gluing operation of elements of the main wind/seismic force-resisting system	**CONTINUOUS**	
2. Nailing, bolting, anchoring and other fastening of elements of the main wind/seismic force-resisting system	PERIODIC	Includes connectors for: shearwall sheathing, roof/floor sheathing, drag struts/collectors, braces, hold downs, roof and floor framing connections to exterior walls.

END SECTION

P. STRUCTURAL – ISOLATION AND ENERGY DISSIPATION SYSTEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

ISOLATION AND ENERGY DISSIPATION SYSTEMS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.2.3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Fabrication and installation	PERIODIC	Verify that fabrication and installation of isolator units and energy dissipation devices conform to manufacturer's recommendations and approved construction documents

END SECTION

[1] **PERIODIC**: Intermittent monitoring by a special inspector of identified tasks that have been or are being performed.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

Q. GEOTECHNICAL - SOILS INSPECTION SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

SOILS INSPECTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.6		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Materials below shallow foundations are adequate to achieve the design bearing capacity.	PERIODIC	
2. Excavations are extended to proper depth and have reached proper material	PERIODIC	
3. Perform classification and testing of compacted fill materials	PERIODIC	
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill	**CONTINUOUS**	
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	PERIODIC	During fill placement, the special inspector shall verify that proper materials and procedures are used in accordance with the provisions of the approved geotechnical report

END SECTION

R. GEOTECHNICAL - DRIVEN DEEP FOUNDATION ELEMENTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

DEEP DRIVEN FOUNDATION CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify element materials, sizes and lengths comply with requirements	**CONTINUOUS**	
2. Determine capacities of test elements and conduct additional load tests as required	**CONTINUOUS**	
3. Inspect driving operations and maintain complete and accurate records for each element	**CONTINUOUS**	
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achiever design capacity, record tip and butt elevations and document ay damage to foundation element	**CONTINUOUS**	

END SECTION

[1] **PERIODIC**: Intermittent monitoring by a special inspector of identified tasks that have been or are being performed.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

S. GEOTECHNICAL - HELICAL PILE FOUNDATIONS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

HELICAL PILE FOUNDATIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.9		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Record installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data. The approved geotechnical report (provided upon request) and the contract documents shall be used to determine compliance	**CONTINUOUS**	

END SECTION

T. GEOTECHNICAL - CAST IN PLACE DEEP FOUNDATION ELEMENTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

CAST IN PLACE DEEP FOUNDATION ELEMENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.8		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspect drilling operations and maintain complete and accurate records for each element.	**CONTINUOUS**	
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable and adequate end-bearing strata capacity. Record concrete or grout volumes	**CONTINUOUS**	

END SECTION

[1] **CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

U. FIRE PROTECTION - SPRAYED FIRE-RESISTANT MATERIALS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

SPRAYED FIRE RESISTANT MATERIALS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.14		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Surface condition	PERIODIC	Prior to application confirm that surface has been prepared per the approved fire-resistance design and manufacturer's instructions.
2. Application	PERIODIC	Prior to application confirm that the substrate meets the minimum ambient temperature per the approved fire-resistance design and manufacturer's instructions.
3. Material thickness	PERIODIC	Verify that the thickness of the SFRM to structural elements is not less than the thickness require by the fire-resistant design in more that 10 percent of the measurement, but in no case less than minimum allowable thickness required by 1705.14.4.
4. Material density	PERIODIC	Verify that the density of the SFRM is not less than the density required by the fire-resistant design and according to IBC 1705.14.5.
5. Bond strength	PERIODIC	Verify cohesive/adhesive bond strength of the cured SFRM applied to the structural element is not less than 150psf and according to IBC 1705.14.6

END SECTION

V. FIRE PROTECTION - MASTIC AND INTUMESCENT COATINGS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

MASTIC AND INTUMESCENT FIRE-RESISTANT COATINGS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.15		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Surface preparation	PERIODIC	Inspections shall be performed in accordance with AWCI 12-B and the contract documents

END SECTION

W. FIRE PROTECTION – FIRE RESISTANT PENETRATIONS AND JOINTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

FIRE RESISTANT PENETRATIONS AND JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.17		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspections of penetration firestop systems conducted in accordance with ASTM E 2174.	**PERFORM**	**[NOTE: This section applies to Risk Category III, IV, & V only. DOR may choose to uncheck this section where project is assigned to Risk Category I or II. Confirm Risk Category with Structural Engineer]**
2. Inspections of fire-resistant joint systems conducted in accordance with ASTM E 2393	**PERFORM**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
PERIODIC: Intermittent monitoring by a special inspector of identified tasks that have been or are being performed.

X. FIRE PROTECTION – SMOKE CONTROL SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

SMOKE CONTROL – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.17		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify device locations and perform leakage testing	PERIODIC	Perform during erection of ductwork and prior to concealment
2. Pressure difference testing, flow measurements and detection and control verification	PERIODIC	Perform prior to occupancy and after sufficient completion

END SECTION

[1] **PERIODIC**: Intermittent monitoring by a special inspector of identified tasks that have been or are being performed.

Y. ARCHITECTURAL - EXTERIOR INSULATION AND FINISH SYSTEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.16		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Water resistive barrier coating applied over a sheathing substrate.	PERIODIC	Verify that water resistive barrier coating complies with ASTM E 2570. **[NOTE: not applicable to masonry or concrete wall applications. Uncheck this section in those cases]**

END SECTION

Z. ARCHITECTURAL – ARCHITECTURAL COMPONENTS

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

ARCHITECTURAL COMPONENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.12.4, 1705.12.7		
TASK	INSPECTION TYPE [1]	DESCRIPTION
[NOTE: This section is not applicable to Seismic Design Categories A, B, & C. Uncheck this section if one of those categories applies. Confirm Seismic Design Category with the structural engineer]		
1. Erection and fastening of exterior cladding and interior and exterior veneer.	PERIODIC	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. **Inspector Note: Inspection not required if height is less than 9.15m or weight is less than 0.24kPa**
2. Interior and exterior non-load bearing walls	PERIODIC	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. **Inspector Note: Inspection not required if height is less than 9.15m. Also, Interior non-load bearing walls need not be inspected if weighing less than 0.72kPa**
3. Access floors	PERIODIC	Verify that anchorage complies with approved construction documents. Inspection of post-installed anchors shall comply with approved ICC-ES report
4. Storage racks	PERIODIC	Verify that anchorage complies with approved construction documents. Inspection of post-installed anchors shall comply with approved ICC-ES report. **Inspector Note: Not required for racks less than 8 feet in height**
5. Acoustical ceiling with 22mm wall molding and clip	PERIODIC	Verify ceiling system is installed per manufacturer details. Conduct special inspection per IBC 2018, 1705.1.1 and provide certification from manufacturer based on the Seismic Design Category of the project.
6. Acoustical ceiling with 50mm wall molding and no clip	PERIODIC	Verify ceiling system is installed per ASTM E580.
7. Elevator equipment, supports and seismic switch	PERIODIC	Verify anchors have been prequalified per ACI 355.2 and designed per ACI 318 Appendix D. Locate switch on loadbearing wall or column. Do not attach to metal stud wall.

END SECTION

[1] **PERIODIC**: Intermittent monitoring by a special inspector of identified tasks that have been or are being performed.

AA. PLUMBING/MECHANICAL DESIGNATED SEISMIC SYSTEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

PLUMBING AND MECHANICAL - DESIGNATED SEISMIC SYSTEMS IBC 1705.12.4, 1705.13.3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
[NOTE: This section is not applicable to Seismic Design Categories A or B. Uncheck this section if one of those categories applies. Confirm Seismic Design Category with structural engineer]		
1. Designated Seismic Systems equipment verification	PERIODIC	✓ Verify model number and serial number are in conformance with project specific seismic qualification (PSSQ) ✓ Verify Tag ID is correct and installed per specifications
2. Designated Seismic Systems equipment Mounting	PERIODIC	✓ Verify that Anchor Base Bolting is installed per PSSQ ✓ Verify that Equipment Bracing is Installed per PSSQ ✓ Verify that Bracing Attachments are installed per PSSQ
3. Designated Seismic Systems utility Conduit/Piping	PERIODIC	✓ Verify that Conduit/Piping is connected to the equipment per PSSQ (flex or rigid) ✓ Verify that Conduit/Piping is seismically supported independently of equipment and in accordance with PSSQ support requirements
4. Designated Seismic Systems clearance	PERIODIC	✓ Adjacent Equipment – Verify that there is adequate gap to eliminate possibility of pounding ✓ Conduit/Piping - Verify that there is adequate gap to eliminate possibility of pounding
5. Installation of Vibration Isolation System (Snubber)	PERIODIC	✓ Verify Anchors have been pre-qualified per ACI 355.2 and designed per ACI 318 Appendix D.

END SECTION

[1] **PERIODIC**: Intermittent monitoring by a special inspector of identified tasks that have been or are being performed.

BB. ELECTRICAL DESIGNATED SEISMIC SYSTEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

ELECTRICAL - DESIGNATED SEISMIC SYSTEMS IBC 1705.12.4		
TASK	INSPECTION TYPE [1]	DESCRIPTION
[NOTE: This section is not applicable to Seismic Design Categories A or B. Uncheck this section if one of those categories applies. Confirm Seismic Design Category with structural engineer]		
1. Generator	PERIODIC	✓ Verify certification of emergency generator, ATS, switchgear, and control panelboard by NIPPON Engine Generator Association (NEGA) ✓ Verify conformance with the Fire Protection Law of Standby Generator
2. Automatic Transfer Switch (ATS)	PERIODIC	✓ Verify certification of emergency generator, ATS, switchgear, and control panelboard by NIPPON Engine Generator Association (NEGA) ✓ Verify conformance with the Fire Protection Law of Standby Generator
3. Uninterrupted Power Source (UPS)	PERIODIC	✓ Verify anchors have been pre-qualified per ACI 355.2 and designed per ACI 318 Appendix D.
4. Electrical Panels	PERIODIC	✓ Verify anchors have been pre-qualified per ACI 355.2 and designed per ACI 318 Appendix D.
5. Switchgear	PERIODIC	✓ Verify Anchors have been pre-qualified per ACI 355.2 and designed per ACI 318 Appendix D.
6. Emergency Fixtures	PERIODIC	✓ Verify light fixtures have been installed per ASTM E580.

END SECTION

[1] **PERIODIC**: Intermittent monitoring by a special inspector of identified tasks that have been or are being performed.

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511	(2007) Standard for Reduced-Pressure Principle Backflow Prevention Assembly

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR List	(continuously updated) List of Approved Backflow Prevention Assemblies
FCCCHR Manual	(10th Edition) Manual of Cross-Connection Control

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

PL 93-523	(1974; A 1999) Safe Drinking Water Act

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(2016; Rev L; Change 2) Obstruction Marking and Lighting

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information onlysubmittals not having a "G" designation are for Contractor Quality Control or Designer of Record approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Site Plan; G
Traffic Control Plan; G
Temporary Utility Connections Plan; G

1.3 CONSTRUCTION SITE PLAN

Prior to the start of work, submit a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

1.4 BACKFLOW PREVENTERS CERTIFICATE

Certificate of Full Approval from FCCCHR List, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval will not be acceptable.

1.4.1 Backflow Tester Certificate

Certification issued by the local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency. Tester must not be affiliated with any company participating in any other phase of this Contract.

1.4.2 Backflow Prevention Training Certificate

Certification recognized by the local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.

1.5 TYPHOON AND STORM PREPARATIONS

In order to minimize damage to public properties and prevent personal injury, the following actions shall be taken upon declaration of the typhoon conditions described below. Ensure that the construction sites are well-prepared for protection from the damages of heavy rain and strong winds. Develop and establish the necessary procedures to be taken for storm preparation. In Part 1 of the Accident Prevention Plan, provide emergency phone numbers and addresses where at least three Contractor officials may be reached and notified in the event that an immediate typhoon alert is declared.

1.5.1 Tropical Cyclone Conditions of Readiness (TCCOR)

a. TCCOR STORM WATCH: The winds are not forecast to exceed 50 knots (58 mph/26 m/s) sustained (the criteria for "destructive winds") but there still exists a probability of high winds due to the proximity of the storm. High winds may include gusts exceeding 50 knots and/or sustained winds meeting TCCOR 1 Caution criteria. The storm is also

close enough to the area that a heightened alert status is necessary in order to rapidly establish elevated TCCOR conditions should the storm deviate from the forecast track. Personnel should follow Standard Operating Procedures for TCCOR Storm Watch and stay alert for any changes to TCCOR status.

When wind gusts of 30 knots (35 mph/16 m/s) or greater are forecast, the Contractor shall be required to perform general area cleanup and monitor TCCOR levels.

When a local storm warning has been issued, the Contractor competent person and/or SSHO shall determine whether it is necessary to implement manufacturer recommendations for securing the equipment to include Weight Handling Equipment (WHE).

Contractor reviews project site storm preparation plans and discuss plan of action with Contracting Officer's Representative.

b. TCCOR 4: Winds of 50 knots (58 mph/26 m/s) sustained or greater are possible within 72 hours.

When wind gusts of 30 knots (35 mph/16 m/s) or greater are forecast, the Contractor will be required to perform general area cleanup and monitor TCCOR levels.

Cranes shall not be operated when wind speeds at the site attain the maximum wind velocity based on the surface/load ratio recommendations of the manufacturer.

At winds greater than 20 mph (17 knots/9 m/s), the operator, rigger, lift supervisor, and SSHO shall cease all crane operations, evaluate conditions and determine if the lift can proceed with Contracting Officer's Representative acceptance.

All elevated work above 6 ft (1.8 m) shall be risk assessed by the Contractor's competent person and/or SSHO and discussed with the Contracting Officer's Representative for acceptance.

c. TCCOR 3: Winds of 50 knots (58 mph/26 m/s) sustained or greater are possible within 48 hours.

(1) Clean and remove all loose debris and waste including scrap wood and metal, empty barrels, and construction form materials no longer required on the job site, to a safe area for proper disposition.

(2) Secure, tie down, and anchor construction field office and storage facilities, scaffolding, concrete forms and supports, doors, windows, opening covers, stored lumber and other materials, mechanized construction equipment, temporary power lines and supports, and other items that may be blown away or that might cause injury or damage.

(3) Inspect all excavation and trenching work in process, and provide necessary temporary drainage and proper protection and shoring for excavation sides and openings, in order to prevent damage to public roads and facilities by slides or flooding. Accumulation of water in the excavation of structure foundation work shall be controlled and minimized.

(4) Inspect scaffolding or work platforms for loose materials, planking, etc. that could become airborne projectile hazards and secure scaffold netting, tarps, etc. from wind loads.

d. TCCOR 2: Winds of 50 knots (58 mph/ 26 m/s) sustained or greater are possible within 24 hours.

Work required at remote areas such as off-shore facilities or high elevations shall cease immediately and the workers shall be evacuated to a safe area. During TCCOR 2, the Contractor shall continue the actions described in TCCOR 3 above and the construction site shall be inspected for storm preparation by the Contracting Officer's Representative. The Contractor shall request an inspection by calling the Contracting Officer's Representative at the appropriate Japan Engineer District field office.

e. TCCOR 1: Winds of 50 knots (58 mph/26 m/s) sustained or greater are possible within 12 hours.

All work shall cease immediately and the Contractor's representative shall insure that all necessary storm preparations, including the items listed below, are completed.

(1) All electrical circuits and equipment including temporary power lines are cut off and secured against unauthorized use.

(2) Gas cylinders, hot work equipment, and flammable materials properly stored at a safe area.

(3) No igniting source is present.

(4) All workers have been evacuated from the construction site. When TCCOR 1 is declared without the normal progression through TCCOR 3 and/or 2, the Contractor shall take the actions listed in TCCOR 3 above, and also follow the procedures described herein.

f. TCCOR 1 Caution: Winds of 35 to 49 knots (39/17 to 56/25 mph/ m/s) sustained are occurring.

Construction Sites Secured.

g. TCCOR 1 Emergency: Winds of 50 knots (58 mph/26 m/s) sustained or greater are occurring.

Construction Sites Secured.

h. TCCOR 1 Recovery: Winds of 50 knots (58 mph/26 m/s) sustained or greater are no longer forecast to occur. Strong winds may still exist.

Installation personnel begin storm damage assessments and clean up.

i. TCCOR Storm Clear: The storm is over and not forecast to return. Used to inform personnel that the threat of the storm is over, but the storm damamge could still present a danger.

Contractor may resume normal activities. The construction site shall be investigated for all damage caused by the typhoon or high winds, and the result of the investigation shall be furnished in verbal or

written form to the Contracting Officer's Representative as soon as practicable.

Complete and submit PODWP 134 Typhoon Damage Report for storm damages or negative report of damage to Emergency Management, Construction Division, and Safety Office.

j. TCCOR All Clear: The storm is over and not forecast to return, and recovery efforts are complete.

Resume normal activities.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNAGE

2.1.1 Bulletin Board

Immediately upon beginning of work, provide a weatherproof glass-covered bulletin board not less than 915 by 1220 mm in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the Contract, Wage Rate Information poster, and other information approved by the Contracting Officer. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer.

2.1.2 Project and Safety Signs

Provide [one (1)] project sign and [one (1)] safety sign fabricated to size and design as shown in Attachment 01 50 00-A. The signs shall be rigidly formed and erected at location designated by the Contracting Officer prior to commencement of work. A blue-line drawing of different letter sizes and style shall be made available by the Contracting Officer upon request. Prior to painting the sign, submit for approval a sketch, similar to diagram shown in Attachment 01 50 00-A, indicating the actual information for the project. The sketch shall indicate lettering dimensions and locations. The Corps of Engineers castle logo shall be painted red per Attachment 01 50 00-A. Correct the data required by the safety sign daily, with light-colored metallic or non-metallic numerals. No separate payment shall be made for the sign, and all costs in connection therewith shall be included in the Contract price for the project. The sign shall be subject to the approval of the Contracting Officer. Erect signs within 15 days after receipt of the Notice to Proceed. Correct the data required by the safety sign daily, with light-colored metallic or non-metallic numerals. Upon completion of work under this Contract, the signs shall be removed from the job site and shall remain the property of the Contractor.

2.2 TEMPORARY TRAFFIC CONTROL

2.2.1 Haul Roads

Construct access and haul roads necessary for proper prosecution of the work under this Contract. Construct with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic are to be avoided. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control must be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads are subject to

approval by the Contracting Officer. Lighting must be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations.

2.2.2 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic barricades will be required. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.2.3 Temporary Wiring

Provide temporary wiring in accordance with NFPA 241 and NFPA 70. Include frequent inspection of all equipment and apparatus.

2.2.4 Backflow Preventers

Reduced pressure principle type conforming to the applicable requirements AWWA C511. Provide backflow preventers complete with 65 kg flanged, mounted gate valve and strainer, stainless steel or bronze, internal parts. After installation conduct Backflow Preventer Tests and provide test reports verifying that the installation meets the FCCCHR Manual Standards.

PART 3 EXECUTION

3.1 EMPLOYEE PARKING

Contractor employees will park privately owned vehicles in an area designated by the Contracting Officer. This area shall be within reasonable walking distance of the construction site. Contractor employee parking must not interfere with existing and established parking requirements of the government installation.

3.2 TEMPORARY BULLETIN BOARD

Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer.

3.3 AVAILABILITY AND USE OF UTILITY SERVICES

3.3.1 Payment for Utility Services

The Government shall make all reasonably required utilities available to the Contractor[, without charge,] from existing outlets and supplies, as specified in the Contract. Carefully conserve any utilities.

3.3.2 Meters and Temporary Connections

At the Contractor's expense and in a manner satisfactory to the Contracting Officer, provide and maintain necessary temporary connections, distribution lines, and meter bases required to measure the amount of each utility used. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards. Submit a Temporary Utility Connections Plan for

approval to the Contracting Officer, fifteen (15) working days before making temporary utility connections.

[
The Government shall
[Furnish the water meter]
[Furnish the electric meter]
[Furnish the backflow preventer]
[Install the water meter]
[Install the electric meter]
[Install the backflow preventer]
][
The Contractor shall
[Furnish the water meter]
[Furnish the electric meter]
[Furnish the backflow preventer]
[Install the water meter]
[Install the electric meter]
[Install the backflow preventer]
]

[3.3.3 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of [6,000] JPY shall be required. Adjustments to the monthly bills shall be settled at the end of the fiscal year ending on 30 September. Services to be rendered for the next fiscal year, beginning 1 October, shall require a new deposit. Notification of the due date for the new deposit shall be mailed to the Contractor prior to the end of the previous fiscal year.

]3.3.4 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, notify the Contracting Officer, in writing, five working days before termination is desired. A final reading shall be taken by the Government. Afterwards, remove all temporary distribution lines, meter bases, meters, and associated appurtenances.[Pay all outstanding utility bills before final acceptance of the work by the Government.]

3.3.5 Sanitation

Provide and properly maintain temporary toilet facility for use of Contractor personnel. Government toilet facilities are not available to Contractor personnel. Toilet facility shall be constructed as required in EM 385-1-1 and by local installation regulations, where directed. Include provisions for pest control and elimination of odors. Upon completion of the Contract, dispose facility outside the limits of Government-controlled land and at Contractor's expense.

3.3.6 Electricity

The Contractor shall be responsible for all temporary connections required, as well as the removal of these temporary connections upon completion of the project. The Contractor's plan for temporary connections shall be submitted to the Contracting Officer Representative for approval prior to making any temporary connections.

Electrical power system frequencies for different installations are as follows:

a. 50 Hertz (Hz): Camp Zama, Sagami Depot, Sagamihara Housing Area, Yokota Air Base, Commander Fleet Activities Yokosuka, Naval Air Facility Atsugi, Misawa Air Base, Camp Fuji, and Naval Support Facility Kamiseya.

b. 60 Hertz (Hz): Marine Corps Air Station Iwakuni, Commander Fleet Activities Sasebo, and all of Okinawa.

3.3.7 Telephone and Data

Make arrangements and pay all costs for telephone facilities and data connections.

3.3.8 Obstruction Lighting of Cranes

Provide a minimum of 2 aviation red or high intensity white obstruction lights on temporary structures (including cranes) over 30 meter above ground level. Light construction and installation shall comply with FAA AC 70/7460-1. Lights shall be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer.

3.3.9 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials daily to minimize potential hazards.

3.4 TRAFFIC PROVISIONS

3.4.1 Maintenance of Traffic

a. Conduct operations in a manner that will not close any thoroughfare or interfere in any way with traffic except with written permission of the Contracting Officer at least 30 calendar days prior to the proposed modification date, and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. The plan must be in accordance with installation regulations. Coordinate with installation officials. Contractor may move oversized and slow-moving vehicles to the worksite once the requirements of the highway authority have been met. Include a schedule of planned road closures in the Inital Project Schedule.

b. Conduct work so [there is no obstruction of traffic, and maintain traffic on the full roadway width at all times][as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times]. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.

c. At the Contractor's expense, provide, erect, and maintain: lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage overhead protection authority having jurisdiction.

3.4.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of

lights around and in front of equipment, the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of any damage to roads caused by construction operations.

3.4.3 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Treat dust abatement on access roads with applications of calcium chloride, water sprinklers, or similar methods or treatment.

3.5 CONTRACTOR'S TEMPORARY FACILITIES

3.5.1 Safety

Protect the integrity of any installed safety systems or personnel safety devices. If entrance into systems serving safety devices is required, the Contractor must obtain prior approval from the Contracting Officer. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish contract requirements, provide alternative means of protection prior to removing or disabling any permanently installed safety devices or equipment and obtain approval from the Contracting Officer.

3.5.2 Administrative Field Offices

Provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

3.5.3 Temporary Project Safety and Storage Area Fencing

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety and storage area fencing to control access by unauthorized people. Fencing shall be able to restrain a force of at least 114 kg. Safety and storage area fencing shall be [1.8 m high wire mesh fence with lockable gates and visibility screening (similar to tennis court screening)][2.5 to 3.0m high sheet metal fence (similar to construction fencing used throughout Japan)] [located around the perimeter of project work areas and the perimeter of Contractor lay-down areas].[Use plastic panels or perforated steel sheets to improve visibility for vehicular traffic when erecting fencing within 3 meters of street corners.] The intent is to block (screen) public view of the construction, and prevent unauthorized access to the site. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Maintain the safety and storage area fencing during the life of the Contract and, upon completion and acceptance of the work, shall become the property of the Contractor and be removed from the work site.

3.5.4 Storage Area

Do not place or store trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the installation boundaries.

Trailers, equipment, or materials must not be open to public view with the exception of those items which are in support of ongoing work on any given day. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

3.5.5 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but will be within the installation boundaries. Fencing of materials or equipment will be required at this site. The Contractor is responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

3.5.6 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes must present a clean and neat exterior appearance and be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on installation property.

3.5.7 Maintenance of Storage Area

Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, will be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles; gravel gradation will be at the Contractor's discretion. Mow and maintain grass to a maximum height of 100 mm located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers will be edged or trimmed neatly.

3.5.8 Security Provisions

Provide adequate outside security lighting at the Contractor's temporary facilities. The Contractor will be responsible for the security of its own equipment.

3.5.9 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

3.5.9.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions must include, but are not limited to, closing openings;

removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

3.6 GOVERNMENT FIELD OFFICE

The Contractor shall be responsible for providing and maintaining, in good condition, an office for the sole use of Government personnel, in a structure physically separated from the Contractor's site offices. Facility shall be furnished at a location designated and approved by the Contracting Officer, and available for use concurrent with availability of Contractor's site office or within 15 calendar days of Notice to Proceed, whichever occurs first. The office facility, including all furniture, equipment, and connections, shall remain the property of the Contractor and, upon completion of work under this Contract, shall be removed from the site by the Contractor and the site returned as nearly as practical to the original conditions.

Contractor shall provide two designated USACE parking spaces as close to the Government Field Office as practicable. The spaces shall not exceed 50 meters from the field office without written approval from the Contracting Officer.

3.6.1 Facility Requirements

Provide the Government an office with a minimum of [67 square meters (720 square feet)] in floor area, windows, a door with lockset individually keyed with two keys, and a battery operated smoke detector in each room. Provide batteries for the smoke detectors, and replace batteries in each smoke detector at least twice annually.

The walls and ceiling of the office shall be insulated. All windows shall be screened. Windows shall be openable and be securely fastened from the inside. Glass panels in windows shall be protected by bars or heavy mesh screens to prevent easy access to the facility through these panels. The office shall contain a minimum of eight (8) standard electrical outlets meeting local requirements and additionally provide for delivery of a minimum 3,000 Watts.

The office shall contain an integral toilet facility with western-type (with a push-type flush button) toilet fixture (bowl), which shall hold water in it at all times, and a wash basin.

The office facility shall contain a kitchenette type facility with a countertop/work area with a minimum surface area of 55 cm (W) by 150 cm (L). A minimum of two electrical outlets (local current) shall be located adjacent to the countertop.

Hot water for all faucets shall be provided.

3.6.2 Furniture and Equipment

Furnish the office with the following furniture and equipment. All furnishing shall be new and manufactured by a recognized supplier of office equipment. All items shall be assembled, installed, and maintained by the Contractor.

a. Two desks (minimum 80 cm by 150 cm) double pedestal with lockable

drawers.

b. Two desk chairs with arms: swivel tilt, hydraulic height-adjustable, medium back, fabric covered seat cushion, castored.

c. One conference table (minimum 120 cm by 250 cm), with a minimum of six new arm-chairs, castored.

d. Three file cabinets, capable of holding US letter-size documents, with a minimum five drawers each.

e. Two bookcases with a minimum of five shelves each. Minimum dimensions are 120 cm (W) by 200 cm (H) by 30 cm (D).

f. One clock: wall hung, quartz, 12 dial, battery powered.

g. Plan racks capable of holding two full-size set of Contract plans.

h. One dry-erase board with a minimum dimension of 1.5 m by 1.0 m. Dry erase markers (minimum four different colors) shall be provided and replaced as depleted.

i. One microwave (minimum 0.028 cubic meter).

j. One refrigerator (minimum 0.70 cubic meter).

3.6.3 Lighting Requirements

The office facility shall include suitable electric lighting to meet the minimum lighting requirements (luminance) of administrative areas as indicated in EM 385-1-1.

3.6.4 Heating/Cooling Requirements

Provide heating and cooling capable of maintaining an interior temperature of between 16 degrees Celsius and 25 degrees Celsius in all seasons. If applicable, use a fluorocarbon gas refrigerant with an Ozone Depletion Potential (ODP) of less than or equal to 0.05.

3.6.5 Drinking Water

Provide potable drinking water for the facility that meets or exceeds PL 93-523.

3.6.6 Data Connection

Provide network connectivity (ADSL, Cable or Fiber), one USACE-dedicated router and one switching hub, eight-5 m network cables, and eight power strips.

3.6.7 Maintenance

Provide maintenance and janitorial services, to include:

a. Emptying of trash at least twice a week.

b. Cleaning of the office, including the toilet facilities, weekly.

c. Replenishment of liquid soap, toilet paper, and paper towels for daily use. Adequate quantity of these supplies shall be provided on-site and replaced as needed.

3.6.8 Security Requirements

The physical security of the Government personnel, property, and field office shall be the responsibility of the Contractor throughout the duration of the Contract.

If the project site is outside of the controlled area of an existing military installation, the Government field office shall have 30 meters of standoff from a fence enclosing the office and all parking or roads. Additional fencing, earth berms, concrete barriers, controlled access points, and similar security features shall be provided to limit access to the site and provide additional building standoff or security.

3.7 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor must install a satisfactory means of communication, such as telephone or other suitable devices and made available for use by Government personnel.

3.8 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store any salvageable materials resulting from demolition activities within the fenced area described above or at the supplemental storage area. Neatly stack stored materials not in trailers, whether new or salvaged.

3.9 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and any other temporary products from the site. All tools, equipment, and materials not the property of the Government shall be removed from the premises and properly disposed of off Government property. After removal of trailers, materials, and equipment from within the fenced area, remove the temporary project safety and storage area fencing. Restore areas used by the Contractor for the storage of equipment or material, or other use to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary. Upon completion of the work, notify the Contracting Officer for final inspection.

-- End of Section --

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Introduction: Construction Project Signs **EP 310-1-6a**
01 Jun 06

The use of signs to identify Corps managed or supervised design, construction, and rehabilitation projects for military is an important part of efforts to keep the public informed of Corps work. For this purpose, a construction project sign package has been adopted. This package consists of two signs: one for project identification and the other to show on-the-job safety performance of the contractor.

These two signs are to be displayed side by side and mounted for reading by passing viewers. Exact placement location will be designated by the contracting officer's representative.

The panel sizes and graphic formats have been standardized for visual consistency throughout all Corps operations.

Panels are fabricated using HDO plywood or aluminum with dimensional lumber uprights and bracing. The sign faces are nonreflective vinyl.

All legends are to be die-cut or computer-cut in the sizes and typefaces specified and applied to the white panel background following the graphic formats shown on pages 16-2 and 16-3. The Communication Red panel on the left side of the construction project sign with Corps Signature (reverse version) is screen-printed onto the white background.

A display of these two signs is shown on the following two pages. Mounting and fabrication details are provided on page 16-4.

Special applications or situations not covered in these guidelines should be referred to the district Sign Program Manager.

EP 310-1-6a (Modified per ECB 2020-1)
01 Jun 06 (ECB modified 1/31/2020)

Construction Project Identification Sign

Below is one sample of the Construction Project Identification sign showing how this panel is to identify military projects. The graphic format for this 4'x 6' sign panel follows the legend guidelines and layout as specified below. The large 4'x 4' section of the panel on the right is to be white with black legend.

The 2'x 4' section of the sign on the left with the full Corps Signature (reverse version) is to be screen-printed Communication Red on the white background. The designation of a sponsor in the area indicated is optional with Military construction signs.

This sign is to be placed with the Safety Performance sign shown on the following page. Mounting and fabrication details are provided on page 16-4.

Special applications or situations not covered in these guidelines should be referred to the district Sign Program Manager.

Post size is 4"x4".
Mounting height is 48".

Legend Group 1: One- to two-line description of Corps relationship to project.
Color: White
Typeface: 1.25" Helvetica Regular
Maximum line length: 19"

Legend Group 2: Division or District Name (optional). Placed below 10.5" reverse Signature (6" Castle).
Color: White
Typeface: 1.25" Helvetica Regular

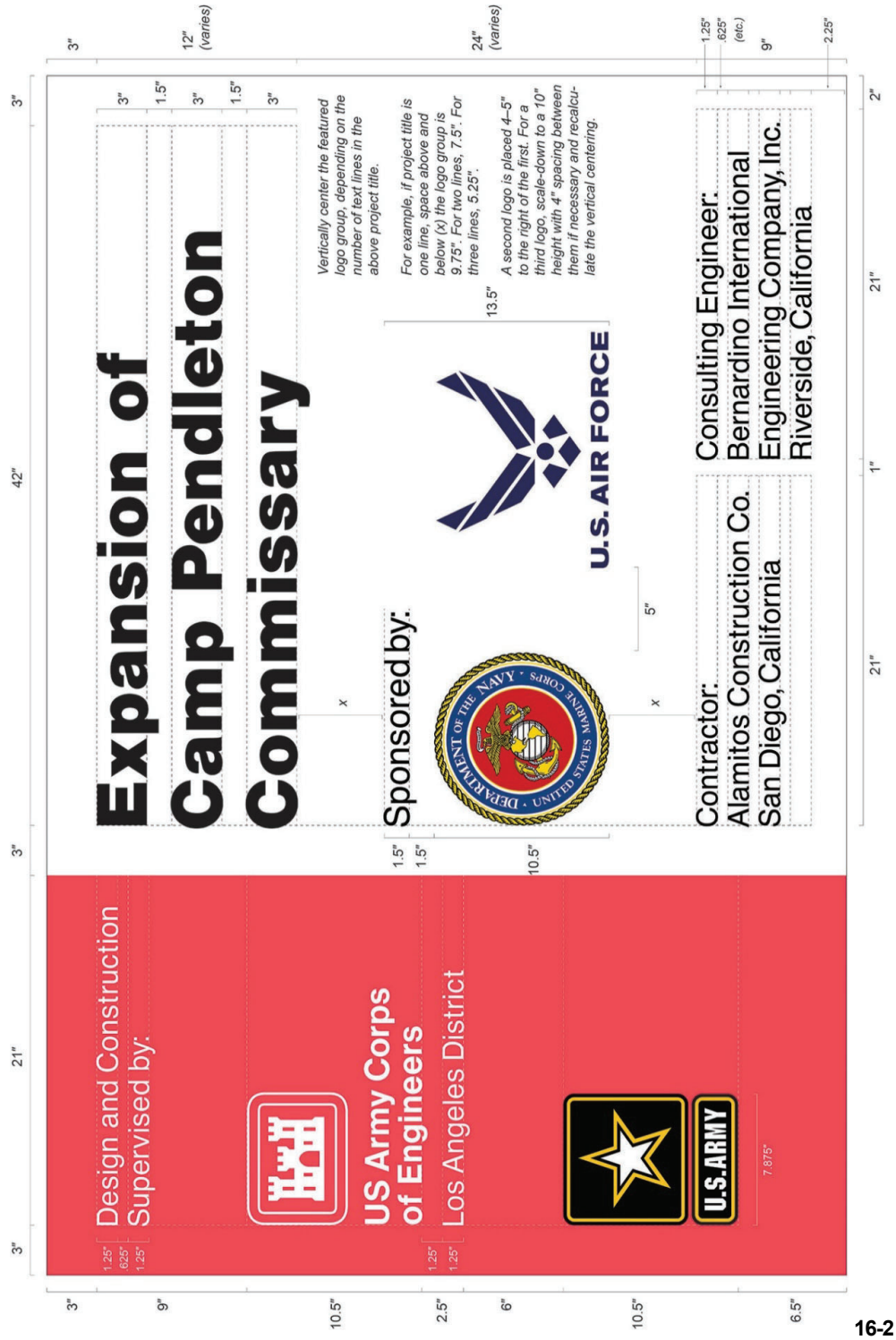
Legend Group 2a: Army Star emblem.
Color: Various

Legend Group 3: One- to three-line project title legend describes the work being done under this contract.
Color: Black
Typeface: 3" Helvetica Bold
Maximum line length: 42"

Legend Group 4: Logo of sponsoring department (military).
Color: Various

Legend Groups 5a-b: One- to five-line identification of prime contractors including: type (architect, general contractor, etc.), corporate or firm name, city, state. Use of Legend Group 5 is optional.
Color: Black
Typeface: 1.25" Helvetica Regular
Maximum line length: 21"

All typography is flush left and rag right, upper and lower case with initial capitals only as shown. Letter- and word-spacing to follow Corps standards as specified in Appendix D.



16-2

Safety Performance Sign **EP 310-1-6a**
01 Jun 06

Each contractor's safety record is to be posted on Corps managed or supervised construction projects and mounted with the Construction Project Identification sign specified on page 16-2.

The graphic format, color, size and typefaces used on the sign are to be reproduced exactly as specified below. The title with First Aid logo in the top section of the sign, and the performance record captions are standard for all signs of this type. Legend groups 2 and 3 below identify the project and the contractor and are to be placed on the sign as shown.

Safety record numbers are mounted on individual metal plates and are screw-mounted to the background to allow for daily revisions to posted safety performance record.

Special applications or situations not covered in these guidelines should be referred to the district Sign Program Manager.

Legend Group 1: Standard two-line title "Safety is a Job Requirement" with 8" (outside diameter) Safety Green first aid logo.
Color: To match Pantone system 347
Typeface: 3" Helvetica Bold
Color: Black

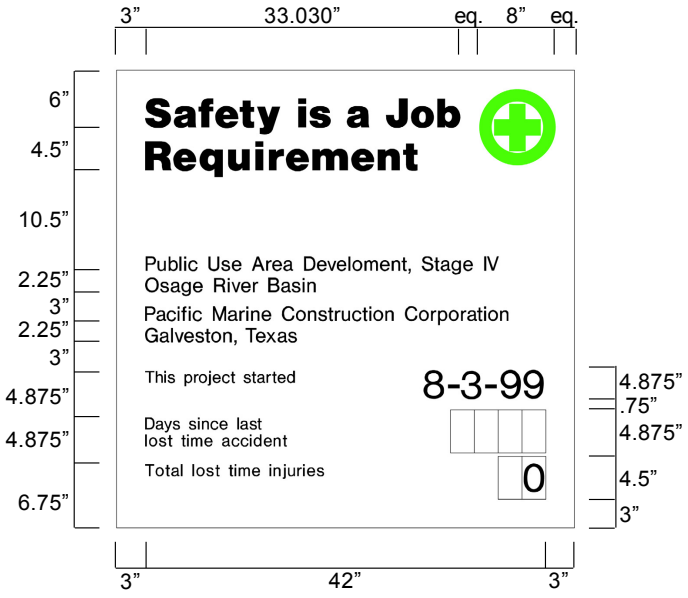
Legend Group 2: One- to two-line project title legend describes the work being done under this contract and name of host project.
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Legend Group 3: One- to two-line identification: name of prime contractor and city, state address. Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

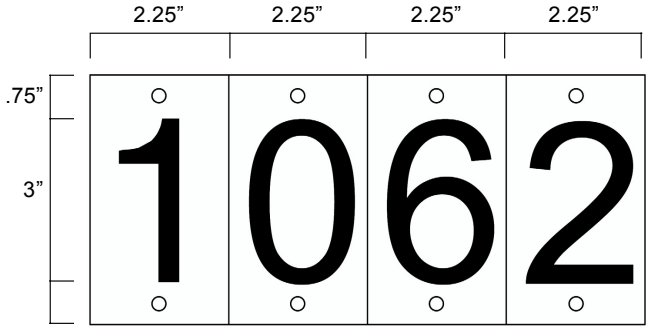
Legend Group 4: Standard safety record captions as shown.
Color: Black
Typeface: 1.25" Helvetica Regular

Replaceable numbers are to be mounted on white .060 aluminum plates and screw-mounted to background.
Color: Black
Typeface: 3" Helvetica Bold
Plate size: 2.5" x 4.5"

All typography is flush left and rag right, upper and lower case with initial capitals only as shown. Letter- and word-spacing to follow Corps standards as specified in Appendix D.



Sign Type	Legend Size (A)	Panel Size	Post Size	Specification Code	Mounting Height	Color Bkg/Lgd
CID-02	various	4'x4'	4"x4"	HDO-3	48"	WH/BK-SG



EP 310-1-6a
01 Jun 06

Fabrication and Mounting Guidelines

All Construction Project Identification signs and Safety Performance signs are to be fabricated and installed as described below. The signs are to be erected at a location designated by the contracting officer representative and shall conform to the size, format, and typographic standards shown on pages16-2 and 16-3. Detailed specifications for HDO plywood panel preparation are provided in Appendix B.

Shown below the mounting diagram is a panel layout grid with spaces provided for project information. Photocopy this page and use as a worksheet when preparing sign legend orders.

For additional information on the proper method to prepare sign panel graphics, contact the district Sign Program Manager.

The sign panels are to be fabricated from .75" High Density Overlay Plywood. Panel preparation to follow HDO specifications provided in Appendix B.

Sign graphics to be prepared on a white nonreflective vinyl film with positionable adhesive backing.

All graphics except for the Communication Red background with Corps Signature on the project sign are to be die-cut or computer-cut nonreflective vinyl, prespaced legends prepared in the sizes and typefaces specified and applied to the background panel following the graphic formats shown on pages 16-2 and 16-3.

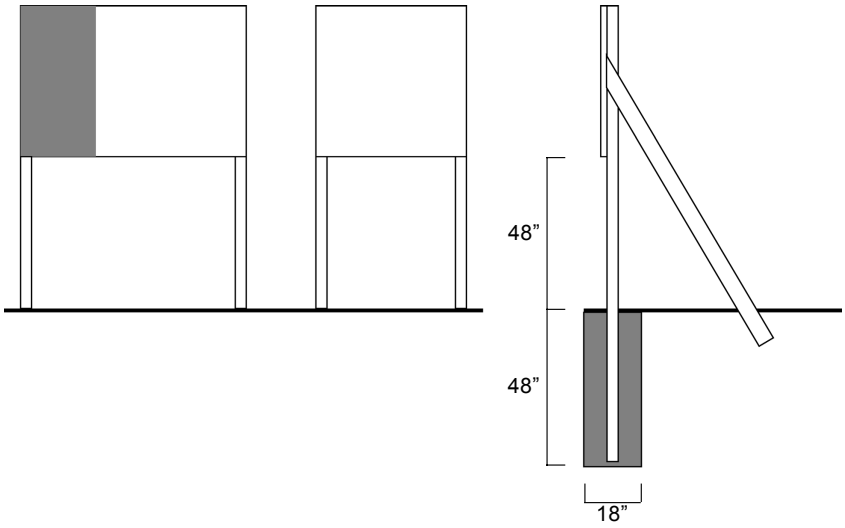
The 2'x 4' Communication Red panel (to match Pantone system 032) with full Corps Signature (reverse version) is to be screen-printed on the white background. Identification of the district or division may be applied under the signature with white cut vinyl letters prepared to Corps standards.

Drill and insert six (6) .375" T-nuts from the front face of the HDO sign panel. Position holes as shown. Flange of T-nut to be flush with sign face.

Apply graphic panel to prepared HDO plywood panel following manufacturers' instructions.

Sign uprights to be structural grade 4" x 4" treated Douglas Fir or Southern Yellow Pine, No.1 or better. Post to be 12' long. Drill six (6) .375" mounting holes in uprights to align with T-nuts in sign panel. Countersink (.5") back of hole to accept socket head cap screw (4" x .375").

Assemble sign panel and uprights. Imbed assembled sign panel and uprights in 4' hole. Local soil conditions and/or wind loading may require bolting additional 2" x 4" struts on inside face of uprights to reinforce installation as shown.



Construction Project Identification Sign
Legend Group 1: Corps Relationship

1. _____
2. _____

Legend Group 2: Division/District Name

1. _____
2. _____

Legend Group 2a: Military/Civil Works Sponsor

1. _____
2. _____

Legend Group 3: Project Title

1. _____
2. _____
3. _____

Legend Group 4: Facility Name

1. _____
2. _____

Legend Group 5: Contractor/A&E

1. _____
2. _____
3. _____
4. _____
5. _____

Legend Group 5b: Contractor/A&E

1. _____
2. _____
3. _____
4. _____
5. _____

Safety Performance Sign
Legend Group 2: Project Title

1. _____
2. _____

Legend Group 3: Contractor/A&E

1. _____
2. _____

16-4

SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. The Contractor shall comply with applicable U.S. Government and Government of Japan (GOJ) laws and regulations, however denominated, including those applicable political subdivision, departments and other entities, to include but not limited to the following:

U.S. DEPARTMENT OF DEFENSE (DOD)

JEGS	(Dec 2022) Japan Environmental Governing Standards

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926.1101	Asbestos
40 CFR 261	Identification and Listing of Hazardous Waste

1.2 DEFINITIONS

In some cases, definitions are given only for illustrative purposes. Prevailing JEGS definitions shall be used for environmental compliance requirements.

1.2.1 Aboveground Storage Tank

A portable or fixed POL aboveground storage container as defined in the JEGS with a capacity greater than 55 gallons.

1.2.2 Asbestos Containing Material (ACM)

Any material containing more than one tenth of one percent (0.1%) asbestos by weight.

1.2.3 Bulky Waste

Large items of solid waste such as household appliances, furniture, large auto parts, trees, branches, stumps, and other oversize wastes whose large size precludes or complicates their handling by normal solid waste collection, processing, or disposal methods.

1.2.4 Chemical Wastes

Salts, acids, alkalis, herbicides, pesticides, organic chemicals, and spent products, which serve no purpose.

1.2.5 Class I and II Ozone Depleting Substance (ODS)

Class I and II ODS are listed in the JEGS.

1.2.6 Construction and Demolition Waste

The waste building materials, packaging, and rubble resulting from construction, remodeling, repair and demolition operations on pavements, houses, commercial buildings, and other structures.

1.2.7 Contractor Generated Hazardous Waste

Contractor generated hazardous waste is materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene), waste thinners, excess paints, excess solvents, waste solvents, excess pesticides, and contaminated pesticide equipment rinse water.

1.2.8 Electronics Waste

Electronics waste is discarded electronic devices intended for salvage, recycling, or disposal.

1.2.9 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally or historically.

1.2.10 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.11 Food Waste

Organic residues generated by the handling, storage, sale, preparation, cooking, and serving of foods (commonly called garbage).

1.2.12 Hazardous Debris

As defined in paragraph SOLID WASTE, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) in accordance with the JEGS. Hazardous debris also includes debris that exhibits a characteristic of hazardous waste in accordance with the JEGS.

1.2.13 Hazardous Materials

Hazardous material is any material that is capable of posing an unreasonable risk to health, safety, or the environment if improperly handled, stored, issued, transported, labeled, or disposed because it displays a characteristic listed in the JEGS, "Typical Hazardous Materials Characteristics," or the material is listed in the "List of Hazardous Waste/Substances/Materials" or is regulated as a hazardous material in accordance with the JEGS or GOJ or local installation regulations, or requires a Safety Data Sheet (SDS), or during end use, treatment, handling, packaging, storage, transpiration, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by the JEGS or prefectural regulations. Munitions are excluded.

Designation of a material by this definition, when separately regulated or controlled by other instructions or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this instruction for "control" purposes. Such material include ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs). Nonetheless, the exposure may occur incident to manufacture, storage, use and demilitarization of these items.

1.2.14 Hazardous Substances

Any substance having the potential to do serious harm to human health or the environment if spilled or released in reportable quantity. A list of these substances and the corresponding reportable quantities is contained in the JEGS, "Characteristics of Hazardous Waste and Lists of Hazardous Waste and Hazardous Material."

1.2.15 Hazardous Waste

Hazardous Waste is discarded material that may be solid, semi-solid, liquid, or contained gas, and either exhibits a characteristic of a hazardous waste as defined in the JEGS. Excluded from this definition are domestic sewage sludge, household wastes, and medical wastes.

1.2.16 Installation Pest Management Coordinator

Installation Pest Management Coordinator (IPMC) is the individual officially designated by the Installation Commander to oversee the Installation Pest Management Program and the Installation Pest Management Plan.

1.2.17 Installation Pest Management Consultant

Installation Pest Management Consultant (IPMC) is the professional DoD pest management personnel located at component headquarters, field operating agencies, major commands, facilities engineering field divisions or activities, or area support activities who provide technical and management guidance for the conduct of installation pest management operations. Some pest management consultants may be designated by their component as certifying officials.

1.2.18 Land Application

Land Application means spreading or spraying discharge water at a rate that allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, or discharge into defined drainage areas (includes drainage ditches, streams, rivers, ocean, etc.) must occur. Comply with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements.

1.2.19 Lead-based Paint (LBP)

Paint or other surface coatings that contain lead greater than or equal to 1.0 milligram per square centimeter, or 0.5 percent by weight, or 5,000 ppm by weight.

1.2.20 Oily Wastes

Oily wastes are those materials that are, or were, mixed with Petroleum, Oils, and Lubricants (POLs) and have become separated from those POLs. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, POLs and may be appropriately tested and discarded in a manner which is in compliance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements..

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that: It is not prohibited in the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements; the amount generated is "de minimus" (a small amount); it is the result of minor leaks or spills resulting from normal process operations; and free-flowing oil has been removed to the practicable extent possible. Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, perform a hazardous waste determination prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

1.2.21 Pesticide

Pesticide is any substance or mixture of substances, including biological control agents that may prevent, destroy, repel, or mitigate pests.

1.2.22 Pesticide Treatment Plan

A plan for the prevention, monitoring, and control to eliminate pest infestation.

1.2.23 Pests

Pests are arthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds and other organisms (except for human or animal disease-causing organisms) that adversely affect readiness, military operations, or the well-being of personnel and animals; attack or damage real property, supplies, equipment, or vegetation; or are otherwise undesirable.

1.2.24 Project Pesticide Coordinator

The Project Pesticide Coordinator (PPC) is an individual who resides at a Civil Works Project office and who is responsible overseeing of pesticide application on project grounds.

1.2.25 Petroleum, Oil, and Lubricants

Refined petroleum, oils, and lubricants, including, but not limited to, petroleum, fuel, lubricant oils, synthetic oils, mineral oils, animal fats, vegetable oil, sludge, and POL mixed with wastes other than dredged spoil.

1.2.26 Polychlorinated Biphenyl (PCB)

Any PCB article, PCB article container, PCB container, or PCB equipment that deliberately or unintentionally contains or has as a part of it any detectable concentration of PCB.

1.2.27 Regulated Waste

Regulated waste are solid wastes that have specific additional Federal, GOJ national, and prefectural controls for handling, storage, or disposal.

1.2.28 Rubbish

A general term for solid waste, excluding food wastes and ashes, taken from residences, commercial establishments, and institutions.

1.2.29 Sanitary Waste

a. Sewage: Wastes characterized as domestic sanitary sewage.

b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2.30 Sediment

Sediment is soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.31 Solid Waste

Solid waste is garbage, refuse, sludge, and other discarded materials, including solid, semi-solid, liquid, and contained gaseous materials resulting from industrial and commercial operations and from community activities. It does not include solids or dissolved material in domestic sewage or their significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial wastewater effluent, dissolved materials in irrigation return flows, or other common water pollutants. Material not regulated as solid waste are: nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production. Types of solid waste typically generated at construction sites may include:

1.2.31.1 Debris

Debris is non-hazardous solid material generated during the construction, demolition, or renovation of a structure that exceeds 60 mmparticle size that is: a manufactured object; plant or animal matter; or natural geologic material (for example, cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials [may][may not] be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

1.2.31.2 Green Waste

Green waste is the vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

1.2.31.3 Hazardous Waste

By definition, to be a hazardous waste a material must first meet the definition of a solid waste. Hazardous waste and hazardous debris are special cases of solid waste. They have additional regulatory controls and must be handled separately. They are thus defined separately in this document.

1.2.31.4 Material Not Regulated as Solid Waste

Material not regulated as solid waste is nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

1.2.31.5 Non-Hazardous Waste

Non-hazardous waste is waste that is excluded from, or does not meet, characteristic of a hazardous waste as defined in the JEGS or is listed as a hazardous waste in the JEGS. Excluded from this definition is medical wastes.

1.2.31.6 Paint Cans

Metal cans that are empty of paints, solvents, thinners and adhesives. If permitted by the paint can label, a thin dry film may remain in the can.

1.2.31.7 Recyclables

Recyclables are materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable, wiring, insulated/non-insulated copper wire cable, wire rope, and structural components. It also includes commercial-grade refrigeration equipment with Freon removed, household appliances where the basic material content is metal, clean polyethylene terephthalate bottles, cooking oil, used fuel oil, textiles, high-grade

paper products and corrugated cardboard, stackable pallets in good condition, clean crating material, and clean rubber/vehicle tires. Metal meeting the definition of lead contaminated or lead based paint contaminated may not be included as recyclable if sold to a scrap metal company.

1.2.31.8 Surplus Soil

Surplus soil is existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars, and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included and must be managed in accordance with paragraph HAZARDOUS MATERIAL MANAGEMENT.

1.2.31.9 Scrap Metal

This includes scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe, and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

1.2.31.10 Wood

Wood is dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included. Treated wood includes, but is not limited to, lumber, utility poles, crossties, and other wood products with chemical treatment.

1.2.32 Surface Discharge

Surface discharge means discharge of water into drainage ditches, storm sewers, or creeks, or waters of Japan. Surface discharges are discrete, identifiable sources and require a permit from the governing agency. Comply with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements.

1.2.33 Wastewater

Wastewater is the used water and solids from a community that flow to a treatment plant.

1.2.33.1 Stormwater

Stormwater is any precipitation in an urban or suburban area that does not evaporate or soak into the ground, but instead collects and flows into storm drains, rivers, and streams.

1.2.34 Waters of Japan

Waters of Japan, as defined by the JEGS, means surface water including the territorial seas recognized under customary international law.

1.2.35 Wetlands

Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

1.3 PROHIBITED PRODUCTS

The following items are forbidden for use by the JEGS or other criteria. Details of each are included in the text of each chapter of the Environmental Protection Plan (EPP) described in this section.

a. Asbestos Containing Materials (ACM).

b. Lead-Containing Paint. Paint containing greater than 0.009 percent lead by weight.

c. Polychlorinated Biphenyls (PCBs). Materials containing PCBs greater than 0.5mg/kg shall not be used.

d. Class I Ozone Depleting Substances (ODS). Class 1 ODS listed in the JEGS shall not be used.

e. Lead Drinking-Water Pipes, Solders, Flux, and Fittings.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Environmental Protection Plan; G[, [_____]]

Environmental Manager Qualifications; G[, [_____]]

Qualifications

Training Program

Written Assessment Of Friable Asbestos Disturbance

SD-06 Test Reports

Solid Waste Management Report; G[, [_____]]

Nonhazardous Solid Waste Diversion Report

Disposal Requirements; G

SD-07 Certificates

ECATTS Certificate Of Completion; G[, [_____]]

Certificate of Competency

Asbestos Certification

Lead Certification

SD-11 Closeout Submittals

Disposal Documentation for Hazardous and Regulated Waste; G[, [_____]](Disposal documentation includes certificates of landfill facility, treatment facility, and transportation of hazardous/regulated waste, and completed signed hazardous/regulated waste manifest.)

[Assembled Employee Training Records; G[, [_____]]]

Solid Waste Management Report; G[, [_____]]

Hazardous Waste/Debris Management; G[, [_____]]

Environmental Records Binder

1.5 PAYMENT

No separate payment shall be made for work covered under this section. Payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor, and payment of all fines/fees for violation or non-compliance with GOJ, Federal, and local laws and regulations are the Contractor's responsibility. All costs associated with this section shall be included in the Contract price.

1.6 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the Contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of this Contract. Comply with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements and management plans pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

Tests and procedures assessing whether construction operations comply with applicable Environmental Laws may be required. Laboratory analyses necessary to implement the JEGS shall be conducted in a laboratory certified by a U.S. or GOJ regulatory authority for the applicable test method, and where required by law, the laboratories shall be certified. In the absence of a certified laboratory, contact the Contracting Officer for further guidance.

Contractor shall be responsible to ensure that subcontractors comply with all environmental protection requirements of this section.

The Contractor shall record any problems in complying with laws, regulations, permit requirements, ordinances, and corrective actions taken. The Contractor shall immediately inform the Contracting Officer of any environmental problems.

1.6.1 Training in Environmental Compliance Assessment Training and Tracking System (ECATTS)

1.6.1.1 Personnel Requirements

The Environmental Manager is responsible for environmental compliance on projects. The Environmental Manager[and other staff], must complete applicable ECATTS training modules (installation specific or general) prior to starting respective portions of on-site work under this Contract. If personnel changes occur for any of these positions after starting work, replacement personnel must complete applicable ECATTS training within 14 days of assignment to the project.

1.6.1.2 Certification

Provide a copy of the ECATTS certificate of completion for personnel who have completed the required ECATTS training in the Environmental Records Binder.. This training is web-based and can be accessed from any computer with Internet access using the following instructions.

[Register for NAVFAC Environmental Compliance Training and Tracking System, by logging on to https://environmentaltraining.ecatts.com/. Obtain the password for registration from the Contracting Officer.]

All Contractor personnel who perform work at CFAS must complete the EMS Awareness Training using the Environmental Compliance, Training and Tracking System (ECATTS). The Contracting Officer will verify completion of training through the ECATTS database.

Go to https://environmentaltraining.ecatts.com/ home page and click "enter". Register as a new user by entering "navfac" (all lower case with no quotation marks) in the Registration Password dialog box. Click the "Create an Account" link to establish an account. Enter the employee's name, e-mail, login ID (pick any ID you choose to use), password (pick any password you choose to use), training type (i.e. Other Construction Contractor or Contract Employee Working on Installation) and work location (Japan, COMFLEACT Sasebo JA). Click the "register" button and the website will generate a password to log into the training site.

Go to the home page and login with the user name and password generated by the website. Click "Japanese language" button, click "Go To Your Training", click "Go To My Training Modules". Open "Environmental Management System Awareness Training", complete the training, take the test and print a certificate for your records. The training takes approximately 20 minutes to complete.

1.6.1.3 Refresher Training

This training has been structured to allow Contractor personnel to receive credit under this Contract and to carry forward credit to future contracts. Ensure the Environmental Manager review their training plans for new modules or updated training requirements prior to beginning work.

ECATTS is available for use by all Contractor and subcontractor personnel associated with this project. These other personnel are encouraged (but not required) to take the training and may do so at their discretion.

1.6.2 Conformance with the Environmental Management System

Perform work under this Contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). Perform work in a manner that conforms to objectives and targets of the environmental programs and operational controls identified by the EMS. Support Government personnel when environmental compliance and EMS audits are conducted by escorting auditors at the Project site, answering questions, and providing proof of records being maintained. Provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, take corrective and preventative actions. In the case of a noncompliance, the Contractor shall assume legal and financial liability for the noncompliance and immediately take corrective action and document the root cause. In the case of a nonconformance, the Contractor shall respond and take corrective action based on the time schedule established by the Contracting Officer. In addition, employees must be aware of their roles and responsibilities under the installation EMS and of how these EMS roles and responsibilities affect work performed under the Contract.

The Contractor shall perform work under this Contract consistent with the following EMS goals and policy.

1.6.2.1 Goals

1. Reduce purchase and use of toxic and hazardous materials.

2. Expand purchase of green products and services; increase recycling.

3. Reduce energy and water use.

4. Increase use of alternative fuels and renewable energy.

5. Integrate green building concepts in major renovations and new construction.

6. Prevent pollution at the source.

7. Continual improvement.

1.6.2.2 Policy

1. Protect public health and the environment by being an environmentally responsible member of Sasebo's community.

2. Preserve natural, historic and cultural resources.

3. Conserve natural resources by reducing what we discard, reusing items, and recycling materials, which includes purchasing products made from recycled materials.

4. Integrate sound environmental practices into all operations and business decisions; Integrate environmental protection

requirements and pollution prevention initiatives into the early planning, design and procurement of facilities, equipment and material.

5. Prevent or minimize pollution at its source and seek out ways to eliminate or further minimize use of hazardous materials and generation of hazardous waste.

6. Maintain a sound partnership with regulatory agencies to sustain compliance with existing and new environmental laws and regulations.

7. Enhance our program as we develop and implement an Environmental Management System.

8. Adhere to this policy, remind one another to do so, and ensure that our entire community knows this is our policy by our actions as well as our words

Coordinate with the installation's EMS coordinator to identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. Provide training documentation to the Contracting Officer. The Installation Environmental Office will retain associated environmental compliance records. Make EMS Awareness training completion certificates available to Government auditors during EMS audits and include the certificates in the Employee Training Records. See paragraph EMPLOYEE TRAINING RECORDS.

The Contractor is responsible for ensuring that their employees receive applicable environmental and occupational health and safety training and remains current on regulatory required specific training for the type of work to be conducted onsite. All on-site Contractor personnel, and their subcontractor personnel, performing tasks that have the potential to cause a significant environmental impact shall be competent on the basis of appropriate education, training or experience.

The Contractor shall provide a list of employees who are expected to perform work or services on CFAS property to the Contracting Officer before the commencement of construction.Provide a copy of the written Training Program to be implemented on this project, including, but not limited to project site-specific training material as indicated in 29 CFR 1926.1101 and comply with applicable laws and regulations of Government of the United States and Japan, however denominated including those applicable political subdivisions, departments, and other entities that will be used to train on-site employees (if required).

1.7 SPECIAL ENVIRONMENTAL REQUIREMENTS

Comply with the special environmental requirements listed here [_____] and attached at the end of this section.

1.7.1 Asbestos Prohibition and Certification

a. Materials or products containing more than one-tenth of one percent (0.1 percent) by total weight, of the material or product, of asbestos shall not be used in this project. The Contracting Officer, at any time prior to acceptance of the work, or during the period designated for warranty of the work, if any, may reject materials and products that contain asbestos in excess of one-tenth of one percent by weight,

and direct the removal of such materials and products from the job site, at the sole expense of the Contractor, and without additional time granted for performance of the work. After completion of this Contract, if asbestos (exceeding 0.1 percent by weight) is discovered in the products or materials (excluding items permitted by the exception) installed by the Contractor, the Government reserves the right to direct the Contractor to perform asbestos abatement and restoration work, as required, at the Contractor's sole cost. Asbestos abatement work (removal and disposal of asbestos-containing materials and products) shall be accomplished in accordance with currently applicable Government standards for such work.

Exception: Where suitable asbestos-free substitutes do not exist for a material or product, the Contractor may use a material or product containing asbestos in the excess of 0.1 percent by weight, with prior written approval of the Contracting Officer. Submit a written request for substitution, accompanied by a certification from the manufacturer of the material or product that shall set forth, in specific detail, the amount of asbestos present in the material or product. When available, laboratory analysis of the material or product for asbestos content shall be included with the submittal.

b. The Government may conduct asbestos testing on suspected asbestos-containing materials and products excluding items permitted by the "exception", and such testing shall be conducted at the expense of the Government. However, wherever destructive testing is required, or a material or product must be utilized by the Government for testing, the Contractor shall, at its own expense, repair or replace the material or product, or the item of work that has been disturbed by testing, if the results confirm presence of asbestos exceeding 0.1 percent by weight. In the event test results indicate 0.1 percent or less asbestos content or complete absence of asbestos, the Contractor shall restore the test site to its original condition and the cost of restoration work, as approved by the Contracting Officer, shall be borne by the Government.

c. As a minimum, furnish manufacturer's certification for the items listed below, excluding items permitted by the "exception", certifying that the items are asbestos-free and do not contain asbestos in excess of 0.1 percent by weight, as applicable. However, when presence of asbestos is suspected in other products and materials used in this project, the Contractor shall be required to provide such certification for those additional items when so directed by the Contracting Officer. Asbestos certification shall be required for the items applicable to this project only.

(1) Vinyl sheet/vinyl tile flooring, including accessories and adhesives.

(2) Insulation materials, including facing.

(3) Gaskets for piping and duct work.

(4) Acoustical tiles.

(5) Firestopping materials.

(6) Fireproofing materials.

(7) Special coating, including factory applied coatings, on sheet metal roofing and siding.

(8) Wallboard for all interior and exterior applications, including joint compounds.

(9) Adhesives (other than item 1) used in the project.

(10) Tape materials used in the project.

(11) Roofing and siding, nonmetallic.

(12) Felt materials and cushion materials.

(13) Pre-mixed mortars, grouts, leveling compounds, fillers, and other cementitious materials.

(14) Caulking and sealing materials.

d. All submittals shall be accompanied by a certification from the manufacturer of the material or product that the material or product is asbestos-free; or shall set forth, in specific detail, the amount of asbestos present in the material or product. Documentary evidence of laboratory analysis of the material or product for asbestos content, conducted by a qualified independent testing laboratory, shall be included with the submittal.

1.7.2 Lead Prohibition and Certification

a. Paint or product coating containing more than 0.009 percent) by total weight of lead shall not be used in this project. The Contracting Officer, at any time prior to acceptance of the work, or during the period designated for warranty of the work, if any, may reject materials and products that contain lead in excess of 0.009 percent by weight, and direct the removal of such materials and products from the job site, at the sole expense of the Contractor, and without additional time granted for performance of the work. After completion of this Contract, if lead (exceeding 0.009 percent by weight) is discovered in the products or materials (excluding items permitted by the exception) installed by the Contractor, the Government reserves the right to direct the Contractor to perform lead abatement and restoration work, as required, at the Contractor's sole cost. Lead abatement work (removal and disposal of lead-containing materials and products) shall be accomplished in accordance with currently applicable Government standards for such work.

Exception: Where suitable lead-free substitutes do not exist for a paint or product coating, the Contractor may use a material or product containing lead in the excess of 0.009 percent by weight, with prior written approval of the Contracting Officer. Submit a written request for substitution, accompanied by a certification from the manufacturer of the material or product that shall set forth, in specific detail, the amount of lead present in the material or product. When available, laboratory analysis of the material or product for lead content shall be included with the submittal.

b. The Government may conduct lead testing on suspected lead-containing materials and products excluding items permitted by the "exception", and such testing shall be conducted at the expense of the Government.

However, wherever destructive testing is required, or a material or product must be utilized by the Government for testing, the Contractor shall, at its own expense, repair or replace the material or product, or the item of work that has been disturbed by testing, if the results confirm presence of lead exceeding 0.009 percent by weight. In the event test results indicate 0.009 percent or less lead content or complete absence of lead, the Contractor shall restore the test site to its original condition and the cost of restoration work, as approved by the Contracting Officer, shall be borne by the Government.

c. As a minimum, furnish manufacturer's certification for the items listed below, excluding items permitted by the "exception", certifying that the items are lead-free and do not contain lead in excess of 0.009 percent by weight, as applicable. However, when presence of lead is suspected in other products and materials used in this project, the Contractor shall be required to provide such certification for those additional items when so directed by the Contracting Officer. Lead certification shall be required for the items applicable to this project only.

1. Paints and Coatings

2. Any product or material with a factory applied coating

1.7.3 Class I and Class II Ozone Depleting Chemicals (ODC) or Substances (ODS)

Class I and II Ozone Depleting Substances listed in the JEGS are prohibited from being used. Contactor must provide certifications that materials utilized do not contain Class I and Class II ODC/ODS.

1.7.4 Polychlorinated Biphenyls (PCB)

Materials (ballasts, capacitors, transformers, dielectric fluid, switches, etc.) that contain PCBs are prohibited. Contractor must provide certifications that materials utilized do not contain PCBs, in accordance with the JEGS.

1.7.5 Hazardous Material Survey

[The Contractor shall review the [title of survey] Survey by [Company that performed Survey] dated [date of survey], attached at the end of this section, to familiarize themselves with the materials that have been sampled and tested for this project. The Contractor shall utilize the information contained within the report to develop their work and compliance plans with regards to Hazardous Materials. During construction, should potentially hazardous material be discovered, which has not been previously tested, the Contractor shall take action to assure that the untested material is not disturbed and contact the Contracting Officer.]

[[No existing Hazardous Material Survey for the material to be disturbed under this project, exists. The Contractor shall assume that all potential ACM is ACM and all paints and coatings contain lead. A Hazardous Material Survey is not required for this project.] [The Contractor shall perform a Hazardous Material Survey prior to initiating any action that could disturb suspect Hazardous Materials as required by this Contract. The Contractor shall notify the Contracting Officer upon finding any material

that will be disturbed under this Contract and is suspected to contain Hazardous Materials. The Contracting Officer will handle the identified materials under, Unexpected Discovery of Hazardous Materials.]]

1.7.6 Cultural/Historic Resources

The Contractor must receive approval from the Contracting Officer prior to working in or near historic buildings and for any excavation work. The Contractor is responsible for fully complying with the JEGS and the CFAS ICRMP which includes both prior work approval and stoppage of work if Cultural Resource (CR) artifacts are discovered. The Contracting Officer must be notified immediately in the case of the discovery of undocumented CR and the location must be secured and protected until investigation by the CFAS Environmental Office.

Prior to any construction, repair, or maintenance work affecting the ground and/or any building or structure, the proposed project must be reviewed by the Installation Cultural Resources Manager (CRM) to determine whether it is located within a culturally sensitive (high probability) area or the building or structure is a cultural property.

If a potential impact to cultural resources exists, CFAS Environmental Office will consult with the Host Nation CR representatives and provide recommendations for minimizing any negative impacts.

1.7.7 Natural Resources

Blasting or use of explosives are not permitted without written permission from the Contracting Officer. Construction activities must be kept under surveillance and control to minimize environment damage by noise. Comply with the provisions of any applicable host nation regulations.

1.7.8 Water Quality Protection

1.7.8.1 Water Supply Systems

Contractors are required to take Drinking Water for Contractors- Japan available through an on-line ECATTS course. Provide proof of training to the Contracting Officer prior to work commencement. File course certificates in Environmental Manager's Binder.

New pipelines and pipelines that will be repaired shall be performed in accordance with AWWA C651 procedures and the JEGS for disinfection of the potable water system.

1.7.8.2 Cross Connection and Backflow Prevention

Personnel or Contractors who use hose bibbs shall keep on hand hose bibb vacuum breakers to connect to hose bibbs that do not already have a backflow preventer installed. The personnel or Contractor shall also ensure that an air gap is maintained between the hose and water surface. When use of the hose bibb is finished, the backflow preventer may be disconnected and put aside for subsequent use on hose bibbs that do not have a backflow preventer.

Construction projects are to be designed without cross-connections. The design must provide adequate backflow protection through the use of approved backflow preventers (BFPs). BFP selection should be based on the Degree of Hazard associated with the cross-connection. All newly installed

BFPs will be tested and certified before being placed into service.

Consult with CFAS PWD Facilities Engineering or Environmental Division to determine if cross connections and backflow protection exist for construction projects based on cross connection surveys and corrective action records.

Document corrective actions taken to correct breaches of cross connection and backflow prevention criteria and report these corrective actions to the Contracting Officer and CFAS PWD Environmental Division within 10 working days after the corrective actions are made.

Installing temporary backflow devices (i.e. check valves) may be required when conducting necessary hydrostatic tests of equipment or piping.

1.7.9 Waste Management

Identify construction activities that will generate hazardous waste or debris. Provide a documented waste determination for resultant waste streams. Identify, label, handle, store, and dispose of hazardous waste or debris in accordance with CFA Sasebo Hazardous Waste Management Plan.

Manage hazardous waste in accordance with the approved Hazardous Waste Management Section of the EPP. Store hazardous wastes in approved containers in accordance with CFA Sasebo Environmental Division Guidelines. Hazardous waste generated within the confines of Government facilities is identified as being generated by the Government. Prior to removal of any hazardous waste from Government property, removal must be coordinated with the installation Environmental Office. Do not bring hazardous waste onto Government property. Provide the Contracting Officer with a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in Japanese Environmental Government Regulations.

1.8 QUALITY ASSURANCE

1.8.1 Regulatory Notifications

Provide regulatory notification requirements in accordance with GOJ national and prefectural laws and regulations and installation requirements.. Include copies of regulatory notifications in the approved EPP prior to commencement of work activities translated to English.

1.8.2 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of hazardous materials that will be brought onto the installation; and types and quantities of wastes/wastewater that may be generated during the Contract. Discuss the results of the Preconstruction Survey at this time.

Prior to initiating any work on site, meet with the Contracting Officer and installation Environmental Office to discuss the proposed Environmental Protection Plan (EPP). Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural and cultural resources, required reports, required permits, permit requirements (such as mitigation measures), and other measures to be taken.

Permits, licenses, or other forms of official approvals are not required by DoD activities and installations. Permits, licenses, or other forms of official approvals may, however, be required under GOJ law for certain contracted activities. When required, all such permits, licenses and other forms of official approval shall be obtained by the Contractor from the appropriate GOJ authorities and included in the Environmental Protection Plan. DoD Components shall assist Contractors when they are applying for a required permit, license or other form of official approval by providing necessary information only.

1.8.3 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager is directly responsible for Environmental Quality Control and coordinating Contractor compliance with the JEGS, Federal, GOJ national and prefectural laws and regulations, and installation requirements. The Environmental Manager must ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the EPP; ensure environmental permits are obtained, maintained, and closed out; ensure compliance with Stormwater Program requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral position; however, the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure Contractor personnel are trained in JEGS requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder and required documentation, including environmental permits compliance and close-out. Insert Environmental Manager Qualificationsinto the Environmental Records Binder to indicate the training and past experience which meets the requirements of this position as described in this section.

Contractor must also provide a written report providing evidence of Qualifications for personnel, facilities, and equipment assigned to the work.

1.8.4 Employee Training Records

Prepare and maintain Employee Training Records throughout the term of the Contract meeting applicable JEGS requirements. Provide Employee Training Records in the Environmental Records Binder. Ensure every employee completes a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures compliance with the JEGS and all applicable Federal, GOJ national or prefectural laws or regulations and installation requirements. All Contractor personnel and their supervisors who are assigned duties involving actual or potential exposure to hazardous waste must successfully complete an appropriate training program prior to assuming those duties and must successfully complete all training as stipulated in the JEGS prior to commencement of project work. [Submit these Assembled Employee Training Records to the Contracting Officer at the conclusion of the project, unless otherwise directed.]

Train personnel to meet the JEGS and all applicable Federal, GOJ national or prefectural laws or regulations, and Installation requirements.

Conduct environmental protection/pollution control meetings for personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, waters of Japan, and endangered species and their habitat that are known to be in the area.

[1.8.4.1 Pest Control Training

Trained personnel in pest control. Conduct a pest control meeting for personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting pest infestation; familiarization with statutory and contractual pest control standards; installation and care of devices, and instruments, if required, for monitoring purposes to ensure adequate and continuous pest control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of waters of the United States, and endangered species and their habitat that are known to be in the area. Provide a Certificate of Competency for the personnel who will be conducting the pesticide application and management of pest control.

]1.8.5 Non-Compliance Notifications

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the JEGS, applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements, and other elements of the Contractor's EPP. After receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions will be granted or equitable adjustments allowed for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the Contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

1.9 ENVIRONMENTAL PROTECTION PLAN

The purpose of the EPP is to present an overview of known or potential environmental issues that must be considered and addressed during construction. Incorporate construction related objectives and targets from the installation's EMS into the EPP. Include in the EPP measures for protecting natural and cultural resources, required reports, and other measures to be taken. Meet with the Contracting Officer or Contracting Officer Representative to discuss the EPP and develop a mutual understanding relative to the details for environmental protection including measures for protecting natural resources, required reports, and other measures to be taken. Submit the EPP within [15][_____] days after [Contract award][notice to proceed] and not less than [_____][10] days before the[preconstruction] meeting. The format of the EPP shall follow the CFAY Environmental template provided as Attachment 01 57 19-A. Commencement of work will not begin until the Environmental Protection Plan has been approved.

Revise the EPP throughout the project to include any reporting requirements, changes in site conditions, or Contract modifications that change the project scope of work in a way that could have an environmental impact. No requirement in this section will relieve the Contractor of the JEGS, and applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements. During Construction, identify, implement, and submit for approval any additional requirements to be included in the EPP. Maintain the current version of the EPP onsite. In addition, the Contractor shall complete a CFAY Environmental Brief Checklist for Contractor and Sub-contractor(s) form and Roster Sheet (Attachment 01 57 19-B). The checklist and roster sheet shall be included as an appendix to the EPP submittal.

The EPP includes, but is not limited to, the following elements as they apply to this project:

1.9.1 General Overview and Purpose

1.9.1.1 Descriptions

A brief description of each specific plan required by environmental permit or elsewhere in this Contract such as[stormwater pollution prevention plan,][spill control plan,][solid waste management plan,][wastewater management plan,][air pollution control plan,][contaminant prevention plan,][pesticide treatment plan,][a historical, archaeological, cultural resources, biological resources and wetlands plan,][traffic control plan][Hazardous, Toxic and Radioactive Waste (HTRW) Plan][Non-Hazardous Solid Waste Disposal Plan][borrowing material plan][_____].

Include a list of applicable Federal, GOJ, JEGS, prefectural laws, regulations, and permits concerning environmental protection, pollution control, and abatement that are applicable to the Contractor's proposed operations and requirements imposed by those laws, regulations, and permits. Whenever there is conflict between Federal, GOJ, JEGS, or prefectural laws, regulations, and permit requirements, the strictest applicable rule applies.

List what notifications, permit applications and licenses must be made or secured. Some permits may take a considerable amount of time to obtain. Demonstrate that those permits have been obtained or applied for by including copies of applicable environmental permits. The EPP will not be approved until the permits have been obtained.

1.9.1.2 Duties

The duties and level of authority assigned to the person(s) on the job site who oversee environmental compliance, such as who is responsible for adherence to the EPP, who is responsible for spill cleanup and training personnel on spill response procedures, who is responsible for manifesting hazardous waste to be removed from the site (if applicable), and who is responsible for training the Contractor's environmental protection personnel.

Provide the name, telephone number, and address of a Primary and Alternate Environmental Representative.

1.9.1.3 Procedures

A copy of any standard or project-specific operating procedures that will be used to effectively manage and protect the environment on the project site.

Provide schedule of digging or trenching actions to include date/time, location, purpose, method and depth.

1.9.1.4 Communications

Communication and training procedures that will be used to convey environmental management requirements to Contractor employees and subcontractors.

1.9.1.5 Contact Information

Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

1.9.2 General Site Information

1.9.2.1 Drawings

Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, jurisdictional wetlands, material storage areas, structures, sanitary facilities, storm drains and conveyances, and stockpiles of excess soil.

1.9.2.2 Work Area

Work area plan showing the proposed activity in each portion of the area and identify the areas of limited use or nonuse. Include measures for marking the limits of use areas, including methods for protection of features to be preserved within authorized work areas and methods to control runoff and to contain materials on site, and a traffic control plan.

1.9.2.3 Documentation

A letter signed by an officer of the firm appointing the Environmental Manager and stating that person is responsible for managing and implementing the Environmental Program as described in this Contract. Include in this letter the Environmental Manager's authority to direct the removal and replacement of non-conforming work.

1.9.3 Management of Natural Resources

a. Land resources

b. Tree protection

c. Replacement of damaged landscape features

d. Temporary construction

e. Stream crossings

f. Fish and wildlife resources

g. Wetland areas

h. Waters of Japan

1.9.4 Protection of Historical and Archaeological Resources

a. Objectives

b. Methods

1.9.5 Stormwater Management and Control

a. Ground cover

b. Erodible soils

c. Temporary measures

(1) Structural Practices

(2) Temporary and permanent stabilization

d. Effective selection, implementation and maintenance of Best Management Practices (BMPs).

e. Erosion Control Plan. Prepared in accordance with the JEGS.

f. Storm Water Pollution Prevention Plan. Prepared in accordance with paragraph Stormwater Pollution Prevention Plan and the JEGS (if required)

1.9.6 Hazardous Material List

Prepared in accordance with paragraph Hazardous Material and the JEGS (if required). Safety Data Sheets (SDS): SDS in English for all Hazardous materials to be used in accordance with the JEGS (if required).

List shall include all pesticides and herbicides that will be brought onto the Installation.

1.9.7 Protection of the Environment from Waste Derived from Contractor Operations

Control and disposal of solid and sanitary waste. Control and disposal of hazardous waste.

Include a Hazardous Waste Management and Disposal Plan prepared in accordance with paragraph Control and Management of Hazardous Waste and the JEGS (if required). This item consists of the management procedures for hazardous waste to be generated. The elements of those procedures will coincide with the Installation Hazardous Waste Management Plan. The Contracting Officer will provide a copy of the Installation Hazardous Waste Management Plan. As a minimum, include the following:

a. List of the types of hazardous wastes expected to be generated

b. Procedures to ensure a written waste determination is made for appropriate wastes that are to be generated

c. Sampling/analysis plan, including laboratory method(s) that will be used for waste determinations and copies of relevant laboratory certifications

d. Methods and proposed locations for hazardous waste accumulation/storage (that is, in tanks or containers)

e. Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted)

f. Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions, applicable Federal, GOJ and prefectural laws and regulations, JEGS, and Installation Hazardous Waste Management Plan. .

g. Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and similar

h. Used oil management procedures in accordance with the JEGS; Hazardous waste minimization procedures, and Installation Hazardous Waste Management Plan.

i. Plans for the disposal of hazardous waste by permitted facilities; and Procedures to be employed to ensure required employee training records are maintained.

j. Procedures to be employed to ensure required employee training records are maintained.

k. Hazardous Waste Disposal local permits or licenses for hazardous waste disposal in accordance with the JEGS (if required).

l. Hazardous Waste Disposal Statement of Agreement. From a treatment, storage, or disposal (TSD) facility that will accept the waste from the Contractor and also a statement from a certified hazardous waste transporter who will transport the waste to the TSD facility in accordance with the JEGS (if required).

1.9.8 Solid Waste Management Plan

Prepared in accordance with paragraph Solid Waste Management Plan and the JEGS.

1.9.9 Site Specific Spill Prevention Plan

Prepared in accordance with paragraph SPILLS and the JEGS (if required).

1.9.10 Prevention of Releases to the Environment

a. Procedures to prevent releases to the environment

b. Notifications in the event of a release to the environment

1.9.11 Regulatory Notification and Permits

List what notifications and permit applications must be made. Some

permits require up to 180 days to obtain. Demonstrate that those permits have been obtained or applied for by including copies of applicable environmental permits. The EPP will not be approved until the permits have been obtained.

1.9.12 Air Quality Compliance

1.9.12.1 Haul Route

Include the truck and material haul routes along with a Dirt and Dust Control Plan for controlling dirt, debris, and dust on Installation roadways as a part of the EPP. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

1.9.12.2 Pollution Generating Equipment

Identify air pollution generating equipment or processes that may generate air emissions and require compliance with the JEGS or GOJ national or prefectural laws and regulations. Determine requirements based on any current JEGS and installation requirements and the impacts of the project. Provide a list of all fixed or mobile equipment, machinery or operations that could generate air emissions during the project to the Installation Environmental Office (Air Program Manager) in the EPP. Air emissions must comply with the JEGS.

1.9.12.3 Stationary Internal Combustion Engines

Identify portable and stationary internal combustion engines that will be supplied, used or serviced in the EPP. Comply with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements. At minimum, include the make, model, serial number, manufacture date, size (engine brake horsepower), and EPA emission certification status of each engine. Maintain applicable records and log hours of operation and fuel use. Logs must include reasons for operation and delineate between emergency and non-emergency operation.

1.9.12.4 Refrigerants

Identify management practices to ensure that heating, ventilation, and air conditioning (HVAC) work involving refrigerants and ozone depleting substances comply with the JEGS and installation requirements. Technicians [must be certified, maintain copies of certification on site, use certified equipment and log work that requires the addition or removal of refrigerant][shall be trained in proper recovery/recycling procedures, leak detection, safety, shipping, and disposal in accordance with recognized industry standards or Japanese equivalent]. Any refrigerant reclaimed is the property of the Government, coordinate with the Installation Environmental Office to determine the appropriate turn in location.

1.9.12.5 Air Pollution-engineering Processes

Identify planned air pollution-generating processes and management control measures (including, but not limited to, spray painting, abrasive blasting, demolition, material handling, fugitive dust, and fugitive emissions). Log hours of operations and track quantities of materials used.

1.9.12.6 Monitoring

For the protection of public health, monitor and control contaminant emissions to the air from Hazardous, Toxic, and Radioactive Waste remedial action area sources to minimize short-term risks that might be posed to the community during implementation of the remedial alternative in accordance with the following.

a. Perimeter Air Contaminant of Concern [_____].

b. Time Averaged Perimeter Action Levels [_____].

Concentration	[_____]
Time	[_____]

c. Perimeter Sampling/Monitoring Location[s] [_____].

d. Monitoring Instruments/Sampling and Analysis Methods [_____].

e. Staffing [_____].

1.9.12.7 Compliant Materials

Provide the Government a list of and SDSs for all hazardous materials proposed for use on site. Materials must be compliant with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements for emissions including solvent and volatile organic compound contents, and applicable National Emission Standards for Hazardous Air Pollutants requirements and either already be included on the CFAS approved Authorized Use List (AUL) or be approved for inclusion on the AUL prior to the project start. The Government may alter or limit use of specific materials as needed to meet installation permit requirements for emissions.

1.10 LICENSES AND PERMITS

Obtain licenses and permits required for the construction of the project and in accordance with FAR 52.236-7. Notify the Government of all general use permitted equipment the Contractor plans to use on site. This paragraph supplements the Contractor's responsibility under FAR 52.236-7. A copy of all Licenses and Permits shall be included in the Environmental Protection Plan.

[a. The following permits have been obtained by the Government:

[(1) [_____]

][(2) [_____]

][(3) [_____]
]]
[b. The following permits will be obtained by the Government:

[(1) [_____]

][(2) [_____]

][(3) [_____]

]]1.11 ENVIRONMENTAL RECORDS BINDER

Maintain on-site a separate three-ring Environmental Records Binder and submit at the completion of the project. Make separate parts within the binder that correspond to each submittal listed under paragraph CLOSEOUT SUBMITTALS in this section.

[1.12 PESTICIDE DELIVERY, STORAGE, AND HANDLING

1.12.1 Delivery and Storage

Deliver pesticides to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses. Store pesticides according to manufacturer's instructions and under lock and key when unattended.

1.12.2 Handling Requirements

Formulate, treat with, and dispose of pesticides and associated containers in accordance with label directions and use the clothing and personal protective equipment specified on the labeling for use during each phases of the application. Furnish SDSs for pesticide products.

]1.13 SOLID WASTE MANAGEMENT PERMIT

Include as a part of the Environmental Protection Plan (EPP) written notification of the quantity of anticipated solid waste or debris that is anticipated or estimated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance from the receiving location or as applicable; submit one copy of the receiving location and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

1.13.1 Solid Waste Management Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

The Contractor shall submit all waste disposal manifests. For each solid waste retained by the Contractor for his own use, the Contractor will include in the solid waste disposal report the information previously described in this paragraph. Prices paid or received will not be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

PART 2 PRODUCTS

2.1 GREEN PROCUREMENT

The Contractor is required to buy items using recovered, or bio-based, materials listed at the following website:

http://www.epa.gov/epp/pubs/products/index.htm provided, however, the cost of buying and transporting these materials does not exceed the cost of buying the listed recovered, or bio-based, materials, and providing that these materials are competitively available and available within reasonable period. A reasonable period is the time required to buy, ship, receive, and use the materials that does not exceed the time allowed for completion of a delivery order. Recovered and bio-based materials include items listed by the EPA in the following categories:

a. Bio-based.

b. Construction Products.

c. Non-Paper Office Products.

d. Miscellaneous Products.

e. Transportation Products.

f. Vehicular Products.

g. Park and Recreation Products.

h. Landscape Products.

i. Paper and Paper Products.

The Contractor shall provide a Recovered Materials Certification and estimate of Percentage of Recovered Material Content for EPA designated items. 2.1.1 Recycled Paper The Contractor shall use, as a minimum, paper that is Processed Chlorine Free (PCF) and contains at least 30 percent recycled content. All printed or copied products shall be double-sided and on recycled paper.

2.1.2 Energy Star and Energy Efficient Products

All applicable products delivered, used in the performance of the work, furnished for Government use, or specified in the design of a building or work shall be Energy Star and Energy Efficient Products.

2.1.3 Electronic Product Environmental Assessment Tool (EPEAT)

Purchased computers, notebook and monitors shall, as a minimum, meet the Electronic Product Environmental Assessment Tool (EPEAT) Bronze level of certification.

2.1.4 Leadership in Energy and Environmental Design (LEED) All new construction Contracts or those performing major renovations shall incorporate the Leadership in Energy and Environmental Design (LEED) System guidelines with Silver being the goal, or shall use Comprehensive Assessment System for Building Environmental Efficiency (CASBEE).

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitats. Prior to the commencement of

activities, consult with the Installation Environmental Office, regarding rare species or sensitive habitats that need to be protected. The protection of rare, threatened, and endangered animal and plant species identified, including their habitats, is the Contractor's responsibility.[The following species are known and could be affected within the construction area: [_____].]

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work that is consistent with the requirements of the Installation Environmental Office or as otherwise specified. Confine construction activities to within the limits of the work indicated or specified.

The Contractor shall take precautions to preserve all such resources as they existed at the time they were first pointed out. The Contractor shall provide and install protection for these resources and be responsible for their preservation during the life of the Contract. Environmental protection shall be conducted as follows:

a. Except in areas indicated on the drawing or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources, including trees, shrubs, vines, grasses, topsoil, and land forms without the Contracting Officer's permission. Vegetation resources, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. Any anticipated vegetation disturbance needs to be coordinated with the Government before it occurs.

3.1.1 Flow Ways

Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as specified and permitted.

3.1.2 Vegetation

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attached ropes, cables, or guys is authorized, the Contractor is responsible for any resultant damage.

Protect existing trees that are to remain to ensure they are not injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. By approved excavation, remove trees with 30 percent or more of their root systems destroyed. Coordinate with the Contracting Officer and Installation Environmental Office to determine appropriate action for trees and other landscape features scarred or damaged by equipment operations. Obtain Contracting Officer's approval prior to replacement.

3.1.3 GOJ-Protected Species

GOJ-Protected species are typically found in undeveloped and unmaintained portions of the base. Projects that may affect protected species shall

include mitigation measures to eliminate or minimize effects.

3.1.4 Streams

Stream crossings must allow movement of materials or equipment without violating water pollution control standards of the JEGS and applicable, Federal, and GOJ national and prefectural laws and regulations, and installation requirements. Construction of stream crossing structures must be in compliance with the JEGS, applicable Federal and GOJ national and prefectural laws and regulations, and installation requirements, including the Storm Water Pollution Prevention Plan.

The Contracting Officer's approval and appropriate permits are required before any equipment will be permitted to ford live streams. In areas where frequent crossings are required, install temporary culverts or bridges. Obtain Contracting Officer's approval prior to installation. Remove temporary culverts or bridges upon completion of work, and repair the area to its original condition unless otherwise required by the Contracting Officer. A copy of all secured permits shall be included in the EPP.

3.1.5 Banyan Trees

All Banyan trees must be preserved and protected. Protect existing trees that are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. Remove trees with 30 percent or more of their root systems destroyed. Any banyan tree requiring destruction or removal must first be coordinated with the installation environmental office or designated representative.

3.1.6 Endangered Species

At any time an endangered or threatened species, flora or fauna, to include sea turtle nests are encountered, all activities shall stop and the Contracting Officer shall be notified.

3.1.7 Indigenous/Native Flora and Fauna

The Contractor shall place emphasis on the protection of habitats favorable to the reproduction and survival of indigenous flora and fauna. The Contractor shall use indigenous flora for planting/sodding.

3.1.8 Invasive Species

Invasive Species are prohibited to be raised, planted, stored or possessed on DoD installations. The Contractor shall not bring in any invasive species to DoD installations.

3.2 STORMWATER

Obtain authorization in advance from the Installation Environmental Office for any release of contaminated water.

3.2.1 Construction Operations and Management

Maintain construction operations and management as required by the Installation Storm Water Pollution Prevention Plan, which addresses

pollution prevention for storm water discharges from construction activities.

[3.2.2 Stormwater Pollution Prevention Plan

If applicable, submit a project-specific Stormwater Pollution Prevention Plan (SWPPP) to the Contracting Officer as a part of the EPP, for approval, prior to the commencement of work. The SWPPP shall meet the requirements of the Japanese Laws, local government regulations and the Installation SWPPP for pollution prevention to storm water discharges from construction sites. The SWPPP along with any required Notice of Intents, Notice of Termination, and appropriate permit fees, shall be incorporated into the EPP. The Contractor shall maintain an approved copy of the SWPPP at the construction on-site office, and continually update as regulations require, to reflect current site conditions. The Contractor may be required to install, inspect, maintain best management practices (BMPs), and submit storm water BMPs inspection reports and storm water pollution prevention plan inspection reports.

The SWPPP must meet the requirements of the JEGS and the Installation's SWPPP.

Include the following:

a. Identify potential sources of pollution which may be reasonably expected to affect the quality of storm water discharge from the site.

b. Comply with terms of the Installation SWPPP for stormwater discharges from construction activities. Prepare SWPPP in accordance with the JEGS and installation requirements.

c. Select applicable BMPs from the JEGS and/or the Installation SWPPP. Applicable Best Management Practices in the JEGS shall be incorporated into the site-specific SWPPP and implemented.

d. The SWPPP shall also address erosion and sediment control measures and stormwater management and control including, but not limited to ground cover, erodible soils, temporary measures - structural practices, temporary and permanent stabilization.

e. Describe and ensure implementation of practices which will be used to reduce the pollutants in storm water discharge from the site.

f. Ensure compliance with terms of the Japanese Law and local government general permit for storm water discharge.

g. Include a completed copy of the Registration Statement, BMP Inspection Report Template and Notice of Termination except for the effective date.

3.2.2.1 Inspection Reports

Insert "Inspection Reports" into the Environmental Records Binder in accordance with the JEGS and applicable GOJ or local laws and regulations.

]3.2.3 Erosion and Sediment Control Measures

Provide erosion and sediment control measures in accordance with the JEGS

and applicable GOJ or local laws and regulations. Preserve vegetation to the maximum extent practicable.

Erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports. Insert "Erosion and Sediment Control Inspection Reports" (E&S) into the Environmental Records Binder once every seven (7) calendar days and within 24 hours of a storm event that produces 12 mm or more of rain.

[3.2.3.1 Erosion Control

Prevent erosion by[mulching,][Compost Blankets,][Geotextiles,][temporary slope drains,][_____]. Stabilize slopes by[chemical stabilization,][sodding,][seeding,][_____] or such combination of these methods necessary for effective erosion control. Use of hay bales is prohibited.

[Provide seeding in accordance with Section 32 92 19 SEEDING.]

Any disturbed area with exposed soil that is not being worked on must be seeded or sodded no later than two weeks from the last disturbance regardless of the installation of any other erosion control measures in place. Remove any temporary measures after the area has been stabilized. No "red soil" shall be allowed to leave the site through runoff.
]

3.2.3.2 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

3.2.3.3 Temporary Protection of Erodible Soils

Use the following methods to prevent erosion and control sedimentation:

a. Mechanical Retardation and Control of Runoff

(1) Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, berms, and use of silt fences and straw bales to retard and divert runoff to protected drainage courses.

b. Sediment Basins

(1) Trap sediment in temporary sediment basins. Select a basin size to accommodate the runoff of a local 10-year storm ("kou no kakuritsu nen"). Pump dry and remove the accumulated sediment, after each storm. Use a paved weir or vertical overflow pipe for overflow. Remove collected sediment from the site. Institute effluent quality monitoring programs.

(2) Install, inspect, and maintain best management practices (BMPs) as required by the general permit. Prepare BMP Inspection Reports as required by the general permit. If required by the permit, include those inspection reports.

c. Vegetation and Mulch

(1) Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

(2) Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to reestablish a suitable stand of grass. The seeding operation will be as specified.

[3.2.3.4 Sediment Control Practices

Implement sediment control practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement sediment control practices prior to soil disturbance and prior to creating areas with concentrated flow, during the construction process to minimize erosion and sediment laden runoff. Best Management Practices (BMPs) may include, but not limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. [Location and details of installation and construction are as indicated on the drawings.] Include the following devices:[silt fence,][temporary diversion dikes,][storm drain inlet protection,][_____,][Location and details of installation and construction are indicated on the drawings.]

]3.2.4 Work Area Limits

Mark the areas that need not be disturbed under this Contract prior to commencing construction activities. Mark or fence isolated areas within the general work area that are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers must be visible in the dark. Personnel must be knowledgeable of the purpose for marking and protecting particular objects.

3.2.5 Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Move or relocate the Contractor facilities only when approved by the Government. Provide erosion and sediment controls for onsite borrow and spoil areas to prevent sediment from entering nearby waters. Control temporary excavation and embankments for plant or work areas to protect adjacent areas.

3.2.6 Silt Screens

Silt screens must be installed prior to start of construction. Silt screens and/or other erosion control devices shall be installed on construction sites that are in or near water. Silt screens shall consist of trenched and staked filter fabric and trenched and staked hay bales. Filter fabric must be toed 8 inches into the soil to avoid sediments that would be transported via water under the screen. Hay bales must be placed

end to end on the downstream side of the screen and be trenched and staked firmly into the ground. Chinking is usually required to fill gaps between the bales. Silt screens must be maintained properly. Screens and other control devices must be inspected once a week and after any rainfall event totaling 1.27 cm (0.5 in.) or more to ensure they are in good repair and functioning properly. In areas that experience high flow rates, extra precautions will be necessary to stabilize screens. Trenching of hay bale barriers is required to adequately control runoff. A series of screens may have to be installed in waters that are especially turbid to properly filter out sediments. Silt screens will remain in place and properly maintained until the site is properly stabilized with sod or seeding.

3.2.7 Protection of Excavated Soil

During the temporary storing of excavated soil until off base disposal or backfill, the excavated soil/rocks shall be completely segregated with materials from other locations, and covered with vinyl sheets to prevent the soil from run-off by rain, and label indicates "Project Name", "Contract Number", "Contractor's Name", "POC phone number" shall be posted on the vinyl sheet.

3.3 SURFACE AND GROUNDWATER

3.3.1 Cofferdams, Diversions, and Dewatering

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure must be constantly controlled to maintain compliance with existing GOJ, Prefectural, installation water quality standards and designated uses of the surface water body. Comply with water quality standards and anti-degradation provisions. Do not discharge excavation ground water to the sanitary sewer, storm drains, or to surface waters without prior specific authorization in writing from the Installation Environmental Office. Discharge of hazardous substances will not be permitted under any circumstances. Use sediment control BMPs to prevent construction site runoff from directly entering any storm drain or surface waters.

Construction site runoff will be prevented from entering any storm drain or the river directly by the use of silt fence, straw bales, or other method suitable to the Environmental Division. Contractor will provide erosion protection of the surrounding soils.

Construction Dewatering shall not be discharged to the sanitary sewer. If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization for any contaminated groundwater release in advance from the Installation Environmental Officer and the GOJ, Prefectural, installation, or local authority, as applicable. Discharge of hazardous substances will not be permitted under any circumstances.

Water pumped from the trenches shall be filtered using an appropriate dewatering devices, such as a weir tank or other suitable devices, before discharging into any storm drain/ditch. Filtration shall be capable of treating the water to meet the allowable limit of total suspended soils (TSS) as listed in the JEGS. Discharging and dumping of wastewaters and waste materials into storm drains, ditches, canals, and local bodies of water are forbidden; this includes mop water, cleaning/stripping solutions and solvents, paint related wastes (including water-borne paints),

pesticides (insecticide, herbicide, and/or fungicide), herbicides, fire extinguishing agents, fuels, oils, hazardous materials, hazardous substances, and hazardous wastes.

3.3.2 Waters of Japan

Do not enter, disturb, destroy, or allow discharge of contaminants into waters of Japan[.][except as authorized herein. The protection of waters of Japan shown on the drawings in accordance with paragraph LICENSES AND PERMITS is the Contractor's responsibility. Authorization to enter specific waters of Japan identified does not relieve the Contractor from any obligation to protect other waters of Japan within, adjacent to, or in the vicinity of the construction site and associated boundaries.]

3.3.3 Wetlands

All wetlands on the installation (currently only Harioshima Ordnance area) must be identified on the project drawings. If wetlands on the project site must be disturbed, coordinate with the CFAS Environmental Office before start of project. The Contractor is required to be cognizant of their responsibility to protect wetlands regardless of whether they are identified on drawings or in the event site conditions have changed since design (JEGS).

3.3.4 Turbidity

In some cases where severe erosion results in waters becoming turbid despite control measures, regular turbidity monitoring and documentation shall be necessary. Any such documentation shall be forwarded to USAG-O Environmental Division for review via the Contracting Officer.

3.3.5 Water Protection

Contractor shall prevent oily wastes or other hazardous substances from entering the ground, drainage areas, or local bodies of water.

3.3.6 Sewage

Contractor is not authorized sewage holding tanks on base and must procure a porta-potty service Contract. The porta-potty Contract must include the correct removal of sewage and maintenance of the facilities.

3.3.7 Wastewater

If the project generates wastewater from rinsing tanks, dewatering sites, etc., contact the Contracting Officer on proper disposal.

3.4 PROTECTION OF CULTURAL RESOURCES

3.4.1 Archaeological Resources

[Existing archaeological resources within the work area are shown on the drawings. Protect these resources and be responsible for their preservation during the life of the Contract.]If, during excavation or other construction activities, any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, activities that may damage or alter such resources will be suspended. Resources covered by this paragraph include, but are not limited to: any human skeletal remains or burials; artifacts; shell,

midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, immediately notify the Installation Cultural Resources Manager via the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. Cease all activities that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources. The Government retains ownership and control over archaeological resources.

3.4.1.1 Restrictions

Project work may be restricted to be performed only during certain periods or times as specified.

3.4.1.2 Protection Measures

The Contractor shall implement and adhere to all protection measures specified to ensure protection of archaeologically sensitive areas and to avoid impact to known properties and artifacts as identified

3.4.1.3 Training and Awareness - Site Walk

When specified, the Contractor shall arrange to have site personnel receive appropriate awareness training to be provided by or under the guidance of the Environmental Office. In addition, a site walk may also be requested in order to ensure that the Contractor understands and is prepared to implement required protection measures.

[3.4.2 Historical Resources

Existing historical resources within the work area are shown on the drawings. Protect these resources and be responsible for their preservation during the life of the Contract.]

3.4.3 Historical and Archaeological Resources

If the items need to be temporarily removed, receive approval from the Contracting Officer and PWD Environmental Cultural Resources Manager (CRM) then carefully protect them from disturbance, including weather conditions, unforeseen traffic, and pilfering. The CRM PWD Environmental Cultural Resources Manager through the Contracting Officer will provide further direction/guidance on how to protect the items. The Government retains ownership and control over historical and archaeological resources.

3.5 AIR RESOURCES

Equipment operation, activities, or processes will be in accordance with the JEGS and all applicable Federal, GOJ national or prefectural air emission and performance laws and regulations.

3.5.1 Oil or Dual-fuel Boilers and Furnaces

Provide product data and details for new, replacement, or relocated fuel fired boilers, heaters, or furnaces to the Installation Environmental Office (Air Program Manager) through the Contracting Officer. Data to be reported include: equipment purpose (water heater, building heat,

process), manufacturer, model number, serial number, fuel type (oil type, gas type) size (MMBTU heat input). Product data shall be provided prior to equipment installation.

3.5.2 Burning

[Burning is prohibited on the Government premises.] [Burning is allowed on Government premises[; confine fires to a closed vessel that is guarded and under constant surveillance until contents have burned out or have been extinguished].[Burning must completely reduce the materials to ashes.]]

3.5.3 Class I and II ODS Prohibition

The Contractor shall be responsible to turn in all of recyclable Class I and II ODS (R22) to DLA Yokosuka. The Contractor shall follow Feb 2017 Turn-in Procedures prepared by DLA, and coordinate with Torii Environmental Division prior to recovering ODS. The Contractor shall conduct necessary sampling, marking, labeling, and attach other required information. For replacement of air conditioning systems/units or in new construction, the Contractor shall provide quantity of refrigerant recovered from the existing equipment as well as the quantity of refrigerant charged in new equipment to the Contracting Officer. Under no circumstances shall the Contractor design or use ODS products for new systems to be installed on the installation.

Class I and II ODS are Government property and must be returned to the Government for appropriate management. Coordinate with the Installation Environmental Office to determine the required recovery cylinders and the appropriate location for turn in of all reclaimed refrigerant.Class I and II ODS as defined and identified herein shall not be used in the performance of this Contract.

The Contractor shall coordinate with the [Refrigerant, AC and Heating Shop, (DSN 644-4302)][] on the quantity of ODS recovered from system for the purpose of recycle, reuse or dilution. In the event the ODS can be recycled, reused or diluted, the entire quantity will be turned over to the [Refrigerant, AC and Heating shop][].

In cases where the ODS is sufficiently contaminated and cannot be recycled, reused and/or diluted, the Contractor shall dispose of the ODS according to the JEGS and local regulations.

In the event of a release of ODS, base personnel and/or Contractor shall inform [Fire and Emergency's Service Branch and Environmental Division][].

3.5.3.1 Recycling Requirements

Recycle used refrigerants and ozone depleting substances generated during the performance of this Contract to the maximum extent practicable to minimize used refrigerant and ozone depleting substance disposal as regulated waste in accordance with the JEGS and local laws and regulations. Test, collect, transfer, recycle, and/or arrange for shipping and proper disposal of used refrigerants and ozone depleting substances generated during the performance of work under this Contract. The Contractor is responsible for all associated costs. Any and all Class I ODS and R-22 recovered by the Contractor as part of this Contract shall be packaged and turned in to the Government for recycling upon the completion of the work covered by this Contract. Turn-in of ODS shall be performed in accordance with "Department of Defense Ozone Depleting Substances Turn-In

Procedures". The Contractor shall arrange for recycling of used refrigerants not turned in to the government, at a licensed refrigerant recycler approved by the Contracting Officer.

3.5.3.2 ODS Storage

The Contractor is prohibited from storing or accumulating cylinders/containers of ODS, refrigerant or fire suppression chemicals on all installations. The Contractor shall store or accumulate the ODS cylinders/containers on Contractor's premises.

3.5.4 Accidental Venting of Refrigerant

Accidental venting of a refrigerant is a release and must be reported immediately to the Contracting Officer. Comply with the JEGS.

3.5.5 Halon Fire Extinguishing Equipment

Remove fire extinguishing equipment without releasing Halons to the atmosphere.

3.5.6 Training/Certification Requirements

Heating and air conditioning technicians must be trained to meet requirements in the JEGS. Maintain copies of certifications at the employees' places of business; technicians must carry certification wallet cards, as provided by GOJ national or prefectural laws and regulations.

3.5.7 Dust Control

Keep dust down at all times, including during nonworking periods.[Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations.] Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster. Do not discharge any construction waste water or surface cleaning water into the storm drain or on-base sewer line directly without authorization of NAVFAC Utilities Services (US) Branch and NAVFAC PWD Environmental Office via the Contracting Officer. Keep sediment leaves, and construction debris away from storm drains (use barriers).

3.5.7.1 Particulates

Dust particles, aerosols and gaseous by-products from construction activities, and processing and preparation of materials (such as from asphaltic batch plants) must be controlled at all times, including weekends, holidays, and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates that would exceed the JEGS and applicable US Federal, GOJ national or prefectural air pollution standards or that would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators, or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp. Provide sufficient, competent

equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with the JEGS, GOJ national or prefectural laws and regulations, and installation requirements.

3.5.7.2 Abrasive Blasting

Blasting operations cannot be performed without prior approval of the Installation Air Program Manager. The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive agent, paint chips, and other debris.[Perform work involving removal of hazardous material in accordance with the JEGS, GOJ national or prefectural laws and regulations, and installation requirements.]

3.5.7.2.1 Disposal Requirements

Submit analytical results of the debris generated from abrasive blasting operations per paragraph entitled Laboratory Analysis of this section. Hazardous waste generated from blasting operations will be managed in accordance with paragraph entitled "HAZARDOUS WASTE AND DEBRIS MANAGEMENT" of this section and with the approved HWMP. Disposal of non-hazardous abrasive blasting debris will be in accordance with paragraph entitled "CONTROL AND MANAGEMENT OF SOLID WASTES".

3.5.8 Odors

Control odors from construction activities. The odors must be in compliance with applicable GOJ national or prefectural laws and regulations and may not constitute a health hazard.

3.6 WATER RESOURCES

Keep construction activities under surveillance, management, and control, and monitor all water areas affected by construction activities in order to prevent pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation when such application may cause contamination. Prevent oily wastes or other hazardous substances from entering the ground, drainage areas, or local bodies of water.

3.6.1 Lead-Free Drinking Water Pipe, Solders, Flux and Fittings

The maximum allowable lead content for pipes, fittings, and fixtures intended to convey or dispense water for human consumption and cooking shall be a weighted average of 0.25 percent with respect to the wetted surfaces of pipes and pipe fittings, plumbing fittings, and fixtures in accordance with NSF 61.

3.7 WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of waste.

Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the EPP. Obtain a copy of the installation's Pollution Prevention/Hazardous Waste Minimization Plan for reference material when preparing this part of the EPP. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the anticipated types of the hazardous materials to be used in the construction when requesting information.

3.7.1 Salvage, Reuse and Recycle

Identify anticipated materials and waste for salvage, reuse, and recycling. Describe actions to promote material reuse, resale or recycling. The following items shall be recycled: scrap metal, Styrofoam, cardboard, glass, scrap wood, wood pallets, concrete, and asphalt. Other waste minimization strategies include composting or mulching green wastes. To the extent practicable, all scrap metal must be sent [for reuse or recycling][to the Installation's Recycling Yard][] and will not be disposed of in a landfill.

Include the name, physical address, and telephone number of the hauler, if transported by a franchised solid waste hauler. Include the destination and, unless exempted, provide a copy of the GOJ, Prefectural, installation or local permit (cover) or license for recycling.

All solid wastes and materials that have been separated for the purpose of recycling shall be stored in such a manner that they do not constitute a fire, health or safety hazard, or provide food or harborage for vectors, and shall be contained or bundled so as to not result in spillage. Containers must be: leak proof, water proof, and vermin proof including sides, seams, tops and bottoms, durable enough to withstand anticipated usage, and stored on a firm, level, well-drained surface).

The Contractor shall complete and submit COMFLEACTY 5090.8A (attachment 4 at the end of this specificaion section), and CFAY PWD Env Jun 2022 (attachment 5, at the end of this specification section) each time material is recycled and turned into the installation recycling center or each time solid waste is disposed of off post, respectively.

3.7.1.1 Prohibitions for Hazardous Waste (CFAS Requirement)

The Contractor shall minimize the amount of hazardous materials brought onto the project work site and only bring onto Government property HM directly associated and necessary to perform work assigned. The Contractor shall also minimize the amount of hazardous waste generated through the use of effective construction management practices. The Contractor is fully responsible to properly handle, segregate and containerize all HW as required by the CFAS Hazardous Waste Management Plan (HWMP) and guidance provided by the Environmental Office HW personnel. Failure by the Contractor to properly manage HW as described above and that results in increased costs to the Government shall be billed back to the Contractor.

3.7.1.2 Prohibitions for Nonhazardous Waste (CFAS Requirement)

No hazardous material shall be brought onto the government property that are not directly related to requirements for the performance of this Contract. The government is not responsible for the disposals of Contractor's wastes/materials brought on the job site which are not required in the performance of this Contract. The intent of this provision is to only dispose of hazardous wastes that is defined in this section, is

generated as part of this Contract, and exist within the boundary of the Contract limits and has not been brought in from offsite by the Contractor.

3.7.2 Rubbish and Debris Disposal and Reporting

Remove rubbish and debris from Government property and dispose in accordance with Japanese law. The Contractor shall provide to the DPW project manager the weight of construction and demolition debris in metric tons within 30 days or sooner of each disposal and detail how it has been disposed of to include landfill, recycle, reuse, composted, or mulched. These metrics are required by Department of the Army 27 Feb 2006 Memorandum for Commander, U.S. Army Garrison Japan.

Segregation measures shall be employed so that no hazardous or toxic waste is co-mingled with solid waste. The Contractor shall transport solid waste off Government property and dispose of it in compliance with applicable laws and regulations of U.S. Government and GOJ, however denominated, including those applicable political subdivisions, departments, and other entities for solid waste disposal. Vehicles used in transporting refuse shall be covered and enclosed to prevent spillage. The Contractor shall be responsible for all expense and cleanup of any spills on- or off-base.

3.7.3 Nonhazardous Solid Waste Diversion Report

Maintain an inventory of nonhazardous solid waste diversion and disposal of construction and demolition debris. Submit a report to the Installation Environmental Office [_____ through] the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that nonhazardous solid waste has been generated. Include the following in the report:

Construction and Demolition (C&D) Debris Disposed	(_____) kilograms or metric tons as appropriate
C&D Debris Recycled	(_____) kilograms or metric tons as appropriate
Total C&D Debris Generated	(_____) kilograms or metric tons as appropriate
Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount)	(_____) kilograms or metric tons as appropriate

3.8 WASTE MANAGEMENT AND DISPOSAL

3.8.1 Waste Determination Documentation

Incorporate the Waste Determination Documentation for Contractor-derived wastes to be generated into the Environmental Records Binder. All potentially hazardous solid waste streams that are not subject to a specific exclusion or exemption from the hazardous waste regulations (e.g. scrap metal, domestic sewage) or subject to special rules, (lead-acid batteries and precious metals) must be characterized in accordance with the requirements of the JEGS and all applicable Federal, GOJ national or

prefectural laws and regulations. Base waste determination on user knowledge of the processes and materials used, and analytical data when necessary. Consult with the Installation environmental staff for guidance on specific requirements. Attach support documentation to the Waste Determination Documentation. As a minimum, provide Waste Determination Documentation for the following waste (this listing is not inclusive): oil- and latex -based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and containers of the original materials.

NOTE: The Contractor should include waste determination/categorization in the EPP for all common construction wastes to be generated under this Contract. If a waste is generated but not included in the approved EPP, additional waste determination may be required by the Government prior to accepting the waste for disposal. Complete Waste Determination Documentation for all Contractor building demolition related derived wastes to be generated. Base the waste determination upon laboratory analysis and attach all support documentation to the Waste Determination. Safety Data Sheets (SDS) by themselves are not adequate other than for disposal of remaining unusable portions of HM.

[3.8.1.1 Sampling and Analysis of Waste

3.8.1.1.1 Waste Sampling

Sample waste in accordance with the JEGS, Installation Hazardous Waste Management Plan, and appropriate Japanese or US EPA testing protocols that meet the purpose of the testing. Clearly mark each sampled drum or container with the Contractor's identification number, and cross reference to the chemical analysis performed.

Excess excavated soil shall become the property of the Contractor and shall be disposed of off base at a properly licensed facility in accordance with the latest version of the JEGS and applicable GOJ federal and local laws and regulations. Any excess soil shall be sampled and tested according to the applicable GOJ federal and local laws and regulations and disposal facility requirements prior to disposal.

3.8.1.1.2 Laboratory Analysis

Follow the analytical procedure and methods in accordance with the JEGS and all applicable GOJ national or prefectural laws and regulations and the Installation Hazardous Waste Management Plan. Provide analytical results and reports performed in the Environmental Records Binder.

3.8.1.1.3 Analysis Type

Identify hazardous waste by analyzing for the following characteristics:[ignitability,][corrosivity,][reactivity,][toxicity based on TCLP results,] [_____].

]3.8.2 Solid Waste Management

3.8.2.1 Solid Waste Management Plan

The Solid Waste Management Plan in the EPP shall include, but not limited to, the following:

a. Description and estimated quantities of the proposed job-site waste to be generated.

b. Landfill Options: The name of the landfill(s) where trash will be disposed of, applicable landfill tipping fee(s), and the projected cost of disposing of all project waste in the landfill(s).

c. Waste Diversion: A list of the waste materials from the project that will be separated for reuse, salvage, or recycling, associated weights and estimated cost savings shall be reported to USAG-O by the 25th day of each month via the Contracting Officer.

d. Handling Procedures: A description of the means by which any waste materials identified in (c) above will be stored and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.

e. Transportation: A description of the means of transportation of the waste and recycled materials (whether materials will be site-separated and self-hauled to designated center, or whether mixed materials will be collected by a waste hauler and removed from the site). Request manufacturers to use the minimum packaging required for protection and identification of project products, and to use packaging materials with recycled content where economically feasible.

f. Submit cost information on the wastes diverted from the landfill to the Contracting Officer or USAG-O by the 25th day of each month via the Contracting Officer.

3.8.2.2 Solid Waste Management Report

Provide copies of the waste handling facilities' weight tickets, receipts, bills of sale, Contractor Certification and other sales documentation. In lieu of sales documentation, a statement indicating the disposal location for the solid waste that is signed by an employee authorized to legally obligate or bind the firm may be submitted. The sales documentation[Contractor certification] must include the receiver's tax identification number and business, GOJ or prefectural registration number, along with the receiver's delivery and business addresses and telephone numbers. Submit a copy of the applicable Japanese local permits and licenses for transportation, treatment, storage and disposal of solid waste ("Sangyou Haikibutsu") by permitted facilities.

3.8.2.3 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers that are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Recycling is encouraged and can be coordinated with the Contracting Officer and the activity recycling coordinator. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with non-hazardous solid waste.[Transport solid waste off Government property and dispose of it in compliance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installationrequirements for solid waste disposal. Solid waste disposal offsite must comply with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Include a copy of all licenses and permits secured in the Environmental Protection Plan]

Manage hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements.

Submit Disposal manifests as specified in Section 01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.

3.8.2.4 Solid Waste Management Plan Implementation

a. The Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing and documenting results of the Solid Waste Management Plan for the project.

b. The Contractor shall distribute copies of the Solid Waste Management Plan to key personnel and submit the plan to the Contracting Officer as part of the Environmental Protection Plan.

c. The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties.

d. The Contractor shall lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

e. The Contractor shall submit a Summary of Solid Waste Generated by the project to USAG-O via the Contracting Officer with each application for progress payment. Failure to submit this information shall render the application for progress payment incomplete and shall delay progress payment. The Summary shall be submitted on a form acceptable to the Owner and shall contain the following information:

(1) The amount (in tons) of material land-filled from the project, the identity of the landfill, the total amount of tipping fees paid at the landfill, and the total disposal cost. Include manifests, weight tickets, receipt, and invoices.

(2) For each material recycled, reused or salvaged from the project, the amount (in tons), the date removed from the jobsite, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of salvage or recycling each material. Attach manifests, weight tickets, receipts, and invoices.

3.8.3 Control and Management of Hazardous Waste

The Contractor shall be considered the primary generator for all hazardous wastes generated throughout the duration of the Contract. However, all hazardous waste management activities shall be coordinated and approved by USAG-O Environmental Division via the Contracting Officer.

All hazardous waste must be managed in accordance with applicable laws and regulations of U.S. Government and GOJ, however denominated, including those applicable political subdivisions, department, and other entities. The Contracting Officer shall contact USAG-O Environmental Division if

handling procedures for hazardous wastes and materials are unclear.

Hazardous wastes, including excavated contaminated soil, shall be stored, transported, and disposed in accordance with applicable laws and regulations of U.S. Government and GOJ, however denominated, including those applicable political subdivisions, departments, and other entities, including obtaining necessary local permits, licenses, and approvals. The Contractor shall identify what wastes are hazardous using specific and technical knowledge and/or sampling and analysis. This responsibility also includes preparation of waste profile sheets, packaging, marking and labeling of wastes in accordance with Federal, JEGS, GOJ, prefectural, and local requirements. All persons involved in the hazardous waste management process or potential exposure to hazardous waste must have hazardous waste training required by the JEGS.

All costs for labor, equipment, materials, transportation, and other services required to comply with applicable laws and regulations of U.S. Government and GOJ, however denominated, including those applicable political subdivisions, departments, and other entities, governing hazardous waste generations are the responsibility of the Contractor. This requirement extends to personnel training and the identification, initial accumulation and transportation of hazardous waste generated during the project.

Contractor must package hazardous waste in a United Nations (UN) approved container, labeled in English and Japanese, furnish analytical results and submit the container(s) and information to the USAG-O Environmental Division via the Contracting Officer. The Contractor shall be responsible for collection and disposal of hazardous wastes. When the waste is ready for shipment, the USAG-O Environmental Division personnel will inspect the Contractor's material if necessary. The Contractor's representative will be present for the inspection and will correct any discrepancies on the spot or remove the unacceptable containers and correct the deficiencies. For further information, contact the USAG-O Hazardous Waste Manager at DSN 644-4910 via the Contracting Officer.

Do not dispose of hazardous waste on Government property. Do not discharge any waste to a sanitary sewer, storm drain, or to surface waters or conduct waste treatment or disposal on Government property without written approval of the Contracting Officer.

3.8.3.1 Hazardous Waste/Debris Management

Identify construction activities that will generate hazardous waste or debris. Provide a documented waste determination for resultant waste streams. Identify, label, handle, store, and dispose of hazardous waste or debris in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements

Manage hazardous waste in accordance with the approved Hazardous Waste Management Section of the EPP. Store hazardous wastes in approved containers in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements. Prior to removal of any hazardous waste from Government property, all hazardous waste manifests must be signed by waste transporter and disposal facility. If hazardous wastes are turned into the Government, submit Hazardous Waste turn-in document instead of manifest. Do not bring hazardous waste onto Government property. Provide the

Contracting Officer with a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in the JEGS. For hazardous wastes spills, verbally notify the Contracting Officer immediately.Hazardous waste generated within the confines of Government facilities will be identified as being generated by the Government and will be labeled, handled, stored, and transport to designated Government facility specified in Section 01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.

3.8.3.2 Contractor Hazardous Waste Accumulation Point (HWAP)

If the work requires the temporary storage/collection of hazardous wastes on site overnight, the Contractor shall request the establishment of a Contractor HWAP at the point of generation. The Contractor must submit a request form with other required documentation/information to the Installation Environmental Office via the Contracting Officer. The Contractor shall not store/collect hazardous waste on site overnight unless the requested Contractor HWAP is approved and managed properly. When hazardous waste will be removed from the job site properly daily, the Contractor HWAP is not required.

Accumulate hazardous waste at HWAP and in compliance with the JEGS and CFAS HWMP. Individual waste streams will be limited to 208 liter (55 gallons) of accumulation, or 0.95 liter (1 quart) for acutely hazardous wastes. If the Contractor expects to generate hazardous waste at a rate and quantity that makes a HWAP impractical, the Contractor must request assistance from the Installation Hazardous Waste Manager via the Contracting Officer.
Submit a request for assistance in writing to the Contracting Officer and provide the following information:

a. Contract Number
b. Contractor
c. Haz Waste or Regulated Waste POC
d. Phone Number
e. Type of Waste
f. Source of Waste
g. Emergency POC
h. Phone Number
i. Location of the Site (Attach Site Plan to the Request)

Attach a waste determination form for the expected waste streams. Allow (10) ten working days for processing this request. Additional compliance requirements (e.g. training and contingency planning) that may be required and are the responsibility of the Contractor.

3.8.3.3 Contractor Disposal Turn-In Requirements

Handling and disposal of HW shall be performed in accordance with the JEGS. Unless otherwise specified or directed, all hazardous waste disposal will be coordinated with the CFAS Environmental Office and transferred to (usually picked up by) CFAS Hazardous Waste personnel to process final disposal. THE CONTRACTOR SHALL NOT DISPOSE OF ANY HAZARDOUS WASTES INTO ANY AREA OUTSIDE THE GOVERNMENT'S CONTROL.

To coordinate hazardous waste disposal needs, the Contractor shall inform the Contracting Officer in writing prior to generation of the hazardous waste by submitting a Hazardous Waste Disposal Disposition form provided by the Contracting Officer. The Government will provide HW accumulation

containers for all HW disposed of through the CFAS Environmental Office

Hazardous waste will also be managed in accordance with the approved Hazardous Waste Management Section of the EPP. Store hazardous wastes in approved containers in accordance with the JEGS. Prior to removal of any hazardous waste from Government property, all hazardous waste manifests must be signed by waste transporter and disposal facility. If hazardous wastes are turned into the Government, submit Hazardous Waste turn-in document instead of manifest. No hazardous waste will be brought onto Government property. Provide to the Contracting Officer a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in the JEGS. For hazardous wastes spills, call base 911 and verbally notify the Contracting Officer immediately.

Prior to shipping any hazardous Waste off the installation, the Contractor must provide the CFAS Environmental Office via the Contracting Officer a copy of the applicable manifest for transportation, treatment, storage, and disposal of hazardous, regulated, or toxic waste.

Incidental wastes used to support this Contract including, but not limited to aerosol cans, waste paints, cleaning solvents, contaminated brushes, rags, clothing, Personal Protection Equipment (PPE), etc. are considered as hazardous wastes. Chemical paint removers shall also be disposed of as Hazardous Waste.

HWAP - For projects that result in generation of HW over a period of time and in such quantity as to need a temporary HWAP to ensure proper, efficient and safe storage of HW at the job site, the CFAS Environmental Office will coordinate with the Contractor and provide guidance to set up a temporary HWAP for the duration of the project task order. The Contractor shall set-up and manage the temporary HWAP to meet the CFAS HWMP and guidance provided by the Environmental Office.

3.8.3.4 Hazardous Waste Records

The Contractor shall maintain sampling, analysis, and turn-in records for all hazardous waste generated during the project. These records shall include, but not be limited to: [waste profile sheets provided by HWSF personnel for wastes streams turned in to the HWSF, manifests (DD forms 1348-1A) for all wastes turned over to the HWSF,]logs of sample locations or container identification data (including time and date of sample collection), analytical results, and quality control data provided by the analytical lab pertaining to the samples analyzed. Copies of this data shall be submitted to [][374 CES/CEIE][35 CES/CEIE][INSERT ORGANIZATION] via the COR after the work is completed.

3.8.3.5 Excavated Soil or Other Excavated Materials

If excavated soil or other excavated materials, not indicated, that may be hazardous waste or hazardous to human health during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately as specified in paragraph entitled "EXCAVATION REQUIREMENTS", Section 01 11 00 GENERAL PARAGRAPHS. Any test results from the excavated soil shall be forwarded to the environment office. Case by case situation for special soil excavations i.e. soil with asbestos, PCB and heavy-metal. For further soil excavation/disposal guidance, contact the Installation Environmental Office.

3.8.3.6 Mercury Containing Items

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, etc., in Base trash enclosures/rubbish containers is strictly prohibited. Such material shall be carefully removed without breaking, appropriately packaged to prevent breakage, and transferred to the Government, coordinate turn-in with the Hazardous Waste Program Manager of Installation's Environmental Office.

In case of breakage or any mercury spillage, the Contactor shall call base 911 and report immediately to the contracting Officer. The Contactor shall cleanup mercury spill area to the satisfaction of the Contracting Officer. Do not recycle a mercury spill cleanup; manage it as a hazardous waste for disposal.

3.8.3.7 Electronics End-of-Life Management

Recycle or dispose of electronics waste, including, but not limited to, used electronic devices such as computers, monitors, hard-copy devices, televisions, mobile devices, in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements.

3.8.3.8 Disposal Documentation for Hazardous and Regulated Waste

[If the Contractor is disposing of Hazardous waste of-base, Contact the Contracting Officer for the facility unique identification number (if applicable) that is to be used on each manifest.

Submit a copy of the applicable local permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifests must be reviewed, signed, and approved by the Contracting Officer before the Contractor may ship waste. To obtain specific disposal instructions, coordinate with the Installation Environmental Office.]The hazardous wastes shall be taken to a TSD facility which has been properly licensed by the prefecture government or the mayor of a city and complies with all the provisions of applicable disposal regulations. An acceptance statement of agreement from the proposed TSD and certified transporters shall be submitted to the Contracting Office not less than 14 days before transporting of wastes. The original return copy of the manifest, signed by the owner or operator of a permitted TSD facility, shall be provided to the Contracting Officer no later than 5 working days following the delivery of the wastes to the TSD facility. Upon completion of waste disposal, a copy of the disposal certificate from TSD facility must also be provided to the Contracting Officer.

The Contractor shall maintain records of all waste sampling and test data. The data includes the results of analyses performed, sample locations, the time of collection, and other pertinent data during the life of the Contract. Transportation, treatment, and disposal methods and dates; the quantities of wastes; and the names and addresses of each transporter and the disposal or reclamation facility, shall also be recorded and available for inspection, as well as the following documents:

(1) Manifests

(2) Waste analyses or waste profile sheets
(3) Certification of final treatment or disposal will be signed by the licensed TSD facility official.

3.8.4 Releases/Spills of Oil and Hazardous Substances

3.8.4.1 Response and Notifications

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated in accordance with the JEGS and Installation plans. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the [Installation][Activity] Fire Department [dial 911 on base], the [Installation][Activity] Command Duty Officer, the [Installation][Activity] Environmental Office, the Contracting Officer. The Contractor shall immediately report all POL or Hazardous Substances spills to the Contracting Officer. Submit verbal and written notifications as required by the JEGS and installation and service component instructions and plans, and local regulations. Provide copies of the written notification and documentation that a verbal notification was made within [the timeframes required by the JEGS and installation instructions][five working days]. Spill response must be in accordance with the JEGS and installation requirements. Contain and clean up these spills without cost to the Government. If the Contractor's response is inadequate, the Navy may respond. If this should occur, the Contractor will be required to reimburse the government for spill response assistance and analysis. Spill response shall be in accordance with the JEGS, CFAS SPRP, GOJ and local Prefecture regulations.

3.8.4.2 Clean Up

The Contractor is responsible for spill cleanup. Determine, as quickly as possible, the nature of the spilled substance and implement necessary safety precautions to protect both human health and the environment. Cleanup shall be in accordance with applicable local laws and regulations as determined by the Environmental Division at no additional cost to the Government, and shall only be performed by personnel adequately trained in spill response and cleanup techniques for the severity of the spill incident.

a. The Contractor shall provide and maintain spill equipment, sufficient in both type and quantity, at all sites involving the storage, use or handling of hazardous materials and/or hazardous wastes. The type of equipment and quantity required will be identified in the Contractor's site specific contingency plans. Equipment must be adequate to contain any release.

b. Cost incurred from any Contractor spills is the responsibility of the Contractor, if the Government has to perform emergency spill response and cleanup, due to the non-availability of designated personnel or if spill is beyond the capability of designated personnel, the Contractor shall be held liable for all costs associated with performing said work. The costs of clean-up will be subject to Contract price offsets.

If remaining Contract payments are insufficient, the government reserves

the right to pursue other offsets, administrative or civil actions to satisfy this. (JEGS)

c. The Contractor shall train employees in the use of the above equipment and document training.

d. The Contractor shall take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing and shall collect waste in suitable containers observing chemical compatibility requirements. If the Contractor is required to stockpile contaminated soil for testing prior to disposal, the Contracting Officer will inform the Contractor of the stockpile location after consultation with USAG-O.

e. The Contractor waives all claims to damage or loss that arise from Government actions after thirty (30) days.

Clean up hazardous and non-hazardous waste spills in accordance with the JEGS, local regulations and the installation's spill response procedures. Reimburse the Government for costs incurred including sample analysis materials, clothing, equipment, and labor if the Government will initiate its own spill cleanup procedures, for Contractor-responsible spills, when: Spill cleanup procedures have not begun within one hour of spill discovery/occurrence; or, in the Government's judgment, spill cleanup is inadequate and the spill remains a threat to human health or the environment.

3.8.4.3 Reporting Requirements

Submit a written follow-up report to the Contracting Officer not later than 7 days after the incident. The written report shall conform to the requirements detailed in the Installation Spill Response Plan and to the site specific spill prevention plan, originally submitted. At a minimum, the report shall provide the information necessary to complete an Army Environmental Pollution Incident Report Form. Copies may be obtained from the Environmental Division.

The Emergency Response Plan as required in EPP section shall include, but not be limited to the following:

a. Information for review by the Contracting Officer to show that the Contractor has successfully performed hazardous waste management (as applicable).

b. The "Site Specific Spill Prevention/Response Plan" shall be adapted to specific sites where the Contractor handles chemicals or hazardous materials. Site-specific spill plans shall be revised as necessary to reflect current hazardous material storage and usage. The plan shall detail the Contractor representative and alternate that will be contacted in the event of an emergency and the equipment to be used to adequately contain and cleanup spills. Revisions to the plan shall be coordinated with Fire Department and USAG-O Environmental Division through the Contracting Officer.

3.8.5 Mercury Materials

Immediately report to the Environmental Office and the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to

the satisfaction of the Contracting Officer.

Do not recycle a mercury spill cleanup; manage it as a hazardous waste for disposal.

3.8.6 Wastewater

3.8.6.1 Disposal of wastewater must be as specified below.

3.8.6.1.1 Treatment

Do not allow wastewater from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, and forms to enter water ways or to be discharged prior to being treated to remove pollutants. Dispose of the construction- related waste water[off-Government property in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements.][by collecting and placing it in a retention pond where suspended material can be settled out or the water can evaporate to separate pollutants from the water. The site for the retention pond must be coordinated and approved with the Contracting Officer. The residue left in the pond prior to completion of the project must be removed, tested, and disposed of off- Government property in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements. Backfill the area to the original grade, top-soiled, and seeded or sodded.[Consult with the Installation Environmental Office on specific testing requirements for water in the retention pond. If required, test the water in the retention pond for [_____] and have the results reviewed and approved by the Installation Environmental Office via the Contracting Officer prior to being discharged or disposed of off-Government property].]

3.8.6.1.2 Surface Discharge

For discharge of ground water,[if applicable, obtain a GOJ or local prefectural permit specific for pumping and discharging ground water prior to surface discharging.][Surface discharge shall be done in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations and installation requirements.]

3.8.6.1.3 Land Application

Water generated from the flushing of lines after[disinfection or disinfection in conjunction with hydrostatic testing][hydrostatic testing] must be[land- applied in accordance with the JEGS and applicable Federal, GOJ, prefectural and local laws and installation requirements for land application][discharged into the sanitary sewer with prior approval and notification to the owner of the sanitary sewer system].

3.9 HAZARDOUS MATERIAL MANAGEMENTfor the performance of this Contract.

Include hazardous material control procedures in the Safety Plan, in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Do not bring hazardous material onto Government property that does not directly relate to requirements for the performance of this Contract. Submit an Safety Data Sheet in both English and Japanese and estimated quantities to be used for

each hazardous material to the Contracting Officer prior to bringing the material on the installation. Typical materials requiring SDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. Use hazardous materials in a manner that minimizes the amount of hazardous waste generated. Containers of hazardous materials must have National Fire Protection Association labels or their equivalent.

Storage and handling of hazardous materials will adhere to the DoD Component policies, including Joint Service Publication on Storage and Handling of Hazardous Materials. Defense Logistics Agency Instruction (DLAI) 4145.11, Army Technical Manual (TM) 38-410, Naval Supply Publication (NAVSUP PUB) 573, Air Force Joint Manual (AFJMAN) 23-209, and Marine Corps Order (MCO) 4450.12A, "Storage and Handling of Hazardous Materials," January 13, 1999 provide additional guidance on the storage and handling of hazardous materials. The International Maritime Dangerous Goods (IMDG) Code and appropriate DoD and Component instructions provide requirements for international maritime transport of hazardous materials originating from DoD installations. International air shipments of hazardous materials originating from DoD installations are subject to International Civil Aviation Organization Technical Instructions or DoD Component guidance, including Air Force Manual 24-204, (Interservice) TM 38-250, NAVSUP PUB 505, MCO P4030.19J, and DLAI 4145.3, DCMAD1, Ch3.4 (HM24), "Preparing Hazardous Materials for Military Air Shipments," 3 December 2012. At the end of the project, provide the Contracting Officer with the maximum quantity of each material that was present at the site at any one time, the dates the material was present, the amount of each material that was used during the project, and how the material was used. Ensure that hazardous materials are utilized in a manner that will minimize the amount of hazardous waste that is generated. Ensure that all containers of hazardous materials have NFPA labels or their Japanese equivalent. Keep copies of the SDS for hazardous materials on site at all times and provide them to the Contracting Officer at the end of the project. Certify that hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste, in accordance with the 40 CFR 261, JEGS, and installation requirements.

3.9.1 Hazardous Material

Contractors bringing hazardous material onto the installation must have a list of the hazmats, along with an SDS in both English and Japanese provided in the EPP submittal documents. These documents must be coordinated and routed through Fire Department and Environmental Division. All excess materials and empty containers are the responsibility of the Contractor and shall be removed at the end of the Contract. Should HM requirements change during the performance period, the Contractor shall immediately notify the Environmental Division and Fire Department of such changes in writing.

Hazardous materials must be stored, handled, used, and disposed of, in accordance with 29 CFR 1910, JEGS, and local regulations.

A list of HM's, and the associated SDS in both English and Japanese must be presented to the Contracting Officer before bringing HM's on the base. All containers with hazardous materials shall be correctly marked/labeled with DD Form 2522 (DD-2522) or an equivalent label with the container contents and protected from damage (compressed gases, fuels, acids, and refrigerants (ODS) are also included).

At the end of the project all Hazardous Materials will be removed from the installation, unless approval is granted by the Environmental Division, Safety and Fire Department via the Contracting Officer.

The Contracting Officer may request documentation for any spills or releases, environmental reports, or off-site transfers.

3.9.2 Contractor Hazardous Material Inventory Log

Insert the "Contractor Hazardous Material Inventory Log"(found at: http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables), which provides information required by (EPCRA Sections 312 and 313) along with corresponding Safety Data Sheets (SDS) into the Environmental Records Binder and update monthly and no later than January 31 of each calendar year during the life of the Contract. Keep copies of the SDSs for hazardous materials onsite. At the end of the project, provide the Contracting Officer with Environmental Records Binder containing copies of the SDSs, and the maximum quantity of each material that was present at the site at any one time, the dates the material was present, the amount of each material that was used during the project, and how the material was used. The Contracting Officer may request documentation for any spills/releases, environmental reports or off-site transfers may be requested by the Contracting Officer.

Hazardous material may require prior approval from the Installation prior to being transported to the project site. The installation shall be contacted for procedures to transport and store hazardous material required by the Contractor. An SDS in both English and Japanese is required to accompany all hazardous materials brought onto the installation.

The Contracting Officer may request documentation for any spills or releases, environmental reports, or off-site transfers.

3.9.3 HAZARDOUS MATERIAL AND HAZARDOUS WASTE PROHIBITIONS

Unless otherwise specified in task order, do not dispose hazardous materials and hazardous waste into any area outside the Government control area. The Contractor shall inform of hazardous waste to be salvaged to the Contracting Officer for the notification purpose to Environmental Hazardous Waste Disposal Br., Environmental Division, PWD Sasebo, NAVFAC FE for CFAS projects in writing and coordinate setting up the boxes with the Contracting Officer. The Contractor shall submit Hazardous Waste Disposal Disposition form provided by the Contracting Officer. No hazardous material shall be brought onto the government property that are not directly related to requirements for the performance of this Contract. The government is not responsible for the disposals of Contractor's wastes/materials brought on the job site which are not required in the performance of this Contract. The intent of "hazardous wastes that exist in the Government facility" is hazardous wastes that is generated as part of this Contract, and is existed within the boundary of the Contract limits and not brought in from offsite by the Contractor. The disposal of incidental materials used to accomplish the work including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor, except the incidental hazardous waste specified in elsewhere of this Contract.

3.10 PREVIOUSLY USED EQUIPMENT

Clean previously used construction equipment prior to bringing it onto the project site. Equipment must be free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds.

[3.11 CONTROL AND MANAGEMENT OF ASBESTOS-CONTAINING MATERIAL (ACM)

Manage and dispose of asbestos- containing waste in accordance with the JEGS and applicable Federal, GOJ national or prefectural laws and regulations. Contractor must double-bag ACM waste, package in a UN approved Tri-wall container, weigh with a certified scale, label in English and Japanese, furnish analytical result and submit information to the USAG-O Environmental Division. The Contractor shall be responsible for collection and disposal of ACM waste. The ACM waste shall be subjected to pre-shipment inspections by the Environmental Division if necessary. [Contact JED Environmental for the most current version of][Refer to] Section 02 82 00 ASBESTOS REMEDIATION. Manifest asbestos-containing waste and provide the manifest to the Contracting Officer. Notifications to the Contracting Officer and Installation Air Program Manager are required before starting any asbestos work.

Removal of mastics, necessary to achieve the Contract's objectives, shall be performed in a manner as if the material contains asbestos.

When applicable, a minimum of 14 calendar days prior to the demolition or renovation of a facility that involves removing or disturbing friable ACM, the Contractor shall prepare a Written Assessment Of Friable Asbestos Disturbance and submit to the COR, who will, in turn submit to the Installation Commander in accordance with the JEGS.

[For any previously untested material suspected to contain asbestos and located in areas impacted by the work, notify the Contracting Officer (CO) who will order up to [_____] bulk samples to be obtained and analyzed at the Contractor's expense. The Contractor shall deliver the sample(s) to a laboratory accredited under the National Institute of Standards and Technology (NIST) "National Voluntary Laboratory Accreditation Program (NVLAP)" and analyzed by PLM. The laboratory shall have a working definition of “Trace” amounts of asbestos, and the laboratory shall report any detectable amount of asbestos in a bulk sample that is less than the PLM Limit of Quantification of 1% as a “Trace” concentration. If PLM does not detect the presence of asbestos (e.g. “non-detect”), the material shall be considered <0.1% asbestos. If PLM analysis detects asbestos in any discernible amount (to include “trace” or “less than 1%”), the material shall be considered >0.1% asbestos unless proven to be non-ACM by the use of quantification methods capable of achieving an analytical sensitivity of less than 0.1%, such as Transmission Electron Microscopy (TEM) or 1000 point counting.

The Contracting Officer (CO) will order, testing by TEM or 1000 point counting, for up to [ ] samples, to be obtained at the Contractor's expense and delivered to a laboratory accredited under the National Institute of Standards and Technology (NIST) "National Voluntary Laboratory Accreditation Program (NVLAP)", for those samples with results of < 1% ACM as analyzed by PLM.

Any additional components identified as ACM that have been approved by the

CO for removal shall be removed and will be paid for by an equitable adjustment to the Contract price under the CONTRACT CLAUSE titled "changes". Sampling shall be conducted by personnel who have successfully completed the EPA Model Accreditation Plan (MAP) "Building Inspector" training course and is AHERA certified as a "Building Inspector".]

][3.12 CONTROL AND MANAGEMENT OF LEAD-BASED PAINT (LBP)

Manage and dispose of lead-contaminated waste in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations and installation requirements. [Contact JED Environmental for the most current version of][Refer to] Section 02 83 00 LEAD REMEDIATION. The Contractor shall assume all paints and coatings that will be disturbed during the course of meeting the contractual requirements, contain detectable levels of lead, requiring the Contractor to incorporate OSHA regulations for worker and occupant protection. Contractor must package lead contaminated waste in a UN approved container, weigh with a certified scale, label in English and Japanese, furnish analytical result and submit information to USAG-O Environmental Division. The Contractor shall be responsible for collection and disposal of LBP waste. The LBP waste shall be subjected to pre-shipment inspections by the Environmental Division if necessary.The Contractor is to assume that all existing paint encountered in this Contract contain detectable levels of lead, and the OSHA regulations referenced in these specification applies. Any attached lead material survey information is provided for disposal purposes only. Manifest any lead-contaminated waste and provide the manifest to the Contracting Officer.No paint containing lead shall be used during the course of this Contract. Work with LBP must comply with 29 CFR 1926.62, 29 CFR 1910.134, JEGS, GOJ, Prefectural, and local requirements. The Contractor must maintain all documentation regarding lead exposure by either historical data or project data. Conduct in accordance with Section [].

a. Prior to the commencement of construction, the prime Contractor, each subcontractor and material/equipment supplier shall provide to the CO and USAG-O Environmental Division the most current Safety Data Sheets proving that the paint does not have any lead content.

b. The Contractor shall be responsible for collection and disposal of all lead paint chips and lead paint-contaminated materials, and for accumulation of these chips/materials on site. The Contractor shall test the paint materials, provide containers for proper disposal, transport and dispose of any resulting hazardous waste as described in paragraphs [].

c. Construction and demolition waste suspected of, or reported to contain LBP contamination must be profiled through the performance of a toxicity analysis. A copy of the toxicity analysis must be provided to USAG-O Environmental Division and the CO. LBP wastes are specially controlled industrial waste having the potential to have lead and cadmium levels above the regulatory levels. Lead and cadmium levels above the 0.3 mg/L regulatory levels will not be disposed of in a solid waste landfill. These types of wastes shall be disposed of as hazardous waste. LBP wastes below the lead and cadmium regulatory levels may be disposed of in a permitted solid waste landfill.

d. Copies of all lead paint-related documentation generated from this project, including lead testing, air monitoring and hazardous waste manifests, shall be provided by the Contractor to the Contracting Officer. A copy shall be forwarded to USAG-O Environmental Division via the

Contracting Officer within 10 working days of task completion.

][3.13 CONTROL AND MANAGEMENT OF POLYCHLORINATED BIPHENYLS (PCBS)

Manage and dispose of PCB-contaminated waste in accordance with the JEGS, installation requirements, and Section 02 84 33 REMOVAL AND DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCB). Purchase of electrical equipment and transformers containing PCBs is prohibited.

3.13.1 Removal Or Installation

Work on PCB equipment is forbidden using this supplement alone. If the project involves the disturbance, relocation, installation, or removal of products that have historically contained PCBs, follow the instructions in the supplement to the specification that pertains to that product's installation or removal (Transformer Replacement, Lighting Replacement, etc.).

a. Transformers

(1) Contractor must provide a manufacturer certification stating that the transformers used in the project are PCB-free (no detectable PCBs). The phrase "No PCBs" must appear on the label of the transformer. (JEGS)

(2) Contractor shall sample the transformer for the presence of PCBs using samples analyzed at a local Japanese laboratory. Results are to be bilingual. Recommend that the laboratory technician pull the sample. Contractor is required to submit bilingual copies of the lab result to USAG-O Environmental Division for approval. Contractor will also provide a copy of the lab result to the CO.

(3) If lab results indicate that the PCBs content is more than 0.5 mg/Kg contact USAG-O Environmental Division for guidance on turn-in procedures of transformers.

(4) If lab results indicate that the transformer is non-PCB (i.e. less than 0.5 mg/Kg) then it may be possible to recycle the transformer and dielectric fluid.

b. Paper Insulated Lead Covered (PILC) Cable

(1) Contractor must provide a manufacturer certification stating that the PILC used in the project is PCB-free (no detectable PCBs) and non-Asbestos. (JEGS).

(2) Contractor shall sample each run of cable for the presence of PCBs and Asbestos using a local Japanese laboratory in accordance with Japanese disposal methods. PCB results are to be bilingual. Asbestos test method is to be in accordance to JIS A 1481 to 0.1% by weight. Recommend that the laboratory technician pull the sample. Contractor is required to submit bilingual copies of the lab result to USAG-O Environmental Division for approval. Contractor will also provide a copy of the lab result to the CO.

(3) If the lab results indicate that there are PCBs present in the PILC in concentrations above 0.5 mg/Kg, contact USAG-O Environmental Division for guidance on turn-in procedures.

(4) Contractor shall take care when handling PILC. Prior to removal, the

Contractor shall lay down tarps (blue poly sheets are acceptable) at the manhole and surrounding area. Cable shall be pulled in long runs, minimizing cuts, and placed in a spool and identified as to which manhole they originated.

(5) Contractor shall seal ends of cable, and any area where sheathing is compromised, with splicing tape such as 3M I SOC or equivalent. A cover, such as a blue poly sheet, is to be placed over the spool of cable to prevent rainfall from contacting the cable. Cable is to be staged away from storm drains while awaiting results.

(6) Contractor shall place splices along with tarps and rags used in pulling cable in UN certified open-head drums and identified as to which manhole they originated. Debris is to be cleaned up and containerized daily.

(7) If the lab results indicate Asbestos is present in the PILC in concentrations above 0.1 % by weight, abate Asbestos in accordance with Section 13280A, Asbestos Hazard Control Activities.

(8) If lab results indicate that the PILC is non-PCB (i.e. less than 0.5 mg/Kg) and non- Asbestos (less than 0.1% by weight) then the material may be managed as a scrap metal and disposed of off-base by the Contractor.

][3.14 CONTROL AND MANAGEMENT OF LIGHTING BALLAST AND LAMPS CONTAINING PCBS

Manage and dispose of contaminated waste in accordance with the JEGS and installation requirements.[[Contact JED Environmental for the most current version of][Refer to] Section 02 84 16 HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBS AND MERCURY.]

If ballasts without a "No PCBs" label are encountered, the manufacturer shall be contacted to determine the PCB-content of the ballast. Furthermore, there is a possibility that ballasts labeled "No PCBs" may still contain PCBs above the Japan-established level of 0.5 mg/Kg. Because the U.S. definition for PCBs is 50 mg/Kg and over, it is possible that some U.S. manufacturers may consider "No PCBs" as 50 mg/Kg or below. Therefore, if a project involves the removal, disposal and installation of ballasts, the manufacturer shall be contacted and an MSDS or a written statement indicating that the ballasts contain less than 0.5 mg/Kg of PCBs shall be requested, even if the existing ballasts are labeled "No PCBs". However, it is best if the manufacturer is able to state that there is absolutely 0 PCBs in their product. If the Contractor cannot obtain any PCB information for the ballasts, the Contractor shall take a representative sample of each model and have the samples analyzed at a local Japanese laboratory. The Contractor is required to submit bilingual copies of the lab results to USAG-O Environmental Division. If the lab results indicate that the PCB-content is more than 0.5 mg/Kg, USAG-O Environmental Division shall be contacted for guidance on the turn-in procedures for the wastes containing PCBs. Segregate PCBs free ballasts from PCBs containing ballasts and further segregated according to model. The ballasts shall be placed in a united nation certified drum container and in separate boxes per brand as well as per US and Japanese products. Contractor must package PCBs ballast in a UN approved container, weigh with a certified scale, label in English and Japanese, furnish analytical result and submit information to USAG-O Environmental Division. For further information, contact the PCBs Manager at 644-4382 or 644-4910.

Light Fixtures waste including, but not limited to mercury containing

equipment such as florescent lamps, mercury vapor lamps, and high pressure sodium lamps shall be disposed as Hazardous Waste and turned in to the Government in accordance with the JEGS. Non hazardous waste shall be disposed off-base in accordance with all applicable JEGS, Japanese laws and local regulations. Lighting fixture ballasts may contain PCB as specified in Paragraph "PCB Contained Waste Materials and Equipment". When the light ballast does not contain PCBs, submit the ballast manufacturer's non-PCB certificate to the NAVFAC PWD Environment Office via the Contracting Officer.

a. Light Ballasts/Capacitors.

(1) Contractor must provide a manufacturer certification stating that the ballasts/capacitors used in the project are PCB-free (no detectable PCBs). The phrase "No PCBs " must appear on the label of the ballast/capacitor. (JEGS).

(2) All ballasts/capacitors must be removed from the fixtures. Ballasts/capacitors are to be segregated based on PCB-free from PCB-containing, U.S. and Japanese-made and according to model. Refer to Section 3.73 of this part for turn-in and disposal.

]3.15 CONTROL AND DISPOSAL OF IONIZATION SMOKE DETECTORS AND TRITIUM EXIT SIGNS

3.15.1 Material Bagging

Remove existing ionization smoke detectors and tritium exit signs, and place like types together; i.e. same manufacturer and model number, in a plastic bag. Provide a label on the bag with the following data:

Manufacturer
Model Number
Isotope/Quantity (if known)
Activity
Contract Number

3.15.2 Material Storage

Do not open smoke detectors due to a small amount of radioactive (Americium 241) material. Store plastic bags in 55-gallon covered drum(s). Do not seal the drum(s). Apply a label entitled "RADIOACTIVE" and the storage inventory form to exterior surface of the cover and side of the drum(s). Provide a record copy, for each drum storage inventory to the Contracting Officer.

3.15.2.1 Storage Site and Disposal for U.S. Products

Deliver drums to designated facility for storage and disposal of U.S made ionization smoke detectors and tritium exit signs as directed by the Contracting Officer.

3.15.3 Storage and Disposal for Japanese Products

The Contractor shall be responsible for storage of Japanese ionization smoke detectors and delivery to each manufacturer in accordance with Japanese law, "Houshasei Douigenso Tou Ni Yoru Houshasen Shougai Boushi Ni Kannsuru Hourishu". If unable to identify the manufacturer, items may be sent to the "Japan Radioisotope Association".

3.16 PETROLEUM, OIL, LUBRICANT (POL) STORAGE AND FUELING

POL products include flammable or combustible liquids, such as gasoline, diesel, lubricating oil, used engine oil, hydraulic oil, mineral oil, and cooking oil. Store POL products and fuel equipment and motor vehicles in a manner that affords the maximum protection against spills into the environment. Manage and store POL products in accordance with the JEGS and installation requirements and applicable GOJ national or prefectural laws and regulations. Use secondary containments, dikes, curbs, and other barriers, to prevent POL products from spilling and entering the ground, storm or sewer drains, stormwater ditches or canals, or navigable waters of Japan. Describe in the EPP (see paragraph ENVIRONMENTAL PROTECTION PLAN) how POL tanks and containers must be stored, managed, and inspected and what protections must be provided.[Storage of oil, including fuel, on the project site is not allowed. Fuel must be brought to the project site each day that work is performed.][Storage of fuel on the project site must be in accordance with the JEGS and installation requirements, and local laws and regulations and paragraph OIL STORAGE INCLUDING FUEL TANKS.]

If temporary petroleum products and lubricants containing tanks/containers are to be stored at a job site, spill preventive measures shall be taken. A secondary containment system shall be applied. Appropriate and compatible spill kits shall be readily available at a job site. A sign larger than 0.3 meters wide and 0.6 meters long or clearly visible from 16 meters shall be provided containing following information in English and Japanese: identification number, maximum storage capacity, the title and telephone number of the point of contact, and state that "DANGER: NO FLAMMABLE OR IGNITION SOURCES WITHIN 50 FEET OR 16 METERS" in red letters. Further guidance on spill prevention measures is available; contact Installation Environmental Office.

3.16.1 Used Oil Management

"Used oil," means any oil or other waste petroleum, oil, or lubricant (POL) product that has been refined from crude oil, or is synthetic oil, has been used and as a result of such use, is contaminated by physical or chemical impurities, or is off specification and cannot be used as intended. Although used oil may exhibit the characteristics of reactivity, toxicity, ignitability, or corrosivity, it is still considered used oil, unless it has been mixed with hazardous waste. Manage used oil generated on site in accordance with the JEGS and installation requirements. Determine if any used oil generated while onsite exhibits a characteristic of hazardous waste. Used oil containing 1,000 parts per million of solvents is considered a hazardous waste and disposed of at the Contractor's expense. Used oil mixed with a hazardous waste is also considered a hazardous waste. Dispose in accordance with paragraph HAZARDOUS WASTE DISPOSAL.

Petroleum Product Used or Remaining In Existing Facility - Turn-in petroleum products generated from existing facilities which is defined as a hazardous waste or recyclable. Turn-in to Government's storage facility in accordance with Section 01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.

3.16.2 Oil Storage Including Fuel Tanks

Provide secondary containment and overfill protection for oil storage

tanks. A berm used to provide secondary containment must be of sufficient size and strength to contain the contents of the tanks plus 12 centimeters freeboard for precipitation. Construct the berm to be impervious to oil for 72 hours that no discharge will permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Use drip pans during oil transfer operations; adequate absorbent material must be onsite to clean up any spills and prevent releases to the environment. Cover tanks and drip pans during inclement weather. Provide procedures and equipment to prevent overfilling of tanks. If tanks and containers with an aggregate aboveground capacity greater than 5000 liter will be used onsite (only containers with a capacity of 208 liter or greater are counted), provide and implement a SPCC plan meeting the requirements of 40 CFR 112. Do not bring underground storage tanks to the installation for Contractor use during a project. Submit the SPCC plan to the Contracting Officer for approval.

Monitor and remove any rainwater that accumulates in open containment dikes or berms. Inspect the accumulated rainwater prior to draining from a containment dike to the environment, to determine there is no oil sheen present. If a sheen is present, remove the sheen in accordance with CFAS Environmental Management Plans, prior to draining containment dike. Maintain a written record of containment dike inspections, sheen removal, and drainage by date and time.

3.16.3 Secondary Containment

A secondary containment capable of holding the entire contents of the largest single tank plus sufficient freeboard to allow for precipitation and expansion of product shall be provided. Alternatively, a double wall container equipped with adequate technical spill and leak prevention options such as overfill alarm and flow shutoff may provide as the secondary containment.

3.16.4 FUEL STORAGE TANKS

US Army Garrison Fire Department and USAG-O Environmental Division must approve the use of fuel storage tanks on base, and the Contractor must ensure adequate spill containment (spill kits) for any tanks approved for use. The Contractor must have written spill procedures for tanks and heavy equipment that they use on base. Temporary gasoline storage is not permitted on base.

Provide secondary containment such as spill pans or impervious berms where necessary when bringing fuel storage tanks on base. Contact the Contracting Officer for inspection to ensure proper setup of fuel storage prior to dispensing of fuel.

All tanks regardless of size must have secondary containment or double wall capable of holding the entire contents of the largest single tank plus sufficient freeboard to allow for precipitation and expansion of product.

When a facility with fuel storage tanks is demolished, demolition of the tank(s) shall be included in the scope of the project. The following standards shall be applied when demolishing an existing tank.

a. Training: Personnel involved in removing tanks must have training on UST/AST removal and confined space entry.

b. Environmental, Health and Safety Plan: Prepare environmental, health and safety plan and keep it at the site during tank removal. Coordinate plan with USAG-O Environmental Division via the Contracting Officer prior to start of construction.

Plan shall include:

(1) All planned safety measures

(2) Protective equipment to be used by workers

(3) Documentation of worker training

(4) Lab analysis of the material in the tank

(5) Disposal method for tank contents and any contamination in accordance with local regulations

(6) Location of post-excavation soil sampling points, analytical methods to be used on samples, and clean up levels. At least 5 sampling points will be used after excavation or soil known to be contaminated has been removed. Consult with USAG-O Environmental Division via the Contracting Officer for assistance in planning sampling.

c. Before Removing Tank: Notify Environmental Division, at least 24 hours before removing tank. Clean the tank (triple rinse) and render tank inert (vapor must not to exceed 10 percent Lower Explosive Limit).

d. Tank Cutting: Cut a 2' by 2' opening on each side of the tank to prevent reuse, paint the Bldg. Number and date of removal on the tank, take photos for documentation purpose.

e. Soil Removal: Segregate clean soil from the contaminated soil. The soil shall be visually inspected for staining after removal of all obviously contaminated soil, then screened for the presence of volatile and/or semi-volatile contamination using an approved vapor monitoring instrument. If the soil is contaminated with petroleum, it shall be disposed of in accordance with local regulations. If it is contaminated with hazardous substance, the Contractor shall dispose of it in accordance with section 3.08 of this part. If additional information is needed, consult with USAG-O Environmental Division via the Contracting Officer.

f. Closure Report: Prepare closure report, including documentation of all of the requirements of this section and the following information as a minimum, and submit to USAG-O Environmental Division via the Contracting Officer.

(1) A cover letter signed by a responsible company official certifying that all services involved have been performed in accordance with the terms and conditions of this section.

(2) A narrative report describing what was encountered at each site, including: condition of the UST, any visible evidence of leaks or stained soils, results of vapor monitoring readings, actions taken including quantities of materials treated or removed, reasons for selecting sample locations, sample locations, whether or not groundwater was encountered.

(3) Copies of all analyses.

(4) Information on who transported and accepted all wastes encountered, including copies of manifests.

(5) Scaled one-line drawings showing tank locations, limits of excavation, limits of contamination, underground utilities within fifty feet, sample locations, and sample identification numbers.

(6) The Contractor shall take site photos including: site condition before work begins, soil stockpile area, tank, excavation area, site condition after the construction.

3.17 INADVERTENT DISCOVERY OF PETROLEUM-CONTAMINATED SOIL OR HAZARDOUS WASTES

If petroleum-contaminated soil, or suspected hazardous waste is found during construction that was not identified in the Contract documents, immediately notify the Contracting Officer. Do not disturb this material until authorized by the Contracting Officer.

3.18 Contaminated Soil

In case the Government assumes that soil on project site is contaminated soil, the Contractor shall store excavated soil and take necessary measure to protect ground from contamination. Excavation and handling soil shall be performed in accordance with direction from Activity environmental office.

In accordance with CNFJ Policy Letter "CONTAMINATED SOIL EXCAVATION AND MANAGEMENT POLICY", back filling of existing contaminated soil to its original place will be allowed and provide covering for the surface. Transport and dispose of excess contaminated soil to off-base facility as specified Paragraph "Disposal of Contaminated Soil" in this section.

3.18.1 Soil Sampling and Testing

If soil contamination is unknown, (i.e. sample results do not exist), previous samples indicating contamination exist, but are over one-year old or soil contamination is suspected then sampling and analysis is required in accordance with Soil Contamination Countermeasures Law Soil Testing Standards. As a minimum, sampling will consist of a composite sample composed of five separate samples per 100 square meters. A sampling plan will be submitted to the Installation Environmental Office for approval.

Sample analysis will be performed utilizing an independent accredited laboratory. Testing shall consist of those contaminants listed in the JEGS. Samples shall be analyzed in accordance with Soil Contamination Countermeasures Law Soil Testing Standards. Results shall be provided to the Activity Environmental Soil Manager for determination of soil disposal methodology. For constituent(s) exceeding the limits of the soil primary leachate standard (JEGS), the Installation Environmental Office will be the determining authority for the need for soil contents test(s).

Soil awaiting analysis or disposal maybe temporarily stored within the installation. Temporary soil staging areas shall be located and maintained in such a way as to prevent damage to cultural / natural resources, impact waterways or drinking water sources, create an air or odorous nuisance or endanger public health. Map(s) indicating temporary storage area location and a plan describing pollution prevention measures shall be submitted to

the Installation Environmental Office for approval.

Contaminated soil piles shall be on an impermeable surface or membrane. Soils shall be completely and securely covered, for the duration of the storage period, with an impermeable material of sufficient strength, thickness, anchoring or weighting to prevent tearing or lifting of the cover, infiltration of precipitation or runoff, and exposure of the soil to the atmosphere.

Appropriate steps shall be taken to deter public access to the storage area. This may include fencing, similar barriers, security patrols or warning signs.

Soils relocated to a Temporary Staging, Transfer, and/or Temporary Storage Area (i.e. an area away from the project site) to await off-site disposition shall have a sign posted identifying in indelible ink:

a. "Temporary Staged Soil"

b. Contract Number

c. POC Phone Number

d. Contaminants

e. Date Soil Staged

3.18.2 Disposal of Contaminated Soil

The Contractor shall dispose of contaminated soil off-base in accordance with Japanese laws, local prefectural regulations, and the JEGS.

[3.19 PEST MANAGEMENT

In order to minimize impacts to existing fauna and flora, coordinate with the Installation Pest Management Coordinator (IPMC) or the Natural Resources Manager in the DPW Environmental Division, through the Contracting Officer, at the earliest possible time prior to pesticide application. Discuss integrated pest management strategies with the [IPMC][PPC] and receive concurrence from the [IPMC][PPC] through the Contracting Officer prior to the application of any pesticide associated with these specifications. Provide Installation Project Office Pest Management personnel the opportunity to be present at meetings concerning treatment measures for pest or disease control and during application of the pesticide.[For termiticide requirements, see[Section 31 31 16.13 CHEMICAL TERMITE CONTROL][Section 31 31 16.19 TERMITE CONTROL BARRIERS]] The use and management of pesticides are regulated under the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations and installation requirements.

3.19.1 Application

Apply pesticides using a DoD-certified or equivalent Japanese-certified pesticide applicator in accordance with guidance given on the pesticide label. The certified applicator must wear clothing and personal protective equipment as specified on the pesticide label. If local nationals will be using the pesticides, the precautionary messages and use instructions shall be in English and Japanese. The Contracting Officer will designate locations for water used in formulating. Do not allow the

equipment to overflow. Inspect equipment for leaks, clogging, wear, or damage and repair prior to application of pesticide.

3.19.2 Pesticide Treatment Plan

Include and update a pesticide treatment plan, as information becomes available. Include in the plan the sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers if applicable, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (that is, pounds of active ingredient applied), equipment used for application and calibration of equipment. Comply with the JEGS or any applicable Federal GOJ national or prefectural and installation pest management record-keeping and reporting requirements as well as any additional Installation Project Office specific requirements in conformance with [DA AR 200-1 Chapter 5, Pest Management, Section 5-4 "Program requirements"] for data required to be reported to the Installation.

]3.20 POST CONSTRUCTION CLEANUP

Clean up areas used for construction in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing by the Contracting Officer, remove traces of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Grade parking area and similar temporarily used areas to conform with surrounding contours.

-- End of Section --

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SECTION 01 57 19.01

TEMPORARY ENVIRONMENTAL CONTROLS - AIR FORCE INSTALLATIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications list the criteria issued by the United States Air Force (USAF), United States Forces Japan (USFJ), 18th Wing, 18th Civil Engineer Group (18CEG), and the 718th Civil Engineer Squadron/Environmental Management (718CES/CEIE). Government of Japan (GoJ) and prefectural laws and regulatory requirements defined in this section are derived from guidance in the Japan Environmental Governing Standards (JEGS) and the practice of applicable laws, referenced or not. The publications are referred to within the text by the basic designation only.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 14001	(2015) Environmental Management Systems - Requirements with Guidance for Use

U.S. AIR FORCE (USAF)

AFI 23-204	(2012) Organizational Fuel Tanks
AFMAN 32-1067	(4 Aug 2020) Water and Fuel Systems
AFI 32-7001	(04 Oct 2019) Environmental Management
AFMAN 32-7002	(4 Feb 2020) Environmental Compliance and Pollution Prevention

U.S. DEPARTMENT OF DEFENSE (DOD)

JEGS	(Dec 2020) Japan Environmental Governing Standards
UFC 3-460-01	(2015) Design: Petroleum Fuel Facilities

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Hazardous Waste Operations and Emergency Response

U.S. AIR FORCE, MISAWA AIR BASE

18WG AST	(Sept 2009) 18th WG AST Installation Details and Standards

1.2 DEFINITIONS

In some cases, definitions are given only for illustrative purposes. Prevailing JEGS definitions shall be used for environmental compliance requirements.

1.2.1 Aboveground Storage Tank

[A portable or fixed POL aboveground storage container as defined in the JEGS with a capacity greater than 55 gallons.][A container with a capacity greater than 55 gallons which is a fixed installation or is portable and is either an aboveground storage container as defined in the JEGS or a below ground storage container as defined in the JEGS which contains POL, hazardous materials, hazardous substances or hazardous waste.]

1.2.2 Asbestos Containing Material (ACM)

Any material containing greater than or equal to one-tenth of one percent (0.1 percent) asbestos, by weight.

1.2.3 Bulky Waste

Large items of solid waste such as household appliances, furniture, large auto parts, trees, branches, stumps, and other oversize wastes whose large size precludes or complicates their handling by normal solid waste collection, processing, or disposal methods.

1.2.4 Chemical Wastes

Salts, acids, alkalis, herbicides, pesticides, organic chemicals, and spent products, which serve no purpose.

1.2.5 Class I and II Ozone Depleting Substance (ODS)

Class I and II ODS are listed in the JEGS.

1.2.6 Construction and Demolition Waste

The waste building materials, packaging, and rubble resulting from construction, remodeling, repair and demolition operations on pavements, houses, commercial buildings, and other structures.

1.2.7 Contractor Generated Hazardous Waste

Contractor generated hazardous waste is materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e. methyl ethyl ketone, toluene), waste thinners, excess paints, excess solvents, waste solvents, excess pesticides, and contaminated pesticide equipment rinse water.

1.2.8 Electronics Waste

Electronics waste is discarded electronic devices intended for salvage, recycling, or disposal.

1.2.9 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally or historically.

1.2.10 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.11 Food Waste

Organic residues generated by the handling, storage, sale, preparation, cooking, and serving of foods (commonly called garbage).

1.2.12 Hazardous Debris

As defined in paragraph SOLID WASTE, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) in accordance with the JEGS. Hazardous debris also includes debris that exhibits a characteristic of hazardous waste in accordance with the JEGS.

1.2.13 Hazardous Materials

Hazardous material is any material that is capable of posing an unreasonable risk to health, safety, or the environment if improperly handled, stored, issued, transported, labeled, or disposed because it displays a characteristic listed in the JEGS. Munitions are excluded.

1.2.14 Hazardous Substances

Any substance having the potential to do serious harm to human health or the environment if spilled or released in reportable quantity. A list of these substances and the corresponding reportable quantities is contained in the JEGS.

1.2.15 Hazardous Waste

Hazardous Waste is discarded material that may be solid, semi-solid, liquid, or contained gas, and either exhibits a characteristic of a hazardous waste as defined in the JEGS. Excluded from this definition are domestic sewage sludge, household wastes, and medical wastes.

1.2.16 Hazardous Waste Accumulation Point

A shop, site, or other work center where hazardous wastes are accumulated until removed to a Hazardous Waste Storage Area (HWSA) or shipped for treatment or disposal. A HWAP may be used to accumulate no more than 208 liters (55 gallons) of hazardous waste, or 1 liter (1 quart) of acute hazardous waste, from each waste stream. The HWAP must be at or near the

point of generation and under the control of the operator.

1.2.17 Installation Pest Management Consultant

Installation Pest Management Consultant (IPMC) is the professional DoD pest management personnel located at component headquarters, field operating agencies, major commands, facilities engineering field divisions or activities, or area support activities who provide technical and management guidance for the conduct of installation pest management operations. Some pest management consultants may be designated by their component as certifying officials.

1.2.18 Land Application

Land Application means spreading or spraying discharge water at a rate that allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, or discharge into defined drainage areas (includes drainage ditches, streams, rivers, ocean, etc.) must occur. Comply with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements.

1.2.19 Lead-Based Paint (LBP)

Paint or other surface coatings that contain greater than or equal to 1.0 milligram per square centimeter (cm), or 0.5 percent by weight, or 5,000 ppm of lead by weight.

1.2.20 Oily Wastes

Oily wastes are those materials that are, or were, mixed with Petroleum, Oils, and Lubricants (POLs) and have become separated from those POLs. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludge, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, POLs and may be appropriately tested and discarded in a manner which is in compliance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that: It is not prohibited in the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements; the amount generated is "de minimus" (a small amount); it is the result of minor leaks or spills resulting from normal process operations; and free-flowing oil has been removed to the practicable extent possible. Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, perform a hazardous waste determination prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

1.2.21 Pesticide

Pesticide is any substance or mixture of substances, including biological control agents that may prevent, destroy, repel, or mitigate pests.

1.2.22 Pesticide Treatment Plan

A plan for the prevention, monitoring, and control to eliminate pest infestation.

1.2.23 Pests

Anthropods, birds, rodents, nematodes, fungi, bacteria, viruses, algae, snails, marine borers, snakes, weeds, undesirable vegetation, and other organisms (except for microorganisms that cause human or animal disease) that adversely affect the well-being of humans or animals; attack real property, supplies, equipment, or vegetation; or are otherwise undesirable.

1.2.24 Petroleum, Oil, and Lubricants

Refined petroleum, oils, and lubricants, including, but not limited to, petroleum, fuel, lubricant oils, synthetic oils, mineral oils, animal fats, vegetable oil, sludge, and POL mixed with wastes other than dredged spoil.

1.2.25 Polychlorinated Biphenyl (PCB)

Any PCB article, PCB article container, PCB container, or PCB equipment that deliberately or unintentionally contains or has as a part of it any detectable concentration of PCB.

1.2.26 Regulated Waste

Regulated waste are solid wastes that have specific additional Misawa AB, JEGS, Federal, or GOJ national and prefectural controls for handling, storage, or disposal.

1.2.27 Rubbish

A general term for solid waste, excluding food wastes and ashes, taken from residences, commercial establishments, and institutions.

1.2.28 Sanitary Waste

a. Sewage: Wastes characterized as domestic sanitary sewage.

b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2.29 Sediment

Sediment is soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.30 Solid Waste

Solid waste is garbage, refuse, sludge, and other discarded materials, including solid, semi-solid, liquid, and contained gaseous materials resulting from industrial and commercial operations and from community activities. It does not include solids or dissolved material in domestic sewage or their significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial wastewater effluent, dissolved materials in irrigation return flows, or other common water pollutants.

Types of solid waste typically generated at construction sites may include:

1.2.30.1 Debris

Debris is non-hazardous solid material generated during the construction, demolition, or renovation of a structure that exceeds 60 mm particle size that is: a manufactured object; plant or animal matter; or natural geologic material (for example, cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials [may][may not] be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

1.2.30.2 Green Waste

Green waste is the vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

1.2.30.3 Material Not Regulated as Solid Waste

Material not regulated as solid waste is nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

1.2.30.4 Non-Hazardous Waste

Non-hazardous waste is waste that is excluded from, or does not meet, characteristic of a hazardous waste as defined in the JEGS or is listed as a hazardous waste in the JEGS. Excluded from this definition is medical wastes.

1.2.30.5 Recyclables

Recyclables are materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable, wiring, insulated/non-insulated copper wire cable, wire rope, and structural components. It also includes commercial-grade refrigeration equipment with Freon removed, household appliances where the basic material content is metal, clean polyethylene terephthalate bottles, cooking oil, used fuel oil, textiles, high-grade paper products and corrugated cardboard, stackable pallets in good condition, clean crating material, and clean rubber/vehicle tires. Metal meeting the definition of lead contaminated or lead based paint contaminated may not be included as recyclable if sold to a scrap metal company.

1.2.30.6 Scrap Metal

This includes scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe, and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of

hazardous material or hazardous waste is not included.

1.2.30.7 Surplus Soil

Surplus soil is existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars, and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included and must be managed in accordance with paragraph HAZARDOUS MATERIAL MANAGEMENT.

1.2.30.8 Wood

Wood is dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included. Treated wood includes, but is not limited to, lumber, utility poles, crossties, and other wood products with chemical treatment.

1.2.30.9 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (for example, thermostats), and lamps (for example, fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal.

1.2.31 Surface Discharge

Surface discharge means discharge of water into drainage ditches, storm sewers, or creeks, or waters of Japan. Surface discharges are discrete, identifiable sources and require a permit from the governing agency. Comply with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements.

1.2.32 Wastewater

Wastewater is the used water and solids from a community that flow to a treatment plant.

1.2.32.1 Stormwater

Stormwater is any precipitation in an urban or suburban area that does not evaporate or soak into the ground, but instead collects and flows into storm drains, rivers, and streams.

1.2.33 Wetlands

Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

1.3 PROHIBITED PRODUCTS

The following items are forbidden for use by the JEGS or other criteria. Details of each are included in the text of each chapter of the Environmental Protection Plan (EPP) described in this section.

a. Asbestos Containing Materials (ACM). Do not use materials containing asbestos unless deemed absolutely necessary. If necessary, asbestos concentration shall be limited to less than 0.1 percent by weight. The Contractor shall provide manufacturer certifications that state that materials utilized do not contain asbestos or justification for ACM and relevant certification.

b. Lead-Containing Paint. Paint containing greater than 0.009 percent lead by weight. Contractor must provide manufacturer certifications that materials utilized are lead free per the JEGS. The contractor shall furnish a certificate for paint and paint related materials proposed for use attesting that the paint is lead free unless deemed necessary.

c. Polychlorinated Biphenyls (PCBs). Materials containing PCBs greater than 0.5mg/kg shall not be used.

d. Class I Ozone Depleting Substances (ODS). Class 1 ODS listed in the JEGS shall not be used.

e. Lead-containing Drinking-Water Pipes, Solders, Flux, and Fittings. Comply with JEGS requirements where applicable

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preconstruction Survey

Regulatory Notifications; G

Environmental Protection Plan; G

Environmental Manager Qualifications; G

Temporary Fuel Storage Tank Approval Request; G

Underground Fuel Storage Tank Approval Request; G

Licenses/Permits/Notifications; G

General Use Permitted Equipment

Fuel Storage Tank Installation/Removal Report; G[, [_____]]

Written Assessment Of Friable Asbestos Disturbance

SD-06 Test Reports

Laboratory Analysis

Nonhazardous Solid Waste Diversion Report

SD-07 Certificates

EMS Certificate of Completion; G

Asbestos Certification; G

Lead Certification; G

SD-11 Closeout Submittals

Environmental Records Binder

1.5 PAYMENT

No separate payment shall be made for work covered under this section. Payment of fees associated with environmental permits, application, and/or notices obtained by the Contractor, and payment of all fines/fees for violation or non-compliance with GOJ, Federal, and local laws and regulations are the Contractor's responsibility. All costs associated with this section shall be included in the Contract price.

1.6 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the Contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of this Contract. Comply with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements pertaining to the environment, including but not limited to water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

Tests and procedures assessing whether construction operations comply with Applicable Environmental Laws may be required. Laboratory analyses necessary to implement the JEGS shall be conducted in a laboratory certified by a U.S. or GOJ regulatory authority for the applicable test method. In the absence of a certified laboratory, contact the Contracting Officer for further guidance.

Contractor shall be responsible to ensure that subcontractors comply with all environmental protection requirements of this section.

The Contractor shall record any problems in complying with laws, regulations, permit requirements, ordinances, and corrective actions taken. The Contractor shall immediately inform the Contracting Officer of any environmental problems.

1.6.1 Environmental Management System (EMS) Training

1.6.1.1 Personnel Requirements

The Environmental Manager is responsible for environmental compliance on

projects. The Environmental Manager [and other staff], must complete applicable EMS training prior to starting respective portions of on-site work under this Contract. Contact 35 CES/CEIE for obtaining training material. If personnel changes occur for any of these positions after starting work, replacement personnel must complete applicable EMS training within 14 days of assignment to the project.EMS Training is available in English and Japanese at https://usaf.learningbuilder.com New users must create a new account. Search for EMS Training once logged in. Print out the EMS Certificate of Completion and submit with the EPP.

1.6.1.2 Certification

Submit a roster of individuals whom have completed the EMS training to 35 CES/CEIE. This training is a one time requirement; 35 CES/CEIE shall maintain a listing of Contractor personnel whom have completed the training, thereby eliminating the need for Contractors who frequently perform work at Misawa AB to take this training prior to each contract.

1.6.2 Conformance with the Environmental Management System

All contractor personnel shall be aware of and comply with the Yokota Air Base Environmental Commitment Statement. The Contractor shall also comply with the EMS program, including all base environmental plans, instructions and the Japan Environmental Governing Standards (JEGS). This also includes instructions/comments provided on planning documents such as 332's (Base Civil Engineer Work Request), and 813s (Request for Environmental Impact Analysis).

Communicate with Environmental Program Managers (EPMs) to be aware of any operational controls (permits, plans, requirements to purchase recycled content, bio-based, or energy efficient products).

Provide copies of environmental records as requested by EPMs to meet recordkeeping requirements.

Ensure that personnel are properly trained in accordance with applicable statutes and regulations.

Immediately report all hazardous waste or hazardous material releases to the installation emergency response activity, and fully cooperate with any emergency response.

Perform work under this Contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). Perform work in a manner that conforms to objectives and targets of the environmental programs and operational controls identified by the EMS. Support Government personnel when environmental compliance and EMS audits are conducted by escorting auditors at the Project site, answering questions, and providing proof of records being maintained. Provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, take corrective and preventative actions. In addition, employees must be aware of their roles and responsibilities under the installation EMS and of how these EMS roles and responsibilities affect work performed under the Contract.

Coordinate with the installation's EMS coordinator to identify training

needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. Provide training documentation to the Contracting Officer. The Installation Environmental Office will retain associated environmental compliance records. Make EMS Awareness training completion certificates available to Government auditors during EMS audits and include the certificates in the Employee Training Records. See paragraph EMPLOYEE TRAINING RECORDS.

1.7 SPECIAL ENVIRONMENTAL REQUIREMENTS

1.7.1 Asbestos Prohibition and Certification

a. Materials or products containing more than one-tenth of one percent (0.1 percent) by total weight, of the material or product, of asbestos shall not be used in this project. The Contracting Officer, at any time prior to acceptance of the work, or during the period designated for warranty of the work, if any, may reject materials and products that contain asbestos in excess of one-tenth of one percent by weight, and direct the removal of such materials and products from the job site, at the sole expense of the Contractor, and without additional time granted for performance of the work. After completion of this Contract, if asbestos (exceeding 0.1 percent by weight) is discovered in the products or materials (excluding items permitted by the exception) installed by the Contractor, the Government reserves the right to direct the Contractor to perform asbestos abatement and restoration work, as required, at the Contractor's sole cost. Asbestos abatement work (removal and disposal of asbestos-containing materials and products) shall be accomplished in accordance with currently applicable Government standards for such work.

   Exception: Where suitable asbestos-free substitutes do not exist for a material or product, the Contractor may use a material or product containing asbestos in the excess of 0.1 percent by weight, with prior written approval of the Contracting Officer. Submit a written request for substitution, accompanied by a certification from the manufacturer of the material or product that shall set forth, in specific detail, the amount of asbestos present in the material or product. When available, laboratory analysis of the material or product for asbestos content shall be included with the submittal.

b. The Government may conduct asbestos testing on suspected asbestos-containing materials and products excluding items permitted by the "exception", and such testing shall be conducted at the expense of the Government. However, wherever destructive testing is required, or a material or product must be utilized by the Government for testing, the Contractor shall, at its own expense, repair or replace the material or product, or the item of work that has been disturbed by testing, if the results confirm presence of asbestos exceeding 0.1 percent by weight. In the event test results indicate 0.1 percent or less asbestos content or complete absence of asbestos, the Contractor shall restore the test site to its original condition and the cost of restoration work, as approved by the Contracting Officer, shall be borne by the Government.

c. As a minimum, furnish manufacturer's certification for the items listed below, excluding items permitted by the "exception", certifying that the items are asbestos-free or do not contain asbestos in excess of 0.1 percent by weight, as applicable. However, when presence of asbestos is suspected in other products and materials used in this

project, the Contractor shall be required to provide such certification for those additional items when so directed by the Contracting Officer. Asbestos certification shall be required for the items applicable to this project only.

(1) Vinyl sheet/vinyl tile flooring, including accessories and adhesives.

(2) Insulation materials, including facing.

(3) Gaskets for piping and duct work.

(4) Acoustical tiles.

(5) Firestopping materials.

(6) Fireproofing materials.

(7) Special coating, including factory applied coatings, on sheet metal roofing and siding.

(8) Wallboard for all interior and exterior applications, including joint compounds.

(9) Adhesives (other than item 1) used in the project.

(10) Tape materials used in the project.

(11) Roofing and siding, nonmetallic.

(12) Felt materials and cushion materials.

(13) Pre-mixed mortars, grouts, leveling compounds, fillers, and other cementitious materials.

(14) Caulking and sealing materials.

d. All submittals shall be accompanied by a certification from the manufacturer of the material or product that the material or product is asbestos-free; or shall set forth, in specific detail, the amount of asbestos present in the material or product. Documentary evidence of laboratory analysis of the material or product for asbestos content, conducted by a qualified independent testing laboratory, shall be included with the submittal.

1.7.2 Lead Prohibition and Certification

a. Paint or product coating containing more than 0.009 percent) by total weight of lead shall not be used in this project. The Contracting Officer, at any time prior to acceptance of the work, or during the period designated for warranty of the work, if any, may reject materials and products that contain lead in excess of 0.009 percent by weight, and direct the removal of such materials and products from the job site, at the sole expense of the Contractor, and without additional time granted for performance of the work. After completion of this Contract, if lead (exceeding 0.009 percent by weight) is discovered in the products or materials (excluding items permitted by the exception) installed by the Contractor, the Government reserves the right to direct the Contractor to perform lead

abatement and restoration work, as required, at the Contractor's sole cost. Lead abatement work (removal and disposal of lead-containing materials and products) shall be accomplished in accordance with currently applicable Government standards for such work.

Exception: Where suitable lead-free substitutes do not exist for a paint or product coating, the Contractor may use a material or product containing lead in the excess of 0.009 percent by weight, with prior written approval of the Contracting Officer. Submit a written request for substitution, accompanied by a certification from the manufacturer of the material or product that shall set forth, in specific detail, the amount of lead present in the material or product. When available, laboratory analysis of the material or product for lead content shall be included with the submittal.

b. The Government may conduct lead testing on suspected lead-containing materials and products excluding items permitted by the "exception", and such testing shall be conducted at the expense of the Government. However, wherever destructive testing is required, or a material or product must be utilized by the Government for testing, the Contractor shall, at its own expense, repair or replace the material or product, or the item of work that has been disturbed by testing, if the results confirm presence of lead exceeding 0.009 percent by weight. In the event test results indicate 0.009 percent or less lead content or complete absence of lead, the Contractor shall restore the test site to its original condition and the cost of restoration work, as approved by the Contracting Officer, shall be borne by the Government.

c. As a minimum, furnish manufacturer's certification for the items listed below, excluding items permitted by the "exception", certifying that the items are lead-free and do not contain lead in excess of 0.009 percent by weight, as applicable. However, when presence of lead is suspected in other products and materials used in this project, the Contractor shall be required to provide such certification for those additional items when so directed by the Contracting Officer. Lead certification shall be required for the items applicable to this project only.

1. Paints and Coatings

2. Any product or material with a factory applied coating

1.7.3 Class I and Class II Ozone Depleting Chemicals (ODC) or Substances (ODS)

Class I and II Ozone Depleting Substances listed in the JEGS are prohibited from being used. Contactor must provide certifications that materials utilized do not contain Class I and Class II ODC/ODS.

1.7.4 Polychlorinated Biphenyls (PCB)

Materials (ballasts, capacitors, transformers, dielectric fluid, switches, etc.) that contain PCBs are prohibited. Contractor must provide certifications that materials utilized do not contain PCBs, in accordance with the JEGS.

1.7.5 Hazardous Material Survey

[The Contractor shall review the [title of survey] by [Company that performed Survey] dated [date of survey], attached at the end of this section, to familiarize themselves with the materials that have been sampled and tested for this project. The Contractor shall utilize the information contained within the report to develop their work and compliance plans with regards to Hazardous Materials. During construction, should potentially hazardous material be discovered, which has not been previously tested, the Contractor shall take action to assure that the untested material is not disturbed and contact the Contracting Officer.]

[No existing Hazardous Material Survey for the material to be disturbed under this project, exists. The Contractor shall assume that all potential ACM is ACM and all paints and coatings contain lead. A Hazardous Material Survey is not required for this project.][The Contractor shall perform a Hazardous Material Survey prior to initiating any action that could disturb suspect Hazardous Materials as required by this contract.][A Hazardous Material Survey is not required for this project.] [The Contractor shall notify the Contracting Officer upon finding any material that will be disturbed under this contract and is suspected to contain Hazardous Materials. The Contracting Officer will handle the identified materials under, Unexpected Discovery of Hazardous Materials.]

1.8 QUALITY ASSURANCE

1.8.1 Preconstruction Survey and Protection of Features

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, perform a Preconstruction Survey of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record. Include in the report a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. The Contractor and the Contracting Officer will sign this survey report upon mutual agreement regarding its accuracy and completeness. Protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference that their preservation may cause to the work under the Contract.

1.8.2 Regulatory Notifications

Provide regulatory notification requirements in accordance with GOJ national and prefectural laws and regulations and installation requirements. Submit copies of regulatory notifications to the Contracting Officer at least [_____] days prior to commencement of work activities.

1.8.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of hazardous materials that will be brought onto the installation; and types

and quantities of wastes/wastewater that may be generated during the Contract. Discuss the results of the Preconstruction Survey at this time.

Prior to initiating any work on site, meet with the Contracting Officer and installation Environmental Office to discuss the proposed Environmental Protection Plan (EPP). Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural and cultural resources, required reports, required permits, permit requirements (such as mitigation measures), and other measures to be taken.

Permits, licenses, or other forms of official approvals are not required by DoD activities and installations. Permits, licenses, or other forms of official approvals may, however, be required under GOJ law for certain contracted activities. When required, all such permits, licenses and other forms of official approval shall be obtained by the Contractor from the appropriate GOJ authorities. DoD Components shall assist Contractors when they are applying for a required permit, license or other form of official approval by providing necessary information only. Submit copies of all Licenses/Permits/Notifications obtained.

[1.8.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager is directly responsible for coordinating Contractor compliance with the JEGS, Federal, GOJ national and prefectural laws and regulations, and installation requirements. The Environmental Manager must ensure adherence to the EPP; ensure all appropriate documents are submitted to 374 CES/CEIE; appoint an emergency response manager for environmental emergencies; train personnel in accordance with the requirements of the EPP; ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the EPP; ensure environmental permits are obtained, maintained, and closed out; ensure compliance with Stormwater Program requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral position; however, the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure Contractor personnel are trained in JEGS requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder and required documentation, including environmental permits compliance and close-out. Submit Environmental Manager Qualifications to the Contracting Officer to indicate the training and past experience which meets the requirements of this position as described in this section.

]1.8.5 Employee Training Records

Prepare and maintain Employee Training Records throughout the term of the Contract meeting applicable JEGS requirements. Provide Employee Training Records in the Environmental Records Binder. Ensure every employee completes a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures compliance with the JEGS and all applicable Federal, GOJ national or prefectural laws or regulations and installation requirements. Submit these Assembled Employee Training Records in the Environmental Records Binder to the

Contracting Officer at the conclusion of the project, unless otherwise directed.

Train personnel to meet the JEGS and all applicable Federal, GOJ national or prefectural laws or regulations, and Installation requirements. Conduct environmental protection/pollution control meetings for personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and avoiding pollution; familiarization with statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, waters of Japan, and endangered species and their habitat that are known to be in the area.

1.8.6 Non-Compliance Notifications

The Contracting Officer shall notify the Contractor in writing of any observed noncompliance with the JEGS, applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements, and other elements of the Contractor's EPP. After receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions will be granted or equitable adjustments allowed for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the Contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

1.9 ENVIRONMENTAL PROTECTION PLAN

The purpose of the EPP is to present an overview of known or potential environmental issues that must be considered and addressed during construction. The EPP consists of [14][15] chapters and requires an entry for each chapter. Incorporate construction related objectives and targets from the installation's EMS into the EPP. Include in the EPP measures for protecting natural and cultural resources, required reports, and other measures to be taken. Meet with the Contracting Officer or Contracting Officer Representative to discuss the EPP and develop a mutual understanding relative to the details for environmental protection including measures for protecting natural resources, required reports, and other measures to be taken. Submit the EPP within 15 days after Contract award and not less than 10 days before the preconstruction meeting. Commencement of work will not begin until the Environmental Protection Plan has been approved.

Revise the EPP throughout the project to include any reporting requirements, changes in site conditions, or Contract modifications that change the project scope of work in a way that could have an environmental impact. No requirement in this section will relieve the Contractor of any JEGS, and applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements. During Construction, identify, implement, and submit for approval any additional requirements to be included in the EPP. Provide an electronic copy of the EPP to 35 CES/CEIE via the Contracting Officer. Maintain the current version of the EPP onsite.

1.9.1 Submission Guidance

The EPP is a required submittal for all projects, and shall be submitted a minimum of 14 days prior to the scheduled start of construction activities or delivery of materials to the site. Work impacted by the contents of the EPP cannot start prior to approval of the EPP. Maintain a copy of the approved EPP on-site at all times.

If disapproved, the Contractor shall revise and resubmit the EPP to properly address reviewer comments. Delays resulting from disapproval are the responsibility of the Contractor.

1.9.2 EPP Drafting Instructions

Address the topic of each chapter at a level of detail commensurate with the environmental issue and the scope of work. The EPP shall explain how the Contractor will meet the requirements in each chapter.[Chapters that are not applicable to this project shall be replaced with a statement indicating as such.][Chapters that are not applicable to this project shall be replaced with the following:

"This chapter does not apply to the Contract because" followed by a brief explanation on why it does not apply.

The EPP shall not be merely a reiteration of the requirements or the text of instructions in this section, except for the "Not Applicable" chapters. The EPP shall explain how the Contractor will meet the requirements in each chapter.

Any site-specific environmental issues identified as necessary by the Government shall be addressed in the EPP even if this supplement does not specifically mention such a situation as a requirement.]

1.9.3 Emergency Review Request

The Contracting Officer may request the Environmental Representative to review an EPP in emergencies or rapidly deteriorating situations. Late submission does not justify a priority review. All other reviews shall be conducted on a first-come, first-served basis. The Contractor bears full responsibilities for any delays resulting from late approval of the EPP.

1.9.4 Work Clearance Request

AF IMT 103: Base Civil Engineering Work Clearance Request, commonly referred to as the "Dig Permit", cannot be signed and approved until the EPP has been submitted, reviewed, and approved by the Environmental Representative.

1.9.5 EPP General Overview and Purpose

1.9.5.1 Descriptions

A brief description of each specific plan required by environmental permit or elsewhere in this Contract such as stormwater pollution prevention plan, spill control plan, solid waste management plan, wastewater management plan, air pollution control plan, contaminant prevention plan, a historical, archaeological, cultural resources, biological resources and wetlands plan, traffic control plan, Hazardous, Toxic and Radioactive

Waste (HTRW) Plan, Non-Hazardous Solid Waste Disposal Plan, and borrowing material plan.

Include a list of applicable Federal, GOJ, JEGS, prefectural laws, regulations, and permits concerning environmental protection, pollution control, and abatement that are applicable to the Contractor's proposed operations and requirements imposed by those laws, regulations, and permits. Whenever there is conflict between Federal, GOJ, JEGS, or prefectural laws, regulations, and permit requirements, the strictest applicable rule applies.

1.9.5.2 Duties

The duties and level of authority assigned to the person(s) on the job site who oversee environmental compliance, such as who is responsible for adherence to the EPP, who is responsible for spill cleanup and training personnel on spill response procedures, who is responsible for manifesting hazardous waste to be removed from the site (if applicable), and who is responsible for training the Contractor's environmental protection personnel.

Provide the name, telephone number, and address of a Primary and Alternate Environmental Representative.

1.9.5.3 Procedures

A copy of any standard or project-specific operating procedures that will be used to effectively manage and protect the environment on the project site.

Provide schedule of digging or trenching actions to include date/time, location, purpose, method and depth.

1.9.5.4 Communications

Communication and training procedures that will be used to convey environmental management requirements to Contractor employees and subcontractors.

1.9.5.5 Contact Information

Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

1.9.6 General Site Information

1.9.6.1 Drawings

Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, jurisdictional wetlands, material storage areas, structures, sanitary facilities, storm drains and conveyances, and stockpiles of excess soil.

Drawings showing locations of any proposed temporary facilities, hazardous materials storage, hazardous and solid waste collection points, excavations, embankments, existing utility lines to include storm drains included in the EPP.

1.9.6.2 Work Area

Work area plan showing the proposed activity in each portion of the area and identify the areas of limited use or nonuse. Include measures for marking the limits of use areas, including methods for protection of features to be preserved within authorized work areas and methods to control runoff and to contain materials on site, and a traffic control plan.

1.9.6.3 Documentation

A letter signed by an officer of the firm appointing the Environmental Manager and stating that person is responsible for managing and implementing the Environmental Program as described in this contract. Include in this letter the Environmental Manager's authority to direct the removal and replacement of non-conforming work.

1.9.6.4 Regulatory Notification and Permits

List the required notifications and permit applications. Some permits require up to 180 days to obtain. Demonstrate that permits have been obtained or applied for by including hard copies. The EPP shall not be approved until the permits have been obtained.

1.9.7 CHAPTER 1: ENVIRONMENTAL REQUIREMENTS AND TRAINING

1.9.7.1 Work Scope Summary

The first page of Chapter 1 shall be a single-page summary that defines all of the work processes and the general sequence of execution. Describe the tasks sufficiently for EPP reviewers to determine the potential environmental impact of the work, the level of risk, and whether additional site-specific plans must be submitted. The EPP may be disapproved if the summary details are insufficient.

1.9.7.2 Criteria Summary

Provide and maintain environmental protective measures to control pollution that develops during normal construction practice during the life of the Contract.

1.9.7.3 Applicable Regulations

Comply with all laws and regulations referenced in the drawings and specifications, as well as applicable GOJ and prefectural laws or regulations, referenced or not.

1.9.7.4 EPP Mandatory Items

Include the following items in the EPP:

a. Environmental Manager Appointment Letter: Include a letter signed by an officer of the firm designating a Primary and an Alternate Environmental Manager with telephone number (office phone number, cell phone number), e-mail address, and mailing address and stating that this person is responsible for managing and implementing the Environmental Program as described in this Contract. Include in this letter the Environmental Manager's authority to direct the removal and replacement of non-conforming work. The Environmental Manager shall

be responsible for providing all project Environmental submittals and for coordinating with the Contracting Officer on any environmental issues encountered during work.

b. Employee Training Letter: The Environmental Manager shall implement a training program to ensure that all Contractor personnel are trained in environmental protection requirements. Include a letter that lists employee's names, types of environmental training completed, and dates of completion.

c. Employee Training Roster: Provide a roster of individuals involved with the project who have completed the required EMS training.

d. Include in this section the requirements outlined in paragraphs 1.9.6.1 - Drawings and 1.9.6.2 - Work Area.

1.9.8 CHAPTER 2: AIR EMISSIONS AND OZONE DEPLETING SUBSTANCES (ODS)

1.9.8.1 Criteria Summary

ODSs, including Hydrofluorocarbons (HFC) and perfluorocarbons (PFC) from refrigeration and fire suppression equipment, are categorized into two specific classes. See the JEGS for proper classifications.

1.9.8.2 EPP Mandatory Items

Insert the following text in Chapter 2 of the EPP:

"CHAPTER 2: AIR EMISSIONS & ODSs

1. No ODS containing items will be serviced, removed or installed during this project.

2. In the event ODS items become unexpectedly involved, the Contractor shall not disturb the item, and immediately notify the Contracting Officer's Representative, who will make a determination on how to proceed."

If this project involves the servicing, relocation, removal, or installation of any ODS containing items, contractor shall provide, in the EPP, an explanation of how requirements of paragraph 3.5 will be achieved/maintained.

Include the following items in the EPP as applicable:

a. Haul Route: Submit truck and material haul routes along with a Dirt and Dust Control Plan in the EPP for controlling dirt, debris, and dust on Installation roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

b. Pollution Generating Equipment: Identify air pollution generating equipment or processes that may require compliance with the JEGS or GOJ national or prefectural laws-regulations. Determine requirements based on any current JEGS and installation requirements and the impacts of the project. Provide a list of all fixed or mobile equipment, machinery or operations that could generate air emissions during the project to the Installation Environmental Office (Air Program Manager).

c. Stationary Internal Combustion Engines: Identify portable and stationary internal combustion engines that will be supplied, used or serviced. Comply with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements. At minimum, include the make, model, serial number, manufacture date, size (engine brake horsepower), and EPA emission certification status of each engine. Maintain applicable records and log hours of operation and fuel use. Logs must include reasons for operation and delineate between emergency and non-emergency operation.

d. Refrigerants: Identify management practices to ensure that heating, ventilation, and air conditioning (HVAC) work involving refrigerants complies with the JEGS and installation requirements. Technicians shall be trained in proper recovery/recycling procedures, leak detection, safety, shipping, and disposal in accordance with recognized industry standards or Japanese equivalent. Any refrigerant reclaimed is the property of the Government; coordinate with the Installation Environmental Office to determine the appropriate turn in location.

e. Training/Certification Requirements: Heating and air conditioning technicians must be trained to meet requirements in the JEGS. Maintain copies of certifications at the employees' places of business; technicians must carry certification wallet cards, as provided by GOJ national or prefectural laws and regulations. Submit training certificates as part of the EPP.

f. Air Pollution-Engineering Processes: Identify planned air pollution-generating processes and management control measures (including, but not limited to, spray painting, abrasive blasting, demolition, material handling, fugitive dust, and fugitive emissions). Log hours of operations and track quantities of materials used.

g. Compliance Materials: Provide the Government a list of and SDSs for all hazardous materials proposed for use on site. Materials must be compliant with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements for emissions including solvent and volatile organic compound contents, and applicable National Emission Standards for Hazardous Air Pollutants requirements. The Government may alter or limit use of specific materials as needed to meet installation permit requirements for emissions.

1.9.8.3 Other Required Submittals

For Contracts servicing, removing, or replacing ODS-containing items, such as refrigeration or fire suppression equipment, follow the guidance for submittals in accordance with the specifications under which the work is being performed (HVAC, Fire Suppression, etc.).

1.9.9 CHAPTER 3: WATER RESOURCES

1.9.9.1 EPP Mandatory Items

Include the following items in the EPP as applicable:

a. Site-Specific Storm Water Pollution Prevention Plan (SWPPP): For any

Contract where work may possibly lead to disruption of the stormwater flow, the Contractor shall develop and submit a project-specific SWPPP as a mandatory part of Chapter 3 of the EPP.

The SWPPP must include effective selection, implementation and maintenance of Best Management Practices (BMPs) as indicated in the JEGS, and include methods and drawings as necessary to prevent storm water pollution as specified in the Storm Water Pollution Prevention Measures section in Part 3. The SWPPP shall also address erosion and sediment control measures and stormwater management and control including, but not limited to ground cover, erodible soils, temporary measures - structural practices, temporary and permanent stabilization. The SWPPP must meet the requirements of the JEGS and the Installation's SWPPP.

If applicable, submit a project-specific Stormwater Pollution Prevention Plan (SWPPP) to the Contracting Officer for approval, prior to the commencement of work. The Contractor shall maintain an approved copy of the SWPPP at the construction on-site office, and continually update as regulations require, to reflect current site conditions. The Contractor may be required to install, inspect, maintain best management practices (BMPs), and submit storm water BMPs inspection reports and storm water pollution prevention plan inspection reports.

The SWPPP must meet the requirements of the JEGS and the Installation's SWPPP.

Include the following:

a. Identify potential sources of pollution which may be reasonably expected to affect the quality of storm water discharge from the site.

b. Comply with terms of the Installation SWPPP for stormwater discharges from construction activities. Prepare SWPPP in accordance with the JEGS and installation requirements.

c. Select applicable BMPs from the JEGS and/or the Installation SWPPP. Applicable Best Management Practices in the JEGS shall be incorporated into the site-specific SWPPP and implemented.

d. The SWPPP shall also address erosion and sediment control measures and stormwater management and control including, but not limited to ground cover, erodible soils, temporary measures - structural practices, temporary and permanent stabilization.

b. Wastewater Management Plan (WWMP): For any Contract that may generate wastewater, the Contractor shall submit a WWMP.

(1) The WWMP must identify the methods and procedures for management and/or discharge of wastewater which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

(2) If a settling/retention pond is required, the WWMP must include the design of the pond, including drawings, removal plan, and testing requirements for possible pollutants. If disposal is to a sanitary sewer, the WWMP must include documentation that the Waste

Water Treatment Plant Operator has approved the flow rate, volume, and type of discharge.

(3) Contractor is not authorized sewage holding tanks on base and is not authorized to dispose of waste from chemical toilets/porta-potties via the installation sewer system.

(4) When using chemical toilets, plan for procuring a porta-potty/chemical toilet service Contract. The porta-potty/chemical toilet service Contract must include the correct maintenance, waste collection, transportation, and disposal of all porta-potty/chemical toilets and content and include provisions for pest control and elimination of odors.

(5) If the project generates wastewater from rinsing tanks, dewatering sites, etc., the Contractor shall ensure proper disposal[.][with CEIE approval. The Contractor may be required to provide further analysis and treatment based on the condition of wastewater.]

1.9.10 CHAPTER 4: HAZARDOUS MATERIALS

1.9.10.1 Criteria Summary

Hazardous Material Inventory, Material Safety Data Sheets, and Safety Data Sheets: Submit documentation and receive approval prior to bringing any hazardous materials (HAZMAT) onto the installation. Consult with the Hazardous Materials Program Manager [718 CES/CEIE at DSN 634-2600][374 CES/CEIE at DSN: 225-5440][INSERT ORGANIZATION AND PHONE NUMBER] for a determination of whether or not a product is a HAZMAT.

1.9.10.2 EPP Mandatory Items

If the project does not involve any HAZMAT, insert the following text into Chapter 4 of the EPP:

"CHAPTER 4: HAZARDOUS MATERIALS

1. No hazardous materials will be brought to the worksite during this project."

For all Contracts where HAZMAT will be brought to the worksite, submit the following documents in Chapter 4 of the EPP:

a. Hazardous Material Inventory: A table listing all hazardous materials brought onto the base, including the estimated amounts of each material that will be used. List shall include all pesticides and herbicides that will be brought onto the Installation.

b. Hazmat SDS (in English and Japanese): An SDS sheet for each hazardous material on the inventory.

c. AF Form 3000.

d. If HAZMAT is suspected to contain lead or asbestos, such as paint, primer, caulking, a certificate from the manufacturer shall be provided to prove that the HAZMAT is free of asbestos/lead.

The AF Form 3000 package must be reviewed by Bioenvironmental (374 AMDS/SGPB), Safety (374 AW/SE) and Environmental (374 CES/CEIE) via

the Contracting Officer.

1.9.10.3 Other Required Submittals

If after beginning work, the Contractor discovers previously undisclosed, unexpected, or suspected HAZMAT, substances, chemicals, or contaminated areas, the Contractor shall immediately report the discovery to the Contracting Officer and to [718 CES/CEIE (DSN 634-2600)][374 CES/CEIE (DSN: 225-5440)][INSERT ORGANIZATION AND PHONE NUMBER]. Contractor personnel shall immediately cease work in the area, unless the work is of an emergency nature and the risk of exposure can be mitigated by the use of personal protective equipment (PPE) or clothing. Submit, in writing, a Notification of Unexpected Hazardous Material Discovery to the Contracting Officer outlining the events leading to the discovery.

1.9.11 CHAPTER 5: HAZARDOUS WASTE

1.9.11.1 EPP Mandatory Items

If the project does not involve any Hazardous waste, insert the following text in Chapter 5 of the EPP:

"CHAPTER 5: HAZARDOUS WASTE

1. No hazardous wastes will be generated during this project.

2. In the event hazardous waste is unexpectedly discovered, the Contractor shall not disturb the item, and immediately notify the Contracting Officer's Representative, who will make a determination on how to proceed."

For all Contracts where Hazardous Waste will be generated, submit the following information and documents in Chapter 5 of the EPP:

a. Hazardous Waste Manager Letter: A letter designating the hazardous waste manager. The letter shall include:

(1) Manager's name.

(2) Training and experience.

(3) Contact information.

b. Management Procedures for Hazardous Waste to be Generated: The elements of those procedures will coincide with the Installation Hazardous Waste Management Plan (HWMP). The Contracting Officer will provide a copy of the Installation Hazardous Waste Management Plan. As a minimum, include the following:

(1) List of the types of hazardous wastes expected to be generated.

(2) Procedures to ensure a written waste determination is made for appropriate wastes that are to be generated.

(3) Sampling/analysis plan, including laboratory method(s) that will be used for waste determinations and copies of relevant laboratory certifications. Follow the analytical procedure and methods in accordance with the JEGS and all applicable GOJ national or prefectural laws and regulations. Identify hazardous waste by

analyzing for the following characteristics: ignitability, corrosivity, reactivity, and toxicity based on TCLP results. Provide analytical results and reports performed to the Contracting Officer. Sample waste in accordance with appropriate Japanese or U.S. EPA testing protocols that meet the purpose of the testing. Clearly mark each sampled drum or container with the Contractor's identification number, and cross reference to the chemical analysis performed.

(4) Methods and proposed locations for hazardous waste accumulation/storage (that is, in tanks or containers).

(5) Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted).

(6) Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions, applicable Federal, GOJ and prefectural laws and regulations, JEGS, and Installation Hazardous Waste Management Plan.

(7) Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and similar.

(8) Used oil management procedures in accordance with the JEGS; Hazardous waste minimization procedures. Obtain a copy of the installation's Pollution Prevention/Hazardous Waste Minimization Plan for reference material when preparing this part of the EPP. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the anticipated types of the hazardous materials to be used in the construction when requesting information.

(9) Plans for the disposal of hazardous waste by permitted facilities; and procedures to be employed to ensure required employee training records are maintained.

(10)Procedures to be employed to ensure required employee training records are maintained.

(11) Hazardous Waste Disposal local permits or licenses for hazardous waste disposal in accordance with the JEGS (if required).

(12) Hazardous Waste Disposal Statement of Agreement. From a treatment, storage, or disposal (TSD) facility that will accept the waste from the contractor and also a statement from a certified hazardous waste transporter who will transport the waste to the TSD facility in accordance with the JEGS (if required).

1.9.11.2 Other Required Submittals

a. Hazardous Waste Analysis Report: For any materials that were sampled and analyzed for hazardous waste content, submit a Hazardous Waste Analysis Report containing:

(1) Who the sample was taken by.

(2) What type of sample was taken (soil, water, chemical, etc.).

(3) Where the sample was taken (building number, room number, etc.).

(4) The sampling time and date.

(5) An explanation of why the material was sampled (disposal determination, final clearance, etc.).

(6) Photographs of the sampled location or material (if required to positively identify the exact location or material later).

(7) The laboratory's certified analysis results letter.

1.9.12 CHAPTER 6: SOLID WASTE

1.9.12.1 EPP Mandatory Items

Solid Waste Management Plan: To ensure the Contractor understands the solid waste reduction requirements, the Contractor is required to submit a Solid Waste Management Plan SWMP, as part of the EPP. The Solid Waste Management Plan shall be consistent with the Installation Integrated Solid Waste Management Plan (ISWMP).

The SWMP has four (4) sections: Diversion, Procedures, Training, and Permits.

Provide the Contracting Officer with written notification of the quantity of anticipated solid waste or debris that is anticipated or estimated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance from the receiving location or as applicable; submit one copy of the receiving location state and local Solid Waste Management Permit or Solid Waste Management License showing such agency's approval of the disposal plan before transporting wastes off Government property.

a. SWMP: Diversion Section

Provide the dates for the start and end of work, the types of wastes expected to be generated by the project, estimated weights for each type of waste, and the facility or facilities where each waste will be taken. Also include a list of which wastes will be salvaged, reused, and recycled, estimated weights for each recyclable commodity, and the facility or facilities where each recyclable will be taken.

To the extent practicable, all scrap metal must be sent for reuse or recycling and will not be disposed of in a landfill. Include the name, physical address, and telephone number of the hauler, if transported by a franchised solid waste hauler. Include the destination and, unless exempted, provide a copy of the state or local permit (cover) or license for recycling.

b. SWMP: Procedures Section: Describe the planned Separation, Contamination Prevention, and Transportation procedures.

(1) Outline how recyclables will be separated from other wastes, how wastes will be collected, and where they will be stored at the project site until transported to recycling facilities. The Separation Procedures shall also detail how other wastes will be collected and where they will be stored at the project site until

transported to disposal facilities. Containers for recyclables and other wastes must meet the requirements in the JEGS that storage of recyclables and other wastes must meet the JEGS and that storage of bulky wastes must meet the JEGS.

(2) Contamination Prevention Procedures shall explain how recyclables will be kept free from contaminants (hazardous, toxic, or other wastes) and how other non-recyclable wastes will be kept free of contaminants (recyclables and hazardous or toxic wastes).

(3) Transportation Procedures shall outline how spills of recyclables or other wastes will be prevented during collection, storage, loading, and transportation. They also detail how the recyclables and other wastes will be transported from the project site to the recycling or disposal facility. These procedures also must state how often recyclables and other wastes will be picked up by the transportation company.

c. SWMP: Training Section

Set forth how employees and subcontractors will be trained on solid waste management policies and procedures. Include how training will be documented and who will conduct the training. Also outline any consequences or repercussions for employees or subcontractors that fail to follow the policies and procedures.

d. SWMP: Permits Section

Include copies of all permits, licenses, and agreements for the recycling and disposal facilities and for the transportation companies utilized during the project. Include English translations for all documents in this section.

1.9.12.2 Other Required Submittals

a. Solid Waste Management Report: During project execution, the Contractor shall submit weight tickets or manifests, receipts, bills of sale, and other sales documentation (with English translations) for all materials removed from the project site. Weight tickets and manifests receipts, bills of sale, and other sales documentation shall be submitted during the project every month by the 5th day of the following month, (include this statement as part of the SWMP). Designate on each document whether the material was disposed of, recycled, or reused, and state the amounts, locations, and names of the businesses receiving the solid waste.

In lieu of sales documentation, a statement indicating the disposal location for the solid waste that is signed by an employee authorized to legally obligate or bind the firm may be submitted. Also include any additional or renewal permits, licenses, or agreements, with recycling or disposal landfills. In addition, a copy of Contract(s) for waste collection/transportation and disposal permits issued from metropolitan/prefectural governments shall be submitted with AF Form 3000 to 374 CES/CEIE via the Contracting Officer. After the disposal, waste manifests shall be submitted to 374 CES/CEIE via the Contracting Officer along with recycling report that shows the amount of waste recycled, incinerated/landfilled (Attachment 1).

1.9.13 CHAPTER 7: FUEL STORAGE TANKS

1.9.13.1 EPP Mandatory Item

If the project does not involve the removal or installation of any POL TANKS, insert the following text in Chapter 7 of the EPP:

"CHAPTER 7: FUEL STORAGE TANKS

No ASTs or USTs will be removed or installed during this project."

Describe in the EPP how POL tanks and containers must be stored, managed, and inspected and what protections must be provided. POL tank work cannot be performed using this section alone. All UST tank removals shall be performed in accordance with SECTION 02 65 00. Tank installations shall be performed in accordance with SECTION 33 56 10, AFI 23-204, and 35FW AST STANDARDS documents. Contact MAB Environmental Section at to obtain copies of the requirements.

1.9.13.2 Other Required Submittals

Fuel Storage Tank Removal/Installation Report: If an AST/UST (to include temporary fuel storage tanks) is installed or removed as part of the project, the Contractor shall prepare a [Fuel Storage Tank Installation/Removal Report][Fuel Storage Tank Installation/Removal Report] and submit it to [718 CES/CEIE][374 CES/CEIE][INSERT ORGANIZATION] via the COR within 30 days of the completion of site work. At a minimum, the report shall include the following as applicable:

a. Summary of work conducted.

b. Installation/Removal date for each installed/removed storage tank.

c. Date placed in service, capacity, manufacturer name, model number, and serial number for each new AST/UST.

d. As-built drawings showing the removed AST/USTs and/or the newly installed AST/USTs and associated infrastructure.

e. Copy of the Manufacturer's Operations and Maintenance Manuals and product information.

f. Copy of the Manufacturer's Warranty Cards.

g. Photo documentation of construction activities, including AST/UST removals and/or new AST/UST installations. Photos shall show the initial and completed site condition, each exposed UST, each tank's condition upon removal, the completed UST excavation(s) to show any contamination, and the contaminated soil pile, if any.

h. If a tank was removed, include a photograph of the old tank with a hole cut into the side as described in paragraph UST REMOVAL. Provide a location map and tank ID (when available).

i. Leak check report for buried piping associated with storage tank at time of installation, modification, construction, relocation or replacement.

1.9.14 CHAPTER 8: HISTORICAL, CULTURAL, AND NATURAL RESOURCES

1.9.14.1 EPP Mandatory Items

a. Description of measures to manage and mitigate damage to natural resources including, but not limited to land resources, tree protection, replacement of damaged landscape features, temporary construction, stream crossings, fish and wildlife resources, and wetlands areas.

b. Objectives and methods to protect identified historical and archeological resources.

1.9.14.2 Other Required Submittals

Notification Of Discovery Or Historical Or Cultural Items: The Contractor shall immediately report the discovery of any historical and/or archaeological items or human remains in the course of work to the Contracting Officer and the [Kadena Air Base][Yokota Air Base][Misawa Air Base] [INSERT INSTALLATION NAME] Environmental Office at DSN [634-2600][225-5440][INSERT CONTACT PHONE NUMBER].

Resources covered by this paragraph include, but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities.

Stop work immediately in the area of the discovery until the Environmental Office evaluates the site. The Contracting Officer will provide direction on how to proceed. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources. The Government retains ownership and control over archaeological resources.

The Contractor shall be responsible for completing and submitting official paperwork on the discovery. The Environmental Office's Cultural Resources Manager will advise the Contractor concerning the content of the report.

1.9.15 CHAPTER 9: POLYCHLORINATED BIPHENYLS (PCB)

1.9.15.1 EPP Mandatory Items

If the project does not involve the disturbance, relocation, removal, or installation of any item that historically contained PCBs, insert the following text in Chapter 9 of the EPP:

"CHAPTER 9: POLYCHLORINATED BIPHENYLS (PCB)

1. Items historically containing PCBs will not be disturbed, removed, or installed during this project.

2. In the event of unexpected discovery of suspected PCB items, the Contractor shall not disturb the material, and immediately notify the Contracting Officer's Representative, who will make a determination on how to proceed."[Information on the PCB equipment that will be removed, including, but not limited to:

(a) Equipment type.

(b) Month/year of manufacture.

(c) Date removed from service.

(d) Building number, circuit number or set number.

(e) Base from which item was removed.

Items (c) - (e) shall also be written on the equipment chassis in permanent ink.]

Provide a list of any equipment which is known, or has potential to contain (contains dielectric fluid) PCBs removed under this project. List shall include equipment serial numbers and map indicating location of equipment. When listing light ballasts provide the quantity to be removed.

If the project involves the removal of an oil-filled transformer or switchgear manufactured prior to 1980, perform the work in accordance with the specification and supplement that applies to the work, such as: (Section 26 12 21 SINGLE-PHASE PAD-MOUNTED TRANSFORMERS, etc.) In Chapter 9 of the EPP, enter the following:

["CHAPTER 9: POLYCHLORINATED BIPHENYLS (PCB)

A separate PCB equipment removal plan will be submitted in accordance with [SECTION 26 XX XX.00] and the local supplement."

If the project involves the removal of an oil-filled transformer or switchgear that was manufactured after 1980, perform the work in accordance with the specification and supplement that applies to the work, such as: (Section 26 12 21 SINGLE-PHASE PAD-MOUNTED TRANSFORMERS, etc.)

In Chapter 9 of the EPP, enter the following:

a. (A transformer) (and) (or) (Switchgear) manufactured (insert month/year of manufacture) will be removed in accordance with (insert spec section) and placed at Bldg 1465 for storage.

(1) Insert the item's month/year of manufacture in the spaces above.

(2) Write the specification used to perform the work in the spec spaces.

b. The Contractor shall write the following information on the chassis with permanent ink.

(1) "Date removed from service".

(2) "Building number", "circuit-number", or "set-number".

(3) "Base" where item was removed."]

1.9.16 CHAPTER 10: PESTICIDES

1.9.16.1 EPP Mandatory Items

If the project does not involve the supplication of pesticides insert the following text in Chapter 10 of the EPP:

"CHAPTER 10: PESTICIDES

No pesticides will be stored or applied as part of this project."

Pesticide Treatment Plan: Include and update a pesticide treatment plan, as information becomes available. Include in the plan the sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers if applicable, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (that is, pounds of active ingredient applied), equipment used for application, and calibration of equipment. Comply with the JEGS or any applicable Federal GOJ national or prefectural and installation requirements.

1.9.17 CHAPTER 11: ASBESTOS CONTAINING MATERIALS (ACM)

1.9.17.1 EPP Mandatory Items

If the project does not involve the disturbance, removal, installation, or relocation of any ACM, insert the following text in Chapter 10 of the EPP:

"CHAPTER 11: ASBESTOS-CONTAINING MATERIALS (ACM)

1. All new materials installed on this project contain less than one-tenth of one percent (0.1 percent) asbestos, by weight.

2. Suspected ACM will not be disturbed, removed, or relocated during this project.

3. In the event of unexpected discovery of suspected ACM, the Contractor shall not disturb the material, and immediately notify the Contracting Officer's Representative, who will make a determination on how to proceed."

Indicate whether the project involves sampling, disturbance, and/or abatement of any ACM. [Refer to section [] for asbestos management and disposal requirements.]

[Insert the following text in Chapter 11 of the EPP:

"CHAPTER 11: ASBESTOS-CONTAINING MATERIALS (ACM)

1. An Asbestos [Sampling and Analysis Report][Hazard Abatement and Disposal Plan] will be submitted separately in accordance with the ACM specifications and supplements. The Contractor understands that the plan must be approved prior to beginning site work."]

1.9.17.2 Other Mandatory Requirements

If ACM is unexpectedly discovered at the worksite, submit an Unexpected Discovery of Asbestos Report to the Contracting Officer, briefly explaining the location of discovery, the time and date.

Consult with the Environmental Representative in advance of drafting the EPP if asbestos applicability is uncertain.

1.9.18 CHAPTER 12: LEAD-BASED PAINT (LBP)

1.9.18.1 EPP Mandatory Items

If the project does not involve the disturbance, removal, or application of paint, insert the following text in Chapter 11 of the EPP:

"CHAPTER 12: LEAD-BASED PAINT (LBP)

1. All paint and coatings applied during this project contain less than 0.009 percent lead, by weight.

2. LBP will not be disturbed or removed during this project.

3. In the event of unexpected discovery of suspected LBP, the Contractor shall not disturb the material, and immediately notify the Contracting Officer's Representative, who will make a determination on how to proceed."

Indicate whether the project involves sampling, disturbance, removal, and/or abatement of lead-containing and/or LBP. [Refer to section [] for lead paint management and disposal requirements].

If the project does involve the disturbance, removal, or abatement of LBP, insert the following text in Chapter 11 of the EPP:

"CHAPTER 12: LEAD-BASED PAINT (LBP)

1. A Lead-Based Paint Abatement and Disposal Plan will be submitted separately in accordance with the LBP specifications and supplements. The Contractor understands that the plan must be approved prior to beginning the site work."

Consult with the Environmental Representative in advance of drafting the EPP if lead applicability is uncertain.

1.9.19 CHAPTER 13: SPILL PREVENTION AND RESPONSE

1.9.19.1 EPP Mandatory Items

If the project does not store POL or hazardous materials on-site, insert the following text in Chapter 12 of the EPP:

"CHAPTER 13: SPILL PREVENTION AND RESPONSE

No POL or hazardous materials will be stored on-site during this project."

Site-specific Spill Contingency Plan (SSCP): The Contractor shall develop and submit a SSCP for any project at which POL or Hazardous Substances are used and/or stored at the project site. The SSCP shall be consistent with the Installation Spill Prevention and Response Plan (SPRP). The Contractor shall train employees on the contents of the SSCP and the use of spill response equipment and shall document such training. The SSCP shall be posted at the work site at all times.

The SSCP must be included in Chapter 13 of the EPP and be at least two pages in length:

a. (Page 1) Description of the spill response procedures, an inventory of POL and/or hazardous substances, probable spill routes, and an

inventory of spill response equipment.

b. (Page 2) Project site layout diagram.

c. An SSCP Plan template can be obtained from [718][374][35] CES Environmental Section by calling DSN [634-2600][225-5440][INSERT PHONE NUMBER].

1.9.19.2 Other Mandatory Requirements

Prevention: Procedures to prevent releases to the environment.

Spill Notification: The Contractor is required to submit a written Spill Notification when a worksite spill occurs. The quantity of POL spilled determines the amount of information required on the report and the deadline for submission. Consult with [Kadena Air Base][Yokota Air Base][Misawa Air Base][INSERT INSTALLATION NAME] Environmental Section on the requirements when initially reporting the spill.

1.9.20 CHAPTER 14: ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

1.9.20.1 Criteria Summary

In accordance with EO 13693, [Kadena Air Base][Yokota Air Base][Misawa Air Base][INSERT INSTALLATION NAME] has implemented the ISO 14001 to recognize environmental impacts, reduce our environmental footprint, and to always look to improve the way business is conducted at [Kadena Air Base][Yokota Air Base][Misawa Air Base][INSERT INSTALLATION NAME].

1.9.20.2 Training

In accordance with AFI 32-7001], the Contractor shall ensure that all personnel and subcontractors complete the EMS Awareness training via the Environmental Occupational Safety Health-Training Network, (https://esohtn.com/start, password: esohtn) prior to commencing construction/project activities or delivery of materials to the site. For questions, please contact [718 CES/CEIE][INSERT ORGANIZATION NAME].

1.9.20.3 EPP Mandatory Items

The Contractor is required to understand and implement EMS and shall describe how this will be accomplished in this Chapter of the EPP. For chapter 14, submit a print-out of the EMS Training Certificate (from the website) for each employee showing completion of EMS Training courses.

1.9.21 CHAPTER 15: SUSTAINABLE PROCUREMENT PROGRAM

1.9.21.1 Criteria Summary

The Sustainable Procurement Program (SPP), establishes goals for all federal employees, to include contractors, to improve sustainable environment practices and procedures through the purchase and use of recycled content, bio-based products, energy and water efficient products, and environmentally preferable products. Recycled content products are made from or contain recycled materials. Bio-based products are made with biological, agriculture, or forestry materials. Energy-efficient products use less energy than comparable equipment. Water-efficient products use less water than comparable equipment. Environmentally preferable products are materials and items that have reduced effects on health and the

environment compared to other products with the same purpose.

In the performance of this contract, the contractor shall make maximum effort to improve sustainable environmental practices and procedures as follows: reduce solid and hazardous waste generation, reduce greenhouse gas emissions, increase the use of renewable energy and bio-based products, reduce the use of ozone depleting substances and hazardous and toxic chemicals, reduce consumption of energy and natural resources, expand markets for green products and services, and reduce dependence on fossil fuel-based products. Make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired:

a. Competitively within a timeframe providing for compliance with the contract performance schedule,

b. Meeting contract performance requirements, or

c. At a reasonable price.

The U.S. Environmental Protection Agency (EPA) has developed the Comprehensive Procurement Guidelines (CPG) to help identify recycled content products. The CPG also provides a "Total Recovered Materials Content" percentage that is a range of how much recycled content should be in each item. CPG-listed items must be purchased at the amounts recommended by EPA (the Total Recovered Materials Content percentage).

The CPG categories are: Paper and Paper Products, Vehicular Products, Construction Products, Transportation Products, Park and Recreation Products, Landscaping Products, Non-paper Office Products, and Miscellaneous Products.

The U.S. Department of Agriculture (USDA) has developed a list of bio-based products, similar to that of EPA's CPG for recycled content products. The Contractor shall purchase bio-based products whenever possible.

The USDA's Biopreferred categories are: Construction and Road Maintenance, Furniture and Furnishings, Housewares and Cleaning, Industrial Supplies, Landscaping and Agriculture, Office Supplies, Personal Care and Toiletries, The Great Outdoors, and Utilities.

Information about this requirement and these products is available at: http://www.biopreferred.gov.

Recycled content products not listed in the CPG may also be used in the execution of any contract. Look for opportunities to maximize the use of products containing recycled content. Green products can and should be used in every construction project, including new construction, addition, renovation, or repair projects, and every service contract.

1.9.21.2 EPP Mandatory Items

For Chapter 14, list products with recycled content, environmentally preferable, bio-based, and energy and water efficient products will be purchased or utilized, if any.

1.10 LICENSES AND PERMITS

Obtain licenses and permits required for the construction of the project and in accordance with FAR 52.236-7. Notify the Government of all general use permitted equipment the Contractor plans to use on site. This paragraph supplements the Contractor's responsibility under FAR 52.236-7.

[a. The following permits have been obtained by the Government:

[(1) [_____]

][(2) [_____]

][(3) [_____]
]]
[b. The following permits will be obtained by the Government:

[(1) [_____]

][(2) [_____]

][(3) [_____]]]

1.11 ENVIRONMENTAL RECORDS BINDER

Maintain on-site a separate three-ring Environmental Records Binder and submit at the completion of the project. Maintain digital copies of records to submit. Make separate parts within the binder that correspond to each submittal listed below:

a) Waste Determination Documentation
b) Disposal Documentation for Hazardous and Regulated Waste
c) Stormwater Inspection Reports and Stormwater Pollution Prevention Plan Compliance Notebook

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitats. Prior to the commencement of activities, consult with the Installation Environmental Office, regarding rare species or sensitive habitats that need to be protected. The protection of rare, threatened, and endangered animal and plant species identified, including their habitats, is the Contractor's responsibility.

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work that is consistent with the requirements of the Installation Environmental Office or as otherwise specified. Confine construction activities to within the limits of the work indicated or specified.

The Contractor shall take precautions to preserve all such resources as they existed at the time they were first pointed out. The Contractor shall provide and install protection for these resources and be responsible for their preservation during the life of the Contract.

Environmental protection shall be conducted as follows:

a. Except in areas indicated on the drawing or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources, including trees, shrubs, vines, grasses, topsoil, and land forms without the Contracting Officer's permission. Any anticipated vegetation disturbance needs to be coordinated with the Government before it occurs.

b. All construction activities shall stay out of the drip line of trees. Damaging roots and/or compacting soil within the dripline of trees is prohibited. Trees, shrubs, and other vegetation not identified for removal shall be protected against removal, injury, defacing, and scarring - no ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such emergency use in permitted, the contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, earth or other material displaced into uncleared areas shall be removed.

c. Where an exception is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times and shall be responsible for any resultant damage.

3.1.1 Flow Ways

Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as specified and permitted.

3.1.2 Vegetation

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attached ropes, cables, or guys is authorized, the Contractor is responsible for any resultant damage.

Protect existing trees that are to remain to ensure they are not injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. Coordinate with the Contracting Officer and Installation Environmental Office to determine appropriate action for trees and other landscape features scarred or damaged by equipment operations.

3.1.3 GOJ-Protected Species

GOJ-Protected species are typically found in undeveloped and unmaintained portions of the base. Projects that may affect protected species shall include mitigation measures to eliminate or minimize effects.

[3.1.4 Banyan Trees

All Banyan trees must be preserved and protected. Banyan trees mark the villages and are used as landmarks for the Okinawans. Any banyan tree requiring destruction or removal must first be coordinated with the [18

CEG/CC][INSERT ORGANIZATION NAME], or in his absence with the [18 CEG/CD][INSERT ORGANIZATION NAME] (for example, trees with 30 percent or more of their root systems destroyed may need to be removed). Protect existing trees from injury, bruising, defacing, or other damage by construction operations.]

For Army projects, any banyan tree requiring destruction or removal must first be coordinated with the Chief of Okinawa Public Works or the designated representative.

3.1.5 Tree Replacement

The relocation of trees is preferred to removal and replacement. If trees can't be relocated, replace removed trees 3 for 1 may be authorized. Exotic plants shall not be introduced to the Installation; indigenous trees/shrubs shall be planted as much as possible. Utilize "Landscape Development Plan Reference Data, Kadena Air Base, Okinawa, Japan, 2nd Edition" for guidance on landscaping. Obtain Contracting Officer's approval before relocation or replacement.

3.1.6 Post-Construction Site Restoration

Remove traces of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other signs of construction. Grade temporary roads, parking areas, and similar temporarily used areas to conform to surrounding contours. Stabilize disturbed soils after construction to prevent erosion.]

3.1.7 Streams

Stream crossings must allow movement of materials or equipment without violating water pollution control standards of the JEGS and applicable, Federal, and GOJ national and prefectural laws and regulations, and installation requirements. Construction of stream crossing structures must be in compliance with JEGS, applicable Federal and GOJ national and prefectural laws and regulations, and installation requirements, including the Storm Water Pollution Prevention Plan.

The Contracting Officer's approval and applicable local permits are required before any equipment will be permitted to ford live streams. In areas where frequent crossings are required, install temporary culverts or bridges. Obtain Contracting Officer's approval prior to installation. Remove temporary culverts or bridges upon completion of work, and repair the area to its original condition unless otherwise required by the Contracting Officer.

3.1.8 Endangered Species

At any time an endangered or threatened species, flora or fauna, to include sea turtle nests are encountered, all activities shall stop and the Contracting Officer shall be notified.

3.1.9 Indigenous/Native Flora and Fauna

The Contractor shall place emphasis on the protection of habitats favorable to the reproduction and survival of indigenous flora and fauna. The Contractor shall use indigenous flora for planting/sodding.

3.1.10 Invasive Species

Invasive Species are prohibited to be raised, planted, stored or possessed on DoD installations. The Contractor shall not bring in any invasive species to DoD installations.

3.2 STORMWATER

Do not discharge stormwater from construction sites to the sanitary sewer. If the water is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization in advance from the Installation Environmental Office for any release of contaminated water. Storm water management and control shall be detailed in the SWPPP submitted as part of Chapter 3 of the EPP submittal. Refer to paragraph [1.9.9.1.a] of this section.

3.2.1 Storm Water Pollution Prevention Measures

The Contractor shall use proper control and management techniques to ensure storm water criteria are met in accordance with the JEGS storm water regulations. As required by the JEGS, erosion/sediment control measures to prevent the discharge of silt into nearby water shall be implemented. Control measures shall include the use of vegetative covers, construction of diversion drains, grading management, filter strips, and use of sediment basins.

3.2.2 Inspection Reports

Submit Inspection Reports and Stormwater Pollution Prevention Plan Compliance Notebook in the Environmental Records Binder and provideto the Contracting Officer in accordance with the JEGS and applicable GOJ or Local Laws and Regulations.

a. Runoff from the construction site or from storms shall be controlled, retarded, and diverted, as indicated on the SWPPP drawings, to protect drainage courses by means of diversion ditches, benches, and berms. Berms, dikes, drains, sedimentation basins, grassing, and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative.

b. Silt screens must be installed prior to start of construction. Silt screens and/or other erosion control devices shall be installed on construction sites that are in or near water. Silt screens shall consist of trenched and staked filter fabric and trenched and staked hay bales. Filter fabric must be toed 8 inches into the soil to avoid sediments that would be transported via water under the screen. Hay bales must be placed end-to-end on the downstream side of the screen and be trenched and staked firmly into the ground. Chinking is usually required to fill gaps between the bales. Silt screens must be maintained properly. Screens and other control devices must be inspected once a week and after any rainfall event totaling one-half inch or more to ensure they are in good repair and functioning properly.

c. In areas that experience high flow rates, extra precautions shall be necessary to stabilize screens. Trenching of hay bale barriers is required to adequately control runoff. A series of screens may have

to be installed in waters that are especially turbid to properly filter out sediments. Silt screens shall remain in place and properly maintained until the site is properly stabilized with sod or seeding.

d. Providing erosion and sediment control measures is the Contractor's responsibility. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards, listed in the JEGS are not violated as a result of construction activities. The area of bare soil exposed at any one time by construction operations shall be kept to a minimum. Construct or install temporary and permanent erosion and sediment control BMPs as indicated on the drawings and as specified in the SWPPP.

e. BMPs may include, but are not limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. The Contractor's Best Management Practices must also be in accordance with the JEGS and the SWPPP. Remove any temporary measures after the area has been stabilized.

f. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Side and back slopes shall be protected as soon as practicable upon completion of rough grading. Earthwork brought to final grade shall be finished as indicated.

g. The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings, or as directed by the Contracting Officer. Temporary movement or relocation of the Contractor's facilities shall be made only when approved. Borrow areas shall be managed to minimize erosion and to prevent sediment from entering nearby waters.

h. Spoil areas shall be managed and controlled to limit spoil intrusion into areas designated on the drawings and to prevent erosion of soil or sediment from entering nearby waters. Spoil areas shall be developed in accordance with the grading plan indicated on the drawings. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas from despoilment.

3.2.3 Erosion and Sediment Control Measures

Provide erosion and sediment control measures in accordance with GOJ, Federal, and Local prefecture laws and regulations, and JEGS. Preserve vegetation to the maximum extent practicable.

Erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports.

3.2.3.1 Erosion Control

Prevent erosion by [mulching], [compost blankets,][geotextiles,] or [temporary slope drains][]. Stabilize slopes by [chemical stabilization,][sodding,][seeding,][_____], or a combination of these methods necessary for effective erosion control. Provide seeding in accordance with Section 32 92 19 SEEDING. Use of hay bales is prohibited.

Any disturbed area with exposed soil that is not being worked on must be

seeded or sodded no later than two weeks from the last disturbance regardless of the installation of any other erosion control measures in place. Remove any temporary measures after the area has been stabilized.

3.2.3.2 Sediment Control Practices

Implement sediment control practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement sediment control practices prior to soil disturbance and prior to creating areas with concentrated flow, during the construction process to minimize erosion and sediment laden runoff. Best Management Practices (BMPs) may include, but not limited to, vegetation cover, stream bank stabilization, slope stabilization, silt fences, construction of terraces, interceptor channels, sediment traps, inlet and outfall protection, diversion channels, and sedimentation basins. [Location and details of installation and construction are as indicated on the drawings.] Include the following devices:[silt fence,][temporary diversion dikes,][storm drain inlet protection,][_____,][Location and details of installation and construction are indicated on the drawings.]

3.2.4 Work Area Limits

Mark the areas that need not be disturbed under this Contract prior to commencing construction activities. Mark or fence isolated areas within the general work area that are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, any markers must be visible in the dark. Personnel must be knowledgeable of the purpose for marking and protecting particular objects.

3.2.5 Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Move or relocate the Contractor facilities only when approved by the Government. Provide erosion and sediment controls for onsite borrow and spoil areas to prevent sediment from entering nearby waters. Control temporary excavation and embankments for plant or work areas to protect adjacent areas.

3.3 SURFACE AND GROUNDWATER

3.3.1 Cofferdams, Diversions, and Dewatering

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure must be constantly controlled to maintain compliance with existing water quality standards and designated uses of the surface water body. Comply with water quality standards and anti-degradation provisions. Do not discharge excavation ground water to the sanitary sewer, storm drains, or to surface waters without prior specific authorization in writing from the Installation Environmental Office. Discharge of hazardous substances will not be permitted under any circumstances. Use sediment control BMPs to prevent construction site runoff from directly entering any storm drain or surface waters.

If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization for any

contaminated groundwater release in advance from the Installation Environmental Officer. Discharge of hazardous substances will not be permitted under any circumstances.

3.3.2 Waters of Japan

Do not enter, disturb, destroy, or allow discharge of contaminants into waters of Japan[.][, except as authorized herein. The protection of waters of Japan shown on the drawings in accordance with paragraph LICENSES AND PERMITS is the Contractor's responsibility. Authorization to enter specific waters of Japan identified does not relieve the Contractor from any obligation to protect other waters of Japan within, adjacent to, or in the vicinity of the construction site and associated boundaries.]

3.3.3 Water Protection

Contractor shall prevent oily wastes or other hazardous substances from entering the ground, drainage areas, or local bodies of water.

3.3.4 Sewage

Contractor is not authorized sewage holding tanks on base and must procure a porta-potty service Contract. The porta-potty Contract must include the correct removal of sewage and maintenance of the facilities.

3.3.5 Wastewater

If the project generates wastewater from rinsing tanks, dewatering sites, etc., contact the Contracting Officer on proper disposal.

3.4 PROTECTION OF CULTURAL RESOURCES

3.4.1 Archaeological Resources

[Existing historical, archaeological, and cultural resources within the Contractor's work area will be so designated by the Contracting Officer if any such areas have been identified.] If, during excavation or other construction activities, any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, activities that may damage or alter such resources will be suspended. Resources covered by this paragraph include, but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, immediately notify the Installation Cultural Resources Manager via the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. Cease all activities that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources. The Government retains ownership and control over archaeological resources.

[3.4.2 Historical Resources

Existing historical resources within the work area are shown on the drawings. Protect these resources and be responsible for their preservation during the life of the Contract.]

3.5 AIR RESOURCES

Equipment operation, activities, or processes will be in accordance with the JEGS and all applicable Federal, GOJ national or prefectural air emission and performance laws and regulations.

3.5.1 Oil or Dual-fuel Boilers and Furnaces

Provide product data and details for new, replacement, or relocated fuel fired boilers, heaters, or furnaces to the Installation Environmental Office (Air Program Manager) through the Contracting Officer. Data to be reported include: equipment purpose (water heater, building heat, process), manufacturer, model number, serial number, fuel type (oil type, gas type) size (MMBTU heat input). Product data shall be provided prior to equipment installation.

3.5.2 Burning

Burning is prohibited on the Government premises.

3.5.3 Class I and II ODS Prohibition

Class I and II ODS are Government property and must be returned to the Government for appropriate management. Coordinate with the Installation Environmental Office to determine the required recovery cylinders and the appropriate location for turn in of all reclaimed refrigerant. Class I and II ODS as defined and identified herein shall not be used in the performance of this contract.

The contractor shall coordinate with the [Refrigerant, AC and Heating Shop, (DSN 644-4302)][] on the quantity of ODS recovered from system for the purpose of recycle, reuse or dilution. In the event the ODS can be recycled, reused or diluted, the entire quantity will be turned over to the [Refrigerant, AC and Heating shop][].

In cases where the ODS is sufficiently contaminated and cannot be recycled, reused and/or diluted, the Contractor shall dispose of the ODS according to the JEGS and local regulations.

In the event of a release of ODS, base personnel and/or Contractor shall inform [Fire and Emergency's Service Branch and Environmental Division][].

3.5.4 Accidental Venting of Refrigerant

Accidental venting of a refrigerant is a release and must be reported immediately to the Contracting Officer. Comply with the JEGS.

3.5.5 Training/Certification Requirements

Heating and air conditioning technicians must be trained to meet requirements in the JEGS. Maintain copies of certifications at the employees' places of business; technicians must carry certification wallet cards, as provided by GOJ national or prefectural laws and regulations.

3.5.6 Dust Control

Keep dust down at all times, including during nonworking periods. Dry power brooming will not be permitted. Instead, use vacuuming, wet

mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster.

3.5.6.1 Particulates

Dust particles, aerosols and gaseous by-products from construction activities, and processing and preparation of materials (such as from asphaltic batch plants) must be controlled at all times, including weekends, holidays, and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates that would exceed the JEGS and applicable U.S. Federal, GOJ national or prefectural air pollution standards or that would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators or other methods shall be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The contractor shall coordinate with 374 CES/CEIE via the Contracting Officer before the commencement of any particulate control activities. Even sprinkling of water should be reconsidered from resource conservation standpoint. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with the JEGS, GOJ national or prefectural laws and regulations, and installation requirements.

Responsible units/activities/stakeholders/contractors must have sufficient, competent equipment available and shall use Best Management Practice (BMP) at all times to accomplish these tasks. Air emission/pollutant control shall be performed as the work proceeds and whenever potential hazards exist, emission standards are listed in the JEGS.

3.5.6.2 Abrasive Blasting

Blasting operations cannot be performed without prior approval of the Installation Air Program Manager. The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive agent, paint chips, and other debris.[Perform work involving removal of hazardous material in accordance with the JEGS, GOJ national or prefectural laws and regulations, and installation requirements.]

3.5.7 Odors

Control odors from construction activities. The odors must be in compliance with applicable GOJ national or prefectural laws and regulations, and may not constitute a health hazard.

3.5.8 All Refrigerant Types

Ensure a weatherproof data plate is permanently attached to refrigeration (or air conditioning) equipment in a location visible to maintenance workers, showing refrigerant type and the full charge quantity.

3.5.9 Other Pollutants

Dust particles, aerosols and gaseous by-products from construction activities, and processing and preparation of materials shall be controlled at all times, including weekends, holidays, and hours when work is not in progress. Responsible units/activities/stakeholders/Contractors must have sufficient, competent equipment available and shall use Best Management Practice (BMP) at all time while accomplishing tasks. Air emission/pollutant control shall be performed as the work proceeds and whenever potential hazards exist. Emission standards are listed in the JEGS .

3.5.10 Class I ODS

Class I ODS listed in the JEGS are prohibited from use in construction, remodeling, or maintenance. Provide certifications that materials utilized during the project do not contain Class I ODSs. The purchase of Class I ODS for fire suppression equipment, air conditioning, and refrigeration equipment for ground applications is prohibited by AFMAN 32-7002 on all new and/or refurbishing projects. Limited exceptions for using Class I ODS for airborne equipment exist, but shall require prior approval.

a. Phase-out of Class I ODS: Installation to comply with the requirements of EO 13148, Sec 505(b), to cost effectively phase-out Class I ODS requirements as equipment using Class I ODS reach the end of their expected service life per AFMAN 32-7002. Class 1 ODS shall not be disposed of off the installation; Contractor shall coordinate with 35 CES/CEIE for procedures to ensure Class I ODSs are turned into the DLA ODS Reserve.

3.5.11 Class II ODS Approval Request

Class II ODS listed in the JEGS and AFMAN 32-7002 must first be approved by [718 CES/CEIE][374 CES/CEIE][35 CES/CEIE], Environmental Office prior to use. [718 CES/CEIE][374 CES/CEIE][35 CES/CEIE] recommends using non-ODS products as a substitute.

a. Phase-out of Class II ODS: Installations, Contractors, and other using agencies shall comply with USAF phase-out goal by 01 Jan 2020 per AFMAN 32-7002.

3.5.12 Refrigerant Recovery and Recycling

Prior to recovery and recycling of ODS, the Contractor is required to coordinate with the using agencies [(918 CES HVAC Shop, 718 CES Housing Maintenance)], or [718 CES][374 CES/CEIE][35 CES/CEIE] Environmental Branch) of the future intended use of the ODS. All repairs, including leak repairs or services to appliances, industrial process refrigeration units, air conditioning units, or motor vehicle air conditioners, must be performed using commercially available refrigerant recovery/recycling equipment operated by trained personnel. Refrigerant technicians shall be trained in proper recovery/recycling procedures, leak detection, safety, shipping, and disposal in accordance with recognized industry standards or Japanese equivalent.

3.5.13 Refrigerant Venting Prohibition

Any class I or class II ODS, HFC, and PFC refrigerant shall not be intentionally released in the course of maintaining, servicing, repairing, or disposing of appliances, industrial process refrigeration units, air conditioning units, or motor vehicle air conditioners. Minor releases associated with good faith attempts to recycle or recover ODS, HFC, and PFC refrigerants are not subject to this prohibition.

3.5.14 Halon Venting Prohibition

Halons shall not be intentionally released into the environment while testing, maintaining, servicing, repairing, or disposing of Halon-containing equipment or using such equipment for technician training. This venting prohibition does not apply to the Halon releases listed in the JEGS.

a. Halon De minims release associated with good faith attempts to recycle or recover halon (i.e. release of residual halon contained in fully discharged total flooding fire extinguishing systems).

b. Emergency release for the legitimate purpose of fire extinguishing, explosion inertion, or other emergency applications for which the equipment or systems were designed.

c. Releases during the testing of fire extinguishing systems if each of the following is true; systems or equipment employing suitable alternative fire extinguishing agents are not available; release of extinguishing agent is essential to demonstrate equipment functionality; failure of system equipment would pose a great risk to human safety or the environment; and simulant agent cannot be used.b. Hydrocarbons and Carbon Monoxide: Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to allowable limits at all times.

3.5.15 Generators, Incinerators, and Boilers

Generators, Incinerators, and Boilers: If generators, incinerators, or boilers are to be installed or replaced as part of the project, they must meet standards listed in the JEGS. Provide [718 CES][374 CES/CEIE][35 CES/CEIE] with the stack height, Fuel Combustion Rate (L/hr) for generators; Grate area (m2), Rate capacity (t/day), Incineration rate (kg/h) for incinerators; and heating area (m2), burner combustion rate (L/hr), Heat input rating (MMbtu/hr) for boilers, manufacturer's results from their product emission testing or other emission testing results, the heat exchange surface area in square meters for boilers, and the fuel oil consumption rate in liters per hour for boilers and generators.

3.5.16 Hydrocarbons and Carbon Monoxide

Hydrocarbons and Carbon Monoxide: Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to allowable limits at all times.

3.6 WATER RESOURCES

Keep construction activities under surveillance, management, and control, and monitor all water areas affected by construction activities in order to prevent pollution of surface and ground waters. Toxic or hazardous

chemicals shall not be applied to soil or vegetation when such application may cause contamination. Prevent oily wastes or other hazardous substances from entering the ground, drainage areas, or local bodies of water.

Monitoring of water areas affected by construction shall be the Contractor's responsibility. All water areas affected by construction activities shall be monitored by the Contractor.

3.6.1 Lead-Free Drinking Water Pipe, Solders, Flux and Fittings

The maximum allowable lead content for pipes, fittings, and fixtures intended to convey or dispense water for human consumption and cooking shall be a weighted average of 0.25 percent with respect to the wetted surfaces of pipes and pipe fittings, plumbing fittings, and fixtures in accordance with NSF 61. Refer to section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.7 WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of waste. Include procedures for pollution prevention/hazardous waste minimization in the Hazardous Waste Management Section of the EPP. Obtain a copy of the installation's Pollution Prevention/Hazardous Waste Minimization Plan for reference material when preparing this part of the EPP. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the anticipated types of the hazardous materials to be used in the construction when requesting information.

3.7.1 Salvage, Reuse and Recycle

Identify anticipated materials and waste for salvage, reuse, and recycling. Describe actions to promote material reuse, resale or recycling. To the extent practicable, all scrap metal must be sent for reuse or recycling and will not be disposed of in a landfill.

Include the name, physical address, and telephone number of the hauler, if transported by a franchised solid waste hauler. Include the destination and, unless exempted, provide a copy of the state or local permit (cover) or license for recycling.

All solid wastes and materials that have been separated for the purpose of recycling shall be stored in such a manner that they do not constitute a fire, health or safety hazard, or provide food or harborage for vectors, and shall be contained or bundled so as to not result in spillage. Containers must be: leak proof, water proof, and vermin proof including sides, seams, tops and bottoms, durable enough to withstand anticipated usage, and stored on a firm, level, well-drained surface).

3.7.2 Nonhazardous Solid Waste Diversion Report

Maintain an inventory of nonhazardous solid waste diversion and disposal of construction and demolition debris. Submit a report to the Environmental Office through the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that nonhazardous solid waste has been generated. [][Include the following in the report:]

[

Construction and Demolition (C&D) Debris Disposed	(_____) cubic meters, as appropriate
C&D Debris Recycled	(_____) cubic meters, as appropriate
Total C&D Debris Generated	(_____) cubic meters, as appropriate
Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount)	(_____) cubic meters, as appropriate

]
Include the completed form, Disposal and Recycling Data Sheet, Attachment A, attached at the end of the section.

3.8 WASTE MANAGEMENT AND DISPOSAL

3.8.1 Waste Determination Documentation

Complete Waste Determination Documentation for Contractor-derived wastes to be generated and submit in the Environmental Records Binder. All potentially hazardous solid waste streams that are not subject to a specific exclusion or exemption from the hazardous waste regulations (e.g. scrap metal, domestic sewage) or subject to special rules, (lead-acid batteries and precious metals) must be characterized in accordance with the requirements of the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements. Base waste determination on user knowledge of the processes and materials used, and analytical data when necessary. Consult with the Installation environmental staff for guidance on specific requirements. Attach support documentation to the Waste Determination form. As a minimum, provide a Waste Determination form for the following waste (this listing is not inclusive): oil- and latex -based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and containers of the original materials.

3.8.1.1 Sampling and Analysis of Waste

3.8.1.1.1 Waste Sampling

Sample waste in accordance with the JEGS, Installation Hazardous Waste Management Plan,appropriate Japanese or U.S. EPA testing protocols that meet the purpose of the testing. Clearly mark each sampled drum or container with the Contractor's identification number, and cross reference to the chemical analysis performed.

Excess excavated soil shall become the property of the Contractor and shall be disposed of off base at a properly licensed facility in accordance with the latest version of the JEGS and applicable GOJ federal and local laws and regulations. Any excess soil shall be sampled and tested according to the applicable GOJ federal and local laws and regulations and disposal facility requirements prior to disposal.

3.8.1.1.2 Laboratory Analysis

Follow the analytical procedure and methods in accordance with the JEGS

and all applicable GOJ national or prefectural laws and regulations and Installation Hazardous Waste Management Plan. Provide analytical results and reports performed to the Contracting Officer.

3.8.1.1.3 Analysis Type

Identify hazardous waste by analyzing for the following characteristics:[[ignitability], [corrosivity], [reactivity], and [toxicity] based on TCLP results.][___]

3.8.2 Solid Waste Management

The Contractor shall establish a program to promote cost-effective waste reduction in all operations and facilities covered by this Contract. The project's recycling program shall include all Contractor employees and subcontractors.

At a minimum, the following items shall be recycled: scrap metal, cardboard, concrete, asphalt, scrap wood, wooden pallets, glass, and plastic. Green wastes should be mulched or composted. The project site(s) must be left clean and clear of all debris upon completion of work.

3.8.2.1 Solid Waste Management Report

Provide copies of the waste handling facilities' weight tickets, receipts, bills of sale, Contractor Certification and other sales documentation in the Environmental Protection Plan. In lieu of sales documentation, a statement indicating the disposal location for the solid waste that is signed by an employee authorized to legally obligate or bind the firm may be submitted. The sales documentation[Contractor certification] must include the receiver's tax identification number and business, GOJ or prefectural registration number, along with the receiver's delivery and business addresses and telephone numbers.

3.8.2.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers that are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with non-hazardous solid waste. Transport solid waste off Government property and dispose of it in compliance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements for solid waste disposal. Solid waste disposal offsite must comply with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate.

Manage hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements.

3.8.3 Control and Management of Hazardous Waste

Do not dispose of hazardous waste on Government property. Do not

discharge any waste to a sanitary sewer, storm drain, or to surface waters or conduct waste treatment or disposal on Government property without written approval of the Contracting Officer.

The Contractor is responsible for managing all hazardous wastes (HW) generated throughout the duration of the Contract. The Contractor shall designate a hazardous waste manager in writing who shall be responsible for all HW management activities. The Contractor may attend the Hazardous Waste Accumulation Point Management course (English only) offered quarterly by [718][374][35]CES/CEIE.Hazardous wastes, including excavated contaminated soil, shall be stored, transported, and disposed of in accordance with the JEGS and applicable
U.S. and GOJ laws and regulations, including obtaining necessary local permits, licenses, and approvals.

All HW generated by the Contractor shall be disposed/recycled off base in accordance with Japanese regulation, Article 3 of "Law of Disposal and Clearing of Waste "Haikibutsu no shori oyobi seisou ni kansuru horitsu" and local regulations. U.S./foreign made ionization smoke detectors shall be turned in to 374 CES/CEOFA (Alarm Shop). The Contractor shall not leave any hazardous waste at work site areas at the end of duty hours. If temporary hazardous waste storage is needed to accumulate hazardous waste on base, the Contractor shall submit spill response plan with site map, the list of all hazardous waste to be stored on-base and estimated quantities to 374 CES/CEIE, 374 CES/CEF, 374 AMDS/SGPB and 374 AW/SE for approval via the Contracting Officer.

The Contractor shall identify what wastes are hazardous using specific and technical knowledge and/or sampling and analysis. This responsibility also includes preparation of waste profile sheets, packaging, marking and labeling of wastes in accordance with the JEGS, U.S. Federal, GOJ, Prefectural, and local requirements.

Under no circumstances may hazardous waste be disposed of in the dumpster of any facility in accordance with Installation HWMP. Do not dispose of hazardous waste on Government property. Do not discharge any waste to a sanitary sewer, storm drain, or to surface waters or conduct waste treatment or disposal on Government property without written approval of the Contracting Officer.

3.8.3.1 Hazardous Waste/Debris Management

Identify construction activities that will generate hazardous waste or debris. Provide a documented waste determination for resultant waste streams. Identify, label, handle, store, and dispose of hazardous waste or debris in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements.

Manage hazardous waste in accordance with the approved Hazardous Waste Management Section of the EPP. Store hazardous wastes in approved containers in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements. Do not bring hazardous waste onto Government property. Provide the Contracting Officer with a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in the JEGS. For hazardous wastes spills, verbally notify the Contracting Officer immediately.

3.8.3.2 Hazardous Waste Disposal Procedures

For Contracts stating that the Contractor shall turn-over hazardous waste to the U.S. Government, the Contractor must package hazardous waste in a United Nations (UN) approved container labeled in English and Japanese, furnish analytical results, and submit the container(s) and information to the Kadena Hazardous Waste Storage Facility (HWSF) located in Bldg 3623. Kadena HWSF personnel will weigh the container(s) and complete a waste profile sheet for the material and manifest document (DD Form 1348-1A). If the Contractor does not provide adequate information for the HWSF to receive the hazardous waste, the Contractor shall correct any discrepancies on the spot or remove the unacceptable containers until the deficiencies can be corrected. For further information, call the Kadena Hazardous Waste Program Manager at DSN 634-2600.

All commercial hazardous waste shipments must be properly packaged, labeled, and the Hazardous Waste Manifest must be signed by a representative of the 718 CES/CEIE prior to being transported. To coordinate hazardous waste pick-up inspections, call DSN 634-2600.

a. For Army projects, submit the analytical results to the U.S. Army Garrison Japan (USAG-J) Environmental Branch, who will assist EP and S in completing a waste profile sheet and DD Form 1348. Submit a copy of the DD Form 1348 showing the material was turned-in. For further information, contact the Hazardous Waste Manager at DSN 644-4910 or 644-5189.

b. For Contracts stating that the Contractor is responsible for disposal of hazardous waste at a Japanese commercial facility, the Contractor shall subcontract a transportation company holding a prefecture-issued Industrial Waste Collection and Transport Business Permit. The hazardous waste shall be disposed of at a landfill or disposal company holding either an Industrial Waste Disposal Business Permit or a Specially Controlled Industrial Waste Disposal Business Permit depending upon the type of waste being disposed.

All commercial hazardous waste shipments must be properly packaged, labeled, and the Hazardous Waste Manifest must be signed by a representative of the 718 CES/CEIE prior to being transported. To coordinate hazardous waste pick-up inspections, call DSN 634-2600.

3.8.3.3 Hazardous Waste Records

The Contractor shall maintain sampling, analysis, and turn-in records for all hazardous waste generated during the project. These records shall include, but not be limited to: [waste profile sheets provided by HWSF personnel for wastes streams turned in to the HWSF, manifests (DD forms 1348-1A) for all wastes turned over to the HWSF,]logs of sample locations or container identification data (including time and date of sample collection), analytical results, and quality control data provided by the analytical lab pertaining to the samples analyzed. Copies of this data shall be submitted to [718 CES/CEIE][374 CES/CEIE][35 CES/CEIE][INSERT ORGANIZATION] via the COR after the work is completed.

3.8.3.4 Electronics End-of-Life Management

Recycle or dispose of electronics waste, including, but not limited to, used electronic devices such as computers, monitors, hard-copy devices,

televisions, mobile devices, in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations,local requirements and installation instructions.

3.8.3.5 Disposal Documentation for Hazardous and Regulated Waste

[Submit a copy of the applicable local permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities in the Environmental Records Binder. Hazardous or toxic waste manifests must be reviewed, signed, and approved by the Contracting Officer before the Contractor may ship waste. To obtain specific disposal instructions, coordinate with the Installation Environmental Office.
][
If the Contract specifies that the Contractor is responsible for disposal at a commercial landfill, submit copies of the following documents:

a. Copy E of the Hazardous Waste Manifest form used to transport from on-base to the off-base disposal facility (Sangyou Haikibutsu Manifesuto) within 60 days of transport.

b. Transportation company's Industrial Waste Collection and Transport Business Permit (Sangyou Haikibutsu Shuushuu Unpangyou no Kyoka) as a part of a separate Hazardous Waste Abatement Plan.

c. Disposal facility's Industrial Waste Business Permit (Sangyou Haikibutsu Shobungyou no Kyoka) as a part of a separate Hazardous Waste Abatement Plan.
]
3.8.4 Releases/Spills of Oil and Hazardous Substances

3.8.4.1 Response and Notifications

The Contractor shall conduct all operations in a manner that prevents spills of POL or other hazardous substances. The Contractor is required to familiarize personnel with spill prevention and response procedures, fire suppression systems, and SDSs for all materials used and/or stored on the project site. The Contractor shall provide and maintain spill equipment, sufficient in both type and quantity, at all sites involving the storage, use, or handling of POL and/or hazardous substances.Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated in accordance with the JEGS and installation plans. Maintain spill cleanup equipment and materials at the work site.

Follow the spill prevention measures detailed in the Installation Spill Prevention and Response Plan. The Contractor is required to familiarize personnel with spill prevention and response procedures, fire suppression systems, and SDSs for all materials used and/or stored on the project site. Provide and maintain spill equipment, sufficient in both type and quantity, at all sites involving the storage, use, or handling of POL and/or hazardous substances.

In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the [18 CES/CEF],Installation Fire Department[(at 911 from a landline or

098-934-5911 from a cell phone)], the Installation Command Duty Officer, the [718 CES][374 CES][35 CES] Installation Environmental Office at DSN [634-2600][225-5440][INSERT ENVIRONMENTAL OFFICE PHONE NUMBER]], and the Contracting Officer.

The Contractor shall immediately report all POL or Hazardous Substances spills to the Contracting Officer, who will report to the Fire Emergency Services (374 CES/CEF) at 911 or Commercial 042-507-6560 (direct number to Yokota Fire Dispatch) as required. Submit verbal and written notifications as required by the JEGS and installation and service component instructions and plans, and local regulations. Provide copies of the written notification and documentation that a verbal notification was made within [the timeframes required by the JEGS and installation instructions][five working days]. Spill response must be in accordance with the JEGS and installation requirements. Contain and clean up these spills without cost to the Government.

Submit verbal and written notifications as required by the JEGS and installations instructions. Provide copies of the written notification and documentation that a verbal notification was made within the timeframes required by the JEGS and installation instructions. Spill response must be in accordance with the JEGS and installation requirements. Contain and clean up these spills without cost to the Government.

3.8.4.2 Clean Up

[The Contractor is responsible for the cleanup of POL and/or hazardous substance spills and disposal of clean-up material. The Contractor shall determine, as quickly as possible, the nature of the spilled substance and implement necessary safety precautions to protect both human health and the environment. Cleanup shall be in accordance with applicable local laws and regulations, as determined by the Fire Department and [718 CES/CEIE, or the Environmental Branch for the Army][374 CES/CEIE][35 CES/CEIE]. Cleanup shall only be performed by personnel adequately trained in spill response and cleanup techniques for the severity of the spill incident.][Clean up hazardous and non-hazardous waste spills.]Reimburse the Government for costs incurred including sample analysis materials, clothing, equipment, and labor if the Government will initiate its own spill cleanup procedures, for Contractor-responsible spills, when: Spill cleanup procedures have not begun within one hour of spill discovery/occurrence; or, in the Government's judgment, spill cleanup is inadequate and the spill remains a threat to human health or the environment.

The Contractor shall be responsible for all costs incurred from any Contractor spills. The Contractor shall be held liable for all costs associated with performing emergency spill response and cleanup by the U.S. Government due to the non-availability of designated personnel or the limited capability of designated personnel. The U.S. Government's cost of cleanup shall be considered a Contract debt and collected in accordance with FAR subpart 32.6. If remaining Contract payments are insufficient, the Government reserves the right to pursue other offsets or administrative or civil actions to satisfy the debt.

3.8.5 Mercury Materials

Immediately report to the Environmental Office and the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to

the satisfaction of the Contracting Officer.

Do not recycle a mercury spill cleanup; manage it as a hazardous waste for disposal.

3.8.6 Wastewater

Disposal of wastewater must be as specified below.

3.8.6.1 Treatment

Do not allow wastewater from construction activities, such as on-site material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, and forms to enter water ways[.][or to be discharged without proper approval from the Contracting Officer.] Dispose of the construction-related waste water off-Government property in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements, or by collecting and placing it in a retention pond where suspended material can be settled out or the water can evaporate to separate pollutants from the water. The site for the retention pond as well as its use must be coordinated and approved with the Contracting Officer. The residue left in the pond prior to completion of the project must be removed and disposed of off-Government property in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations, and installation requirements. Backfill the area to the original grade, top-soiled, and seeded or sodded. [Consult with the Installation Environmental Office on specific testing requirements for water in the retention pond. If required, test the water in the retention pond for [_____] and have the results reviewed and approved by the Installation Environmental Office via the Contracting Officer prior to being discharged or disposed of off-Government property].]

3.8.6.2 Surface Discharge

For discharge of ground water,[if applicable, obtain a GOJ or local prefectural permit specific for pumping and discharging ground water prior to surface discharging.][Surface discharge in accordance with federal, state, and local laws and regulations.][Surface discharge shall be done in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations and installation requirements.]

3.8.6.3 Land Application

Water generated from the flushing of lines after[disinfection or disinfection in conjunction with hydrostatic testing][hydrostatic testing] must be[land- applied in accordance with the JEGS and applicable Federal, GOJ, prefectural and local laws and installation requirements for land application][discharged into the sanitary sewer with prior approval and notification to the owner of the sanitary sewer system].

3.8.7 Contaminated Soil Stockpile Request

The Contractor shall submit a Contaminated Soil Stockpile Request to [718][374][35] CES/CEIE for stockpiling contaminated soil for testing prior to disposal. Upon receipt of request, [718][374][35] CES/CEIE will inform the Contractor of an approved stockpile location. The Contractor shall be responsible for containment and monitoring of the contaminated soil stockpile at no additional cost to the U.S. Government.

3.9 HAZARDOUS MATERIAL MANAGEMENT

Include hazardous material control procedures in the Safety Plan, in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Do not bring hazardous material onto Government property that does not directly relate to requirements for the performance of this Contract. Submit a Safety Data Sheet and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on the installation. Typical materials requiring SDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. Use hazardous materials in a manner that minimizes the amount of hazardous waste generated. Containers of hazardous materials must have National Fire Protection Association labels or their equivalent.

Storage and handling of hazardous materials will adhere to the DoD Component policies, including Joint Service Publication on Storage and Handling of Hazardous Materials. Defense Logistics Agency Instruction (DLAI) 4145.11, Army Technical Manual (TM) 38-410, Naval Supply Publication (NAVSUP PUB) 573, Air Force Joint Manual (AFJMAN) 23-209, and Marine Corps Order (MCO) 4450.12A, "Storage and Handling of Hazardous Materials," January 13, 1999 provide additional guidance on the storage and handling of hazardous materials. The International Maritime Dangerous Goods (IMDG) Code and appropriate DoD and Component instructions provide requirements for international maritime transport of hazardous materials originating from DoD installations. International air shipments of hazardous materials originating from DoD installations are subject to International Civil Aviation Organization Technical Instructions or DoD Component guidance, including Air Force Manual 24-204, (Interservice) TM 38-250, NAVSUP PUB 505, MCO P4030.19J, and DLAI 4145.3, DCMAD1, Ch3.4 (HM24), "Preparing Hazardous Materials for Military Air Shipments," 3 December 2012. Certify that hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste, in accordance with the JEGS and installation requirements.

3.9.1 Hazardous Material Approval

Contractors seeking approval to bring HAZMAT onto the installation must submit an [AF Form 3952][AF Form 3000]. A Safety Data Sheet (SDS) or Safety Data Sheet (SDS), in English and Japanese, must accompany the [AF Form 3952][AF Form 3000]. For specific details on information required for submitting an [AF Form 3952][AF Form 3000], contact the Hazardous Material Program Manager at DSN [634-2600][INSERT PHONE NUMBER]. The Contractor must coordinate and route the [AF Form 3952][AF Form 3000] through [18th Wing][] Safety, Fire Department, Bioenvironmental, and [718][374][35] CES/CEIE. All excess materials and empty containers are the responsibility of the Contractor and shall be removed at the end of the Contract. If HAZMAT requirements change during the project, submit a new or revised [USAF Form 3952][AF Form 3000] and obtain approval before bringing the HAZMAT onto the installation. For Army projects, the AF Form 3952 shall be coordinated through the Directorate of Logistics (DOL) HAZMAT and approved by Fire Department, Safety, and Environmental. When occupants of the facility request that the contractor leave the excess HAZMAT, the Contractor shall coordinate with and obtain approval from 374 CES/CEIE.

3.9.2 Hazardous Material Storage, Handling and Marking

HAZMAT must be stored, handled, used, and disposed of in accordance with 29 CFR 1910, JEGS, and local regulations. The Contractor shall observe HAZMAT storage practices in accordance with regulations, policies, plans, and procedures employed by the Installation. All containers with HAZMAT shall be correctly marked/labeled with DD Form 2522 or an equivalent label. The label shall include the container's contents, shall be legible, and shall be protected from damage (e.g., by covering label with plastic or tape). Labeling requirements apply to all HAZMAT containers, including compressed gas cylinders, fuel containers, acid containers, and ODS containers. Consult with HAZMAT at [DSN 644-4739] to determine if an item is a HAZMAT or not.

Storage of oils, greases, chemicals, fuels or other liquids will require spill prevention and security. Contractor is not allowed to store HAZMAT on base for over 24 hours without authorization. If on-base HAZMAT storage areas are needed, Contractor shall submit the list of all items that are to be stored on-base and estimated quantities to 374 CES/CEIE, 374 CES/CEF and 374 AW/SE for approval. Hazardous materials storage areas may be inspected by 374 CES/CEIE, 374 CES/CEF and 374 AW/SE. SDSs must be available at storage and on site at all times.

3.10 PREVIOUSLY USED EQUIPMENT

Clean previously used construction equipment prior to bringing it onto the project site. Equipment must be free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds.

[3.11 CONTROL AND MANAGEMENT OF ASBESTOS-CONTAINING MATERIAL (ACM)

Manage and dispose of asbestos- containing waste in accordance with the JEGS and applicable Federal, GOJ national or prefectural laws and regulations. [Contact JED Environmental for the most current version of][Refer to] Section 02 82 00 ASBESTOS REMEDIATION. Manifest asbestos-containing waste and provide the manifest to the Contracting Officer. Notifications to the Contracting Officer and Installation Air Program Manager are required before starting any asbestos work.

Removal of mastics, necessary to achieve the contract's objectives, shall be performed in a manner as if the material contains asbestos.

When applicable, a minimum of 14 calendar days prior to the demolition or renovation of a facility that involves removing or disturbing friable ACM, the Contractor shall prepare a written assessment of friable asbestos disturbance and submit to the COR, who will, in turn submit to the Installation Commander in accordance with the JEGS.

For any previously untested material suspected to contain asbestos and located in areas impacted by the work, notify the Contracting Officer, who will order up to [_____] bulk samples to be obtained and analyzed at the Contractor's expense. The Contractor shall deliver the sample(s) to a laboratory accredited under the National Institute of Standards and Technology (NIST) "National Voluntary Laboratory Accreditation Program (NVLAP)" and analyzed by PLM. The laboratory shall have a working definition of "Trace" amounts of asbestos, and the laboratory shall report any detectable amount of asbestos in a bulk sample that is less than the PLM Limit of Quantification of 1 percent as a "Trace" concentration. If

PLM does not detect the presence of asbestos (e.g. "non-detect"), the material shall be considered less than 0.1 percent asbestos. If PLM analysis detects asbestos in any discernible amount (to include “trace” or "less than 1 percent"), the material shall be considered greater than 0.1 percent asbestos unless proven to be non-ACM by the use of quantification methods capable of achieving an analytical sensitivity of less than 0.1 percent, such as Transmission Electron Microscopy (TEM) or 1000 point counting.

The Contracting Officer (CO) will order, testing by TEM or 1000 point counting, for up to [ ] samples, to be obtained at the Contractor's expense and delivered to a laboratory accredited under the National Institute of Standards and Technology (NIST) "National Voluntary Laboratory Accreditation Program (NVLAP)", for those samples with results of < 1% ACM as analyzed by PLM.

Any additional components identified as ACM that have been approved by the Contracting Officer for removal shall be removed and will be paid for by an equitable adjustment to the Contract price under the CONTRACT CLAUSE titled "changes". Sampling shall be conducted by personnel who have successfully completed the EPA Model Accreditation Plan (MAP) "Building Inspector" training course and is AHERA certified as a "Building Inspector".]

3.11.1 Sample Result Reporting

The contractor shall submit to the Contracting Officer a "Suspected ACM Discovery Report" within 5 days of receiving the final laboratory analysis. The report shall contain, at a minimum, a text description of the location, building and room number of the discovery, and the condition of the material; a copy of the sampler's "Building Inspector" certificate; copies of the laboratory's accreditations; a color photograph of the sampled location; the chain of custody document; a certified copy of laboratory analysis sheet discerning the non-detect/detect threshold at 0.1 percent.

3.11.2 Contract Changes

ACM-related work beyond the scope of this specification, such as the removal of ACM identified by the contractor after beginning site work, must be approved by the Contracting Officer, in advance, and will be paid for by an equitable adjustment to the Contract price under the CONTRACT CLAUSE titled "changes".

3.11.3 New Materials

All materials provided by the Contractor shall contain less than 0.1% asbestos per weight in accordance with the JEGS. The COR may request the contractor to provide documentation from the manufacturer for any material suspected of containing asbestos to confirm asbestos content.

3.11.4 Flooring/Base Cove Mastic

Removal of mastics, necessary to achieve the contract's objectives, shall be performed in a manner as if the material contains asbestos.

3.11.5 Additional Requirements

All such work "changes" must be performed in accordance with Section

ASBESTOS REMEDIATION [02 82 00 ASBESTOS REMEDIATION][and is subject to the submittal requirements listed therein] [specifications not included in this contract that will be added as a part of the contract "changes"].]]

[3.12 CONTROL AND MANAGEMENT OF LEAD-BASED PAINT (LBP)

[Manage and dispose of lead-contaminated waste in accordance with the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations and installation requirements. [Contact JED Environmental for the most current version of][Refer to] Section [02 83 00 LEAD REMEDIATION]. The Contractor is to assume that all existing paint encountered in this Contract contain detectable levels of lead, and the OSHA regulations referenced in these specification applies. Any attached lead material survey information is provided for disposal purposes only. Manifest any lead-contaminated waste and provide the manifest to the Contracting Officer.]

[For LBP and other lead abatement projects, refer to the JEGS and Section [02 83 00 LEAD REMEDIATION].

3.12.1 New Materials

The JEGS defines LBP as any paint or coating containing greater than 0.5 percent lead, by weight, and mandates the implementation of a program to reduce LBP hazards. U.S. law requires all new paint to contain less than 0.009 percent lead, by weight. Some Japanese and other foreign paints containing greater than 0.5 percent lead are legally manufactured and sold, but are classified as LBP under U.S. law, and not suitable for use on USFJ projects.

The Contracting Officer may request the Contractor to provide manufacturer's documentation for any material suspected of containing high levels of lead or other hazardous materials.

3.12.2 Suspected LBP and Specially Controlled Industrial Wastes

The Contractor shall assume existing paint or other materials encountered on this Contract may contain detectable levels of lead or other hazardous substances. If such materials are disturbed during the work, the contractor is responsible to comply with the applicable sections of the JEGS, OSHA, Japanese Labor Safety and Health Law and prefectural waste disposal regulation. Refer to the JEGS to determine if C&D waste exceeds the regulatory levels for disposal as general industrial waste.

Contractors are required to identify, sort, test, and dispose of all C&D waste in accordance with Japan National and local laws and regulations regardless of their identification, or lack of, as hazardous materials by the government in this contract.

][3.13 CONTROL AND MANAGEMENT OF POLYCHLORINATED BIPHENYLS (PCBS)

Manage and dispose of PCB-contaminated waste in accordance with the JEGS, installation requirements, and Section 02 84 33 REMOVAL AND DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCB). Purchase of electrical equipment and transformers containing PCBs is prohibited.

The JEGS prohibits the acquisition of any new items containing any detectable PCBs. Items that historically contained PCB includes, but are not limited to: any dielectric oil-filled items such as transformers,

switchgear, capacitors, rectifiers, high-voltage paper insulated lead cable (PILC), magnetic lighting ballasts (including some labeled No-PCB), high-voltage potheads, High Intensity Discharge (HID) lighting ballasts, hydraulic oil-filled machinery, etc.

Some items manufactured for the U.S. market that are labeled "No-PCB" may legally contain as high as 49ppm PCBs. However, these items are regulated under the JEGS and not suitable for use on USFJ projects.

All procurement of transformers or any other equipment containing dielectric or hydraulic fluid shall be accompanied by the manufacturer's certification that all materials/equipment (e.g., ballasts, capacitors, transformers, Paper Insulated Lead Covered (PILC) Cable, etc.) contain non-PCB dielectric fluid. All Non-PCB certificates shall be submitted to the 374 CES/CEIE and CEOFE with the list of the new material/equipment information prior to transformer or equipment installation (Atch D). Newly procured transformers and equipment shall have permanent plate affixed stating they are PCB-free in Japanese and in English. The plate should be a 200mm long and 50mm wide acrylic plate with heat treated paint. Base color should be green and letter color should be white. The plate must state "PCB Free by Japanese standard; date of installation, manufacturer, and serial number" in both Japanese and English. The sample of PCB Free Plate is attached (Attachment B). The plate should be affixed to the outside of transformer or cubicle enclosure in an easily identifiable location.

Follow the JEGS regarding the strict handling, storage, marking, transportation, disposal, and recordkeeping for all equipment containing less than 0.5 ppm PCB.

All transformers or any other equipment containing dielectric/hydraulic fluid shall be considered and treated as PCB containing unless information to the contrary exists. All suspected PCB materials removed for disposal must be sampled for analysis. The Contractor shall identify if the material contains PCB by using Japanese approved method required by the Ministry of the Environment. After the material is confirmed as PCB, the Contractor shall provide the sample result to 374 CES/CEIE. In addition, all sample results, regardless of PCB contamination, must be provided to 374 CES/CEIE. Material and equipment which cannot be sampled such as those hermetically sealed shall be treated as PCB containing. If the material is confirmed as Non-PCB, the Contractor is able to dispose of it as a regular industrial waste or recycle it by following applicable local Japanese regulations. Government will provide PCB sampling results to the Contractor, if available. If the material is confirmed as PCB, the Contractor shall turn in the material to 374 CES/CEIE for proper disposal. All PCB containing materials must be containerized in appropriate UN certified drum or placed in a metal secondary containment which holds 125 percent of total oil volume. PCB item(s) and secondary containment must be placed on a pallet and secured with metal strap bands. Prior to turn in, the Contractor shall provide a list of PCB items to 374 CES/CEIE (01 57 19-X). The list must contain country of origin, name of manufacturer, year of manufacture, serial number, KVA, PCB concentration, oil volume, weight of item, weight of drum/secondary containment, weight of pallet and total weight. The list needs to be reviewed by 374 CES/CEIE prior to turn in. The Contractor must not remove any PCB identification label affixed on the material, and ensure the PCB items do not spill during handling, storage and transportation.

3.13.1 Removal Or Installation

Work on PCB equipment is forbidden using this supplement alone. If the project involves the disturbance, relocation, installation, or removal of products that have historically contained PCBs, follow the instructions in the supplement to the specification that pertains to that product's installation or removal (Transformer Replacement, Lighting Replacement, etc.). Should the project scope of work require the installation of a new transformer or the removal of an existing transformer, the Contractor shall fill and submit attachments D and E, respectively.

][3.14 CONTROL AND MANAGEMENT OF LIGHTING BALLAST AND LAMPS CONTAINING PCBS

Manage and dispose of contaminated waste in accordance with the JEGS and installation requirements. [[Contact JED Environmental for the most current version of][Refer to] Section [02 84 16 HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBS AND MERCURY][Section 02 84 16.01 HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBS AND MERCURY - Tailored for Kadena AB.]

Lighting ballasts removed under Section [02 84 16 HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBs AND MERCURY][Section 02 84 16.01 HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBS AND MERCURY - Tailored for Kadena AB.] (if applicable) shall be turned in at [Kadena Air Base Building 3625][] on [any Friday (except for federal holidays) between the hours of 0800 and 1200][]. The Contractor must [complete a Ballast Turn-in Inventory form that can be obtained by calling the Kadena Air Base Environmental Section at DSN 634-2600][].

The Contractor shall identify if lighting fixture/ballast(s) contain PCBs. Japanese lighting fixtures/ballasts may be identified with the manufacturer's website. All U.S. lighting fixtures/ballasts shall be treated as PCBs unless there is a label stating as Non-PCB. All U.S. made ballasts with or without a label stating PCB Free shall be treated as PCB containing materials in Japan unless information to the contrary exists. U.S. made ballasts without label may contain greater than 500ppm PCBs, and those with "PCB Free" label may contain less than 50ppm PCBs. If the lighting fixture/ballast is confirmed as Non-PCB item, the Contractor is able to dispose of it as a regular industrial waste or recycle it following local Japanese regulations. If the lighting fixture/ballast is confirmed as to contain PCBs, the Contractor shall segregate ballasts by country and manufacturer, and shrink wrap each individually for turn in to the 374 CES/CEIE. Prior to turn in, the Contractor shall submit a list of PCB waste including country of origin, name of manufacturer, serial number, year of manufacture, weight and quantity of ballasts to 374 CES/CEIE for proper disposal (attachment C).

Small quantities can be brought in "as-is". However, quantities over 100 must be stacked on pallets and sorted by manufacturer type. Assistance unloading pallets may be available, but Contractor is required to call to make an appointment to ensure the service is available.

Do not attempt to open sealed ballasts or perform an oil analysis. If ballasts are leaking when removed, notify the Contracting Officer and call the [Kadena Air Base][Yokota Air Base][Misawa Air Base] Environmental Section immediately for instructions on how to proceed.

]3.15 PETROLEUM, OIL, LUBRICANT (POL) STORAGE AND FUELING

POL products include flammable or combustible liquids, such as gasoline, diesel, lubricating oil, used engine oil, hydraulic oil, mineral oil, and cooking oil. Store POL products and fuel equipment and motor vehicles in a manner that affords the maximum protection against spills into the environment. Manage and store POL products in accordance with the JEGS and installation requirements. Use secondary containments, dikes, curbs, and other barriers, to prevent POL products from spilling and entering the ground, storm or sewer drains, stormwater ditches or canals, or navigable waters of Japan. Describe in the EPP (see paragraph ENVIRONMENTAL PROTECTION PLAN) how POL tanks and containers must be stored, managed, and inspected and what protections must be provided.[Storage of oil, including fuel, on the project site is not allowed. Fuel must be brought to the project site each day that work is performed.][Storage of fuel on the project site must be in accordance with the JEGS and installation requirements, and local laws and regulations and paragraph OIL STORAGE INCLUDING FUEL TANKS.]

3.15.1 Used Oil Management

"Used oil," means any oil or other waste petroleum, oil, or lubricant (POL) product that has been refined from crude oil, or is synthetic oil, has been used and as a result of such use, is contaminated by physical or chemical impurities, or is off specification and cannot be used as intended. Although used oil may exhibit the characteristics of reactivity, toxicity, ignitability, or corrosivity, it is still considered used oil, unless it has been mixed with hazardous waste. Manage used oil generated on site in accordance with the JEGS and installation requirements. Determine if any used oil generated while onsite exhibits a characteristic of hazardous waste. Used oil containing 1,000 parts per million of solvents is considered a hazardous waste and disposed of at the Contractor's expense. Used oil mixed with a hazardous waste is also considered a hazardous waste. Dispose in accordance with paragraph HAZARDOUS WASTE DISPOSAL.

3.15.2 Oil Storage Including Fuel Tanks

Provide secondary containment and overfill protection for oil storage tanks. A berm used to provide secondary containment must be of sufficient size and strength to contain the contents of the tanks plus 12 centimeters freeboard for precipitation. Construct the berm to be impervious to oil for 72 hours that no discharge will permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Use drip pans during oil transfer operations; adequate absorbent material must be onsite to clean up any spills and prevent releases to the environment. Cover tanks and drip pans during inclement weather. Provide procedures and equipment to prevent overfilling of tanks. If tanks and containers with an aggregate aboveground capacity greater than 5000 liter will be used onsite (only containers with a capacity of 208 liter or greater are counted), provide and implement a SPCC plan meeting the requirements of 40 CFR 112. Do not bring underground storage tanks to the installation for Contractor use during a project. Submit the SPCC plan to the Contracting Officer for approval.

Monitor and remove any rainwater that accumulates in open containment dikes or berms. Inspect the accumulated rainwater prior to draining from a containment dike to the environment, to determine there is no oil sheen present.

3.15.3 Temporary Fuel Storage Tanks

The use of temporary fuel storage tanks on base as part of a project must be approved by [718 CES/CEIE][374 CES/CEIE][35 CES/CEIE]. The Contractor shall submit a Temporary Fuel Storage Tank Approval Request to [718 CES/CEIE][374 CES/CEIE][35 CES/CEIE]. The approval request must contain justification for the use of a temporary tank and design details, including a layout diagram indicating the proposed location of the tank within the project site.

If approved, temporary fuel storage tanks shall be installed in accordance with all applicable regulation (JEGS, AFIs, UFCs, etc.) and the [18WG AST standards][INSERT STANDARD], which are maintained by [718][374][35] CES/CEIE and are available upon request. In addition, a site-specific Spill Contingency Plan (SSCP) must be developed. After construction/installation of a temporary fuel storage tank, the Contractor shall contact [718][374][35] CES/CEIE at DSN [634-2600][225-5440][INSERT PHONE NUMBER] and the Fuels Management Flight [(18 LRS/LGRF) at DSN 634-7039 or 634-7037][INSERT ORG CODE AND PHONE NUMBER] to coordinate an initial inspection of the tank before it is put in service.

3.15.4 Aboveground Storage Tank (AST) Installation

If the Contractor is installing a permanent aboveground fuel storage tanks as part of the project, it must be approved by 35 CES/CEIE, Storage Tank Program Manager. Tank approval request must contain justification for the installation tank and design details, including a layout diagram indicating the proposal location of the tank within the project site. the tanks shall be installed in accordance with all applicable regulations (JEGS, AFIs, UFCs, etc.) and the [18WG AST][] standards, which are maintained by [718 CES/CEIE][374 CES/CEIE][35 CES/CEIE] and are available upon request. The Contractor is responsible for conducting all operational checks, including providing fuel for the tests, prior to turnover to the Installation. The Contractor shall ensure that design drawings contain adequate detail to demonstrate that the AST will be installed in accordance with all applicable regulations.

[718][374][35] CES/CEIE will assign a Tank ID Number to each AST that will be used on tank signage and in project documentation. After construction/installation of an AST, the Contractor shall contact [718][374][35] CES/CEIE at DSN [634-2600][225-5440][INSERT PHONE NUMBER] and the [Fuels Management Flight (18 LRS/LGRF) at DSN 634-7039 or 634-7037][INSERT ORG CODE AND PHONE NUMBER] to coordinate an Initial Inspection of the tank before it's put in-service in accordance with [AFI 23-204 KADENAABSUP][INSERT INSTALLATION REFERENCE].

3.15.5 Underground Storage Tank (UST) Installation

As per PACAF UST Policy, USTs shall not be installed. Fuel storage tanks shall be installed above ground, unless overriding requirements exist against above ground installation such as safety, fire protection measures, or force protection measures. Installation of a UST requires the approval of [718][374][35] CES/CEIE and approval will only be granted if adequate justification of overriding requirements against installation of an AST is provided.

To request approval for installation of a UST, the Contractor shall submit an Underground Fuel Storage Tank Approval Request to [718][374][35]

CES/CEIE. The approval request must contain a detailed justification of the overriding requirements against installation of an AST. If a UST is approved for installation as part of a project, the Contractor shall ensure that design drawings contain adequate detail to demonstrate that the UST will be installed in accordance with all applicable regulations. After construction/installation of a UST, the Contractor shall contact [718 CES/CEIE at DSN 634-2600 and the Fuels Management Flight (18 LRS/LGRF) at DSN 634-7039 or 634-7037][] to coordinate an initial inspection of the tank in accordance with AFI 23-204 KADENAABSUP before it's put in-service.

3.15.6 AST Removal

When a facility with a fuel storage tank(s) is demolished, demolition of the tank(s) and associated infrastructure, including above ground piping, underground piping to the building serviced by the tank, indoor piping to the equipment serviced by the tank, secondary containment curbing, tank saddles, tank pads, Oil Water Separators (OWS), grounding stations, signage, fencing around the AST, and sidewalks leading to the AST shall be included in the scope of the project. The Contractor shall comply with applicable regulations, including, but not limited to AFMAN 32-1067, UFC 3-460-01, and 33 01 50.55 CLEANING OF PETROLEUM STORAGE TANKS.

3.15.7 UST Removal

The following standards shall be applied when removing a UST, as required by the UST Removal Procedures appendix of the PACAF UST Policy. Additional UST standards shall also be applied, including but not limited to the JEGS , AFMAN 32-1067, UFC 3-460-01, Section 02 65 00 UNDERGROUND STORAGE TANK REMOVAL,, and 33 01 50.55 CLEANING OF PETROLEUM STORAGE TANKS.:

a. Tank Removal. Notify the Environmental Representative at least 24 hours before removing a tank. Deactivate any electrical power connected to the tank or associated infrastructure. Clean the tank (triple rinse) and render tank inert (vapor must not exceed 10 percent Lower Explosive Limit for the substance(s) that were in the tank).

b. Excavation. Place barricades around all excavations, excavated soils, removed tanks, and equipment until completion. The Contractor must have an approved AF IMT 103 prior to any excavation.

c. Tank Cutting. Cut a 0.6 m by 0.6 m opening on each side of the tank to prevent reuse, paint the Tank ID Number (obtained from [718][374][35] CES/CEIE) and date of removal on the tank, and take photos for documentation purposes.

d. Soil Removal. If exposed free product and/or obviously contaminated soil is encountered during UST removal, contact [718][374][35] CES/CEIE immediately. When a leaking UST is removed, exposed free product and/or obviously contaminated soil in the immediate vicinity of the tank will be removed and appropriately disposed of in accordance with the JEGS. If soil contamination is caused by the Contractor's mismanagement, the Contractor is responsible for cleanup and disposal in accordance with spill response procedures outlined in this specification and local applicable regulations.

If additional contaminated soil is present beyond the immediate vicinity of the tank, [718][374][35] CES/CEIE will provide additional guidance on necessary actions. Segregate clean soil from the contaminated soil. Only

clean soil shall be used as backfill. If the soil is contaminated with Petroleum, Oil, and Lubricants (POL), it shall be disposed of in accordance with local regulations. If it is contaminated with hazardous substances, the Contractor shall dispose of it in accordance with Paragraph CHAPTER 5: HAZARDOUS WASTE and the JEGS. If additional information is needed, consult the Environmental Representative.

3.16 INADVERTENT DISCOVERY OF PETROLEUM-CONTAMINATED SOIL OR HAZARDOUS WASTES

If petroleum-contaminated soil, or suspected hazardous waste is found during construction that was not identified in the Contract documents, immediately notify the Contracting Officer. Do not disturb this material until authorized by the Contracting Officer.

3.17 PEST MANAGEMENT

In order to minimize impacts to existing fauna and flora, coordinate with the [Installation Pest Management Consultant (IPMC) and the Natural Resources Manager], through the Contracting Officer, at the earliest possible time prior to pesticide application. Discuss integrated pest management strategies with the IPC and receive concurrence from the IPM through the Contracting Officer prior to the application of any pesticide associated with these specifications. Provide Installation Project Office Pest Management personnel the opportunity to be present at meetings concerning treatment measures for pest or disease control and during application of the pesticide. The use and management of pesticides are regulated under the JEGS and all applicable Federal, GOJ national or prefectural laws and regulations and installation requirements.

3.17.1 Application

Apply pesticides using a DoD-certified or equivalent Japanese-certified pesticide applicator in accordance with guidance given on the pesticide label. Labels will bear the appropriate use instructions and precautionary message based on the toxicity category of the pesticide. The certified applicator must wear clothing and personal protective equipment as specified on the pesticide label. If local nationals will be using the pesticides, the precautionary messages and use instructions shall be in English and Japanese. The Contracting Officer shall designate locations for water used in formulating. Do not allow the equipment to overflow. Inspect equipment for leaks, clogging, wear, or damage and repair prior to application of pesticide.

3.17.2 Pesticide Treatment Plan

Include and update a pesticide treatment plan, as information becomes available. Include in the plan the sequence of treatment, dates, times, locations, pesticide trade name, EPA registration numbers if applicable, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient (that is, pounds of active ingredient applied), equipment used for application, and calibration of equipment. Comply with the JEGS or any applicable Federal GOJ national or prefectural and installation requirements.

3.18 PESTICIDES IN SOIL

Evaluate excess soils and concrete foundation debris generated during the demolition of housing units or other wooden structures for the presence of

pesticides prior to reuse or final disposal.

3.19 SOUND INTRUSION

Make the maximum use of low-noise emission products, as certified by the EPA or Japanese equivalent. Blasting or use of explosives are not permitted without written permission from the Contracting Officer, and then only during the designated times. Confine pile-driving operations to the period between 0800 and 1600, Monday through Friday, exclusive of holidays, unless otherwise specified.

Keep construction activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the 29 CFR 1910, and applicable GOJ, U.S. Federal, and local rules and regulations.

3.20 POST CONSTRUCTION CLEANUP

Clean up areas used for construction in accordance with Contract Clause CLEANING UP. Unless otherwise instructed in writing by the Contracting Officer, remove traces of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Grade and seed disturbed areas to conform to surrounding contours.

-- End of Section --

ENVIRONMENTAL PROTECTION

1. GENERAL

1.1 SECTION INCLUDES: This specification covers the requirements for environmental protection during construction activities.

1.2 REFERENCES:

The Contractor shall comply with applicable laws and regulations of the Governments of the United States and Japan, however denominated, including those applicable political subdivisions, departments, and other entities, to include but not be limited to, the most current versions of the following:

A. DOD Japan Environmental Governing Standards (JEGS), Headquarters, U.S. Forces Japan

B. Air Force Instructions (AFIs)

C. 374AWI 32-7001 Solid Waste Management

D. 374AWI 32-7002 Water Pollution Control Facilities

E. Other applicable regulations and management plans

1.3 ENVIRONMENTAL PROTECTION REQUIREMENTS:

A. The Contractor shall minimize environmental pollution and damage as the result of contractor's performance. The control of environmental pollution and damage requires consideration of land, water, and air, and includes management of visual aesthetics, solid waste, as well as other pollutants. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract.

B. Subcontractors: The Contractor shall ensure compliance with this section by their subcontractors.

C. Environmental Protection Plan: The Contractor shall submit an Environmental Protection Plan (EPP) within 15 days after receipt of the notice to proceed. Approval of the Contractor's plan will not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures. The EPP shall include, but not be limited to, the statement under 1.3.1 through 1.3.13:

D. The Project Manager (or designee) shall be responsible for the execution of the EPP. His or her responsibilities are, but not limited to, as follows:

1. Ensuring adherence to the Environmental Protection Plan;
2. Ensuring all appropriate documents are submitted to Environmental Element (374 CES/CEIE);
3. Appointing an emergency response manager for environmental emergencies, and;
4. Training personnel in accordance with the requirements of this plan.

E. The use of the following materials is prohibited:

1. Do not use materials containing asbestos unless deemed absolutely necessary. If necessary, asbestos concentration shall be limited to less than 0.1 percent by weight.

2. Do not use materials containing lead-based paint greater than 0.06 percent lead by weight.
3. Do not use materials containing polychlorinated biphenyl's (PCB) greater than 0.5mg/kg.
4. Do not use class 1 ozone depleting substances (ODS) listed in JEGS, Chapter 2.

1.3.1. ENVIRONMENTAL MANAGEMENT SYSTEM

A. All contractor personnel shall be aware of and comply with the Yokota Air Base Environmental Commitment Statement. The contractor shall also comply with the EMS program, including all base environmental plans, instructions and the Japan Environmental Governing Standards (JEGS). This also includes instructions/comments provided on planning documents such as 332's (Base Civil Engineer Work Request), and 813s (Request for Environmental Impact Analysis).

B. Communicate with Environmental Program Managers (EPMs) to be aware of any operational controls (permits, plans, requirements to purchase recycled content, bio-based, or energy efficient products).

C. Provide copies of environmental records as requested by EPMs to meet recordkeeping requirements.

D. Ensure that personnel are properly trained in accordance with applicable statutes and regulations.

E. Immediately report all hazardous waste or hazardous material releases to the installation emergency response activity, and fully cooperate with any emergency response.

1.3.2. AIR QUALITY

A. Equipment operation and activities or processes performed by the Contractor in accomplishing the specified construction shall be in accordance with all applicable Federal and local laws and standards.

B. Class I Ozone Depleting Substances (ODS): Class I ODS listed in JEGS, Chapter 2 are prohibited from being used in construction, remodeling, or maintenance. Contractor must provide certifications that refrigerant utilized during the project do not contain Class I ODS. The purchase of Class I ODS for air conditioning and refrigeration equipment for ground applications is also prohibited by AFI 32-7086 on all new and/or refurbishing projects. NOTE: Limited exceptions exist for using Class I ODS for airborne equipment with prior approval. Contact 374 CES/CEIE for details.

C. Class II ODS Approval Request: Class II ODS listed in JEGS, Chapter 2 must first be approved by 374 CES/CEIE prior to use.

D. All Refrigerant Types: Ensure a weatherproof data plate is permanently attached to refrigeration (or air conditioning) equipment, in a location visible to maintenance workers, showing refrigerant type and full charge quantity.

E. Generators, Incinerator, and Boilers: If generators, incinerator or boilers are to be installed or replaced as part of the project, the contractor shall provide 374 CES/CEIE stack height with:

1) Fuel Combustion Rate (L/hr) for Generators;
2) Grate area (m2), Rated Capacity (t/day), Incineration rate(kg/h) for Incinerator;
3) Heating area (m2), Burner combustion rate (L/hr), Heat Input rating (MMbtu/hr) for Boilers.

F. Particulates: Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The contractor shall coordinate with 374 CES/CEIE before the commencement of any activities. Even sprinkling of water should be reconsidered from resource conservation standpoint. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

G. Hydrocarbons and Carbon Monoxide: Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to allowable limits at all times.

H. Odors: Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

I. Sound Intrusions: The Contractor shall control noise to minimize environment damage.

1.3.3.WATER RESOURCES

A. The Contractor shall manage their activities to avoid pollution of surface and ground waters. Toxic or hazardous chemicals shall not cause contamination of the fresh water reserve. Monitoring of water areas affected by construction shall be the Contractor's responsibility. All water areas affected by construction activities shall be monitored by the Contractor.

B. Washing and Curing Water: Wastewaters originating from construction activities shall not be allowed to enter water areas.

C. Fish and Wildlife: The Contractor shall minimize interference with, disturbance to, and damage of fish and wildlife. Species that require specific attention along with measures for their protection shall be listed by the Contractor prior to beginning of construction operations.

D. Wastewater Management: The Contractor is not authorized sewage holding tanks on base and is not authorized to dispose of waste from chemical toilets/porta-potties via the installation sewer system. When using chemical toilets, the contractor shall plan for procuring a porta-potty/chemical toilet service contract. The porta-potty/chemical toilet service contract must include the correct maintenance, waste collection, transportation and disposal of all porta-potty/chemical toilets and content to include provisions for pest control and elimination of odors. If the project generates wastewater from rinsing tanks, dewatering sites, etc, the contractor shall ensure proper disposal after CEIE’s approval. The Contractor may be required to provide further analysis and treatment based on the condition of wastewater.

1.3.4. HAZARDOUS MATERIALS

A. Approval is required before bringing any hazardous materials (HAZMAT) on to the installation. Contractors seeking approval to bring HAZMAT onto the installation must submit AF Form 3000 along

with Safety Data Sheet (SDS) in English and Japanese. The contractor is also required to provide the estimated amount of HAZMAT to be used during the project. If the HAZMAT is suspected to contain lead or asbestos, such as paint, primer, caulking, a certificate from the manufacturer has to be provided to prove that the HAZMAT is free of asbestos/lead. The AF Form 3000 package has to be reviewed by Bioenvironmental (374 AMDS/SGPB), Safety (374 AW/SE) and Environmental (374 CES/CEIE). The Contractor should use non or less -hazardous chemicals when available. All excess materials and empty containers are the responsibility of the contractor and shall be removed at the end of the contract. When the occupants of the facility request the contractor leave the excess HAZMAT, the contractor has to coordinate with and be approved by 374 CES/CEIE.

B. Storage: All containers of HAZMAT in the work place should be labeled, tagged or marked in both English and Japanese with the identity of the products. The contractor shall ensure adequate handling and storage in accordance with JEGS where the HAZMAT is stored. Storage of oils, greases, chemicals, fuels or other liquids will require spill prevention and security. Contractor is not allowed to store HAZMAT on base for over 24 hours without authorization. If on-base HAZMAT storage areas are needed, Contractor shall submit the list of all items that are to be stored on-base and estimated quantities to 374 CES/CEIE, 374 CES/CEF and 374 AW/SE for approval. Hazardous materials storage areas may be inspected by 374 CES/CEIE, 374 CES/CEF and 374 AW/SE. SDSs must be available at storage and on site at all times.

1.3.5. WASTE DISPOSAL

A. Every effort shall be made to use recycling and/or reuse (diversion) measures to reduce the amount of waste generated under the Contract. Waste minimization and disposal plan shall be included in the EPP. In addition, a copy of contract(s) for waste collection/transportation and disposal permits issued from metropolitan/prefectural governments shall be submitted with AF Form 3000 to 374 CES/CEIE separate from the EPP. The plan also needs to list waste that will be generated from the contract and how they are treated (recycled/incinerated/landfilled). After the disposal, waste manifests shall be submitted to 374 CES/CEIE along with recycling report that shows the amount of waste recycled, incinerated/landfilled (Atch 1).

B. Solid Wastes: Solid wastes (excluding clearing debris) shall be placed in containers which are emptied on a regular schedule. Handling and disposal shall be conducted to prevent contamination. Segregation measures shall be employed so that no hazardous or toxic waste will become co-mingled with solid waste. The Contractor shall transport solid waste off government property and dispose of it in compliance with applicable federal and local requirements for solid waste disposal. The Contractor shall comply with site procedures Federal and local laws and regulations pertaining to the use of landfill areas. At a minimum, the following items will be recycled: scrap metal, cardboard, concrete, asphalt, scrap wood, wooden pallets, glass and plastic. Green wastes should be mulched or composted.

C. Hazardous Waste (HW): All HW generated by the contractor shall be disposed/recycled off base in accordance with Japanese regulation, Article 3 of "Law of Disposal and Clearing of Waste *"Haikibutsu no shori oyobi seisou ni kansuru horitsu"* and local regulations. US/foreign made ionization smoke detectors shall be turned in to 374 CES/CEOFA (Alarm Shop). The Contractor shall not leave any hazardous waste at work site areas at the end of duty hours. If temporary hazardous waste storage is needed to accumulate hazardous waste on base, the contractor shall submit spill response plan with site map, the list of all hazardous waste to be stored on-base and estimated quantities to 374 CES/CEIE, 374 CES/CEF, 374 AMDS/SGPB and 374 AW/SE for approval.

E. Burning: Open burning is prohibited for the purpose of reducing waste.

1.3.6. FUEL STORAGE TANKS

A. Temporary Fuel Storage Tanks: The use of temporary fuel storage tanks with capacities greater than 55 gallons as part of a project must be approved by 374 CES/CEIE. The approval request must contain justification for the use of a temporary tank and design details, including a layout diagram indicating the proposed location of the tank within the project site. If a temporary fuel storage tank is approved for use, a Site-specific Spill Contingency Plan (SSCP) must be developed. After construction/installation of a temporary fuel storage tank, the Contractor shall contact project manager or 374 CES/CEIE at 225-5440 to inform Fuels Management Flight (374 LRS/LGRF) to coordinate an initial inspection (AFI 23-204).

B. Aboveground Storage Tank (AST) Installation: If the contractor is installing a permanent aboveground fuel storage tanks as part of the project, it shall be designed and installed in accordance with all applicable regulations (JEGS, AFIs, UFCs, etc). The contractor is responsible to conduct all operation check, including providing fuel for the test, before hand over to the base. AST will be assigned a Tank ID Number by 374CES/CEIAP and this Tank ID Number shall be used on tank signage and in project documentation. After construction/installation of an AST, the Contractor shall contact project manager or 374CES/CEIE at 225-5440 and the Fuels Management Flight (374 LRS/LGRF) at 225-4617 to coordinate an initial inspection (AFI 23-204).

C. Underground Storage Tank (UST) Installation: In general, USTs should not be installed. Fuel storage tanks shall be installed aboveground, unless overriding requirements exist against aboveground installation such as safety, fire protection measures, or force protection measures. The contractor shall report justification of overriding requirements against installation of an AST to 374 CES/CEIE. If a UST is approved for installation as part of a project, the Contractor shall ensure that design drawings contain adequate detail to demonstrate that the UST will be installed in accordance with all applicable regulations. The contractor is responsible to conduct all operation checks, including providing fuel for the test, before hand over to the base. After construction/installation of an AST, the Contractor shall contact project manager or 374CES/CEIE at 225-5440 and the Fuels Management Flight (374 LRS/LGRF) at 225-4617 to coordinate an initial inspection (AFI 23-204).

D. AST Removal: When a facility with a fuel storage tank(s) is demolished, demolition of the tank(s) and associated infrastructure, including above-ground piping, underground piping to the building serviced by the tank, indoor piping to the equipment serviced by the tank, secondary containment curbing, tank saddles, tank pads, Oil Water Separators (OWS), grounding stations, signage, fencing around the AST, associated equipment and sidewalks leading to the AST shall be included in the scope of the project. Contractor shall ensure to comply with applicable regulations such as AFI32-7044, UFC 3-460-01 and UFGS 33 01 50.01, 33 65 00.

E. UST Removal: The following standards of UST removal shall be applied as required including but not limited to applicable JEGS Chapter 19, AFI32-7044, UFC 3-460-01, USGF 02 65 00, 33 01 50.01, 33 65 00 the UST Removal Procedures appendix of the PACAF UST Policy: Contractor shall ensure to comply with above regulations.

F. Contaminated Soil Removal: If exposed free product and/or obviously contaminated soil is encountered during UST removal, contact 374CES/CEIE immediately. If soil contamination is caused by the contractor’s mismanagement, the contractor is responsible for cleanup and disposal in accordance with spill response procedures outlined in this specification and local applicable regulations.

G. Fuel Storage Tank Installation/Removal Report: If an AST/UST is installed or an AST/UST is removed as part of the project, the Contractor shall prepare a Fuel Storage Tank Installation/Removal Report and provide it to 374CES/CEIE within 30 days of the completion of site work. At a minimum, the report shall include the following:

1) Summary of work conducted;
2) Removal date for each removed storage tank;
3) Date placed in service, capacity, manufacturer name, model number, and serial number for each new AST/UST;
4) As-built drawings showing the removed AST/USTs and new ASTs and associated infrastructure;
5) Leak check report for buried piping associated with storage tank at time of installation, modification, construction, relocation or replacement.
6) Manufacturer Operations & Maintenance Manuals and product information;
7) Manufacturer Warranty Cards(Copy);
8) Photo documentation of construction activities, including AST/UST removals and/or new AST installations.

1.3.7. POLYCHLORINATED BIPHENYLS (PCBs)

A. Procurement of No PCB Containing Materials: Materials that contain PCBs are prohibited from being used under this Contract. All procurement of transformers or any other equipment containing dielectric or hydraulic fluid shall be accompanied by the manufacturer's certification that all materials/equipment (e.g., ballasts, capacitors, transformers, Paper Insulated Lead Covered (PILC) Cable, etc.) contain non-PCB dielectric fluid. All Non-PCB certificates shall be submitted to the 374 CES/CEIE and CEOFE with the list of the new material/equipment information prior to transformer or equipment installation (Atch 2). Newly procured transformers and equipment shall have permanent plate affixed stating they are PCB-free in Japanese and in English. The plate should be a 200mm long and 50mm wide acrylic plate with heat treated paint. Base color should be green and letter color should be white. The plate must state "PCB Free by Japanese standard; date of installation, manufacturer, and serial number" in both Japanese and English. The sample of PCB Free Plate is attached (Atch 3). The plate should be affixed to the outside of transformer or cubicle enclosure in an easily identifiable location.

B. Lighting Fixture/Ballast Disposal: The contractor shall identify if lighting fixture/ballast(s) contain-PCBs. Japanese lighting fixtures/ballasts may be identified with the manufacturer's website. All US lighting fixtures/ballasts shall be treated as PCBs unless there is a label stating as Non-PCB. All US made ballasts with or without a label stating PCB Free shall be treated as PCB containing materials in Japan unless information to the contrary exists. US made ballasts without label may contain >500ppm PCBs, and those with "PCB Free" label may contain <50ppm PCBs. If the lighting fixture/ballast is confirmed as Non-PCB item, the contractor is able to dispose of it as a regular industrial waste or recycle it following local Japanese regulations. If the lighting fixture/ballast is confirmed as to contain PCBs, the Contractor shall segregate ballasts by country and manufacturer, and shrink wrap each individually for turn in to the 374 CES/CEIE. Prior to turn in, the contractor shall submit a list of PCB waste including country of origin, name of manufacturer, serial number, year of manufacture, weight and quantity of ballasts to 374 CES/CEIE for proper disposal.

C. PCB Transformer/Equipment Disposal: All transformers or any other equipment containing dielectric/hydraulic fluid shall be considered and treated as PCB containing unless information to the contrary exists. All suspected PCB materials removed for disposal must be sampled for analysis. The Contractor shall identify if the material contains PCB by using Japanese approved method required by the Ministry of the Environment. After the material is confirmed as PCB, the Contractor shall provide the sample result to 374 CES/CEIE. In addition, all sample results, regardless of PCB contamination, must be provided to 374 CES/CEIE. Material and equipment which cannot be sampled such as those hermetically sealed shall be treated as PCB containing. If the material is confirmed as Non-PCB, the Contractor is able to dispose of it as a regular industrial waste or recycle it by following applicable local Japanese regulations. Government will provide PCB sampling results to the contractor, if available. If the material is confirmed as PCB, the Contractor shall turn in the material to 374 CES/CEIE for proper disposal. All PCB containing materials must be containerized in appropriate UN certified drum or placed in a metal secondary containment which holds 125 percent of total oil volume. PCB item(s) and secondary containment must be placed on a pallet and secured with metal strap bands. Prior to turn in, the Contractor shall provide a list of PCB items to 374 CES/CEIE (Atch 2). The list must contain country of origin, name of manufacturer, year of manufacture, serial number, KVA, PCB concentration, oil volume, weight of item, weight of drum/secondary containment, weight of pallet and total weight. The list needs to be reviewed by 374 CES/CEIE prior to turn in. The Contractor must remove any PCB identification label affixed on the material, and ensure the PCB items do not spill during handling, storage and transportation.

1.3.8. ASBESTOS

A. No Asbestos Containing Materials (ACM): Material that contains asbestos is prohibited from being used in construction, remodeling, or maintenance unless deemed absolutely necessary. If necessary, asbestos concentration shall be limited to less than 0.1% by weight. The Contractor must provide manufacturer certifications that state materials utilized do not contain asbestos or justification for ACM and relevant certification.

B. Asbestos Sampling and Analysis Plan (SAP): If historical asbestos sampling data is not available for the building materials to be disturbed, asbestos sampling may be required prior to the start of the project. If the contractor is required to collect samples, an asbestos Sampling and Analysis Plan must be submitted and approved by 374 CES/CEIE prior to sample collection. The SAP must adhere to Asbestos Hazard Emergency Response Act (AHERA) sampling requirements.

C. Asbestos Abatement & Disposal Plan: An Asbestos Abatement and Disposal Plan must be submitted and approved by 374 CES/CEIE prior to starting asbestos abatement.

D. Asbestos Accident Prevention Plan: If asbestos abatement work is required, the Contractor shall prepare a written comprehensive site-specific Accident Prevention Plan (APP).

E. Notification of Unexpected Discovery of Asbestos During Work: If the Contractor discovers previously untested building components suspected to contain asbestos and located in areas impacted by the work, the Contractor shall not disturb the suspect material. In such instances, the Contractor shall notify the CO and 374 CES/CEIE immediately for direction.

F. Asbestos Disposal Manifests: A copy of the asbestos disposal manifest indicating final disposal

must be provided to 374 CES/CEIE and the CO within 60 days after issuance. It will be kept for a minimum of five years. If a copy of the manifest is not received by the CO within 60 days after issuance, the government will investigate the Contractor's work for transportation or disposal and report the findings to USFJ/J42E.

1.3.9. LEAD-BASED PAINT

A. Lead-Based Paints: Paint containing lead is prohibited from being used in construction, remodeling, or maintenance. Contractor must provide manufacturer certifications that materials utilized are lead free per JEGS, Chapter 17. The contractor shall furnish a certificate for paint and paint related materials proposed for use attesting that the paint is lead free unless deemed necessary. If so, the concentration of lead shall be no more than 0.06 percent lead.

B. Lead-Based Paint Sampling Plan: If historical lead-based paint sampling data is not available for the building materials to be disturbed, lead-based paint sampling may be required prior to the start of the project. If the contractor is required to collect samples, Lead-Based Paint Sampling and Analysis Plan must be submitted and approved by 374 CES/CEIE prior to sample collection.

C. Lead-Based Paint Abatement & Disposal Plan: A Lead-Based Paint Abatement and Disposal Plan must be submitted and approved by 374 CES/CEIE and 374 AMDS/SGPB prior to starting lead-based paint abatement activities.

D. Lead-Based Paint Clearance Sampling Results: Clearance sampling must be coordinated with 374 AMDS/SGPB for approval prior to tearing down the containment enclosure. The contractor will provide sample analysis results to the CO, 374 CES/CEIE, and 374 AMDS/SGPB. 374 AMDS /SGPB will provide approval for containment tear-down. The on-site QA will ensure the site is returned to the base in proper condition and will notify the CO of the site status.

E. Lead Waste Disposal: The contractor must collect, characterize for possible hazardous toxicity, and dispose of in accordance with applicable local regulations.

1.3.10. HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

A. Existing historical, archaeological, and cultural resources within the contractor's work area will be so designated by the Contracting Officer if any has been identified. The contractor shall take precautions to preserve all such resources as they existed at the time they were first pointed out. The contractor shall provide and install protection for these resources and be responsible for their preservation during the life of the contract. If any previously unidentified or unanticipated resources are discovered during the project, stop any type of work, which is anticipated, to damage the resource and report the fact to the Contracting Officer. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rocks or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer.

1.3.11. LAND RESOURCES

A. The contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated on the drawings or as directed by the Contracting Officer. Temporary

movement or relocation of contractor facilities shall be made only when approved. The contractor shall manage to minimize erosion and to prevent sediment from entering nearby waters. The contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the contractor shall identify the land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the contractor shall not remove, cut deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without permission. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such emergency use in permitted, the contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, earth or other material displaced into uncleared areas shall be removed.

B. Work Area Limits: Prior to any construction, the contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence.

C. Landscape: Vegetation resources, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques. Any anticipated vegetation disturbance needs to be coordinated with the Government before it occurs.

D. Unprotected Erodible Soils: All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils.

E. Disturbed Areas: The Contractor shall effectively prevent erosion and control sedimentation. Control methods should be coordinated with the Government.

F. Preconstruction Survey: Prior to starting any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey after which the Contractor shall prepare a brief report indicating on a layout plan the condition of trees, shrubs and grassed areas immediately adjacent to work sites and adjacent to the assigned storage area and access routes as applicable. This report will be signed by both the Contracting Officer and the Contractor upon mutual agreement as to its accuracy and completeness.

1.3.12. ENVIRONMENTAL EMERGENCY PROCEDURES

A. Drawing: Drawings showing locations of any proposed temporary facilities, hazardous materials storage, hazardous and solid waste collection point, excavations, embankments, existing utility lines to include storm drains shall be attached to EPP and submitted to 374 CES/CEIE for review.

B. Notification: The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the previously mentioned Federal or local laws or regulations, permits, and other elements of the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action when approved. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspensions.

C. Spill Prevention and Response:

1) The Contractor shall conduct all operations in a manner that prevents spills of POL and Hazardous Substances. The Contractor is required to familiarize personnel with spill prevention and response procedures, fire suppression systems, and SDSs for all materials used and/or stored on the project site. The Contractor shall provide and maintain spill equipment, sufficient in both type and quantity, at all sites involving the storage, use, or handling of POL and/or hazardous substances.

2) Site-specific Spill Contingency Plan (SSCP): An SSCP must be developed for any project at which POL or Hazardous Substances are used and/or stored at the project site. The SSCP shall include spill response procedures, an inventory of POL and/or hazardous substances, probable spill routes, a project site layout diagram, and a spill response equipment inventory. A template SSCP can be obtained from 374CES/CEIE. The Contractor shall train employees on the contents of the SSCP and the use of spill response equipment and shall document such training.

3) Spill Reporting: The Contractor shall immediately report all POL or Hazardous Substances spills to the Fire Emergency Services (374 CES/CEF) at 911 or Commercial 042-507-6560 (direct number to Yokota Fire Dispatch).

4) Spill Cleanup:

a. The Contractor is responsible for clean-up of POL and/or hazardous substance spills and disposal of clean-up material. The Contractor shall determine, as quickly as possible, the nature of the spilled substance and implement necessary safety precautions to protect both human health and the environment at no additional cost to the US Government, and shall only be performed by personnel adequately trained in spill response and cleanup techniques for the severity of the spill incident.

b. Costs incurred from any Contractor spills are the responsibility of the Contractor. If the US Government has to perform emergency spill response and cleanup, due to the non-availability of designated personnel or if the spill is beyond the capability of designated personnel, the Contractor shall be held liable for all costs associated with performing said work.

1.3.13. OTHERS

A. Previously Used Equipment: The Contractor shall thoroughly clean all construction equipment previously used at other sites before it is brought into the work areas, ensuring that soil residuals are removed and that egg deposits from plant pests are not present.

B. Post Construction Cleanup: The contractor shall clean up all areas used for construction.

C. Restoration of Landscape Damage: The Contractor shall restore landscape features damaged or destroyed during construction operations.

D. Training of Contractor Personnel: The Contractor's personnel shall be trained in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental pollution control.

Attachments:

1. Construction Debris Disposal and Recycling Data
2. New & Existing Transformer List
3. PCB Free Plate
4. PCB Lighting Fixture/Ballast List

END OF SECTION

Disposal and Recycling Data Sheet

Project Number		**Name of Contractor**	
Title of Project		**Name of Project Manager**	
Date Project Started		**Phone Number of Contractor**	
Date of Final Inspection		**Name of Inspector/Office Symbol**	
Date of Submission		**Phone Number of Inspector**	

Items	Concrete Debris	Recycle Amount	Metals	Recycle Amount	Asphalt Debris	Recycle Amount	Wood	Recycle Amount	Others (soil not included)	Recycle Amount
Generated Weight (ton)										
Volume (m3)										
Recycle Rate (%)										
Remarks										

1. Fill out and submit this form to CE Environmental through government representative before final inspection is completed.

2. Specify method of recycling in "Remarks".

3. If any other wastes are recycled, list them below.

4. Specify how the waste get disposed of (incinerated, landfilled etc.)

Existing Transformer List (to-be-removed)

既存の変圧器リスト(撤去予定）

Project #（プロジェクト番号）：

Project Title（プロジェクト名）：

No.	Bldg # 建物番号	Facilty Name 施設名	Trans ID トランスＩＤ	Type 型式	KVA 容量	Phase 相数	Serial# 製造番号	MFR Name 製造元	MFG Date 製造年・月	Oil (L) 油量	Total Weight (Kg) 総重量	Non PCB Certificate/Analytical Results (Y/N) ＰＣＢ不含証明書/分析結果の有・無
1			T-									
2			T-									
3			T-									
4			T-									
5			T-									
6			T-									
7			T-									
8			T-									
9			T-									
10			T-									

Please submit this list to CE Environmental Office (DSN: 225-5440) with Non-PCB Certificate prior to install transformer(s) listed above.
本リストは上記の変圧器の撤去前にＣＥ環境課(内線　225-5440)へＰＣＢ不含証明書もしくは分析結果とともにご提出願います。

New Transformer List (to-be-installed)

新規変圧器リスト(設置予定）

Project #（プロジェクト番号）：

Project Title（プロジェクト名）：

No.	Bldg # 建物番号	Facilty Name 施設名	Trans ID トランスＩＤ	Type 型式	KVA 容量	Phase 相数	Serial# 製造番号	MFR Name 製造元	MFG Date 製造年・月	Oil (L) 油量	Total Weight (Kg) 総重量	Non PCB Certificate/Analytical Results (Y/N) ＰＣＢ不含証明書/分析結果の有・無
1			T-									
2			T-									
3			T-									
4			T-									
5			T-									
6			T-									
7			T-									
8			T-									
9			T-									
10			T-									

Please submit this list to CE Environmental Office (DSN: 225-5440) with Non-PCB Certificate prior to install transformer(s) listed above.
本リストは上記の変圧器の設置前にＣＥ環境課(内線　225-5440)へＰＣＢ不含証明書もしくは分析結果とともにご提出願います。

Attachment 3: Example of PCB Free Plate

Project # (プロジェクト番号)：

Project Title (プロジェクト名):

Bldg (建物番号）：

	MFR Name 製造元	Serial/Catalog# 製造・カタログ番号	Power Factor 力率	Country of Origin 生産国	MFG Date 製造年	Qty 数量	Method of PCB Identiciation (PCB判別方法）
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

SECTION 01 74 19

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY (DA)

DA AR 200-1	(2007) Environmental Protection and Enhancement
DA AR 420-1	(2008; Revision 2012) Army Facilities Management

U.S. DEPARTMENT OF DEFENSE (DOD)

JEGS	(Dec 2020) Japan Environmental Governing Standards

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED BDC Ref Guide	(2019) LEED BDC Reference Guide for Building Design and Construction, Version 4.1]

1.2 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction and use of facilities. As part of the implementation of that policy, practice efficient waste management when sizing, cutting, and installing products and materials, and use all reasonable means to divert construction and demolition waste from landfills and incinerators and to facilitate their recycling or reuse. Divert a minimum of 60 percent by weight of total project solid waste from the landfill.[Comply with TPC requirements as specified in Section 01 33 29 SUSTAINABILITY REPORTING.]

1.3 MANAGEMENT

Develop and implement a waste management program. Take a pro-active, responsible role in the management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate in the effort. The Environmental Manager, as specified in Section [01 57 19][01 57 19.01] TEMPORARY ENVIRONMENTAL CONTROLS, is responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the project. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste, consider the availability of viable markets, the condition of the material, the ability

to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates. Implement any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recyclable materials not claimed by the Government will accrue to the Contractor. Appropriately permit firms and facilities used for recycling, reuse, and disposal for the intended use to the extent required by federal, state, and local regulations. Also, provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information onlysubmittals not having a "G" designation are for Contractor Quality Control or Designer of Record approval. Submit the following in accordance with Section 01 33 00SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Waste Management Plan; G

SD-11 Closeout Submittals

Records

1.5 MEETINGS

Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting with the Contracting Officer to discuss the proposed Waste Management Plan and to develop a mutual understanding relative to the details of waste management. The requirements for this meeting may be fulfilled during the coordination and mutual understanding meeting outlined in Section 01 45 00.00 10 QUALITY CONTROL. At a minimum, discuss environmental and waste management goals and issues at the following additional meetings:

a. Pre-bid meeting.

b. Preconstruction meeting.

c. Regular QC meetings.

d. Work safety meetings.

1.6 WASTE MANAGEMENT PLAN

Submit a Waste Management Plan within 15 days after Notice to Proceed. The plan demonstrates how to meet the the project waste diversion goal. Also, include the following in the plan:

a. Name of individuals on the Contractor's staff responsible for waste prevention and management.

b. Actions that will be taken to reduce solid waste generation, including coordination with Subcontractors to ensure awareness and participation.

c. Description of the regular meetings to be held to address waste management.

d. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of wastes.

e. Characterization, including estimated types and quantities, of the waste to be generated.

f. Name of landfill and/or incinerator to be used and the estimated costs for use, assuming that there would be no salvage or recycling on the project.

g. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used materials such as materials exchange networks and Habitat for Humanity. Include the name, location, and phone number for each reuse facility to be used, and provide a copy of the permit or license for each facility.

h. List of specific waste materials that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Identify the recycling facilities by name, location, and phone number, including a copy of the permit or license for each facility.

i. Identification of materials that cannot be recycled/reused with an explanation or justification, to be approved by the Contracting Officer.

j. Description of the means by which any waste materials identified in item (h) above will be protected from contamination.

k. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).

l. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue generated by sale of the materials and the incineration and/or landfill cost avoidance.

Revise and resubmit Plan as required by the Contracting Officer. Approval of Contractor's Plan shall not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Distribute copies of the Waste Management Plan to each Subcontractor, the Quality Control Manager, and the Contracting Officer.

1.7 RECORDS

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration.[Keep records in accordance with the LEED BDC Ref Guide.] Quantities may be measured by weight or by volume, but must be consistent throughout. List each type of waste

separately noting the disposal or diversion date. Identify the landfill, recycling center, waste processor, or other organization used to process or receive the solid waste. Provide explanations for any waste not recycled or reused. With each application for payment, submit updated documentation for solid waste disposal and diversion, and submit manifests, weight tickets, receipts, and invoices specifically identifying the project and waste material. Make the records available to the Contracting Officer during construction, and deliver to the Contracting Officer upon completion of the construction a copy of the records.

1.8 REPORTS

Provide quarterly reports and a final report to Contracting Officer. Include project name, information for waste generated this quarter, and cumulative totals for the project in quarterly and final reports. Also include in each report, supporting documentation to include manifests, weight tickets, receipts, and invoices specifically identifying the project and waste material. Include timber harvest and demolition information, if any. See Section [01 57 19] [01 57 19.01] TEMPORARY ENVIRONMENTAL CONTROLS for Nonhazardous Solid Waste Diversion Report requirements.

1.9 COLLECTION

Separate, store, protect, and handle at the site identified recyclable and salvageable waste products in a manner that maximizes recyclability and salvagability of identified materials. Provide the necessary containers, bins and storage areas to facilitate effective waste management and clearly and appropriately identify them. Provide materials for barriers and enclosures around recyclable material storage areas which are nonhazardous and recyclable or reusable. Locate out of the way of construction traffic. Provide adequate space for pick-up and delivery and convenience to Subcontractors. Recycling and waste bin areas are to be kept neat and clean, and handle recyclable materials to prevent contamination of materials from incompatible products and materials. Clean contaminated materials prior to placing in collection containers. Use cleaning materials that are nonhazardous and biodegradable. Handle hazardous waste and hazardous materials in accordance with applicable regulations and coordinate with Section [01 57 19][01 57 19.01] TEMPORARY ENVIRONMENTAL CONTROLS. Separate materials by one of the following methods:

1.9.1 Source Separated Method

Separate waste products and materials that are recyclable from trash and sorted as described below into appropriately marked separate containers. Transport materials to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Separate materials into the following category types as appropriate to the project waste and to the available recycling and reuse programs in the project area:

a. Land clearing debris.

b. Asphalt.

c. Concrete and masonry.

d. Metal (e.g. banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, lead brass, bronze).

(1) Ferrous.

(2) Non-ferrous.

e. Wood (nails and staples allowed).

f. Debris.

g. Glass (colored glass allowed).

h. Paper.

(1) Bond.

(2) Newsprint.

(3) Cardboard and paper packaging materials.

i. Plastic.

(1) Type 1 - Polyethylene Terephthalate (PET, PETE).

(2) Type 2 - High Density Polyethylene (HDPE).

(3) Type 3 - Vinyl (Polyvinyl Chloride or PVC).

(4) Type 4 - Low Density Polyethylene (LDPE).

(5) Type 5 - Polypropylene (PP).

(6) Type 6 - Polystyrene (PS).

(7) Type 7 - Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

j. Gypsum.

k. Non-hazardous paint and paint cans.

l. Carpet.

m. Ceiling tiles.

n. Insulation.

o. Beverage containers.

1.9.2 Co-Mingled Method

Place waste products and recyclable materials into a single container and then transport to a recycling facility where the recyclable materials are sorted and processed.

1.9.3 Other Methods

Other proposed methods may be used when approved by the Contracting Officer.

1.10 DISPOSAL

Control accumulation of waste materials and trash. Where materials are to be turned over to the Contractor for disposal, every effort shall be made to obtain credit from the disposal to reduce the cost of the Contract. Recycle or dispose of collected materials off of Government property at intervals approved by the Contracting Officer and in compliance with waste management procedures of JEGS, DA AR 200-1, DA AR 420-1, and local laws and regulations. Except as otherwise specified in other sections of the specifications, dispose of in accordance with the following:

1. Reuse. Give first consideration to salvage for reuse since little or no re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Consider sale or donation of waste suitable for reuse.

2. Recycle. Recycle waste materials not suitable for reuse, but having value as being recyclable. Recycle all fluorescent lamps, HID lamps, and mercury-containing thermostats removed from the site. Arrange for timely pickups from the site or deliveries to recycling facilities in order to prevent contamination of recyclable materials.

3. Compost. Consider composting on-site if a reasonable amount of compostable material will be available. Compostable materials include plant material, sawdust, and certain food scraps.

4. Waste. Dispose of materials with no practical use or economic benefit to waste-to-energy plants where available. As the last choice, dispose of materials at a landfill or incinerator.

5. Return. Set aside and protect misdelivered and substandard products and materials and return to supplier for credit.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

SECTION 01 78 00

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E1971	(2005; R 2011) Stewardship for the Cleaning of Commercial and Institutional Buildings

GREEN SEAL (GS)

GS-37	(2017) Cleaning Products for Industrial and Institutional Use

SPATIAL DATA STANDARDS FOR FACILITIES, INFRASTRUCTURE, AND ENVIRONMENT (SDSFIE)

SDSFIE 3.1.0.1	(2015) Air Force Data Model

U.S. ARMY CORPS OF ENGINEERS (USACE)

ERDC/ITL TR-12-1	(2015) A/E/C Graphics Standard, Release 2.0
ERDC/ITL TR-12-6	(2015) A/E/C CAD Standard - Release 6.0

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-300-08	(2009, with Change 2, 2011) Criteria for Transfer and Acceptance of DoD Real Property

1.2 DEFINITIONS

1.2.1 As-Built Drawings

As-built drawings are the marked-up drawings, maintained by the Contractor on-site, that depict actual conditions and deviations from the Contract Documents. These deviations and additions may result from coordination required by, but not limited to: contract modifications; official responses to submitted Requests for Information (RFI's); direction from the Contracting Officer; design that is the responsibility of the Contractor, and differing site conditions. Maintain the as-builts throughout construction as red-lined hard copies on site and/or red-lined PDF files. These files serve as the basis for the creation of the record drawings.

1.2.2 Record Drawings

The record drawings are the final compilation of actual conditions reflected in the as-built drawings.

1.2.3 USACE CAD/BIM Technology Center

The USACE CAD/BIM Technology Center hosts all standard content for USACE. This content can be accessed through the CAD/BIM Technology Center website, https://cadbimcenter.erdc.dren.mil/.

1.3 SOURCE DRAWING FILES

Request the full set of electronic drawings, in the source format, for Record Drawing preparation, after award and at least 30 days prior to required use.

1.3.1 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction drawings and data for the referenced project. Any other use or reuse shall be at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim and waives to the fullest extent permitted by law, any claim or cause of action of any nature against the Government, its agents or sub consultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic CAD drawing files are not construction documents. Differences may exist between the CAD files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic CAD files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished Source drawing files, the signed and sealed construction documents govern. The Contractor is responsible for determining if any conflict exists. Use of these Source Drawing files does not relieve the Contractor of duty to fully comply with the contract documents, including and without limitation, the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction drawings anddata related to this contract, remove all previous indicia of ownership (seals, logos, signatures, initials and dates).

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information onlysubmittals not having a "G" designation are for Contractor Quality Control or Designer of Record approval. Submit the following in accordance with Section 01 33 00SUBMITTAL PROCEDURES:

SD-03 Product Data

Warranty Management Plan; G

Warranty Tags

Final Cleaning

Spare Parts Data

SD-08 Manufacturer's Instructions

Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

SD-11 Closeout Submittals

As-Built Drawings; G

Record Drawings; G

As-Built Record of Equipment and Materials; G

Final Approved Shop Drawings; G

Construction Contract Specifications; G

Interim DD FORM 1354; G

Checklist for DD FORM 1354; G

1.5 SPARE PARTS DATA

Submit two copies of the Spare Parts Data list.

a. Indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

1.6 QUALITY CONTROL

Additions and corrections to the contract drawings must be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols must be the same as the original line colors, line weights, lettering, layering conventions, and symbols.

1.7 WARRANTY MANAGEMENT

1.7.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to FAR 52.246-21 Warranty of Construction. At least 30 days before the planned pre-warranty conference, submit one set of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to

which it is entitled. The plan narrative must contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Submit warranty information, made available during the construction phase, to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period must begin on the date of project acceptance and continue for the full product warranty period. Conduct a joint 4 month and 9 month warranty inspection, measured from time of acceptance; with the Contractor, Contracting Officer and the Customer Representative. The warranty management plan must include, but is not limited to, the following:

a. Roles and responsibilities of personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

b. For each warranty, the name, address, telephone number, and email of each of the guarantor's representatives nearest to the project location.

c. A list and status of delivery of Certificates of Warranty for extended warranty items, including roofs, HVAC balancing, pumps, motors, transformers, and for commissioned systems, such as fire protection and alarm systems, sprinkler systems, and lightning protection systems.

d. As-Built Record of Equipment and Materials list for each warranted equipment, item, feature of construction or system indicating:

(1) Name of item.
(2) Model and serial numbers.
(3) Location where installed.
(4) Name and phone numbers of manufacturers or suppliers.
(5) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.
(6) Cross-reference to warranty certificates as applicable.
(7) Starting point and duration of warranty period.
(8) Summary of maintenance procedures required to continue the warranty in force.
(9) Cross-reference to specific pertinent Operation and Maintenance manuals.
(10) Organization, names and phone numbers of persons to call for warranty service.
(11) Typical response time and repair time expected for various warranted equipment.

e. The plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

f. Procedure and status of tagging of equipment covered by extended warranties.

g. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty or safety reasons.

1.7.2 Performance Bond

The Performance Bond must remain effective throughout the construction period.

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.7.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. At this meeting, establish and review communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact must be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.7.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and back charge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Life Safety Systems
(1) Fire suppression systems.
(2) Fire alarm system(s) in place in the building.

Code 1-Air Conditioning Systems
(1) Recreational support.
(2) Air conditioning leak in part of building, if causing damage.
(3) Air conditioning system not cooling properly.

Code 1-Doors
(1) Overhead doors not operational, causing a security, fire, or safety problem.
(2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

Code 3-Doors
(1) Overhead doors not operational.
(2) Interior/exterior personnel doors or hardware not functioning properly.

Code 1-Electrical
(1) Power failure (entire area or any building operational after 1600 hours).
(2) Security lights
(3) Smoke detectors

Code 2-Electrical
(1) Power failure (no power to a room or part of building).
(2) Receptacle and lights (in a room or part of building).

Code 3-Electrical
Street lights.

Code 1-Gas
(1) Leaks and breaks.
(2) No gas to family housing unit or cantonment area.

Code 1-Heat
(1) Area power failure affecting heat.
(2) Heater in unit not working.

Code 2-Kitchen Equipment
(1) Dishwasher not operating properly.
(2) All other equipment hampering preparation of a meal.

Code 1-Plumbing
(1) Hot water heater failure.
(2) Leaking water supply pipes.

Code 2-Plumbing

(1) Flush valves not operating properly.
(2) Fixture drain, supply line to commode, or any water pipe leaking.
(3) Commode leaking at base.

Code 3 -Plumbing
Leaky faucets.

Code 3-Interior
(1) Floors damaged.
(2) Paint chipping or peeling.
(3) Casework.

Code 1-Roof Leaks
Temporary repairs will be made where major damage to property is occurring.

Code 2-Roof Leaks
Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2-Water (Exterior)
No water to facility.

Code 2-Water (Hot)
No hot water in portion of building listed.

Code 3-All other work not listed above.

1.7.5 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also, submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Type of product/material	
Model number	
Serial number	
Contract number	
Warranty period from/to	
Inspector's signature	
Construction Contractor	
Address	

Telephone number	
Warranty contact	
Address	
Telephone number	
Warranty response time priority code	
WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.	

PART 2 PRODUCTS

2.1 RECORD DRAWINGS

Prepare the CAD drawing files in AutoCAD Release 2013 format and Bentley Microstation V8i format compatible with a Windows 7 or higher operating system.

2.1.1 Additional Drawings

If additional drawings are required, prepare them using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings.

2.1.1.1 Sheet Numbers and File Names

If a sheet needs to be added between two sequential sheets, append a Supplemental Drawing Designator in accordance with ERDC/ITL TR-12-6 Adding a drawing sheet, and ERDC/ITL TR-12-1.

2.2 PDF AS-BUILT FILES

Provide electronic PDF "plots" of all contract drawings sheets associated with the as-built drawing submittal. Compile and organize the PDF set to match the contract drawings.

2.3 REDLINES AND MARKUPS

Provide PDFs of the current working redlines and/or markups complying with the as-builts drawing and markup requirements contained in this specification.

2.4 AS-BUILT RE-SUBMISSION REQUIREMENTS

If elements of an as-built submittal or advanced modeling package are rejected, provide the following for each re-submission, in addition to any information required in Section 01 33 00 SUBMITTAL PROCEDURES:

a. Re-submit all components required under paragraph As-Builts or

Advanced Modeling Package, including a new Advanced Modeling Submittal Checklist and updated content in response to Government comments.

b. Provide a copy of all Government review comments.

c. Provide a disposition/response to each Government review comment for a back-check of the re-submission deliverable.

PART 3 EXECUTION

3.1 AS-BUILT DRAWINGS

Provide and maintain two black line print copies of the PDF contract drawings for As-Built Drawings. Maintain the as-builts throughout construction as red-lined hard copies on site and/or red-lined PDF files. Submit As-Built Drawings 30 days prior to Beneficial Occupance Date (BOD).

3.1.1 Markup Guidelines

Make comments and markup the drawings complete without reference to letters, memos, or materials that are not part of the As-Built drawing. Show what was changed, how it was changed, where item(s) were relocated and change related details. These working as-built markup prints must be neat, legible and accurate as follows:

a. Use base colors of red, green, and blue. Color code for changes as follows:

(1) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.

(2) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.

(3) Additions (Green) - Added items, lettering in notes and leaders.

b. Provide a legend if colors other than the "base" colors of red, green, and blue are used.

c. Add and denote any additional equipment or material facilities, service lines, incorporated under As-Built Revisions if not already shown in legend.

d. Use frequent written explanations on markup drawings to describe changes. Do not totally rely on graphic means to convey the revision.

e. Use legible lettering and precise and clear digital values when marking prints. Clarify ambiguities concerning the nature and application of change involved.

f. Wherever a revision is made, also make changes to related section views, details, legend, profiles, plans and elevation views, schedules, notes and call out designations, and mark accordingly to avoid conflicting data on all other sheets.

g. For deletions, cross out all features, data and captions that relate to that revision.

h. For changes on small-scale drawings and in restricted areas, provide

large-scale inserts, with leaders to the applicable location.

i. Indicate one of the following when attaching a print or sketch to a markup print:

1) Add an entire drawing to contract drawings

2) Change the contract drawing to show

3) Provided for reference only to further detail the initial design.

j. Incorporate all shop and fabrication drawings into the markup drawings.

3.1.2 As-Built Drawings Content

Revise As-Built Drawings in accordance with ERDC/ITL TR-12-1 and ERDC/ITL TR-12-6. Keep these working as-built markup drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes from the contract drawings which are made during construction or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes. Submit the working as-built markup drawings for approval prior to submission of each monthly pay estimate. For failure to maintain the working and final record drawings as specified herein, the Contracting Officer will withhold 10 percent of the monthly progress payment until approval of updated drawings. Show on the as-built drawings, but not limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

b. The location and dimensions of any changes within the building structure.

c. Layout and schematic drawings of electrical circuits and piping.

d. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

e. Changes in details of design or additional information obtained from working drawings specified to be prepared or furnished by the Contractor; including but not limited to shop drawings, fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment, and foundations.

f. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

g. Changes or Revisions which result from the final inspection.

h. Where contract drawings or specifications present options, show only

the option selected for construction on the working as-built markup drawings.

i. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.

j. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

k. Changes in location of equipment and architectural features.

j. Modifications (include within change order price the cost to change working as-built markup drawings to reflect modifications).

l. Actual location of anchors, construction and control joints, etc., in concrete.

m. Unusual or uncharted obstructions that are encountered in the contract work area during construction.

n. Location, extent, thickness, and size of stone protection particularly where it will be normally submerged by water.

3.1.3 GIS Data

Provide GIS data with as-builts. GIS data shall be in a format accepted by ESRI software. Data shall comply with SDSFIE 3.1.0.1. The Air Force adaptation data dictionary can be obtained from the Kadena GeoBase Office (718ces.geobase@us.af.mil or DSN 634-9322). All GIS data shall be delivered with the following requirements:

a. Projection: UTM Zone 52N

b. Datum: WGS 1984

c. Geoid: EGM 96

d. Units: Meters

3.1.4 GIS Data

Provide GIS data with as-builts. GIS data shall be in a format accepted by ESRI software. Data shall comply with SDSFIE 3.1.0.1. All GIS data shall be delivered with the following requirements:

a. Projection: JGD 2000 Zone 15

b. Datum: WGS 1984

c. Geoid: EGM 96

d. Units: Meters

3.2 RECORD DRAWING FILES

If additional drawings are required, prepare them using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any

new final record drawings must be identical to that used on the contract drawings. Accomplish additions and corrections to the contract drawings using CAD files. Provide all program files and hardware necessary to prepare final PDF record drawings. The Contracting Officer will review final PDF record drawings for accuracy and return them to the Contractor for required corrections, changes, additions, and deletions.

3.2.1 Rename the CAD Drawing files

Rename the CAD Drawing files using the [ACES-PM Project Number as the Project Code field, (e.g., LXEZ11745C-101.DWG)][Contract number as the Project Code field, (e.g., W912HV-15-C-0001-A-101.DWG)] as instructed in the Pre-Construction conference. Use only those renamed files for the Marked-up changes. Make all changes on the layer/level as the original item.

a. For AutoCAD files (DWG), enter all as-built delta changes and notations on the AS-BUILT layer.

c. When final revisions have been completed, show the wording "RECORD DRAWING AS-BUILTS" followed by the name of the Contractor in letters at least 5 mm high on the cover sheet drawing. Date RECORD DRAWING AS-BUILTS" drawing revisions in the revision block.

d. Within 20 days after Government approval of all of the working record drawings for a phase of work, prepare the final CAD record drawings for that phase of work and submit PDF drawing files and two sets of prints for review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days revise the CAD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days of substantial completion of all phases of work, submit the final record drawing package for the entire project. Submit one set of electronic CAD files, and one set of the approved working record PDF files on an optical disc with two sets of prints. The CAD files must be complete in all details and identical in form and function to the CAD drawing files supplied by the Government. Prepare AutoCAD files for transmittal using e-Transmit. Make any transactions or adjustments necessary to accomplish this. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CAD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final record PDF drawing files, CAD files and marked prints as specified will be cause for withholding any payment due under this contract. Approval and acceptance of final record drawings must be accomplished before final payment is made.

3.3 RECORD DRAWINGS

Prepare final record drawings after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (such as Foundations, Utilities, or Structural Steel as appropriate for the project). Transfer the changes from the approved working as-built markup drawings to the original electronic CAD drawing files. Modify the as-built CAD drawing files to correctly show the features of the project as-built by bringing the working CAD drawing set into agreement with approved working as-built markup drawings, and adding such additional drawings as may be necessary. Refer to ERDC/ITL TR-12-1. Jointly review

the working as-built markup drawings with printouts from working as-built CAD drawing PDF files for accuracy and completeness. Monthly review of working as-built CAD drawing PDF file printouts must cover all sheets revised since the previous review. These PDF drawing files are part of the permanent records of this project. Any drawings damaged or lost must be satisfactorily replaced at no expense to the Government.

Drawing revisions (include within change order price the cost to change working and final record drawings to reflect revisions) and compliance with the following procedures.

a. Follow directions in the revision for posting descriptive changes.

b. The revision delta size must be 8 mm unless the area where the delta is to be placed is crowded. Use a smaller size delta for crowded areas.

c. Place a revision delta at the location of each deletion.

d. For new details or sections which are added to a drawing, place a revision delta by the detail or section title.

e. For minor changes, place a revision delta by the area changed on the drawing (each location).

f. For major changes to a drawing, place a revision delta by the title of the affected plan, section, or detail at each location.

g. For changes to schedules or drawings, place a revision delta either by the schedule heading or by the change in the schedule.

3.3.1 Final Record Drawing Package

Submit the final record PDF and CAD drawings package for the entire project within 20 days of substantial completion of all phases of work. Submit one set of A1 size PDF and CAD files on optical disc, read-only memory (ROM), two sets of A1 size prints and one set of the approved working record drawings. The package must be complete in all details and identical in form and function to the contract drawing files supplied by the Government.

3.4 FINAL APPROVED SHOP DRAWINGS

Submit final approved project shop drawings 30 days after transfer of the completed facility.

3.5 CONSTRUCTION CONTRACT SPECIFICATIONS

Submit final PDF file record construction contract specifications, including revisions thereto, 30 days after transfer of the completed facility.

3.6 AS-BUILT RECORD OF EQUIPMENT AND MATERIALS

Furnish one copy of preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 2 days after final inspection with Government comments. Submit Two sets of final record of equipment and materials 10 days after final inspection. Key the designations to the

related area depicted on the contract drawings. List the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA				
Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used

3.7 OPERATION AND MAINTENANCE MANUALS

Provide project operation and maintenance manuals as specified in Section 01 78 23 OPERATION AND MAINTENANCE MANUALS DATA. Provide one electronic copy of the Operation and Maintenance Manual files and three hard copies of the Operation and Maintenance Manuals. Submit to the Contracting Officer for approval within 30 calendar days of the Beneficial Occupancy Date (BOD). Update and resubmit files for final approval at BOD.

3.8 CLEANUP

Provide final cleaning in accordance with ASTM E1971 and submit two copies of the listing of completed final clean-up items. Leave premises "broom clean." Comply with GS-37 for general purpose cleaning and bathroom cleaning. Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Clean filters of operating equipment and comply with the Indoor Air Quality (IAQ) Management Plan as required. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site. Recycle, salvage, and return construction and demolition waste from project in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS, and 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.9 REAL PROPERTY RECORD

Near the completion of Project, but a minimum of 60 days prior to final acceptance of the work, complete and submit an accounting of all installed property with Interim DD FORM 1354. Contact the Contracting Officer for any project specific information necessary to complete the DD FORM 1354. Refer to UFC 1-300-08 for instruction on completing the DD FORM 1354. Refer to Attachment 01 78 00-A for the Draft DD FORM 1354.Attach the Real Property receiving Component's completed High Performance and Sustainable Building (HPSB) Checklist for each applicable building to the completed DD 1354, in accordance with Section 01 33 29 SUSTAINABILITY REPORTING. For convenience, a blank fillable PDF DD FORM 1354 may be obtained at the following link:
www.esd.whs.mil/Portals/54/Documents/DD/forms/dd/dd1354.pdf

Submit the completed Checklist for DD FORM 1354 of Installed Building Equipment items. Attach this list to the updated DD FORM 1354.

-- End of Section --

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TRANSFER AND ACCEPTANCE OF DoD REAL PROPERTY

Form Approved
OMB No. 0704-0188

PAGE OF PAGES

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE ABOVE ORGANIZATION.

1. FROM *(Organization Name)*	2. DATE PREPARED *(YYYYMMDD)*	3. PROJECT/JOB NUMBER	4. SERIAL NUMBER
5. TO *(Organization - Installation Code and Name)*	6. RPSUID/SITENAME/ INSTCODE/INSTNAME	7. CONTRACT NUMBER(S)	7a. PLACED-IN-SERVICE DATE *(YYYYMMDD)*

8. TRANSACTION DETAILS

a. METHOD *(X all that apply)*
- ☐ ACQUISITION BY CONSTRUCTION
- ☐ TRANSFER BETWEEN SERVICES
- ☐ CAPITAL IMPROVEMENT
- ☐ INVENTORY ADJUSTMENT

b. WHEN/EVENT *(X one)*
- ☐ TOTAL ASSET PLACED-IN-SERVICE
- ☐ PARTIAL ASSET PLACED-IN-SERVICE

c. TYPE *(X one)*
☐ DRAFT ☐ FINAL ☐ INTERIM

9. ITEM NO.	10a. FACILITY NO.	10b. RPUID	11. CATEGORY CODE	12. CATCODE DESCRIPTION	13. TYPE CODE	14. SUST. CODE	AREA		OTHER		19. COST	20. FUND SOURCE	21. FUND ORG	22. INTER-EST CODE	23. ITEM REMARKS
							15. PRIMARY UM	16. PRIMARY UM QUANTITY	17. SECONDARY UM	18. SECONDARY UM QUANTITY					

24. STATEMENT OF COMPLETION. The facilities listed hereon are in accordance with maps, drawings, and specifications and change orders approved by the authorized representative of the using agency except for the deficiencies listed on the reverse side.

a. TRANSFERRED BY *(Typed Name and Signature)*	b. DATE SIGNED *(YYYYMMDD)*
c. TITLE *(Area Engr./Base Engr./DPW/Construction Agent)*	

25a. ACCEPTED BY *(Typed Name and Signature)*	b. DATE SIGNED *(YYYYMMDD)*
c. TITLE *(DPW/RPAO)*	26. PROPERTY VOUCHER NUMBER

DD FORM 1354, AUG 2013 PREVIOUS EDITION MAY BE USED. Adobe Designer 9.0

ATTACHMENT 01 78 00-A Page 1

JAPAN EDITED SPECIFICATIONS

JES

27. CONSTRUCTION DEFICIENCIES *(Attach blank sheet for continuations)*	28. PROJECT REMARKS *(Attach blank sheet for continuations)*

INSTRUCTIONS

GENERAL. This form has been designed and issued for use in connection with the transfer of military real property between the military departments and to or from other government agencies. It supersedes ENG Forms 290 and 290B (formerly used by the Army and Air Force) and NAVDOCKS Form 2317 (formerly used by the Navy).

Existing instructions issued by the military departments relative to the preparation of DD Form 1354 are applicable to this revised form to the extent that the various items and columns on the superseded forms have been retained. The military departments may promulgate additional instructions, as appropriate.

For detailed instructions on how to fill out this form, please refer to Unified Facilities Criteria (UFC) 1-300-08, dated 16 April 2009 or later.

SPECIFIC DATA ITEMS.

1. From. Name of the transferring agency.

2. Date Prepared. Date of actual preparation. Enter all dates in YYYYMMDD format (Example: March 31, 2010 = 20100331).

3. Project/Job Number. Project number on a DD Form 1391 or Individual Job Order Number.

4. Serial Number. Sequential serial number assigned by the preparing organization (e.g., 2010-0001).

5. To. Name and address of the receiving installation, activity, and Service of the Real Property Accountable Officer (RPAO).

6. RPSUID/SITENAME/INSTCODE/INSTNAME. Site Unique Identifier and name or installation code and name where the constructed facility is located.

7. Contract Number(s). Contract number(s) for this project.

7a. Placed-In-Service Date. RPA Placed In Service Date. This is the date the asset is actually placed-in-service.

8. Transaction Details.
a. Method of Transaction. Mark (X) as many boxes as apply.
b. When/Event. When or event causing preparation of DD Form 1354. X only one box.
c. Type. Draft, interim, or final DD Form 1354. X only one box.

9. Item Number. Use a separate item number for each facility, no item number for additional usages.

10a. Facility Number. Assigned in accordance with the Installation/Base Master Numbering Plan.

10b. RPUID. Identified in Real Property Inventory.

11. Category Code. The category code describes the facility usage.

12. Catcode Description. The category code name which describes the facility usage.

13. Type. Type of construction: P for Permanent; S for Semi- permanent; T for Temporary.

14. Sustainability Code. Reports whether or not an asset meets the sustainability guidelines set forth in Section 2(g) of Executive Order 13514. Valid values are: 1 (asset meets the guidelines); 2 (asset does not meet the guidelines); 3 (asset not evaluated); 4 (asset not subject to guidelines).

15. Area: UM 1. Area unit of measure; use the unit of measure associated with the category code selected in 11.

16. Total Quantity UM 1. The total area for the measure identified in Item 15. Use negative numbers for demolition.

17. Other: UM 2. Unit of Measure 2 is the capacity or other measurement unit (e.g., LF, MB, EA, etc.).

18. Total Quantity UM 2. The total capacity/other for the measure identified in Item 17.

19. Cost. Cost for each facility; for capital improvements to existing facilities, show amount of increase only. If there is no increase for the capital improvement, enter N/A.

20. Fund Source. Enter the Fund Source Code for this item.

21. Funding Organization. Enter the code for the organization responsible for acquiring this facility.

22. Interest Code. Enter the code that reflects government interest or ownership in the facility.

23. Item Remarks. Remarks pertaining only to the item number identified in Item 9; show cost sharing.

24. Statement of Completion. Typed name, signature, title, and date of signature by the responsible transferring individual or agent.

25. Accepted By. Typed name, signature, title, and date of signature by the RPAO or accepting official.

26. Property Voucher Number. Next sequential number assigned by the RPAO in voucher register.

27. Construction Deficiencies. List construction deficiencies in project during contractor turnover inspection.

28. Project Remarks. Project level remarks and continuation of blocks.

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E1971	(2005; R 2011) Stewardship for the Cleaning of Commercial and Institutional Buildings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information onlysubmittals not having a "G" designation are for Contractor Quality Control or Designer of Record approval. Submit the following in accordance with Section 01 33 00SUBMITTAL PROCEDURES:

SD-10 Operation and Maintenance Data

O&M Database; G
Training Plan; G
Training Outline; G
Training Content; G

SD-11 Closeout Submittals

Training Video Recording; G
Validation of Training Completion; G

1.3 OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data for the provided equipment, product, or system, defining the importance of system interactions, troubleshooting, and long-term preventive operation and maintenance. Compile, prepare, and aggregate O&M data to include clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.3.1 Package Quality

Documents must be fully legible. Operation and Maintenance data must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

1.3.2 Package Content

Provide data package content in both English and Japanese, and in accordance with paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES. Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows. Use Data Package 5 for commissioned items without a specified data package requirement in the individual technical sections. Provide a Data Package 5 instead of Data Package 1 or 2, as specified in the individual technical section, for items that are commissioned.

1.3.3 Changes to Submittals

Provide manufacturer-originated changes or revisions to submitted data if a component of an item is so affected subsequent to acceptance of the O&M Data. Submit changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data within 30 calendar days of the notification of this change requirement.

[### 1.3.4 Commissioning Authority Review and Approval

Submit the commissioned systems and equipment submittals to the Commissioning Authority (CxA) to review for completeness and applicability. Obtain validation from the CxA that the systems and equipment provided meet the requirements of the Contract documents and design intent, particularly as they relate to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. The CxA communicates deficiencies to the Contracting Officer. Submit the O&M manuals to the Contracting Officer upon a successful review of the corrections, and with the CxA recommendation for approval and acceptance of these O&M manuals. This work is in addition to the normal review procedures for O&M data.

]## 1.4 O&M DATABASE

Develop an editable, electronic spreadsheet based on the equipment in the Operation and Maintenance Manuals that contains the information required to start a preventive maintenance program. As a minimum, provide list of system equipment, location installed, warranty expiration date, manufacturer, model, and serial number.

1.5 OPERATION AND MAINTENANCE MANUAL FILE FORMAT

Assemble data packages into electronic Operation and Maintenance Manuals. Assemble each manual into a composite electronically indexed file using the most current version of Adobe Acrobat or similar software capable of producing PDF file format. Provide compact disks (CD) or data digital versatile disk (DVD) as appropriate, so that each one contains operation, maintenance and record files, project record documents, and training videos. Include a complete electronically linked operation and maintenance directory.

1.5.1 Organization

Bookmark Product and Drawing Information documents using the current version of CSI Masterformat numbering system, and arrange submittals using

the specification sections as a structure. Use CSI Masterformat and UFGS numbers along with descriptive bookmarked titles that explain the content of the information that is being bookmarked.

1.5.2 CD or DVD Label and Disk Holder or Case

Provide the following information on the disk label and disk holder or case:

a. Building Number.

b. Project Title.

c. Activity and Location.

d. Construction Contract Number.

e. Prepared For: (Contracting Agency).

f. Prepared By: (Name, title, phone number and email address).

g. Include the disk content on the disk label.

h. Date.

i. Virus scanning program used.

1.6 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

The following are a detailed description of the data package items listed in paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES.

1.6.1 Operating Instructions

Provide specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.6.1.1 Safety Precautions and Hazards

List personnel hazards and equipment or product safety precautions for operating conditions. List all residual hazards identified in the Activity Hazard Analysis provided under Section 01 35 26 GOVERNMENT SAFETY REQUIREMENTS. Provide recommended safeguards for each identified hazard.

1.6.1.2 Operator Prestart

Provide procedures required to install, set up, and prepare each system for use.

1.6.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.6.1.4 Normal Operations

Provide Control Diagrams with data to explain operation and control of systems and specific equipment. Provide narrative description of Normal

Operating Procedures.

1.6.1.5 Emergency Operations

Provide Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Provide Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.6.1.6 Operator Service Requirements

Provide instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gauge readings.

1.6.1.7 Environmental Conditions

Provide a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.6.1.8 Operating Log

Provide forms, sample logs, and instructions for maintaining necessary operating records.

1.6.1.9 Additional Requirements for HVAC Control Systems

Provide Data Package 5 and the following for control systems:

a. Narrative description on how to perform and apply functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.

b. Full as-built sequence of operations.

c. Copies of checkout tests and calibrations performed by the Contractor (not Cx tests).

d. Full points list. Provide a listing of rooms with the following information for each room:

(1) Floor.

(2) Room number.

(3) Room name.

(4) Air handler unit ID.

(5) Reference drawing number.

(6) Air terminal unit tag ID.

(7) Heating or cooling valve tag ID.

(8) Minimum cfm.

(9) Maximum cfm.

e. Full print out of all schedules and set points after testing and acceptance of the system.

f. Full as-built print out of software program.

g. Marking of system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

1.6.2 Preventive Maintenance

Provide the following information for preventive and scheduled maintenance to minimize repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.6.2.1 Lubrication Data

Include the following preventive maintenance lubrication data, in addition to instructions for lubrication required under paragraph OPERATOR SERVICE REQUIREMENTS:

a. A table showing recommended lubricants for specific temperature ranges and applications.

b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.

c. A Lubrication Schedule showing service interval frequency.

1.6.2.2 Preventive Maintenance Plan, Schedule, and Procedures

Provide manufacturer's schedule for routine preventive maintenance, inspections, condition monitoring (predictive tests) and adjustments required to ensure proper and economical operation and to minimize repairs. Provide instructions stating when the systems shall be retested. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

a. Define the anticipated time required to perform each of each test (work-hours), test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize repairs.

b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include

electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

1.6.2.3 Cleaning Recommendations

Provide environmentally preferable cleaning recommendations in accordance with ASTM E1971.

1.6.3 Repair

Provide manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.6.3.1 Troubleshooting Guides and Diagnostic Techniques

Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.6.3.2 Wiring Diagrams and Control Diagrams

Provide point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.6.3.3 Repair Procedures

Provide instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.6.3.4 Removal and Replacement Instructions

Provide step-by-step procedures and a list of required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Use a combination of text and illustrations.

1.6.3.5 Spare Parts and Supply Lists

Provide lists of spare parts and supplies required for repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.6.3.6 Repair Work-Hours

Provide manufacturer's projection of repair work-hours including requirements by type of craft. Identify, and tabulate separately, repair that requires the equipment manufacturer to complete or to participate.

1.6.4 Real Property Equipment

Provide a list of installed equipment furnished under this Contract. Include all information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Submit the final list 30 days after transfer of the completed facility.

Key the designations to the related area depicted on the Contract drawings. List the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA

Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used

1.6.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.6.5.1 Product Submittal Data

Provide a copy of SD-03 Product Data submittals documented with the required approval.

1.6.5.2 Manufacturer's Instructions

Provide a copy of SD-08 Manufacturer's Instructions submittals documented with the required approval.

1.6.5.3 O&M Submittal Data

Provide a copy of SD-10 Operation and Maintenance Data submittals documented with the required approval.

1.6.5.4 Parts Identification

Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing must show the index, reference, or key number that shall cross-reference the illustrated part to the listed part. Group the parts shown in the listings by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.

1.6.5.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or Contract documents in order to keep warranties in force. Include warranty information for primary componentsof the system. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

1.6.5.6 Extended Warranty Information

List all warranties for products, equipment, components, and sub-components whose duration exceeds one year. For each warranty listed, indicate the applicable specification section, duration, start date, end date, and the point of contact for warranty fulfillment. Also, list or reference the specific operation and maintenance procedures that must be performed to keep the warranty valid. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

1.6.5.7 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.6.5.8 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

1.6.5.9 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms. Provide final set points.

1.6.5.10 Field Test Reports

Provide a copy of Field Test Reports (SD-06) submittals documented with the required approval.

1.6.5.11 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.7 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Provide the O&M data packages specified in individual technical sections. The information required in each type of data package follows:

1.7.1 Data Package 1

a. Safety precautions and hazards.

b. Cleaning recommendations.

c. Maintenance and repair procedures.

d. Warranty information.

e. Extended warranty information.

f. Contractor information.

g. Spare parts and supply list.

1.7.2 Data Package 2

a. Safety precautions and hazards.

b. Normal operations.

c. Environmental conditions.

d. Lubrication data.

e. Preventive maintenance plan, schedule, and procedures.

f. Cleaning recommendations.

g. Maintenance and repair procedures.

h. Removal and replacement instructions.

i. Spare parts and supply list.

j. Parts identification.

k. Warranty information.

l. Extended warranty information.

m. Contractor information.

1.7.3 Data Package 3

a. Safety precautions and hazards.

b. Operator prestart.

c. Startup, shutdown, and post-shutdown procedures.

d. Normal operations.

e. Emergency operations.

f. Environmental conditions.

g. Operating log.

h. Lubrication data.

i. Preventive maintenance plan, schedule, and procedures.

j. Cleaning recommendations.

k. Troubleshooting guides and diagnostic techniques.

l. Wiring diagrams and control diagrams.

m. Maintenance and repair procedures.

n. Removal and replacement instructions.

o. Spare parts and supply list.

p. Product submittal data.

q. O&M submittal data.

r. Parts identification.

s. Warranty information.

t. Extended warranty information.

u. Testing equipment and special tool information.

v. Testing and performance data.

w. Contractor information.

x. Field test reports.

1.7.4 Data Package 4

a. Safety precautions and hazards.

b. Operator prestart.

c. Startup, shutdown, and post-shutdown procedures.

d. Normal operations.

e. Emergency operations.

f. Operator service requirements.

g. Environmental conditions.

h. Operating log.

i. Lubrication data.

j. Preventive maintenance plan, schedule, and procedures.

k. Cleaning recommendations.

l. Troubleshooting guides and diagnostic techniques.

m. Wiring diagrams and control diagrams.

n. Repair procedures.

o. Removal and replacement instructions.

p. Spare parts and supply list.

q. Repair work-hours.

r. Product submittal data.

s. O&M submittal data.

t. Parts identification.

u. Warranty information.

v. Extended warranty information.

w. Personnel training requirements.

x. Testing equipment and special tool information.

y. Testing and performance data.

z. Contractor information.

aa. Field test reports.

1.7.5 Data Package 5

a. Safety precautions and hazards.

b. Operator prestart.

c. Start-up, shutdown, and post-shutdown procedures.

d. Normal operations.

e. Environmental conditions.

f. Preventive maintenance plan, schedule, and procedures.

g. Troubleshooting guides and diagnostic techniques.

h. Wiring and control diagrams.

i. Maintenance and repair procedures.

j. Removal and replacement instructions.

k. Spare parts and supply list.

l. Product submittal data.

m. Manufacturer's instructions.

n. O&M submittal data.

o. Parts identification.

p. Testing equipment and special tool information.

q. Warranty information.

r. Extended warranty information.

s. Testing and performance data.

t. Contractor information.

u. Field test reports.

v. Additional requirements for HVAC control systems.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TRAINING

Prior to acceptance of the facility by the Contracting Officer for Beneficial Occupancy, provide comprehensive training conducted in English for the systems and equipment specified in the technical specifications. The training must be targeted for the Facilities Management Specialist, building maintenance personnel, and applicable building occupants. Instructors must be well-versed in the particular systems that they are presenting. Address aspects of the Operation and Maintenance Manual submitted in accordance with Section 01 78 00 CLOSEOUT SUBMITTALS. Training must include classroom or field lectures based on the system operating requirements. Notify the Contracting Officer in writing seven (7) calendar days prior of the scheduled instructional services. The location of classroom training requires approval by the Contracting Officer.

3.1.1 Training Plan

Submit a written training plan to the Contracting Officer for approval at least 60 calendar days prior to the scheduled training.[Training plan must be approved by the Commissioning Authority (CxA) prior to forwarding to the Contracting Officer. Also, coordinate the training schedule with the Contracting Officer and CxA.] Include within the plan the following elements:

a. Equipment included in training.

b. Intended audience.

c. Location of training.

d. Dates of training.

e. Objectives.

f. Outline of the information to be presented and subjects covered

including description.

g. Start and finish times and duration of training on each subject.

h. Methods (e.g. classroom lecture, video, site walk-through, actual operational demonstrations, written handouts).

i. Instructor names and instructor qualifications for each subject.

j. List of texts and other materials to be furnished by the Contractor that are required to support training.

k. Description of proposed software to be used for video recording of training sessions.

3.1.2 Training Content

The core of this training must be based on manufacturer's recommendations and the operation and maintenance information.[The CxA is responsible for overseeing and approving the content and adequacy of the training.] Spend 95 percent of the instruction time during the presentation on the OPERATION AND MAINTENANCE DATA. Include the following for each system training presentation:

a. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.

b. Relevant health and safety issues.

c. Discussion of how the feature or system is environmentally responsive. Advise adjustments and optimizing methods for energy conservation.

d. Design intent.

e. Use of O&M Manual Files.

f. Review of control drawings and schematics.

g. Interactions with other systems.

h. Special maintenance and replacement sources.

i. Tenant interaction issues.

3.1.3 Training Outline

Provide the Operation and Maintenance Manual Files (Bookmarked PDF) and a written course outline listing the major and minor topics to be discussed by the instructor on each day of the course to each trainee in the course. Provide the course outline 14 calendar days prior to the training.

3.1.4 Training Video Recording

Record classroom training session(s) on video. Provide to the Contracting Officer two copies of the training session(s) in DVD video recording format. Capture within the recording, in video and audio, the instructors' training presentations including question and answer periods

with the attendees. The recording camera(s) must be attended by a person during the recording sessions to assure proper size of exhibits and projections during the recording are visible and readable when viewed as training.

3.1.5 Unresolved Questions from Attendees

If, at the end of the training course, there are questions from attendees that remain unresolved, the instructor must send the answers, in writing, to the Contracting Officer for transmittal to the attendees, and the training video must be modified to include the appropriate clarifications.

3.1.6 Validation of Training Completion

Ensure that each attendee at each training session signs a class roster daily to confirm Government participation in the training. At the completion of training, submit a signed validation letter that includes a sample record of training for reporting what systems were included in the training, who provided the training, when and where the training was performed, and copies of the signed class rosters. Provide two copies of the validation to the Contracting Officer, and one copy to the Operation and Maintenance Manual Preparer for inclusion into the Manual's documentation.

3.1.7 Quality Control Coordination

Coordinate this training with[the CxA in accordance with] Section 01 45 00.00 10 QUALITY CONTROL.

-- End of Section --

SECTION 01 91 00.15 10

TOTAL BUILDING COMMISSIONING

PART 1 GENERAL

1.1 SUMMARY

Commission the building systems listed herein. Employ the services of an independent Commissioning Firm. The Commissioning Firm must be a 1st tier subcontractor of the General or Prime Contractor and must be financially and corporately independent of all other subcontractors. The Commissioning Firm must employ a Lead Commissioning Specialist for the Contractor (CxC) that coordinates all aspects of the commissioning process. Perform Commissioning in accordance with the requirements of the contract specifications and the standard under which the Commissioning Firm's qualifications are approved. In the case of a conflict, the most stringent requirement will prevail.

The Commissioning Specialist for the Government (CxG) is a Government employee. In general, the CxC coordinates the commissioning activities and reports to the Contracting Officer's Representative/CxG, copying the General or Prime Contractor on all results in accordance with Third Party Certification (TPC) requirements. The CxC's responsibilities, along with all other contractors' commissioning responsibilities are detailed in the specifications. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

1.2 SYSTEMS TO BE COMMISSIONED

Commission the following systems:

[Heating, Ventilating, Air Conditioning, and Refrigeration Systems (HVAC)
][Building Automation System
][Utility Monitoring and Control System
][Lighting Systems
][Power Distribution Systems
][Power Generation Systems
][Renewable Energy Systems
][Service Water Heating Systems
][Plumbing Systems
][Natural Gas and Propane Systems
][Water Pumping and Mixing Systems
][Irrigation Systems
][Water Harvesting/Reclaim Systems
][Compressed Air and Vacuum Systems
][Energy and Water Utility Metering Systems and Sub-Meters
] Building Envelope: moisture and thermal integrity and air tightness
[Fenestration Control Systems
]

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by

the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 180	(2012) Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
ASHRAE 202	(2013) Commissioning Process for Buildings and Systems

ASSOCIATED AIR BALANCE COUNCIL (AABC)

ACG Commissioning Guideline	(2005) Commissioning Guideline

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB Commissioning Standard	(2009) Procedural Standards for Whole Building Systems Commissioning of New Construction; 3rd Edition

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1429	(1994) HVAC Systems Commissioning Manual, 1st Edition

1.4 COMMUNICATION WITH THE GOVERNMENT

The Lead Commissioning Specialist (CxC) must submit all plans, schedules, reports, and documentation directly to the Contracting Officer's Representative concurrent with submission to the CQC System Manager. The Lead Commissioning Specialist must have direct communication with the Contracting Officer's Representative regarding all elements of the commissioning process; however, the Government has no direct contract authority with the Lead Commissioning Specialist.

1.5 SEQUENCING AND SCHEDULING

1.5.1 Sequencing

Complete the following prior to starting Functional Performance Tests of mechanical systems:

a. All equipment and systems have been completed, cleaned, flushed, disinfected, calibrated, tested, and operate in accordance with contract documents and construction plans and specifications.

b. Performance Verification Tests of the controls systems have been completed and the Performance Verification Test Report has been submitted and approved in accordance with Specifications.

c. Testing, Adjusting, and Balancing has been completed and the Testing, Adjusting, and Balancing Report, has been submitted and approved in accordance with Specification Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

d. The building envelope is enclosed according to contract documents with

final construction completed, the Air Barrier Pressure Tests have been completed and the Air Leakage Test Reports and Diagnostic Test Reports have been submitted and approved in accordance with Specification Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS.

e. The Pre-Functional Checklists have been submitted and approved.

f. The Certificate of Readiness for mechanical systems has been submitted and approved.

Complete the following prior to starting Functional Performance Tests of the electrical systems:

a. All electrical, power generation, and lighting equipment and systems have been completed, calibrated, tested, and operate in accordance with contract documents and construction plans and specifications.

b. The building envelope is enclosed according to contract documents with final construction completed.

c. Ceiling tiles, floor coverings, and window coverings are in place.

d. The Certificate of Readiness for electrical systems has been submitted and approved.

e. Lamps have completed a minimum 100 hour burn-in period.

1.5.2 Project Schedule

Include the following tasks in the project schedule required by Section [01 32 01.00 10 PROJECT SCHEDULE][01 32 16.00 20 SMALL PROJECT CONSTRUCTION PROGRESS SCHEDULES]. Ensure sufficient time is scheduled to accommodate the requirements of this specification section. The order of items listed below is not intended to imply a specified sequence:

a. Submission and approval of the Commissioning Firm and Commissioning Specialist

b. Submission and approval of the Testing, Adjusting, and Balancing (TAB) Firm and TAB Specialist specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

c. Submission of the Design Review Report specified herein.

d. Submission of the Design Review Report specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

e. Submission and approval of the Construction Phase Commissioning Plan

f. Installation of permanent utilities (gas, water, electric)

g. Building Envelope Construction

h. Submission and approval of the Building Envelope Inspection Checklists

i. Air Barrier Pressure Tests specified in Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS

j. Drainage and Vent, Building Sewers, Water Supply Systems and Backflow Prevention Assembly Tests specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE

k. Factory Acceptance Testing for each of the systems to be commissioned as required by technical specifications

l. Manufacturer's Equipment Start-Up for each of the systems to be commissioned.

m. Potable Water System Flushing specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE

n. Operational Tests of the plumbing system specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

o. Potable Water System Disinfection specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE

p. Submission and approval of the TAB Schematic Drawings, Report Forms, and Procedures specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

q. Submission and approval of Duct Air Leakage Test Procedures specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

r. Duct Air Leakage Test Execution specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

s. Submission and approval of the Final Duct Air Leakage Test Report specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

t. Testing, Adjusting, and Balancing (TAB) Field Work required by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

u. Submission and approval of the TAB Report specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

v. TAB Field Acceptance Testing required by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

w. Submission and approval of the Start-Up Testing Report.

x. Submission and approval of the Performance Verification Test Procedures.

y. Performance Verification Tests.

z. Performance Verification Test Report.

aa. Pre-Functional Checklist Submittal

bb. Functional Performance Testing for each system to be commissioned

cc. Integrated Systems Tests

dd. Post-Test Deficiency Correction for each system to be commissioned

ee. Re-Testing

ff. Endurance Tests

gg. Training for each of the systems to be commissioned

hh. Systems Manual/Computerized Maintenance Management System Manual, Maintenance Plan, and Service Life Plan submission and approval

ii. Submission and approval of the Commissioning Report

jj. Seasonal Testing

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Commissioning Firm; G

Lead Commissioning Specialist

Technical Commissioning Specialists

Commissioning Firm's Contract

SD-06 Test Reports

Design Review Report; G

Interim Construction Phase Commissioning Plan; G

Final Construction Phase Commissioning Plan; G

Building Envelope Inspection Checklists; G

Pre-Functional Checklists; G

Issues Log

Commissioning Report; G

Post-Construction Trend Log Report; G

SD-07 Certificates

Certificate of Readiness; G

SD-10 Operation and Maintenance Data

Training Plan; G

Training Attendance Rosters

Systems Manual; G

Maintenance and Service Life Plans

SD-11 Closeout Submittals

Construction Phase Commissioning Plan; G

Final Commissioning Report; G

1.7 COMMISSIONING FIRM

Provide a Commissioning Firm that is certified in commissioning by one of the following: the AABC Commissioning Group (ACG); the National Environmental Balancing Bureau (NEBB); the International Certification Board/Testing, Adjusting, and Balancing Bureau (ICB/TABB), the Building Commissioning Association (BCA); the Association of Energy Engineers (AEE). The Commissioning Firm must be certified in all systems to be commissioned to the extent such certifications are available from the certifying body. Describe any lapses in certification or disciplinary action taken by the certifying body against the proposed Commissioning Firm or Lead Commissioning Specialist in detail. Any firm or commissioning professional that has been the subject of disciplinary action by the certifying body within the five years preceding contract award is not eligible to perform any duties related to commissioning.

a. Submit the Commissioning Firm's certification of qualifications including the name of the firm and certifications no later than 60 calendar days after Notice to Proceed. Submit four hard copies and an electronic copy.

b. The Commissioning Firm's and Commissioning Specialists' certifications must be maintained for the entire duration of the duties specified herein. If, for any reason, the firm or a specialist loses a certification during this period, immediately notify the Contracting Officer's Representative and submit another Commissioning Firm or Commissioning Specialist for approval. All work specified in this specification section performed by the Commissioning Firm or associated Commissioning Specialists is invalid if the Commissioning Firm or Commissioning Specialist loses its certification prior to contract completion and must be performed by an approved successor.

c. The Commissioning Firm must oversee and assist the General or Prime Contractor with the work specified herein. Submit the Commissioning Firm's Contract including the Scope of Work associated with the paragraph POST-CONSTRUCTION SUPPORT no later than 30 calendar days after approval of the Commissioning Firm. Submit four hard copies and an electronic copy.

d. The Commissioning Firm may act as the Pressure Test Agency required by Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS provided that all qualification requirements of that specification section are met.

1.7.1 Lead Commissioning Specialist

The Commissioning Firm must provide a Lead Commissioning Specialist (CxC) that has a minimum of five years of commissioning experience, including two projects of similar size and complexity, and that is one of the

following: a NEBB qualified Systems Commissioning Administrator (SCA); ACG Certified Commissioning Authority (CxA); ICB/TABB Certified Commissioning Supervisor; BCA Certified Commissioning Professional (CCP); AEE Certified Building Commissioning Professional (CBCP); University of Wisconsin-Madison Qualified Commissioning Process Provider (QCxP); ASHRAE Building Commissioning Professional (BCxP).

a. Submit the Lead Commissioning Specialist's certification of qualifications including the name of the specialist and firm; certifications; years of experience; and a listing of representative projects of similar size and complexity no later than 60 calendar days after Notice to Proceed. Submit four hard copies and an electronic copy.

b. The Lead Commissioning Specialists certifications must be maintained for the entire duration of the duties specified herein. If, for any reason, the specialist loses a certification during this period, immediately notify the Contracting Officer's Representative and submit another Lead Commissioning Specialist for approval. All work specified in this specification section to be performed by the Lead Commissioning Specialist is invalid if the Lead Commissioning Specialist loses its certification prior to contract completion and must be performed by an approved successor.

c. The Lead Commissioning Specialist must lead and oversee the commissioning work specified herein and be the primary point of contact for the Government regarding the commissioning work.

1.7.2 Technical Commissioning Specialists

Technical Commissioning Specialists, employed by the Commissioning Firm or financially and corporately independent subcontractor hired by the Commissioning Firm, and that have the following qualifications, must perform the technical work specified herein associated with each system to be commissioned:

a. The technical work associated with mechanical systems including Heating, Ventilating, Air Conditioning, and Refrigeration Systems; Building Automation System; Utility Monitoring and Control System; Service Water Heating Systems; Plumbing Systems; Water Pumping and Mixing Systems; [Irrigation Systems]; [Compressed Air and Vacuum Systems]; Energy and Water Utility Metering Systems must be performed by a Commissioning Specialist certified by NEBB, ACG, ICB/TABB, or BCA in the commissioning of HVAC systems with five years of experience in the commissioning of HVAC systems.

b. The technical work associated with electrical systems including Lighting Systems; Power Distribution Systems; Power Generation Systems; Renewable Energy Systems must be performed by an engineering technician certified by the InterNational Electrical Testing Association (NETA) or the National Institute for Certification in Engineering Technologies (NICET) with five years of experience inspecting, testing, and calibrating electrical distribution and generation equipment, systems, and devices.

c. The technical work associated with the Building Envelope system must be performed by a registered architect with five years of building envelope design or construction experience. The Commissioning Firm team member with the required experience related to the building

envelope may act as the Air Barrier Inspector required by specification section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM provided that all qualification requirements of that specification section are met. The Commissioning Firm team member with the required experience related to the building envelope may act as the thermographer required by specification section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS provided that all of the qualification requirements of that specification section are met.

d. Submit the Technical Commissioning Specialist's certification of qualifications including the name of the specialist and firm; certifications; years of experience; and a listing of representative projects of similar size and complexity no later than 60 calendar days after Notice to Proceed. Submit four hard copies and an electronic copy.

1.7.3 Commissioning Standard

Comply with the requirements of the commissioning standard under which the Commissioning Firm and Specialists qualifications are approved. When the firm and specialists are certified by BCA, AEE, ASHRAE, or the University of Wisconsin-Madison, comply with the requirements of one of the acceptable standards unless otherwise stated herein. The acceptable standards are ACG Commissioning Guideline, NEBB Commissioning Standard, SMACNA 1429, or ASHRAE 202. Comply with applicable NETA and NICET testing standards for electrical systems.

a. Implement all recommendations and suggested practices contained in the Commissioning Standard and electrical test standards.

b. Use the Commissioning Standard for all aspects of Commissioning, including calibration of instruments.

c. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the Commissioning Standard, adhere to the manufacturer calibration recommendations.

d. All quality assurance provisions of the Commissioning Standard such as performance guarantees are part of this contract.

e. The Commissioning Specialists must develop commissioning procedures for any systems or system components not covered in the Commissioning Standard.

f. Use any new requirements, recommendations, and procedures published or adopted prior to contract solicitation by the body responsible for the Commissioning Standard.

[1.8 SUSTAINABILITY THIRD PARTY CERTIFICATION (TPC)

The Commissioning Specialists must execute and document the commissioning activities required of the Commissioning Authority for the purposes of complying with the Third Party Certification (TPC) requirements for the project in accordance with Section 01 33 29 SUSTAINABILITY REPORTING. Provide all commissioning documentation required to meet the TPC requirements.

]1.9 ISSUES LOG

The Lead Commissioning Specialist must develop and maintain an Issues Log for tracking and resolution of all deficiencies discovered through commissioning review, inspection, and testing. Include the date of final resolution of issues as confirmed by the Commissioning Specialist. Submit the Issues Log on a monthly basis at a minimum. At any point during construction, any commissioning team member finding deficiencies may communicate those deficiencies in writing to the Commissioning Specialist for inclusion into the Issues Log.

Track construction deficiencies identified in the Issues Log using QCS as specified in Specification Section 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM).

1.10 CERTIFICATE OF READINESS

Prior to scheduling Functional Performance Tests for each system, issue a Certificate of Readiness for the system certifying that the system is ready for Functional Performance Testing. The Certificate of Readiness must include, for each system to be commissioned, all equipment and system start-up reports; Performance Verification Test Reports; completed Building Envelope Inspection Checklists; completed Pre-Functional Checklists; Testing, Adjusting, and Balancing (TAB) Report; HVAC Controls Start-Up Reports; and the Air Leakage Test Reports and Diagnostic Test Reports to the extent applicable to the system. The Contractor; the Lead Commissioning Specialist; the Contractor's Quality Control Representative; the Mechanical, Electrical, Controls, and TAB subcontractor representatives must sign and date the Certificate of Readiness. Submit the Certificate of Readiness for each system no later than 14 calendar days prior to Functional Performance Tests of that system. Submit four hard copies and an electronic copy. Do not schedule Functional Performance Tests for a system until the Certificate of Readiness for that system receives approval by the Government.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

3.1 CONSTRUCTION PHASE

3.1.1 Construction Commissioning Coordination Meeting

The Lead Commissioning Specialist must lead a Construction Commissioning Coordination Meeting no later than 14 days after approval of the Commissioning Firm and Commissioning Specialists to discuss the commissioning process including contract requirements, lines of communication, roles and responsibilities, schedules, documentation requirements, inspection and test procedures, and logistics as specified in this specification section. The Contractor's Superintendent or Project Manager, the Contractor's Quality Control Representative, and the Government must attend this meeting. Invite the User and a Directorate of Public Works Representative, Reserve Support Command Representative, or a Base Civil Engineer Office Representative to attend this meeting.

3.1.2 Construction Phase Commissioning Plan

3.1.2.1 Interim Construction Phase Commissioning Plan

The Lead Commissioning Specialist (CxC) must prepare the Interim Construction Phase Commissioning Plan. Submit the Interim Construction Phase Commissioning Plan no later than 30 calendar days after the Construction Commissioning Coordination Meeting and no later than 14 days prior to the start of construction of the building envelope. Submit four hard copies and an electronic copy.

Identify the commissioning and testing standards and outline the overall commissioning process, the commissioning schedule, the commissioning team members and responsibilities, lines of communication, documentation requirements for the construction phase of the project, and Template Building Envelope Inspection Checklists in the Interim Construction Phase Commissioning Plan. A Template Construction Phase Commissioning Plan is attached to this specification and is available in word format upon request. Please note that the Template Construction Phase Commissioning Plan is provided as a supplement and contains additional detailed requirements not specifically addressed within this specification section. The CxC is required to develop a commissioning plan that is comprehensive in scope and conforms to the requirements of the contract documents.

3.1.2.1.1 Checklists

Download example Building Envelope Inspection Checklists, Pre-Functional Checklists, Functional Performance Test Checklists, and Integrated Systems Test Checklists for specification section 01 91 00.15 TOTAL BUILDING COMMISSIONING at the following location: http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphic The checklists submitted in the Interim and Final Construction Phase Commissioning Plans must contain the same level of detail shown in the examples. The submitted checklists are not required to match the format of the examples.

3.1.2.1.2 Contents

In addition to the requirements listed above and those included in the Template Commissioning Plan, include the following in the Interim Construction Phase Commissioning Plan:

a. Plan purpose

b. Commissioning scope

c. Systems to be commissioned

d. Examples and description of development of pre-functional, integrated systems test, and functional performance test checklists

e. Building information

f. Contact information for the Commissioning Specialists, the Contracting Officer's Technical Representative, and the Commissioning Team listed in paragraph Commissioning Team

g. Roles and responsibilities

h. Management plan

i. Owner's Project Requirements

j. Description of design reviews by the Commissioning Specialists

k. Description and templates for site observation reports and the issues log

l. Listing and description of required meetings

m. Identification and sequence of commissioning and acceptance tasks for incorporation into the Project Schedule

n. Listing of required submittals to Government and Commissioning Specialists

o. Description of execution of building envelope inspection, pre-functional checks, integrated systems tests, and functional performance tests

p. Description of Endurance Tests

q. Acceptance testing of critical systems as identified in contract documents

r. Operation and maintenance manual requirements

s. Description of training requirements

t. Description of required Systems Manual

u. Description of the Commissioning Report

3.1.2.1.3 Template Building Envelope Inspection Checklists

The Building Envelope Technical Commissioning Specialist must develop the Template Building Envelope Inspection Checklists. Include items that verify the building materials and construction maintain the required thermal and moisture integrity and air tightness of the building envelope system in the Building Envelope Inspection Checklists.

3.1.2.2 Final Construction Phase Commissioning Plan

The Lead Commissioning Specialist (CxC) must prepare the Final Construction Phase Commissioning Plan. Submit the Final Construction Phase Commissioning Plan no later than 30 calendar days prior to the start of Pre-Functional Checks. Submit four hard copies and an electronic copy.

Include the information provided in the Interim Construction Phase Commissioning Plan. In addition, the Technical Commissioning Specialist must develop the Pre-Functional Checklists, Integrated Systems Test Checklists, and Functional Performance Test Checklists for each building, for each system required to be commissioned, and for each component for inclusion in the Final Construction Phase Commissioning Plan.

3.1.2.2.1 Pre-Functional Checklists

The Pre-Functional Checklists must include items for physical inspection or testing that demonstrate that installation and start-up of equipment and systems is complete. See paragraph Pre-Functional Checks for more information.

3.1.2.2.2 Functional Performance Test Checklists

Functional Performance Test Checklists must include procedures that explain, step-by-step, the actions and expected results that will demonstrate that the system performs in accordance with the contract. See paragraph Functional Performance and Integrated Systems Tests for more information. Include the following sections and details appropriate to the systems being tested in the Functional Performance Test Checklists:

a. Notable system features including information about controls to facilitate understanding of system operation

b. Conclusions and recommendations. Conclusions must clearly indicate if system does or does not perform in accordance with contract requirements. Recommendation must clearly indicate that the system should or should not be accepted by the Government.

c. Test conditions including date, beginning and ending time, and beginning and ending outdoor air conditions

d. Attendees

e. Identification of the equipment involved in the test

f. Control system feature identification

g. Point-to-point observations including demonstrating system flow meters and sensors have been calibrated and are correctly displayed on the Operator work station

h. Actuator operation observations demonstrating actuator responses to commands from the control system

i. As-found condition of the system operation

j. List of test items with step numbers along with the corresponding feature or control operation, intended test procedure, expected system response, and pass/fail indication.

k. Space for comments for each test item.

3.1.2.2.3 Integrated Systems Test Checklists

Integrated Systems Test Checklists must include test procedures that explain, step-by-step, the actions and expected results that will demonstrate that the system performs in accordance with the contract. See paragraph Functional Performance and Integrated Systems Tests for more information. Include the following sections in the Integrated Systems Test Checklists:

a. Notable features of the interconnected systems organized by discipline including information to facilitate understanding of system operation

b. Conclusions and recommendations. Conclusions must clearly indicate if the systems do or do not perform in accordance with contract requirements. Recommendation must clearly indicate that the systems should or should not be accepted by the Government

c. Test conditions including date and beginning and ending time

d. Attendees

e. Identification of the equipment and systems involved in the test

f. List of test items with step numbers along with the corresponding feature or control operation, intended test procedure, expected system response, and pass/fail indication.

g. Space for comments for each test item.

3.1.3 Design Review

The Lead Commissioning Specialist and Technical Commissioning Specialists must review the construction contract plans and specifications.

a. Advise the Contracting Officer's Representative of any deficiencies that would prevent the building systems and features from operating or performing effectively and from being adequately maintainable.

b. The Commissioning Specialists must provide a Design Review Report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation or performance. Submit four hard copies and an electronic copy of the report to the Contracting Officer's Representative no later than 30 days after approval of the Commissioning Specialists.

c. The Lead Commissioning Specialist must participate in a meeting to discuss any items contained in the report no later than 14 calendar days after submission of the report.

3.1.4 Construction Submittals

Provide all submittals associated with the systems to be commissioned, including shop drawings; equipment submittals; test plans, procedures, and reports; and resubmittal's to the Commissioning Specialists. The Technical Commissioning Specialist must review the submittals to the extent necessary to verify that the equipment and system installation will comply with the contract requirements.

3.1.5 Inspection and Testing

Demonstrate that all system components have been installed, that each control device and item of equipment operates, and that the systems operate and perform, including interactive operation between systems, in accordance with contract documents and the Owner's Project Requirements. Requirements in related specification sections are independent from the requirements of this section and do not satisfy any of the requirements specified in this specification section. Provide all materials, services, and labor required to perform the Pre-Functional Checks, Building Envelope Inspection, Integrated Systems Tests, and Functional Performance Tests.

3.1.5.1 Commissioning Team

Provide a commissioning representative for each sub-contractor associated with the systems to be commissioned. Each commissioning representative is responsible for coordination of their respective sub-contractor's execution of the commissioning activities and participation in the inspection and testing required by this specification section. The designers listed below are the designers of record for their respective systems. Substitutes must be approved by the Contracting Officer's Representative. The General or Prime Contractor shall provide a detailed schedule of all Functional Performance and Integrated System Testing activities to be accomplished at least 14 calendar days prior to the start date of testing.

3.1.5.1.1 Building Envelope Inspections Team

The following team members must participate in building envelope inspections:

Designation	Function
CxB	Building Envelope Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
BEC	Contractor's Building Envelope Commissioning Representative
[AD]	[Architectural Designer]

3.1.5.1.2 Mechanical System Pre-Functional Checks Team

The following team members must participate in Pre-Functional checks of mechanical systems:

Designation	Function
CxM	Mechanical System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
MC	Contractor's Mechanical Commissioning Representative
EC	Contractor's Electrical Commissioning Representative
CC	Contractor's Controls Commissioning Representative
TABC	Contractor's TAB Commissioning Representative
PC	Contractor's Plumbing Commissioning Representative

Designation	Function
IC	Contractor's Irrigation Commissioning Representative

3.1.5.1.3 Electrical System Pre-Functional Checks Team

The following team members must participate in Pre-Functional checks of electrical systems:

Designation	Function
CxE	Electrical System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
EC	Contractor's Electrical Commissioning Representative

3.1.5.1.4 Mechanical Systems Test Team

The following team members must participate in Functional Performance, Seasonal,and Integrated Systems Testing of mechanical systems:

Designation	Function
CxM	Mechanical System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
MC	Contractor's Mechanical Commissioning Representative
EC	Contractor's Electrical Commissioning Representative
CC	Contractor's Controls Commissioning Representative
TABC	Contractor's TAB Commissioning Representative
PC	Contractor's Plumbing Commissioning Representative
IC	Contractor's Irrigation Commissioning Representative
[MD]	[Mechanical Designer]
[PD]	[Plumbing Designer]

3.1.5.1.5 Electrical Systems Test Team

The following team members must participate in Functional Performance and Integrated Systems Testing of electrical systems:

Designation	Function
CxE	Electrical System Technical Commissioning Specialist
QAR	Contracting Officer's Quality Assurance Representative
CQC	Contractor's Quality Control Personnel
EC	Contractor's Electrical Commissioning Representative
[ED]	[Electrical Designer]

3.1.5.1.6 Other Pre-Functional and Functional Performance Participants

The following may participate as team members during Pre-Functional Checks and Functional Performance Testing:

Designation	Function
[DPW]	[Directorate of Public Works Representative]
[BCE]	[Base Civil Engineer Office Representative]
[RSC]	[Reserve Support Command Representative]
[PWD]	[Public Works Division Representative]
User	Using Agent's Representative

3.1.5.2 Building Envelope Inspection

Document building envelope inspection by the commissioning team using the approved Template Building Envelope Inspection Checklists. Indicate commissioning team member inspection and acceptance of each Building Envelope Inspection Checklist item by initials at the time they are inspected and found to be in conformance with contract requirements. Inspect checklist items before they become hidden as construction progresses.

a. Submit the completed and initialed Building Envelope Inspection Checklists no later than 7 calendar days after completion of inspection of all checklists items. Submit four hard copies and an electronic copy.

b. The Building Envelope Technical Commissioning Specialist must make at least two site visits to the site to observe construction of the building envelope in-progress. On each visit, the Building Envelope Commissioning Specialist must review the Contractor's in-progress checklists to ensure that the commissioning team is inspecting the

building envelope as required.

c. The Building Envelope Technical Commissioning Specialist must witness the building envelope pressure tests and diagnostic tests specified in Specification Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS. The Building Envelope Technical Commissioning Specialist must review the resulting reports and provide recommendations for correction of any deficiencies or further testing.

3.1.5.3 Pre-Functional Checks

Pre-Functional Checklists from the approved Final Construction Phase Commissioning Plan must be completed by the commissioning team. Complete one Pre-Functional Checklist for each individual item of equipment or for each system required to be commissioned including, but not limited to, ductwork, piping, equipment, fixtures (lighting and plumbing), and controls. Indicate commissioning team member inspection and acceptance of each Pre-Functional Checklist item by initials. Acceptance of each Pre-Functional Checklist item by each team member indicates that item conforms to the construction contract requirements in their area of responsibility. Technical Commissioning Specialist acceptance of each Pre-Functional Checklist item indicates that each item has been installed correctly and in accordance with contract documents and the Owner's Project Requirements. Submit the completed and initialed Pre-Functional Checklists no later than 7 calendar days after completion of inspection of all checklists items for each system. Submit four hard copies and an electronic copy. Include manufacturer start-up checklists associated with equipment with the submission of the Pre-Functional Checklists.

3.1.5.4 Testing, Adjusting, and Balancing (TAB) Report and Field Acceptance Testing

The Mechanical System Technical Commissioning Specialist must review the pre-final TAB Report required by Specification Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. Identify any deficiencies to the Contracting Officer's Representative and the Contractor's Quality Control Personnel. Resolve all deficiencies prior to TAB Field Acceptance Testing.

The Mechanical System Technical Commissioning Specialist must witness the TAB Field Acceptance Testing specified by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. Include a certification by the Mechanical Technical Specialist that no outstanding deficiencies exist in the systems relative to Testing, Adjusting, and Balancing with the final TAB Report submittal.

3.1.5.5 HVAC Controls Test Reports

The Mechanical System Technical Commissioning Specialist must review the Performance Verification Testing Plan, Checklists, and Report. Include a certification by the Mechanical System Technical Commissioning Specialist that the submittals contain no deficiencies or that the submittals do not indicate any deficiencies in the HVAC systems or HVAC control systems with each of these submittals.

3.1.5.6 Tests

3.1.5.6.1 Functional Performance and Integrated Systems Tests

Schedule Functional Performance Tests for each system only after the Certificate of Readiness has been approved by the Government for the system. Correct all deficiencies identified through any prior review, inspection, or test activity before the start of Functional Performance Tests. Perform Integrated Systems Tests only after the Functional Performance Tests for each associated system are completed with all deficiencies resolved and after the related Functional Performance Test Checklists have been signed by each commissioning team member.

a. Functional Performance Tests and Integrated Systems Tests must be performed with the Contracting Officer's Quality Assurance Representative present.

b. Abort Functional Performance Tests or Integrated Systems Tests when any system deficiency prevents the successful completion of the test.

c. Technical Commissioning Specialists must lead and document all Functional Performance Tests and Integrated Systems Tests for the systems to be commissioned with the Contractor and appropriate sub-contractors performing the Functional Performance Tests and Integrated Systems Tests. The representatives listed in the paragraph Commissioning Team must attend the tests. Abort Functional Performance Tests or Integrated Systems Tests when any required commissioning team member is not present for the test.

3.1.5.6.1.1 Checklist

Use the Functional Performance Test and Integrated Systems Test Checklists from the approved Final Construction Phase Commissioning Plan to guide the Functional Performance Tests and Integrated Systems Tests. Functional Performance Tests must be performed for each item of equipment and each system required to be commissioned and verify all sensor calibrations, control responses, safeties, interlocks, operating modes, sequences of operation, capacities, lighting levels, and all other performance requirements comply with construction contract regardless of the specific items listed within the Functional Performance Test and Integrated Systems Test Checklists provided. Testing must progress from equipment or components to subsystems to systems to interlocks and connections between systems. Integrated Systems Tests must be performed for the interactive operation between systems such as HVAC systems, fire protection systems, back-up electrical supply, energy generation systems, and other systems, and verify correct interactive operation, acceptable speed of response, and other contract requirements for both normal and failure modes. Examples of Integrated Systems Tests include the correct operation of HVAC systems during emergency system activation, correct operation of uninterruptible power supplies or energy generators and connected systems, or lighting system operation during power outage or emergency system activation. The order of components and systems to be tested must be determined by the Technical Commissioning Specialists.

3.1.5.6.1.2 Acceptance

Indicate acceptance of each item of equipment and systems tested by signature of each commissioning team member for each Functional Performance Test or Integrated Systems Test Checklist. The Contractor's

Quality Control Representative and the Technical Commissioning Specialists must indicate acceptance after the equipment and systems are free of deficiencies.

3.1.5.6.2 HVAC Test Methods

Perform Functional Performance Tests in accordance with the following:

3.1.5.6.2.1 Prior to Testing

Prior to testing operating modes, sequences of operation, interlocks, and safeties, complete control point-to-point observations, test sensor calibrations, and test actuator commands.

3.1.5.6.2.2 Simulating Conditions

Over-writing control input values through the controls system is not acceptable, unless approved by the Contracting Officer's Representative . Identify proposed exceptions in a protocol submitted to the Contracting Officer's Representative for approval. Before simulating conditions, overwriting values (if approved), or changing set-points, calibrate all sensors, transducers and devices. Below are several examples of exceptions that would be considered acceptable:

a. When varying static pressures inside ductwork can not be simulated within the duct, and where a sensor signals the controls system to initiate sequences at various duct static pressures, it is acceptable to simulate the various pressures with a Pneumatic Squeeze-Bulb Type Signaling Device with gauge temporarily attached to the sensing tube leading to the transmitter. It is not acceptable to reset the various set-points, nor to simulate an electric analog signal (unless approved as noted above).

b. Dirty filter pressure drops can be simulated using sheets of cardboard at filter face.

c. Freeze-stat safeties can be simulated by packing portion of sensor with ice.

d. High outside air temperatures can be simulated with a hair blower.

e. High entering cooling coil temperatures can be used to simulate entering cooling coil conditions.

f. Do not use signal generators to simulate sensor signals unless approved by the Contracting Officer's Representative , as noted above, for special cases.

g. Control set points can be altered. For example, to see the air conditioning compressor lockout work at an outside air temperature below 13 degrees C, when the outside air temperature is above 13 degrees C, temporarily change the lockout set point to be minus 18 degrees C above the current outside air temperature. Caution: Set points are not to be raised or lowered to a point such that damage to the components, systems, or the building structure and/or contents will occur.

h. Test duct mounted smoke detectors in accordance with the manufacturer's recommendations. Perform the tests with air system at

minimum airflow condition in ductwork.

i. Test current sensing relays used for fan and pump status signals to control system to indicate unit failure and run status by resetting the set point on the relay to simulate a lost belt or unit failure while the unit is running. Confirm that the failure alarm was generated and received at the control system. After the test is conducted, return the set point to its original set-point or a set-point as indicated by the Contracting Officer's Representative .

3.1.5.6.2.3 Setup

Perform each test under conditions that simulate actual conditions as close as is practically possible. Provide all necessary materials and system modifications to produce the necessary flows, pressures, temperatures, and other conditions necessary to execute the test according to the specified conditions. At completion of the test, return the affected building equipment and systems to their pre-test condition.

3.1.5.6.3 Sample Strategy

Perform Functional Performance Tests and Integrated System Tests for all equipment and systems. Prepare and complete a Functional Performance Test checklist for each piece of equipment or system. Prepare and complete an Integrated Systems Test Checklist for all systems and equipment having interactive operation. Test 100 percent of all HVAC Central Plant equipment and primary air handling units. [Test [100] percent of renewable energy systems/equipment]. Sample testing of 10 units or [twenty] percent, whichever is greater, is allowed for HVAC equipment with identical controllers such as air terminal units and fan coil units. [Sample testing of [twenty] percent is allowed for other equipment and systems.]

3.1.5.6.4 Seasonal Tests

3.1.5.6.4.1 Initial Functional Performance Tests

Perform Initial Functional Performance Tests as soon as all contract work is completed, regardless of the season. Develop and implement means of artificial loading to demonstrate, to a reasonable level of confidence, the ability of the HVAC systems to handle peak seasonal loads.

3.1.5.6.4.2 Full-Load Conditions

In addition to the Initial Functional Performance Tests, perform Functional Performance Tests of HVAC systems under full-load conditions during peak heating and cooling seasons during outdoor air condition design extremes. Test cooling equipment and systems with the building fully occupied when performing the Functional Performance Tests during peak cooling season.

Schedule Seasonal Functional Performance Tests in coordination with the Government.

3.1.5.6.4.3 System Acceptance

Systems may be partially accepted prior to seasonal testing if they comply with all construction contract that can be tested during initial Functional Performance Tests. All Functional Performance Test procedures must be completed prior to full systems acceptance.

3.1.5.6.5 Aborted Tests and Re-Testing

Abort Functional Performance Tests, Integrated Systems Tests, or Seasonal Tests if any deficiency prevents successful completion of the test or if any required commissioning team member is not present for the test. reimburse the Government for all costs associated with effort lost due to re-testing due to test failures and aborted tests. These costs must include salary, travel costs, and per diem for Government commissioning team members. Re-test only after all deficiencies identified during the original tests have been corrected.

3.1.5.6.5.1 100 Percent Sample

Systems or equipment for which 100 percent sample size are tested fail if one or more of the test procedures results in discovery of a deficiency and the deficiency cannot be resolved within 5 minutes during the test.

Re-test to the extent necessary to confirm that the deficiencies have been corrected without negatively impacting the performance of the rest of the system.

3.1.5.6.5.2 Less than 100 Percent Sample

For systems tests with a sample size less than 100 percent, if one or more of the test procedures for an item of equipment or a system results in discovery of a deficiency, regardless of whether the deficiency is corrected during the sample tests, the item of equipment or system fails the test.

a. If the system failure rate is 5 percent or less, meaning that 5 percent or less of the equipment or systems tested had at least one deficiency, re-test only on the items which experienced the initial failures.

b. If the system failure rate is greater than 5 percent, meaning that more than 5 percent of equipment or systems tested had at least one deficiency, re-test the items which experienced the initial failures to the extent necessary to confirm that the deficiencies have been corrected . In addition, test another random sample of the same size as the initial sample for the first time. If the second random sample set has any failures, re-test those failed items and all remaining equipment and systems to complete 100 percent testing of that system type.

3.1.6 Training Plan

Develop a training plan which identifies all training required by specification sections associated with commissioned systems. Include a matrix listing each training requirement, content of the training, the trainer name, trainer contact information, and schedule and location of training. Submit four hard copies and an electronic copy of the Training Plan to the Commissioning Specialists and the Government no later than 30 calendar days prior to the associated training.

Document training attendance using training attendance rosters and provide completed attendance rosters to the Commissioning Specialists and the Government no later than 7 calendar days following the completion of training for each system to be commissioned. Submit four hard copies and

an electronic copy..

3.1.7 Systems Manual

Prepare and submit a Systems Manual including, for all commissioned systems, the Owner's Project Requirements, system single line diagrams, as-built sequences of operation and controls drawings, as-built control setpoints, recommended schedule for sensor and actuator calibration, recommended schedule of maintenance when not in the O&M manuals, recommended re-testing schedule with proposed testing forms, and full equipment warranty information. Update and resubmit the Systems Manual based on any corrective action taken during the warranty period. Include a signed certification or letter from the Lead Commissioning Specialist with the submittal stating that the Systems Manual is complete, clear, and accurate.

Submit Systems Manual no later than 30 calendar days following completion of Functional Performance Tests. Submit four hard copies and an electronic copy.

3.1.8 Maintenance and Service Life Plans

3.1.8.1 Maintenance Plan

Prepare and submit a Maintenance Plan for the project mechanical, electrical, plumbing, and fire protection systems. Prepare the HVAC and refrigeration sections of the Maintenance Plan in accordance with ASHRAE 180. Develop required inspection and maintenance tasks similar to Section 5 of ASHRAE 180 for the other commissioned systems and fire protection systems.

Submit the Maintenance Plan no later than 30 calendar days following the completion of Functional Performance tests. Submit four hard copies and an electronic copy.

3.1.8.2 Service Life Plan

Prepare and submit a Service Life Plan for the building envelope, structural systems, and site hardscape that includes the following for each assembly or component:

a. A description of each including the materials or products.

b. The estimated service life, in years.

c. The estimated maintenance frequency and description of maintenance tasks.

d. The point of maintenance access for the components with estimated service life less than service life of the building.

Submit the Service Life Plan no later than 30 calendar days following the completion of Functional Performance tests. Submit four hard copies and an electronic copy.

3.2 COMMISSIONING REPORT

Following the completion of Functional Performance Tests and Integrated Systems Tests, with the exception of Seasonal Tests, the Lead

Commissioning Specialist must prepare a Commissioning Report.

a. Include an executive summary describing the overall commissioning process, the results of the commissioning process, any outstanding deficiencies and recommended resolutions, and any seasonal testing that must be scheduled for a later date. Indicate, in the executive summary, whether the systems meet the requirements of the construction contract and the Owner's Project Requirements.

b. Detail any deficiencies discovered during the commissioning process and the corrective actions taken in the report. Include the completed Building Envelope Inspection Checklists, Pre-Functional Checklists, Functional Performance Test Checklists, Integrated Systems Test Checklists, the Commissioning Plans, the Issues Log, control sequences, meeting minutes, progress and site visit reports, Performance Verification Test Reports, Training Attendance Rosters, the Design Review Report, the final TAB Report.

c. Submit the Commissioning Report no later than 14 calendar days following commissioning team acceptance of all Functional Performance Tests and Integrated Systems Tests with the exception of Seasonal Tests. Submit four hard copies and an electronic copy.

d. Following any Seasonal Tests or Post-Construction Activities, update the Final Commissioning Report to reflect any changes and resubmit.

3.3 POST-CONSTRUCTION SUPPORT

3.3.1 Post-Construction Endurance Test

Perform a one-week Endurance Test once during the peak heating season and once during the peak cooling season during outdoor air condition extremes using the building control system to trend all points necessary to evaluate the installed equipment and system performance or as shown as requiring a trend on the project schedules. If insufficient buffer capacity exists to trend the entire endurance test, upload trend logs during the course of the endurance test to ensure that no trend data is lost. Poll all points shown in the project schedules with an alarm condition at 5 minute intervals. Poll all points shown in the project schedules required for trending, overrides, or graphical displays at 15 minute intervals.

The Mechanical System Commissioning Specialists must review the trend logs from the Endurance Tests to ensure that the systems have stable operation and operate as required by the construction contract and the Owner's Project Requirements. The Commissioning Specialists must provide a Post-Construction Trend Log Report that identifies any deficiencies noted in operation and includes a graphical representation of the trends. Provide one Trend Log Report for the peak cooling season and one Trend Log Report for the peak heating season. Submit four hard copies and one electronic copy of the Post-Construction Trend Log Reports no later than 14 calendar days following receipt of the trend log data by the Commissioning Specialist.

3.3.2 Post-Construction Site Visit

The Commissioning Specialists must visit the building site concurrent with the 9 month warranty inspection to inspect building system equipment and review building operation with the building operating/maintenance staff.

The Commissioning Specialists must identify any deficiency of the building systems to operate in accordance with the contract requirements and the Owner's Project Requirements. The Commissioning Specialists must advise the Contracting Officer's Representative of any identified deficiencies and the proposed corrective action. Submit an updated commissioning report and systems manual documenting the results of the post-construction inspection.

Project Name
Project Location

TEMPLATE - Construction Phase Commissioning Plan

Prepared by:

Date

TEMPLATE - Construction Phase Commissioning Plan

Summary

The *Construction Phase Commissioning Plan* is developed in draft form for the specific project during the design phase. During the design phase, the plan provides direction for the development of the site-specific commissioning specifications by the design team. During the construction phase, the plan provides direction for the commissioning tasks during construction. The plan focuses on providing support for the specifications and provides forms for the application of the commissioning process.

Table of Contents

Commissioning Plan—Construction Phase

Project: **Project Name**
Project Location

Date: _____

Cx Plan Version

_x_ TEMPLATE Construction Phase
___ **Final Construction Phase**

1. Overview

1.1 Abbreviations and Definitions

The following are common abbreviations used in this document.

A/E	Architect and design engineers	FPT	Function Performance Test
BOD	Basis of Design	HVAC	Heating, Ventilating and Air Conditioning
CxG	Commissioning Specialist for the Government	GC	General contractor
		MC	Mechanical contractor
CC	Controls contractor		
COR	Contracting Officer's Representative	PC	Prefunctional Checklist
Cx	Commissioning	PE	Project Engineer – Gov't
Cx Plan	Commissioning Plan document	PM	Project Manager – Gov't
CxC	Commissioning Specialist for the Contractor	Subs	Subcontractors to General
DA	Design Agent		
DOR	Designer of Record	TAB	Test and Balance Contractor
EC	Electrical contractor	USACE	US Army Corps of Engineers
FPC	Fire Protection Contractor	User	Facility User/Occupant – Gov't

1.2 Purpose of the Commissioning Plan

The purpose of the construction phase commissioning plan is to document a plan for the commissioning process during construction.

This plan does not provide a detailed explanation of required testing procedures. In general, this plan identifies roles and responsibilities, systems to be commissioned, commissioning standards and procedures, and sample forms to indicate the level of detail desired. Additionally, this plan does not provide extensive narrative on all commissioning concepts, as this information can be found in commissioning guide references.

1.3 Commissioning Scope

Commissioning is a systematic process of ensuring that all building systems perform interactively according to the Owner's Project Requirements (OPR) and contract documents. This is achieved by, beginning in the design phase, documenting the design intent and continuing through construction, acceptance and the warranty period with actual verification of performance.

Commissioning during the construction and acceptance phase of this project is intended to achieve the following specific objectives:

- Ensure that applicable equipment and systems are installed properly and receive adequate operational checkout by installing contractors.
- Verify and document proper performance of equipment and systems.
- Ensure that O&M documentation is complete and is in custody of the owner.
- Ensure that the Owner's operating personnel are adequately trained.

1.4 Commissioned System

(NOTE: THIS IS AN EXAMPLE. THIS IS NOT A COMPLETE LIST FOR THIS PROJECT. THIS MUST BE EDITED FOR EACH PROJECT TO REFLECT ALL EQUIPMENT AND SYSTEMS TO BE COMMISSIONED.)

The following systems will be commissioned in this project (shall include, but not limited to):

HVAC System (and all integral equipment controls)
- _x_ Computer Room Air Conditioning Units*
- _x_ Hydronic Hot Water System*
- _x_ Chilled Water System*
- _x_ Pumps*
- _x_ Variable speed drives
- _x_ Piping, cleaning and flushing
- _x_ Ductwork
- _x_ Air handling units (including energy recovery modules, MUAs, coils, etc)*
- _x_ Fan Coil Units
- _x_ VAV Terminal Units
- _x_ Testing, Adjusting and Balancing work
- _x_ Unit heaters
- _x_ Exhaust Fans
- _x_ Building automation system (controlled devices, control loops and system integration)*
- _x_ Renewable Energy Systems/Equipment
- _x_ Other energy transfer or producing equipment

Electrical Systems
- _x_ Automatic Lighting Controls
- _x_ Daylighting/dimming controls
- _x_ Occupancy Controls

Plumbing
- _x_ Domestic hot water system

Other
- _x_ Building Air Tightness
- _x_ Control system
- _x_ Indoor Air Quality
- _x_ Water Measurement Devices*
- _x_ Energy Measurement Devices*
- _x_ Fire Protection Systems*

* Denotes critical equipment

2. General Building Information

Owner: **FEDERAL GOVERNMENT**

Project: **PROJECT NAME**

Location: **PROJECT LOCATION**

Building Type (office, court, etc.): Building Type
Square Footage: ###### GSF Number of stories: ##

3. Cx Team Data (primary parties)

(NOTE: THIS IS NOT A COMPLETE LIST. THIS IS A TEMPLATE AND SHOULD BE EDITED FOR EACH PROJECT TO INCLUDE CX TEAM MEMBERS.)

Team Member	Contact Name	Email Address, Phone
Project Manager		
Design Team Leader		
Project Engineer		
General Contractor		
Commissioning Specialist Government		
Commissioning Specialist Contractor		
Mechanical Designer/Eng.		
Electrical Designer/Eng.		
Tenant Representative		
Mechanical Contractor		
Electrical Contractor		
TAB Contractor		
Controls Contractor		
Mechanical Independent Technical Review		
Architect		

4. Roles and Responsibilities (Note this is a template. This must be edited and coordinated with the specifications for this project. Add roles and responsibilities for Cx team members not specifically addressed below such as the Technical Commissioning Specialists.)

4.1 Team Members

The members of the commissioning team consist of the CxC, CxG, PE/COR, GC, A/E (particularly the mechanical engineer), the mechanical contractor, electrical contractor, TAB representative, controls contractor, any other installing subcontractors or suppliers of equipment and those performing technical design review of the construction documents. If known, the Owner's building or plant operator/ engineer is also a member of the commissioning team. Additional information on roles and responsibilities of the CxC and CxG is provided in APPENDIX D.

4.2 General Management Plan

The CxC will be hired by the General Contractor. The CxG is a Government employee. In general, the CxC coordinates the commissioning activities and reports to the CxG and Contracting Officer's Representative copying the GC on all results in accordance with LEED. The CxC's responsibilities, along with all other contractors' commissioning responsibilities are outlined herein or detailed in the specifications. The Specifications will take precedence over this Cx Plan. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. Refer to the management protocols section below.

4.3 Descriptions of Roles and Responsibilities

General descriptions of the commissioning roles are as follows:

Commissioning Specialist for the Contractor (CxC):

a. Directs/Coordinates the Cx process and activities.
b. Coordinates all commissioning schedule and activities with the CxG.
c. Obtain copies of all shop drawings, manufacturer's literature, maintenance information or other information as may be needed for systems to be commissioned.
d. Collect the information needed for development of a complete Commissioning Plan and functional performance tests.
e. Obtain all proposed start-up and Prefunctional Checklists documentation.
f. Obtain updates to all project documentation to reflect all supplemental instructions, addenda or other revisions to the project construction documents.
g. Obtain submittals for all systems to be commissioned including controls system and wiring diagrams and narrative sequences of operation, in time for use in preparing the Functional Test Procedures.
h. Obtain preliminary TAB report, indicating all actual field values recorded, prior to initiation of functional testing.
i. Obtain complete operation and maintenance information and as-built drawings for verification, organization and distribution.
j. Update and finalize the Draft Construction Phase Commissioning Plan.
k. As part of Final Commissioning Plan, develop Prefunctional Checklists and Functional Test Procedures from Contract Documents and final equipment submittals including narrative sequences of operation, control diagrams and software code for execution with the assistance of Contractor staff as required. Sample PC and FPT documents located under Appendix C are examples representing the scope and rigor of the commissioning procedures required, and shall be used as the basis for developing the detailed checklists and functional performance test procedures for all equipment requiring commissioning.

l. Perform site observations to follow installation progress and to verify system installation and readiness for testing.
m. Reviews and implements the contractor Start-up Procedures and Forms
n. Review submittal of all required prefunctional and start-up documentation provided by Contractor for completeness and reasonableness. This includes installation documentation, start-up documentation, point-to-point checklists and preliminary TAB report, prior to initiation of functional testing.
o. Schedule, direct and witness complete functional testing as defined in the Commissioning Plan and Functional Test Procedures. All testing shall be performed by the Contractors and subcontractors, and documented by the Commissioning Specialist.
p. Conduct commissioning meetings.
q. Provide site observation, functional tests or other project reports in a timely manner.
r. Identify and document inconsistencies or deficiencies in system operations and system compliance. System deficiencies shall be forwarded to the Contractor and Contracting Officer and documented in a Communication Log and the CQC system.
s. Provides limited problem resolution assistance.
t. Coordinate the participation of Government's personnel with equipment, component and systems performance verification and participation in required training.
u. When commissioning has been successfully completed, recommend acceptance to the Government.
v. Once all functional tests have been successfully completed and all outstanding issues resolved, the Commissioning Specialist will provide the Contracting Officer with a Final Commissioning Report of all commissioning activities and test results that occurred during the project.
w. Observe and document training of government personnel on commissioning systems and equipment.
x. Develop Systems Manual and obtain all necessary information/documentation needed for inclusion.
y. Perform Post Occupancy Activities.

Owner/Government Representative (CxG, COR, PE, or PM):
a. Facilitates and supports the Cx process assuring that all commissioning activities are performed in accordance with LEED requirements and contract documents..
b. Approves the Final Commissioning Plan including PCs and FPTs.
c. Approves the Commissioning Report.
d. Performs construction observation.
e. Has final authority in decision making processes

General Contractor:
a. Facilitate the Cx process.
b. Ensure CxC receives copies of all shop drawings, manufacturer's literature, maintenance information or other information as may be needed for systems to be commissioned.
c. Ensure CxC is provided necessary information for updating the Commissioning Plan and development of checklists and functional tests. The Contractor shall review these documents and confirm in writing to the CxC, PE/COR and CxG any known areas of conflict or areas requiring clarifications.
d. Assists in development of Prefunctional Checklists (PC).
e. Ensure all proposed start-up and Prefunctional Checklists documentation is provided to the CxC.
f. Assists in the development of the Functional Performance Testing Procedures and Forms (FPT).
g. Plan for and incorporate all commissioning activities into the construction schedule.

h. Provide a fully operational system per Specifications, started, verified, debugged, calibrated, balanced, tested and under automatic control.
i. Provide qualified personnel to participate in the commissioning tests, including seasonal testing.
j. Provide updates to all project documentation to reflect all supplemental instructions, addenda or other revisions to the project construction documents. Updates and supplemental instructions must be posted to the master set of documentation for review and reference by all Contractors and for the Commissioning Specialist's use.

k. Provide adequate time and resources to support CxC with functional testing of systems to be commissioned.
l. Coordinate participation of the mechanical, electrical, controls and TAB subcontractors, and all Contractor Quality Control personnel in the commissioning process. Ensure that Subs perform their responsibilities.
m. Ensure CxC and CxG receive submittals for all systems to be commissioned including controls system and wiring diagrams and narrative sequences of operation, in time for use in preparing the Functional Test Procedures.
n. Participate in any efforts to finalize sequences of operations with Government and CxC.
o. Verify that coordination, installation, quality control and final testing have been completed such that installed systems and equipment comply with construction documents.
p. Review the Commissioning Plan, interim reports such as issues log and progress reports, and Commissioning Report to include test results and submit comments to the CxC.
q. In a timely manner, address issues identified during construction that may affect the commissioning process or final system performance.
r. Perform start-up and testing of mechanical and electrical equipment and systems and document as required with start-up reports and completion of Prefunctional Checklists. These checklists include installation documentation, start-up documentation, controls point-to-point documentation and calibration documentation, verification that controls sequence of operations meets design intent and TAB final documentation. Reports will be stored in the Contractor's field trailer. Contractor will coordinate efforts to complete the prefunctional documentation.
s. Ensure preliminary TAB report, indicating all actual field values recorded is provided to the CxC and CxG, prior to initiation of functional testing. These reports shall be incorporated in the commissioning field notebook. The final TAB report is distinguished from the preliminary TAB report by the fact that all submittals and corrections shall be approved by the issuance of the final TAB report. All balancing issues and corrections shall have been resolved to the satisfaction of all parties by the final TAB report.
t. Issue a written Certificate of Readiness for each system to CxC, CxG and PE/COR upon completion of all systems work, start-up and Prefunctional Checklists requirements by trade contractors.
u. Responsible for and demonstrate proper system installation and performance (typically through the use of installers, subs and/or manufacturers). Operate equipment and systems as required for functional performance testing. This includes, but is not limited to; manipulating the appropriate controls systems to execute the Functional Test Procedures.
v. Participate in the fine-tuning or troubleshooting of system performance, if either of these measures becomes necessary.
w. Ensure complete operation and maintenance information and as-built drawings is provided to the CxC and CxG for verification, organization and distribution.
x. Provide documentation of training for the systems specified.
y. Provide test equipment required to test all the systems and equipment in this project.
z. Review operating and maintenance data for verification, organization, distribution and conformance to requirement of the Contract Documents.

aa. Provide necessary information/documentation to CxC for inclusion in the Systems Manual.

Subcontractors:

- Demonstrate proper system installation and performance.
- Assists in development of Prefunctional Checklists (PC).
- Assists in the development of the Functional Performance Testing Procedures and Forms (FPT).

Architect/Engineer (A/E or DOR):

- Develops and updates Basis of Design.
- Incorporates Commissioning requirements in construction documents.
- Performs construction observation.
- Assists in resolving problems.

Project Manager:

- Facilitates and supports the Cx process.

5. Construction Phase Commissioning Activities

This section sequentially details the commissioning process by commissioning task or activity.

5.1 Construction Commissioning Coordination Meeting

A commissioning scoping meeting is planned and conducted by the CxC early during the construction phase. Cx Team members such as the GC, CxG, PE/COR, A/E, Technical Commissioning Specialists, and the mechanical, electrical, controls, and TAB subs shall attend. The agenda should include but is not limited to:

- Cx party introductions
- Cx process overview
- Management and lines of reporting and communication are determined
- Draft Cx Plan is reviewed
- Roles and Responsibilities
- Proposed Cx Schedule
- Documentation flow and submittal data the CxG will receive
- Review of building systems to be commissioned including intended operation
- Process questions are addressed

The outcome of the meeting is increased understanding by all parties of the commissioning process and their respective responsibilities. The meeting provides the CxC additional information needed to update the *Cx Plan*, including the commissioning schedule.

Prior to this meeting the CxC is given, by the GC, all drawings and specifications and the construction schedule by trade. The CxC keeps notes from the meeting and distributes them, along with the updated Cx Plan, to each team member.

5.2 Final Commissioning Plan and Schedule - Construction Phase

The CxC develops a final *Construction Phase Cx Plan* using the information gathered from the scoping meeting. The initial commissioning schedule is also developed and integrated into the construction schedule. The Cx schedule will be adjusted as construction progresses. Reference Project Schedule in Total Building Commissioning Specification.

5.3 Site Observation

The CxC will make periodic site visits to observe equipment and system installations. The CxG, selected maintenance personnel and the PE/COR should be notified and may accompany the CxC during these visits. Site visits shall begin regularly by the time 40% of the commissioned systems are installed. The frequency of these visits shall be monthly at a minimum. As construction progresses and mechanical system installation activity increases, CxC representatives will need to increase site observation frequency. The CxC shall provide a site observation report for each visit. Additional CxC visits should include, but not limited to, selective witnessing of DALT, hydrostatic pressure testing, startup, controls startup/point verification, TAB, and spot checking contractor performed Prefunctional Checkout for completeness and accuracy. Observed deficiencies shall be documented and tracked in a construction Cx issues log. The GC will maintain the master issue log.

5.4 Periodic Meetings

The CxC attends selected planning and job-site meetings while on site in order to remain informed on construction progress and to update parties involved in commissioning. The PE/COR and GC provide the CxC and CxG with information regarding substitutions, change orders and any supplemental instructions that may affect commissioning equipment, systems or the commissioning schedule. The CxC and CxG may review construction meeting minutes, change orders or requests for information for the same purpose. Later during construction, necessary meetings between various commissioning team parties will be scheduled by the CxC, through the GC, as required to meet the project's needs. These periodic meetings shall initially be held monthly (and may coincide with the CxC site visits) and then more frequently as project nears completion or as requested by the COR or CxG. The COR and CxG should be notified of all meetings. The CxC will provide minutes for these meetings.

5.5 Miscellaneous Management Protocols

The following protocols will be used on this project.

Issue	Protocol
Requests for Information (RFI) or formal documentation requests:	The CxC goes first through the GC and CxG.
Minor or verbal information and clarifications:	The CxC communicates directly with subcontractors while keeping the CxG, PE/COR and GC informed.
Deficiencies notification:	The CxC documents deficiencies through the CxG and PE/COR, but may discuss deficiency issues with GC prior to notifying the CxG and PE/COR. Copies of deficiency reports shall be provided to CxG and PE/COR.
Functional Test Scheduling or Training:	The CxC may provide input for (and do some coordination of) testing and training, but does not schedule testing or training.
Scheduling Commissioning meetings:	The CxC coordinates date and schedules through GC, CxG, and PE/COR. The GC notifies attendees directly.
Significant Change requests:	The CxC has no authority to issue change orders.
For making small changes in specified sequences of operations:	The CxC may suggest (to the DOR, for approval by the PE/COR) changes in sequences of operations to improve efficiency or to control or to correct deficiencies.
Disagreements between contractors and CxC's interpretations:	Try and resolve with the CxC first. Then work through CxG and GC who will work with CxC directly.

5.6 Progress Reporting and Logs

At the beginning of construction, the CxC provides the PE/COR with monthly C*ommissioning Progress Reports*. Thirty (30) days prior to the startup of the first piece of major equipment, the frequency of progress reports is increased to twice per month, until startup is completed. Thirty (30) days before functional testing of equipment begins, weekly progress reports are required until functional testing and all non-conformance issues are resolved. The CxC may increase the reporting frequency as needed. The progress reports shall include, but are not limited to, an update of the schedule with list of requested schedule changes and new items added to the schedule, a list of new and outstanding deficiencies, and a description of commissioning progress corresponding to the plan. The CxC keeps a log of all commissioning-related issues that require current or future attention using a *Commissioning Issues Log*. Samples of the *Commissioning Progress Report and Commissioning Issues Log* are included in Appendix A.

The CxC regularly communicates with all members of the commissioning team, keeping them apprised of outstanding issues, commissioning progress, and scheduling through memos, progress reports, etc. The CxC maintains all commissioning related materials in an organized notebook to become part of the final Cx report.

5.7 Cx Related Submittals and Documentation

5.7.1 Standard Submittals

The CxC provides all Subs responsible for commissioned equipment with commissioning documentation requirements for their respective equipment and systems through the GC. Subcontractor documentation submissions typically coincide with the normal submittal process. At a minimum, this documentation includes manufacturer's installation instructions, start-up and check-out procedures, O&M data, performance data and control drawings. The CxC reviews and approves submissions relative to commissioning issues expressed in the contract documents. CxC recommendations are provided to the DOR, CxG, owner and/or PE/COR as directed.

5.7.2 Special Submittals, Notifications and Clarifications

The Subs, GC or DOR shall notify the CxC within one (1) week of approval of any design intent or operating parameter changes, added control strategies and sequences of operation, or other change orders that may affect commissioned systems. Thirty (30) days prior to performing any applicable tests, the Subs must provide the CxC full procedure details. As TAB phases are completed, a draft TAB report is provided to the CxC with full explanations of approach, methods, results, data table legends, etc. The final TAB report is provided to the CxC and CxG upon completion.

These submittals to the CxC do not constitute O&M manual submittal compliance. Documentation requirements for the O&M manuals are discussed in Section 5.11, herein.

The CxC may request additional design narrative from the DOR and/or the contractor depending on completeness of original bid documents. The CxC may submit written RFIs to contractors through the standard process.

5.8 Prefunctional Checklists, Tests and Startup

Prefunctional checklists (PC) are important to ensure that the equipment and systems are installed and operational and that functional performance testing (FPT) may proceed without unnecessary delays. The CxC will assist/develop with commissioning team members detailed prefunctional checklists and start up plans. The CxC shall provide prefunctional checklists and start up plans to CxG for review. Each piece of equipment receives full prefunctional checkout by the GC/Subs. No sampling strategies are used. The

prefunctional checkout for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

Prefunctional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (oil levels OK, fan belt tension, labels affixed, gages in place, sensor calibration, etc.). Some prefunctional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). Prefunctional checklists augment and are combined with the manufacturer's start-up checklist.

Contractors typically already perform some, if not all, of the prefunctional checklist items the commissioning authority will recommend. Few contractors actually document in writing the execution of these checklist items. This project requires that the procedures be documented in writing by the installing technician. To document the prefunctional testing and startup process, site technicians performing line item tasks, initial and date each checklist item. Only individuals having direct knowledge of a line item being completed shall check and initial forms. The CxC may not witness all of the prefunctional checks, but will perform spot checks and will witness prefunctional testing of larger or more critical pieces of equipment. Critical equipment requiring witnessing by the CxC is identified in paragraph 1.4 Commissioned Systems.

Subcontractors will execute and sign the prefunctional checks and start up procedures. The GC ensures that each PC is properly completed and provides them to the CxC.

5.8.1 Start-up Plan

The CxC assists the commissioning team members responsible for startup in developing detailed start-up plans for all equipment. The parties responsible for each part of startup and initial checkout are identified on the prefunctional checklists by the GC.

The following procedures will be used for this project: (the Subs are responsible for the plan development)

1. The CxC adapts and enhances, if necessary, the representative prefunctional checklists (PC) and procedures and develops original lists, as necessary.
2. The CxC transmits them to the GC who designates which trade or contractor is responsible to fill out each line item on the Prefunctional Checklist from the CxC. The GC then transmits the checklist to the responsible Subs.
3. The Sub designated to develop the Start-up Plan obtains manufacturer installation, start-up and checkout data, including actual field checkout sheets used by the field technicians.
4. The Sub copies all pages with important instructional data and procedures (not covered in manufacturer field checkout sheets) from the start-up and checkout manuals and adds a signature line in the column by each procedure.
5. The copied pages, along with the prefunctional checklist provided by the GC (originally from the CxC) and the manufacturer field checkout sheets become the "Start-up and Checkout Plan." For systems that may not have adequate manufacturer start-up and checkout procedures, particularly for components being integrated with other equipment, the Sub should provide the added necessary detail and documenting format to the CxC for approval, prior to execution.
6. The GC/Subs transmit the full Start-up Plan to the CxC and CxG for review and approval.
7. The CxC and CxG review and approve the procedures and the format for documenting them, using a standard form, noting any procedures that need to be added, and conveys to the GC. The GC then transmits the full start-up plan to the Subs for their review and use. (This

usually means that the Prefunctional Checklist, alone, will go to more than one Sub, while the full plan will go to the primary installing contractor.)

5.8.2 Execution of Checklists and Startup

Four weeks prior to startup, the GC and Subs shall incorporate the startup and initial checkout activities into the overall construction schedule and notify all applicable parties. The startup and initial checkout plan shall be executed. The CxC, and CxG if available, will observe, at minimum, the procedures for each piece of primary equipment. For components of equipment, (e.g., VAV boxes), the CxC observes a sampling of the prefunctional and start-up procedures.

To document the process of startup and checkout, the site technician performing the line item task initials and dates each paragraph of procedures in the "Startup Plan" and checks off items on the prefunctional and manufacturer field checkout sheets, as they are completed. Only individuals having direct knowledge of a line item being completed shall check or initial the forms.

The Subs and vendors execute the checklists and tests and submit a signed copy of the completed start-up and prefunctional tests and checklists to the CxC. The CxC and CxG may review prefunctional checklists in progress, as necessary.

5.8.3 Sampling Strategy for CxC Observation of Prefunctional Checkout and Startup

(NOTE: THIS IS AN EXAMPLE. THIS IS NOT A COMPLETE LIST FOR THIS PROJECT. THIS MUST BE EDITED FOR EACH PROJECT TO REFLECT ALL EQUIPMENT AND SYSTEMS TO BE OBSERVED.)

Equipment or System	Fraction To Be Observed by CxC
Chillers/Boilers/HRCH	100%
Air Handling Units (including Energy Recovery)	100%
Pumps, VFD's	100%
Pipe flushing	At beginning and end
Computer Room Units	100%
VAV Terminal Units	25%
Building automation system	100% review of PVT Report
TAB work	100% review of TAB Report
Other misc. equipment/systems	25%

5.8.4 Deficiencies and Non-Conformance

The Subs clearly list any outstanding items of the initial start-up and prefunctional procedures that were not completed successfully at the bottom of the procedures form or on an attached sheet. The procedures form and deficiencies are provided to the CxC within 48 hours of test completion. The CxC works with the Subs and vendors to correct and retest deficiencies or uncompleted items, involving the CxG, PE/COR and others as necessary. The GC, through installing Subs or vendors, corrects all areas that are deficient or incomplete according to the checklists and tests in a timely manner, and shall notify the CxC as soon as outstanding items have been corrected and resubmit an updated report. Upon satisfactory completion, the CxC recommends approval of the execution of PCs and startup and initial checkout of each system to the CxG and PE/COR using a standard form.

5.8.5 TAB

The TAB contractor submits the outline of the TAB plan and approach to the CxC and the controls contractor eight weeks prior to starting the TAB. Included in the approach, is an explanation of the intended use of the building control system. The CxC reviews the plan and approach for understanding and coordination issues and may comment, but does not "approve." The controls contractor reviews the feasibility of using the building control system for assistance in the TAB work. The TAB submits weekly written reports of discrepancies, contract interpretation requests and lists of completed tests to the GC, CxC, and CxG. This facilitates quicker resolution of problems and will result in a more complete TAB before functional testing begins. TAB work will not begin until the control system has been prefunctionally tested and approved by the CxC.

5.8.6 Controls Checkout Plan

The controls contractor develops and submits a written step-by-step plan to the CxC, CxG, and PE/COR through the GC which describes the process they intend to follow in checking out the control system for proper operation. This Controls Checkout Plan shall include forms for the documentation of individual component verification which is considered the Performance Verifications Test (PVT) or Point-to-Point test. Components that are tested and verified on an individual basis are part of the Prefunctional Checks and are documented in conjunction with these forms.

The GC shall verify that the controls contractor reviews the TAB plan with the TAB contractor prior to starting TAB work in order to determine the control system capabilities to aid in executing TAB work. The controls contractor will provide the TAB with any necessary unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.). The controls contractor shall also provide a technician qualified to operate the controls to assist the TAB contractor in performing TAB and the CxC in performing all PCC checkouts.

All CxC required controls prefunctional checklists, calibrations, start-up and selected functional tests of the system shall be completed and approved by the CxC prior to TAB. The GC through the controls contractor shall execute tests and trend logs and remain on site for assistance for mechanical system functional tests.

5.8.7 Certificate of Readiness

The GC shall issue a Certificate of Readiness certifying that all equipment, systems, and controls are complete and ready for Functional Performance Testing. The Certificate of Readiness shall include all equipment and system start-up reports, Performance Verification Test Reports, Prefunctional Checklists, TAB Report, and the Building Air Tightness Report. The GC and the Mechanical, Electrical, Controls, and Testing, Adjusting, and Balancing Representatives shall sign and date the Certificate of Readiness.

5.9 Development of Functional Performance Test and Verification Procedures

5.9.1 Overview

Functional performance testing (or functional testing) is the dynamic testing of systems (rather than just components) under full automatic operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint, etc). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all of the control system's sequences of operation and components are verified to be responding as the sequences state. The CxC develops the functional performance test procedures in a

sequential written format and coordinates, oversees and documents the actual testing, which is performed by the installing contractor or vendor.

5.9.2 Development Process

Before test procedures are written, the CxC obtains all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, control sequences and setpoints. The CxC develops specific test procedures to verify proper operation of each piece of equipment and system listed in the Cx Plan and Specifications. The CxC obtains clarification, as needed, from contractors and the DOR regarding sequences and operation to develop these tests. Prior to execution, the CxC provides a copy of the equipment and systems functional testing to the installing Sub (through the GC) who reviews the tests for feasibility, safety, warranty and equipment protection. Blank copies of the procedures are input into the O&M manuals for later use by operations staff. The test procedure forms shall include the following, at a minimum:

a. System and equipment or component name(s) and configuration(s).
b. Equipment location and ID number.
c. Unique test ID number, and reference to unique PC and startup documentation ID numbers.
d. Date.
e. Project name.
f. Participating parties.
g. A copy of the specific sequence of operations or other specified parameters being verified.
h. Formulas used in any calculations.
i. Required pre-test field measurements.
j. Instructions for setting up the test, including special cautions, alarm limits, or other equipment-specific information.
k. Specific step-by-step procedures to execute the test in a clear, sequential, and repeatable format.
l. Acceptance criteria of proper performance with a Yes / No check box to allow for clear marking of whether or not proper performance of each part of the test was achieved.
m. A section for comments.
n. Signature and date blocks for the CxC, CxG, Contractor, PE and DOR.

Functional testing and verification shall be achieved by manual testing (persons manipulate the equipment and observe performance) and by monitoring the performance and analyzing the results using the control system's trend log capabilities.

5.9.3 Functional Testing Plan Overview

The CxC develops a testing plan overview to provide the Cx Team with a better idea of where functional testing lies in the schedule, what issues prevent the start of testing, which contractors are needed for each test and how much time might be expected from them. This is developed after most equipment has been started up and when functional testing dates are not too far off. The testing plan overview is provided to the contractors to assist in moving more efficiently to functional testing.

5.10 Execution of Functional Testing Procedures

5.10.1 Overview and Process

Functional Performance Testing shall be performed after PCs, startup, calibration, control checkout and TAB are complete and Certificate of Readiness has been submitted for a given system. The CxC schedules functional tests through the GC, CxG, and PE/COR. The CxC directs, witnesses, and documents the functional testing of all equipment and systems according to the Specifications and the Cx Plan. The CxG will oversee/witness the functional testing. The Subs execute the tests, unless otherwise specified. The control system shall be successfully tested before it can be used to verify dependent system and/or component performance. Air and water system balancing shall be complete and reconciled prior to functional testing of related equipment and /or systems. Testing proceeds from components to subsystems to systems and finally to interlocks and connections between systems. The CxC documents the results of the test.

Functional Performance Tests shall be demonstrated to the satisfaction of the CxC. FPTs shall be witnessed and endorsed by the CxC upon satisfactory completion. The CxG recommends acceptance of each test to the PE/COR. The PE/COR gives final approval on each test. The actual testing program shall be conducted in accordance with the approved FPT procedures and shall be documented as required. The GC shall notify the CxG and PE/COR at least 14 calendar days prior to date of each functional performance tests.

5.10.2 Deficiencies and Retesting

Every effort shall be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. Nonconformance and deficiencies observed in materials, installation, or operation shall be addressed immediately, in terms of notification to responsible parties, and providing recommended actions to correct deficiencies. The GC shall have responsibility for resolving construction deficiencies. Corrections of minor deficiencies identified are made during the tests at the discretion of the CxC and CxG. The CxC shall maintain a master deficiency and resolution log, and shall provide the PE and CxG with written progress reports and test results with recommended actions. The CxC shall also document the deficiency and resolution on the test procedure form. Subs correct deficiencies and notify the CxC of corrective action. The CxC schedules retesting through the GC, CxG and PE/COR. Decisions regarding deficiencies and corrections are made at as low a level as possible, preferably between CxC, CxG or PE/COR and the Sub. For areas in dispute, final authority resides with the PM.

5.10.3 Facility Staff Participation

The Owner's facilities operating staff are encouraged to attend and participate in the testing process. The CxC will notify the PE/COR, who will then notify the facility staff when the commissioning events will occur.

5.10.4 Sampling

Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Critical Equipment, requiring 100% of systems/components to be functionally tested, is identified in 1.4 Commissioned Systems. The following table provides additional information on the sampling strategy to be used on this project: **(NOTE: THIS IS AN EXAMPLE. THIS IS NOT A COMPLETE LIST FOR THIS PROJECT. THIS MUST BE EDITED FOR EACH PROJECT TO REFLECT ALL EQUIPMENT AND SYSTEMS TO BE SAMPLED.)**

Equipment or System	**Fraction To Be Observed by CxC**
Chillers/Boilers/HRCH	100%
Air Handling Units (including Energy Recovery)	100%
Pumps, VFD's	100%
Computer Room Units	100%
Electrical Systems	20%
Domestic Hot Water	20%
Building Air Tightness	100%
Indoor Air Quality	100%
Other misc. equipment/systems	20%

5.11 Deferred Testing

5.11.1 Unforeseen Deferred Tests

If any check or test cannot be completed due to the building structure, required occupancy condition, or other deficiency, a request for delay execution of checklists and FPT may be delayed contingent on approval of the PM. These tests shall be conducted as soon as possible in the same manner as seasonal testing.

5.11.2 Seasonal Testing

The CxC shall schedule, coordinate, and observe additional testing for seasonal variation in operations and control strategies during the opposite season to verify performance of the HVAC system and controls. The GC shall execute and document tests and correct deficiencies with facilities staff and the CxC, CxG, and/or PE witnessing. Testing shall be completed during the warranty period to fully test all sequences of operation. The GC shall make necessary revisions to O&M manuals and records due to the testing.

a. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed, regardless of season. For the major heating and cooling generation and distribution systems, means of artificial loading shall be developed by the CxC as a means of demonstration, to a reasonable level of confidence, the ability to handle larger peak seasonal loads. Subsequent commissioning shall be undertaken at the appropriate time thereafter to ascertain adequate performance during the different seasons.

b. All equipment and systems shall be tested and commissioned in a peak season to observe full-load performance. Heating equipment shall be tested during winter design extremes. Cooling equipment shall be tested during summer design extremes, with a fully occupied building. Each Contractor and supplier will be responsible to participate in the initial and the alternate peak season test of the systems required to demonstrate performance.

c. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance. Each Contactor and supplier will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

d. Based on the scheduling of seasonal testing, the Contractor and COR shall discuss/coordinate Beneficial Occupancy and start of warranty period for affected systems.

5.11.3 Short-Term Diagnostic Testing

After initial occupancy, the GC shall perform short-term diagnostic testing, using data acquisition equipment or the building automation system to record system operation over a two- to three-week period. The dynamic interactions between components in the building system shall be investigated. The scheduling, interaction between heating and cooling, and effectiveness of the HVAC system in meeting the comfort requirements and design conditions shall be evaluated. The GC shall document tests and findings, and correct deficiencies according to the original testing requirements.
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6. Occupancy and Operation Phase Commissioning Activities

6.1 O&M Manuals and Warranties

6.1.1 Standard O&M Manuals

The CxC, CxG, and DOR review the O&M manuals, documentation and redline as-builts for systems that were commissioned to verify compliance with the Specifications. They recommend approval and acceptance of these sections of the O&M manuals to the PE/COR. The PE/COR gives final approval on these documents. The CxC, CxG, DOR and PE/COR review each equipment warranty and verify that all requirements to keep the warranty valid are clearly stated.

6.1.2 Systems Manual

The CxC will compile, organize and index the following commissioning data by equipment into labeled, indexed and tabbed, three-ring binders and deliver it to the GC, to be included with the O&M manuals.

The Systems Manual shall include the following (ASHRAE Guideline 0, Annex O shall be used for format and content):

a. Index of Systems Manual with notation as to content storage location if not in actual manual.
b. Executive Summary.
c. Owner's Project Requirements.
d. Construction Record Documents, specifications, and approved submittals.
e. A list of recommended operational record-keeping procedures, including sample forms, logs, or other means, and a rationale for each.
f. Ongoing optimization guidance.

g. Operations and maintenance manuals (includes operating procedures for all normal, abnormal, and emergency modes of operation; maintenance procedures; parts and recommended spare parts list; troubleshooting guide; and systems schematics (one-line diagrams).
h. Training materials.
i. Commissioning Report.

6.2 Training and Orientation of Owner Personnel

The GC shall provide Owner/Maintenance personnel training and orientation for all commissioned equipment and systems as required by the contract documents. Training will be coordinated by the GC.

6.3 Warranty Period

During the warranty period, seasonal testing and other deferred testing required is completed according to the Specifications. The CxC coordinates this activity. Tests are executed and deficiencies corrected by the appropriate Subs, witnessed by CxC, facilities staff, the PE/COR and the CxG. Any final adjustments to the O&M manuals and as-builts due to the testing are made. In addition the CxC will return to the project approximately 10 months into the 12 month warranty period. During this visit(s) the CxC will review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning and review and analyze trend data for compliance to the construction documents. The CxC will also interview facility staff and identify problems or concerns they have operating the building as originally intended. The CxC will make suggestions for improvements and for recording these changes in the O&M manuals. The CxC will identify areas that may come under warranty or under the original construction contract. The CxC will also assist facility staff in developing reports and documents and requests for services to remedy outstanding problems. Results of this inspection shall be documented in the final summary Commissioning Report.

6.4 System Performance Verification

The CxC shall review the operation of the building with the operation and maintenance staff and occupants within ten months of facility acceptance by the Government. The CxC shall resolve all outstanding commissioning related issues during the warranty period.

The CxC shall implement a thermal comfort survey of building occupants within a period of six to ten months of facility acceptance by the Government. This survey shall collect anonymous responses about thermal comfort in the buildings, including an assessment of overall satisfaction with thermal performance and identification of thermal comfort-related problems. The CxC shall develop a plan for corrective action if the survey results indicate that more than 20% of occupants are dissatisfied with thermal comfort in the building. This plan shall include measurement of relevant environmental variables in problem areas in accordance with ASHRAE Standard 55.

The main parameter to be measured in the thermal comfort survey shall be satisfaction with thermal environment. The answer shall be posed in a seven-point scale format running from very satisfied (+3) to very dissatisfied (-3) with the center (0) signifying the neutral point. The percent dissatisfied shall be the percentage of respondents who answer "dissatisfied" (any of the lower three points of the seven point scale). The survey shall identify each thermal zones by room number(s) and ask the respondent to identify his/her thermal zone. Survey shall include follow-up questions that are asked if the respondent indicates dissatisfaction to identify the nature and cause of the problem. The survey shall be administered in person, over the phone, over networked computers, or on paper. The CxC shall be responsible for collecting each completed survey. The survey shall be consistently applied and available for participation by all regular occupants.

The CxC shall develop a corrective action plan. This plan shall identify each question and the number of responses for each answer of each question. The corrective action plan shall identify the percent dissatisfied for each question. The corrective action plan shall identify the nature and location of any thermal environmental problems. The plan shall suggest directions for corrective actions based on the follow-up questions that identify the nature and cause of the problem.

7. Written Work Products

The written work products are described in Appendix B, Formal Written Work Products. The table describes each product, responsible party, due date, recipients, and approving authority.

7.1 Final Commissioning Report

A final summary report by the CxG will be provided to the PE/COR within thirty (30) days of substantial completion. The report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For all commissioned equipment, the report should contain the disposition of the commissioning specialist regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas: 1) Equipment meeting the equipment specifications, 2) Equipment installation, 3) Functional performance and efficiency, 4) Equipment documentation and design intent, and 5) Operator training. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment shall include a brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

Appendices shall contain control sequences, meeting minutes, progress reports, issues logs, site visit reports, findings, unresolved issues, communications, etc. The commissioning plan, prefunctional checklists and functional tests (along with blanks for the operators) and monitoring data and analysis will be provided.

A copy of the Commissioning Report will be included in the project's LEED documentation.

8. Commissioning Schedule

8.1 General Issues

The following sequential priorities are followed:

1. Equipment shall not be used for heating/cooling during construction until pre-start checklist items and all manufacturers' pre-start procedures have been completed. Moisture, dust and other environmental and building integrity issues must also have been addressed.
2. Equipment/system functional testing shall begin only after prefunctional, startup, and TAB work has been completed.
3. Functional testing of controls system and its controlled equipment shall begin only after all points have been calibrated and prefunctional testing has been completed.
4. TAB shall begin only after the controls system has been approved by the CxC for use for TAB work.
5. TAB work shall begin only after envelope work and ceiling installation have been completed.

APPENDIX A

Example Construction Phase Forms

COMMISSIONING ISSUES LOG

Project:_____

Location:_____

Prepared by:_____ **Page _____ of _____**

Attach additional pages as necessary for issues requiring more explanation and tracking.

#	Issue	Date Found	Effects	Possible Cause	Recommendations	Actions Taken	O&M Doc. Issue?	Open/ Closed (Date)

COMMISSIONING PROGRESS REPORT

Project: _____ Date: _____ Prepared by: _____

Reporting Period: _____ Report #:_____

Commissioning tasks worked on since last report and general progress:

_____
_____
_____
_____
_____
_____
_____
_____

Areas where schedule is not being met: _____

_____
_____
_____

Recommended actions: _____

_____
_____
_____
_____

Requested schedule adjustments: _____

_____
_____

Next steps: _____

_____

Other comments (include general comments and field notes): _____

_____
_____

Non-Compliance Report attached. (Y/N) _____ *Issues Log Attached. (Y/N)* _____
Misc. comment sheets attached. (Y/N) _____

_____
Commissioning Agent

APPENDIX B

Commissioning-Related Formal Written Work Products and Submittals

Product	Created By	Product Description and Form	Approved By	Product Assigned In
Final Cx Plan	CxC	Final Cx plan for const. phase	CxG recommends approval to PE/COR	Cx Plan 5.2
Cx Schedule	GC/CxC/Subs	Schedule of Cx Activities	PE/COR	Cx Plan 7.2
Cx related submittals	GC/Subs	Detailed data on all commissioned equipment	CxC/CxG recommends approval to PE/COR	Cx Plan 5.7
Prefunctional Tests and Checklists	CxC, GC and Subs	List by equipment of prefunctional checklists and prefunctional tests	CxG recommends approval to PE/COR	Cx Plan 5.8
Start-up and initial checkout plans	GC and Subs	Specific listing of procedures for combining CxG prefunctional checklists with Sub's startup and checkout.	CxC/CxG	Cx Plan 5.8.1
Start-up and initial checkout reports	GC and Subs	Filled out prefunctional checklists, tests, startup and initial checkout	CxC/CxG recommends approval to PE/COR	Cx Plan 5.8.2
Controls Contractor Initial Check-out Plan	Controls Contr.	Complete step-by-step plan on checkout and calibration procedures, including forms for documentation	CxC/CxG recommends approval to PE/COR	Cx Plan 5.8.6
TAB plan and approach	TAB	Outline of TAB plan, approach and schedule	CxC; PE/COR	Cx Plan 5.8.5, Specifications
TAB progress reports	TAB	List of discrepancies, interpretations needed, tests completed	none	Cx Plan 5.8.5
Draft TAB report	TAB	Draft TAB report with method and results	CxC/CxG (Required for Cx)	Cx Plan 5.7.2
Final TAB report	TAB	Final TAB report with method and results	CxC/CxG (Required for Cx)	Cx Plan 5.7.2
Change orders	GC; PE/COR	Change orders that affect Commissioned equipment	N/A	Cx Plan 5.7.2
Issues Log	CxC	Record / track of all issues and deficiencies	N/A	Cx Plan 5.6
Systems Manual	CxC	Record / track of all submittals, checklists, tests, etc.	N/A	Cx Plan 6.1.2

Cx progress reports	CxC	Gives scheduling needs and update, deficiency report, Cx progress	N/A	Cx Plan 5.6
Functional Performance Test forms	CxC	Full description of test procedures in “form” format	CxG recommends approval to PE/COR	Cx Plan 5.9
Completed Functional Performance Test forms	CxC	Recorded documentation of the test on the form	CxG recommends approval to PE/COR	Cx Plan 5.9
Final Cx report	CxC	Summary report with status of each system and important findings, etc. Compilation of all important Cx data (checks, tests, issues, reviews, etc.)	CxG recommends approval to PC/COR	Cx Plan 7.1
O&M manuals	GC and Subs	Documentation of design, equipment, operations and maintenance, as-builts, etc.	CxC/CxG recommends approval to PE/COR (required for Cx)	Cx Plan 6.1 and Specifications
Thermal Comfort Survey	CxC	Survey used to collect data from building occupants regarding thermal comfort and satisfaction	N/A	Cx Plan 6.3
Corrective Action Plan	CxC	Plan recommending correction action for issues identified during occupancy phase commissioning and thermal comfort survey	N/A	Cx Plan 6.3

APPENDIX C

Example Prefunctional Checklists, Functional Performance Tests, Integrated System Tests, and Building Envelope Inspection Checklists

Download example Building Envelope Inspection Checklists, Pre-Functional Checklists, Functional Performance Test Checklists, and Integrated Systems Test Checklists for specification section 01 91 00.15 TOTAL BUILDING COMMISSIONING at the following location: **http://www.wbdg.org/FFC/NAVGRAPH/graphtoc.pdf**. The checklists submitted in the Interim and Final Construction Phase Commissioning Plans must contain the same level of detail shown in the examples. The submitted checklists are not required to match the format of the examples.

APPENDIX D

CxC and CxG Roles and Responsibilities

DESIGN PHASE	CxG	CxC
Ensure that design team has OPR	X	
Develop Cx plan (DESIGN PHASE include draft CONSTRUCTION PHASE)	X	
Review concept level design submission against OPR	X	
Start developing Cx specification	X	
Ensure that design concept is in compliance with OPR	X	
Develop format for the systems manual	X	
Review midpoint design submission against OPR	X	
Update and incorporate comments into Cx specification	X	
Review completed design documents prior to release for construction against OPR	X	
Finalize Cx specification	X	
Ensure the completed design documents are in compliance with the OPR prior to release for construction	X	
Review Basis of Design (BOD) and concur that it is compliance with the requirements in the OPR	X	
Develops format for Construction Phase Cx issues log	X	
Develop draft Sample Prefunctional Checklists (PC)	X	
Develop draft Sample Functional Performance Tests (FPT)	X	
Compile Design Phase Cx report	X	
CONSTRUCTION PHASE	**CxG**	**CxC**
Review construction submittals and shop drawings against contract documents and maintain Cx Submittal Log		X
Assure construction submittals and shop drawings have been reviewed by CxC in accordance with Cx Spec, conducting random audits of Cx Submittal log and construction submittals	X	
Reviews and recommend approval of Cx schedule	X	X
Finalize commissioning plan in accordance with Cx spec		X
Review and recommend approval of Final Commissioning Plan	X	
Perform routine inspections	X	X
Chairs Cx construction progress meetings		X
Maintains Cx issue log		X
Review Cx issue log	X	
Finalize PFC for installed equipment using draft PFC as template		X

Review and recommend approval of finalized PFC	X	
Executes PFC as required (CxC must witness in accordance with Cx Plan)		X
Review and recommend approval of completed PFC	X	
Develops FPT for installed equipment using draft FPT as starting point		X
Review and recommend approval of finalized FPT	X	
Executes FPT as required by Cx Plan		X
Witness representative sample of FPT during execution	X	
Review and recommend approval of completed FPT	X	
Compile Construction Phase Cx report		X
Review and approve Construction Phase Cx Report	X	
Compile Systems Manual		X
Review and approve Systems Manual	X	
Ensure turnover of Systems O&M Manual (by Contractor) to Facility Staff	X	X
Submits all Cx documentation required per LEED	X	X
Ensure proper Systems O&M training has been provided (by Contractor) to Facility Staff	X	X
OCCUPANCY AND OPERATIONS PHASE	**CxG**	**CxC**
Verify any seasonal testing of the facility.	X	X
Review the facility and its performance within 10 months of substantial completion.	X	X
Within 10 months of substantial completion, review building operation with operations staff and occupants in order to identify any problems in operating the building as originally intended.	X	X
Verify training effectiveness of O&M staff within 10 months after substantial completion	X	X
Document results of post occupancy review		X
Review post occupancy review documentation	X	

ROLES AND RESPONSIBILITIES MATRIX

(excerpt from ER 1110-345-723, Total Building Commissioning Procedures)

Pre-Design Phase(D-B-B)/RFP Development(D-B) Commissioning Roles & Responsibilities		CxG = Gov't Comm Specialist COR = Contracting Officer Rep DOR = Designer of Record CxD = Design Comm Specialist CxC = Construction Comm Specialist O&M = Gov't Facility O&M					L = Lead P =Participate A = Approve R = Review O = Optional N/A = Not Applicable	
Category	**Task Description**	**CxG**	**COR**	**CxD**	**DOR**	**CxC**	**O&M**	**Notes**
Meetings	Pre-Design Kick-Off Meeting	P	P	P	L	N/A	P	
	Owner's Project Requirements Meeting	P	P	P	L	N/A	P	
	Commissioning Planning Meetings	P	P	L	P	N/A	O	
Coordination	Coordinate with [COR, DOR, etc.] to ensure that Cx is incorporated into project planning and documents.	L	P	P	P	N/A	O	
Cx Plan & Spec	Draft Commissioning Plan	R	A	L	R	N/A	R	
Schedules	Preliminary Commissioning Schedule	R	A	L	R	N/A	O	
OPR	Prepare Owner's Project Requirements	R	A	P	L	N/A	P	
Commissioning Documents	Identify systems to be commissioned	P	P	L	P	N/A	R	
	Preliminary acceptance criteria	R	P	L	P	N/A	R	
	Commissioning Documents preliminary templates	R	R	L	R	N/A	R	

Note: *(Appendix C) is just a sample to depict how such a matrix would be developed. There are many more commissioning tasks to be identified beyond what the sample identifies. The type of involvement shown is for instruction purposes only and would need to be developed on a project by project basis for the scope, size, and complexity of the project, the degree of rigor required, and with consideration of available District resources and expertise.*

Design Phase (D-B-B)		CxG = Gov't Comm Specialist COR = Contracting Officer Rep DOR = Designer of Record CxD = Design Comm Specialist CxC = Construction Comm Specialist O&M = Gov't Facility O&M					L = Lead P =Participate A = Approve R = Review O = Optional N/A = Not Applicable	
Category	**Task Description**	**CxG**	**COR**	**CxD**	**DOR**	**CxC**	**O&M**	**Notes**
Coordination Cx Plan & Spec Schedules	Coordinate with [COR, AHJ, Vendors, etc.] to ensure that Cx interacts properly with other systems as needed to support OPR and BoD	P	P	P	L	N/A	P	
	Preliminary Commissioning Plan	R	A	L	R	N/A	R	
	Preliminary Cx Specifications	R	A	L	R	N/A	R	
	Design Phase Commissioning Schedule	R	A	P	L	N/A	O	
OPR and BoD	Maintain OPR on behalf of Owner	P	P	P	L	N/A	P	
	Review Basis of Design Document vs. OPR	R	P	L	P	N/A	P	
	Maintain BoD on behalf of Owner	P	P	P	L	N/A	P	
Reviews	Focused Concept Design Review	R	L	P	P	N/A	P	
	Focused Design Development (35-50%) Review	R	L	P	P	N/A	P	
	Focused Construction Document Review	R	L	P	P	N/A	P	
	Focused Pre-Final Construction Document	R	L	P	P	N/A	P	
	Focused Final Construction Document	R	L	P	P	N/A	P	
	Final Construction Document Comment Backcheck	R	L	P	P	N/A	P	
Functional	Draft Pre-Functional Checklists (PFC)	R	A	L	R	N/A	R	
Test Protocols	Draft System Functional Performance Tests (FPT)	R	A	L	R	N/A	R	

Note: *(Appendix C) is just a sample to depict how such a matrix would be developed. There are many more commissioning tasks to be identified beyond what the sample identifies. The type of involvement shown is for instruction purposes only and would need to be developed on a project by project basis for the scope, size, and complexity of the project, the degree of rigor required, and with consideration of available District resources and expertise.*

Design Phase (D-B)		CxG = Gov't Comm Specialist COR = Contracting Officer Rep DOR = Designer of Record CxD = Design Comm Specialist CxC = Construction Comm Specialist O&M = Gov't Facility O&M						L = Lead P =Participate A = Approve R = Review O = Optional N/A = Not Applicable
Category	**Task Description**	**CxG**	**COR**	**CxD**	**DOR**	**CxC**	**O&M**	**Notes**
Coordination Cx Plan & Spec Schedules	Coordinate with [COR, AHJ, Vendors, etc.] to ensure that Cx interacts properly with other systems as needed to support OPR and BoD	P	P	N/A	L	P	P	
	Preliminary Commissioning Plan	R	A	N/A	R	L	R	
	Preliminary Cx Specifications	R	A	N/A	R	L	R	
	Design Phase Commissioning Schedule	R	A	N/A	L	P	O	
OPR and BoD	Maintain OPR on behalf of Owner	P	P	N/A	L	P	P	
	Review Basis of Design Document vs. OPR	R	P	N/A	P	L	P	
	Maintain BoD on behalf of Owner	P	P	N/A	L	P	P	
Reviews	Focused Concept Design Review	R	L	N/A	P	R	P	
	Focused Design Development (35-50%) Review	R	L	N/A	P	R	P	
	Focused Construction Document Review	R	L	N/A	P	R	P	
	Focused Pre-Final Construction Document	R	L	N/A	P	R	P	
	Focused Final Construction Document	R	L	N/A	P	R	P	
	Final Construction Document Comment Backcheck	R	L	N/A	P	R	P	
Functional	Draft Pre-Functional Checklists (PFC)	R	A	N/A	R	L	R	
Test Protocols	Draft System Functional Performance Tests (FPT)	R	A	N/A	R	L	R	

Note: *(Appendix C) is just a sample to depict how such a matrix would be developed. There are many more commissioning tasks to be identified beyond what the sample identifies. The type of involvement shown is for instruction purposes only and would need to be developed on a project by project basis for the scope, size, and complexity of the project, the degree of rigor required, and with consideration of available District resources and expertise.*

Construction Phase (D-B-B & D-B) Commissioning Roles & Responsibilities		CxG= Gov't Comm Specialist COR = Contracting Officer Rep CxD = Design Comm Specialist DOR = Designer of Record CxC=Construction Comm Specialist O&M = Gov't Facility O&M					L=Lead P = Participate A = Approve R=Review O=Optional N/A=Not Applicable	
Category	**Task Description**	**CxG**	**COR**	**CxD**	**DOR**	**CxC**	**O&M**	**Notes**
Meetings*	Construction Commissioning Kick Off meeting	P	P	N/A	O	L	P	
	Commissioning/Issues Resolution Meetings	P	P	N/A	O	L	O	
	Project Commissioning Progress Meetings	P	P	N/A	O	L	O	
	Controls Meeting	P	P	N/A	P	L	P	
Coordination	Coordinate with [COR, AHJ, Vendors, etc.] to ensure that Cx interacts properly with other systems as needed to support OPR and BoD	P	P	N/A	P	L	P	
Cx Plan	Final Commissioning Plan w/ final PFCs and FPTs	R	A	N/A	R	L	R	
Schedules*	Duration Schedule for Commissioning Activities	R	A	N/A	O	L	R	
Doc Reviews*	TAB Plan Review	P	A	N/A	R	P	O	
	Submittal and Shop Drawing Review	P	A	N/A	R	P	O	
	Review Contractor Equipment Startup Checklists	P	A	N/A	O	P	O	
	Review Change Orders, ASI, and RFI	P	A	N/A	R	P	O	
Site Observation*	Witness Factory Testing	P	P	N/A	O	P	O	
	Construction Observation Site Visits	P	P	N/A	O	P	O	

Note: *(Appendix C) is just a sample to depict how such a matrix would be developed. There are many more commissioning tasks to be identified beyond what the sample identifies. The type of involvement shown is for instruction purposes only and would need to be developed on a project by project basis for the scope, size, and complexity of the project, the degree of rigor required, and with consideration of available District resources and expertise.*

**For D-B-B acquisition, DOR participation or review for tasks indicated as optional for the DOR should be determined on a case-by-case basis with consideration of scope and complexity of the project/system, availability of resources, and potential benefit of DOR participation/review; these additional services require funding consideration.*

Acceptance Phase (D-B-B & D-B) Commissioning Roles & Responsibilities		CxA = Commissioning Authority COR = Contracting Officer Rep CxG= Gov't Comm Consultant A/E = Designer of Record CxC = Construction Comm Specialist O&M = Gov't Facility O&M				L = Lead P = Participate A = Approve R = Review O = Optional N/A = Not Applicable		
Category	**Task Description**	**CxG**	**COR**	**CxD**	**DOR**	**CxC**	**O&M**	**Notes**
Meetings*	Pre-Test Coordination Meeting	P	P	N/A	O	L	P	
	Issues Resolution and Commissioning Report Review Meetings	P	P	N/A	O	L	P	
Document Reviews*	Review Completed Pre-Functional Checklists	R	A	N/A	R	L	P	
	Pre-Functional Checklist Verification	R	A	N/A	O	L	P	
	Review Operations & Maintenance Manuals	R	A	N/A	O	L	P	
	Training Plan Review	R	A	N/A	O	L	P	
	Warranty Review	R	P	N/A	O	L	P	
	Review TAB Report	R	A	N/A	R	P	P	
	Systems Manual	R	A	N/A	O	L	R	
Site Observations*	Construction Observation Site Visits	P	P	N/A	O	L	P	
	Witness Selected Equipment Startup	P	P	N/A	O	P	P	
Functional Test Protocols*	TAB Verification	P	A	N/A	O	P	P	
	Systems Functional Performance Testing	P	A	N/A	O	L	P	
Reports & Logs*	Final Commissioning Report	R	A	N/A	R	L	R	
	Submit Final Systems Manuals	R	A	N/A	O	L	R	

Note: *(Appendix C) is just a sample to depict how such a matrix would be developed. There are many more commissioning tasks to be identified beyond what the sample identifies. The type of involvement shown is for instruction purposes only and would need to be developed on a project by project basis for the scope, size, and complexity of the project, the degree of rigor required, and with consideration of available District resources and expertise.*

**For D-B-B acquisition, DOR participation or review for tasks indicated as optional for the DOR should be determined on a case-by-case basis with consideration of scope and complexity of the project/system, availability of resources, and potential benefit of DOR participation/review; these additional services require funding consideration.*

Post Occupancy Phase (D-B-B & D-B)	CxG= Gov't Comm Specialist COR = Contracting Officer Rep CxD = Design Comm Specialist DOR = Designer of Record CxC = Construction Comm Specialist O&M = Gov't Facility O&M	L = Lead P = Participate A = Approve R = Review O = Optional N/A = Not Applicable
Commissioning Roles & Responsibilities		

Category	Task Description	CxG	COR	CxD	DOR	CxC	O&M	Notes
Document Reviews*	Systems Monitoring Trended Data	R	R	N/A	R	L	P	
	Systems Manuals Update	R	A	N/A	O	L	R	
Site Observations*	Periodic Warranty (4 & 9 Month) Site Visits	P	P	N/A	O	P	P	
Functional Test Protocols*	Deferred and/or seasonal Testing	P	A	N/A	O	L	P	
Technical Activities*	Commissioning/Issues Resolution/Lessons Learned Meetings	P	P	N/A	O	L	P	
	Post-Occupancy Warranty Checkup and review of Significant Outstanding Issues	P	P	N/A	O	L	P	
Reports and Logs*	Final Commissioning Report Amendment	R	A	N/A	R	L	R	
	Issues Logs Closure Report	R	R	N/A	O	L	R	

Note: *(Appendix C) is just a sample to depict how such a matrix would be developed. There are many more commissioning tasks to be identified beyond what the sample identifies. The type of involvement shown is for instruction purposes only and would need to be developed on a project by project basis for the scope, size, and complexity of the project, the degree of rigor required, and with consideration of available District resources and expertise.*

**For D-B-B acquisition, DOR participation or review for tasks indicated as optional for the DOR should be determined on a case-by-case basis with consideration of scope and complexity of the project/system, availability of resources, and potential benefit of DOR participation/review; these additional services require funding consideration.*

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SECTION 02 61 13

EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL
09/22 (Tailored for Japan)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D698	(2012; E 2014; E 2015) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2167	(2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D5434	(2012) Field Logging of Subsurface Explorations of Soil and Rock
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D7928	(2017) Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety -- Safety and Health Requirements Manual

U.S. DEPARTMENT OF DEFENSE (DOD)

JEGS	(April 2022) Japan Environmental Governing

Standards

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926	Safety and Health Regulations for Construction

1.2 DESCRIPTION OF WORK

The work consists of excavation and temporary storage of approximately [_____] cubic meters of contaminated material. Approximate locations of contaminated material are shown on the drawings. Characterization data on the nature and extent of the contaminated material is shown in Appendix [_____]. Subsurface conditions are shown [on the drawings] [in Appendix [_____]]. Submit a Work Plan as specified below. Notify the Contracting Officer within [24] [_____] hours, and before excavation, if contaminated material is discovered that has not been previously identified or if other discrepancies between data provided and actual field conditions are discovered. Backfill material is [not available onsite] [available onsite and typically consists of [_____]]. Ground water is approximately [_____] meters below pre-excavation ground surface. Required sampling and chemical analysis shall be conducted in accordance with [_____].

1.2.1 Scheduling

Notify the Contracting Officer [_____] calendar days prior to the start of excavation of contaminated material. The [Contracting Officer will] [Contractor shall] be responsible for contacting regulatory agencies in accordance with the applicable reporting requirements.

1.2.2 Work Plan

Submit a Work Plan within [30] [_____] calendar days after notice to proceed. No work at the site, with the exception of site inspections and surveys, shall be performed until the Work Plan is approved. Allow [30] [_____] calendar days in the schedule for the Government's review. No adjustment for time or money will be made if resubmittals of the Work Plan are required due to deficiencies in the plan. At a minimum, the Work Plan shall include:

a. Schedule of activities.

b. Method of excavation and equipment to be used.

c. Shoring or side-wall slopes proposed.

d. Dewatering plan.

e. Storage methods and locations for liquid and solid contaminated material.

f. Borrow sources and haul routes.

g. Decontamination procedures.

h. Spill contingency plan.

1.2.3 Other Submittal Requirements

Submit separate cross-sections of each area before and after excavation and after backfilling, test results, and [_____] copies of the Closure Report within [14] [_____] calendar days of work completion at the site.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Work Plan; G[, [_____]]

Sampling And Analysis Plan; G

SD-02 Shop Drawings

Surveys

SD-06 Test Reports

Compaction

Analytical Results; G

Closure Report; G[, [_____]]

1.4 REGULATORY REQUIREMENTS

1.4.1 Permits and Licenses

Obtain required federal, GoJ, and local prefectural permits for excavation and storage of contaminated material. Permits shall be obtained at no additional cost to the Government.

1.4.2 Air Emissions

Air emissions shall be monitored and controlled in accordance with the JEGS, GoJ, and local prefectural laws.

PART 2 PRODUCTS

2.1 SPILL RESPONSE MATERIALS

Provide appropriate spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Spill response materials shall be available at all times when contaminated materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of materials and contaminants being handled.

[

2.2 BACKFILL

Backfill material shall be obtained from [the location indicated on the drawings] [offsite sources approved by the Contracting Officer]. Backfill shall be classified in accordance with ASTM D2487 as GW, GP, GM, GC, SW, SP, SM, SC, ML, MH, CL, or CH and shall be free from roots and other organic matter, trash, debris, snow, ice or frozen materials. Backfill material shall be tested for the parameters listed below at a frequency of once per [3000] [_____] cubic m. A minimum of one set of classification tests shall be performed per borrow source. [One] [_____] backfill sample per borrow source shall also be collected and tested for the chemical parameters listed below.

Physical Parameter	Criteria	Test Method
Grain Size	[_____]	ASTM D7928
Compaction	[_____]	ASTM D698
[_____]	[_____]	[_____]

Chemical Parameter	Test Frequency	Criteria
[_____]	[_____]	[_____]

Do not use material for backfill until borrow source chemical and physical test results have been submitted and approved.]

PART 3 EXECUTION

3.1 SURVEYS

Perform surveys immediately prior to and after excavation of contaminated material to determine the volume of contaminated material removed. Also, perform surveys immediately after backfill of each excavation. Provide cross-sections on [7.6] [_____] meter intervals and at break points for all excavated areas. Locations of confirmation samples shall also be surveyed and shown on the drawings. Perform surveys in accordance with Section: [_____].

3.2 EXISTING STRUCTURES AND UTILITIES

No excavation shall be performed until site utilities have been field located. Take the necessary precautions to ensure no damage occurs to existing structures and utilities. Damage to existing structures and utilities resulting from the Contractor's operations shall be repaired at no additional cost to the Government. Utilities encountered that were not previously shown or otherwise located shall not be disturbed without approval from the Contracting Officer.

[

3.3 CLEARING

Clearing shall be performed to the limits shown on the drawings in

accordance with Section 31 11 00 CLEARING AND GRUBBING.]

3.4 CONTAMINATED MATERIAL REMOVAL

3.4.1 Excavation

Areas of contamination shall be excavated to the depth and extent shown on the drawings and not more than [60] [_____] mm beyond the depth and extent shown on the drawings unless directed by the Contracting Officer. Excavation shall be performed in a manner that will limit spills and the potential for contaminated material to be mixed with uncontaminated material. As material is removed from the excavation, field analysis shall be used to determine the presence of [_____] contamination using [a real time vapor monitoring instrument] [immunoassay field kits] [_____]. Excavated contaminated material shall be separated and stored from excavated uncontaminated material. An excavation log describing visible signs of contamination encountered shall be maintained for each area of excavation. Excavation logs shall be prepared in accordance with ASTM D5434.

3.4.2 Shoring

If workers must enter the excavation, it shall be evaluated, shored, sloped or braced as required by EM 385-1-1 and 29 CFR 1926 section 650.

3.4.3 Dewatering

Surface water shall be diverted to prevent entry into the excavation. [Dewatering shall be limited to that necessary to assure adequate access, a safe excavation, prevent the spread of contamination, and to ensure that compaction requirements can be met.] [No dewatering shall be performed without prior approval of the Contracting Officer.]

3.5 CONFIRMATION SAMPLING AND ANALYSIS

After all material suspected of being contaminated has been removed, the excavation shall be examined for evidence of contamination. If the excavation appears to be free of contamination, field analysis shall be used to determine the presence of [_____] contamination using [a real time vapor monitoring instrument] [immunoassay field kits] [_____]. Excavation of additional material shall be as directed by the Contracting Officer. Confirmation samples shall be collected and analyzed for the following contaminants:

Chemical Parameter	Action Level
[_____]	[_____]

Samples shall be collected at a frequency of one per [_____][5000] square m from the bottom [and each of the side walls] or as directed by the Contracting Officer. A minimum of one sample shall be collected from the bottom [and each side wall] of the excavation. Additional excavation shall be subject to approval by the Contracting Officer. Locations of samples shall be marked in the field and documented on the as-built drawings.

3.6 CONTAMINATED MATERIAL STORAGE

Material shall be placed in temporary storage after excavation . The

following paragraphs describe acceptable methods of material storage. Storage units shall be in good condition and constructed of materials that are compatible with the material or liquid to be stored. If multiple storage units are required, each unit shall be clearly labeled with an identification number and a written log shall be kept to track the source of contaminated material in each temporary storage unit.

3.6.1 Stockpiles

Stockpiles shall be constructed to isolate stored contaminated material from the environment. The maximum stockpile size shall be [_____] [100][400] cubic m. Stockpiles shall be constructed to include:

a. [A chemically resistant geomembrane liner free of holes and other damage. Non-reinforced geomembrane liners shall have a minimum thickness of [0.5] [_____] mm. Scrim reinforced geomembrane liners shall have a minimum weight of 20 kg/100 square m. The ground surface on which the geomembrane is to be placed shall be free of rocks greater than 13 mm in diameter and any other object which could damage the membrane.] [Pavement shall be used as the liner system. Pavement shall be constructed in accordance with Section [_____]].

b. Geomembrane cover free of holes or other damage to prevent precipitation from entering the stockpile. Non-reinforced geomembrane covers shall have a minimum thickness of 0.25 mm. Scrim reinforced geomembrane covers shall have a minimum weight of 13 kg/100 square m. The cover material shall be extended over the berms and anchored or ballasted to prevent it from being removed or damaged by wind.

c. Berms surrounding the stockpile, a minimum of 300 mm in height. Vehicle access points shall also be bermed.

d. The liner system shall be sloped to allow collection of leachate. Storage and removal of liquid which collects in the stockpile, in accordance with paragraph Liquid Storage.

3.6.2 Roll-Off Units

Roll-off units used to temporarily store contaminated material shall be water tight. A cover shall be placed over the units to prevent precipitation from contacting the stored material. The units shall be located [as shown on the drawings] [_____]. Liquid which collects inside the units shall be removed and stored in accordance with paragraph Liquid Storage.

3.6.3 Liquid Storage

Liquid collected from excavations and stockpiles shall be temporarily stored in [220 L barrels] [[2000] [_____] L tanks]. Liquid storage containers shall be water-tight and shall be located [as indicated] [_____].

3.7 SAMPLING

The Contractor shall submit a Sampling and Analysis Plan prior to conducting any sampling of material. Use a laboratory [participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA).][in

accordance with GoJ requirements.] All analytical results shall be submitted to the Contracting Officer upon receipt from the laboratory. The sampling and analysis plan shall include at a minimum the following information:

1) Introduction and Site Background

2) Data Quality Objectives

3) Sampling Methodology/Technical Approach

4) Sample Collection Procedures

5) Field Decontamination/IDW

6) Sample Documentation and Chain of Custody

7) Packaging and Shipment of Samples

8) QA/QC management (Sampling and Analytical Data)

9) Reporting requirements

10) Lab requirements and certifications

3.7.1 Sampling of Stored Material

Samples of stored material shall be collected at a frequency of once per [_____][100][400] cubic m. Samples shall be tested for [all analytes listed in the JEGS][the following:

Chemical Parameter	Action Level
[_____]	[_____]

]
Stored material with contaminant levels that exceed the action levels shall be disposed of offsite. Analyses for contaminated material to be taken to an offsite disposal facility shall conform to the JEGS, local prefectural, GoJ, and federal criteria as well as to the requirements of the disposal facility. Documentation of all analyses performed shall be furnished to the Contracting Officer. Additional sampling and analyses to the extent required by the approved offsite storage or disposal (TSD) facility shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

3.7.2 Sampling Liquid

Liquid collected from [excavations] [storage areas] [decontamination facilities] shall be sampled at a frequency of once for every [2,000] [_____] L of liquid collected. Samples shall be tested for [all analytes listed in the JEGS][the following:

Chemical Parameter	Action Level
[_____]	[_____]

]
Liquid with contaminant levels that exceed action levels shall be disposed offsite. Analyses for contaminated liquid to be taken to an offsite disposal facility shall conform to local prefectural, GoJ, and federal

criteria as well as to the requirements of the disposal facility. Documentation of all analyses performed shall be furnished to the Contracting Officer. Additional sampling and analysis to the extent required by the approved offsite storage or disposal (TSD) facility receiving the material shall be the responsibility of the .

3.7.3 Sampling Beneath Storage Units

Samples from beneath each storage unit shall be collected prior to construction of and after removal of the storage unit. Samples shall be collected at a frequency of one per each [_____] [5000] square m from a depth interval of [0 to 0.15] [_____] m and shall be tested [all analytes listed in JEGS Table 13.1][for the following:

Chemical Parameter	Action Level
[_____]	[_____]

]

Based on test results, soil which has become contaminated above action levels shall be removed at no additional cost to the Government. Contaminated material which is removed from beneath the storage unit shall be handled in accordance with paragraph Sampling of Stored Material. As directed by the Contracting Officer and at no additional cost to the Government, additional sampling and testing shall be performed to verify areas of contamination found beneath stockpiles have been cleaned up to below action levels.

3.8 SPILLS

In the event of a spill or release of a hazardous substance (as designated in JEGS), pollutant, contaminant, or oil, notify the Contracting Officer immediately. If the spill exceeds the reporting threshold, follow the pre-established procedures as described in the Installation Spill Response and Prevention Plan for immediate reporting and containment. Immediate containment actions shall be taken to minimize the effect of any spill or leak. Cleanup shall be in accordance with the JEGS, applicable federal, GoJ, and local prefectural regulations. As directed by the Contracting Officer, additional sampling and testing shall be performed to verify spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to the Government.

[

3.9 BACKFILLING

3.9.1 Confirmation Test Results

Excavations shall be backfilled immediately after all contaminated materials have been removed and confirmation test results have been approved. Backfill shall be placed and compacted to the lines and grades shown on the drawings.

3.9.2 Compaction

Place approved backfill in lifts with a maximum loose thickness of [200] [_____] mm. Compact soil to [90] [_____] percent of [ASTM D698] [ASTM D1557] maximum dry density. Perform density tests at a frequency of once per [930] [_____] square meters per lift. conduct a minimum of [one density test] [[_____] density tests] on each lift of backfill placed. Determine field in-place dry density in accordance with ASTM D1556/D1556M, ASTM D2167, or ASTM D6938. If ASTM D6938 is used, a minimum of one in ten

tests shall be checked using ASTM D1556/D1556M or ASTM D2167. Test results from ASTM D1556/D1556M or ASTM D2167 shall govern if there is a discrepancy with the ASTM D6938 test results.]

3.10 DISPOSAL REQUIREMENTS

Offsite disposal of contaminated material shall be in accordance with the JEGS, GoJ, and local prefectural laws at a GoJ-approved facility..

3.11 CLOSURE REPORT

Submit [_____] copies of a Closure Report within [14] [_____] calendar days of completing work at the site. The report shall be labeled with the contract number, project name, location, date, name of general Contractor, and the Corps of Engineers District contracting for the work. The Closure Report shall include the following information as a minimum:

a. A cover letter signed by the Environmental Manager certifying that all services involved have been performed in accordance with the terms and conditions of the contract documents and regulatory requirements.

b. A narrative report including, but not limited to, the following:

(1) site conditions, ground water elevation, and cleanup criteria;

(2) excavation logs;

(3) field screening readings;

(4) quantity of materials removed from each area of contamination;

(5) quantity of water/product removed during dewatering;

(6) sampling locations and sampling methods;

(7) sample collection data such as time of collection and method of preservation;

(8) sample chain-of-custody forms; and

(9) source of backfill.

c. Copies of all chemical and physical test results.

d. Copies of all manifests and land disposal restriction notifications.

e. Copies of all certifications of final disposal signed by the responsible disposal facility official.

f. Waste profile sheets.

g. Scale drawings showing limits of each excavation, limits of contamination, known underground utilities within 15 m of excavation, sample locations, and sample identification numbers. On-site stockpile, storage, loading, and disposal areas shall also be shown on the drawings.

h. Progress Photographs. Color photographs shall be used to document progress of the work. A minimum of four views of the site showing the

location of the area of contamination, entrance/exit road, and any other notable site conditions shall be taken before work begins. After work has been started, activities at each work location shall be photographically recorded [daily] [weekly]. Photographs shall be a minimum of 76.2 by 127.0 mm and shall include:

(1) Soil removal and sampling.

(2) Dewatering operations.

(3) Unanticipated events such as spills and the discovery of additional contaminated material.

(4) Contaminated material/water storage, handling, and transport.

(5) Site or task-specific employee respiratory and personal protection.

(6) Fill placement and grading.

(7) Post-construction photographs. After completion of work at each site, take a minimum of four views of each excavation site.

A digital version of all photos shown in the report shall be included with the Closure Report. Photographs shall be a minimum of 76 by 127 mm and shall be mounted back-to-back in double face plastic sleeves punched to fit standard three ring binders. Each print shall have an information box attached. The box shall be typewritten and arranged as follows:

Project Name:	Direction of View:
Location:	Date/Time:
Photograph No.:	Description of View:

-- End of Section --

SECTION 02 65 00

UNDERGROUND STORAGE TANK REMOVAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API PUBL 1628	(1996) A Guide to the Assessment and Remediation of Underground Petroleum Releases
API RP 1604	(1996; R 2010) Closure of Underground Petroleum Storage Tanks
API RP 2003	(2015; 8th Ed) Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents
API RP 2219	(2016) Safe Operation of Vacuum Trucks Handling Flammable and Combustible Liquids in Petroleum Service
API STD 2217A	(2017) Safe Work in Inert Confined Spaces in the Petroleum and Petrochemical Industries
API Std 2015	(2018) Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks

ASTM INTERNATIONAL (ASTM)

ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2167	(2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D4397	(2016) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and

	Soil-Aggregate by Nuclear Methods (Shallow Depth)

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 530-R-97-007	(1997) Best Management Practices (BMPs) for Soils Treatment Technologies;, Suggested Operational Guidelines to Prevent Cross-Media Transfer of Contaminants During Cleanup Activities
EPA 600/4-79/020	(1983) Methods for Chemical Analysis of Water and Wastes
EPA SW-846	(Third Edition; Update IV) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 279	Standards for the Management of Used Oil
40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)

1.2 SYSTEM DESCRIPTION

The work consists of removal, decontamination and disposal of one , 3785 L underground storage tank and associated piping and ancillary equipment, including but not limited to dewatering (if approved), disposal of contaminated soil, providing reports which are required by regulatory

agencies, and backfilling.. The tank is constructed of steel and is at the location shown on the drawings . The 3785 L tank was used for storing fuel oil and must be taken out of service once the replacement generator is operational. Residue remaining in the tank is considered a special waste. Subsurface conditions are represented on drawings . Existing native soils are predominantly Kanto loam. Backfill material should conform to the Satisfactory Materials paragraph in Section 31 00 00. Groundwater was not encountered during soil borings conducted from 5 to 10 m below grade. Ground water near Fussa City is commonly encountered deeper than 30 m. However, perched rain water can cause temporary high ubsurface water levels at the site that dissipate over time after a storm event. Verify the actual conditions prior to submitting a bid. The site is not a hazardous waste site, but due due to the nature of the materials and hazards present, use specified procedures until closure activities are complete.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Work Plan; G.
Site Safety and Health Plan; G
Excavation and Material Handling Plan; G
Field Sampling and Laboratory Testing Plan; G
Tank and Piping Removal And Disposal Plan; G
Spill and Discharge Control Plan; G
Qualifications; G
Laboratory Services; G
State Licensed Waste Transporter

SD-06 Test Reports

Laboratory and Field Testing Reports
Tank Contents Verification
Contaminated Water Disposal
Soil Examination, Testing, and Analysis
Backfilling; G.

SD-11 Closeout Submittals

Salvage Rights; G
Tank Closure Report

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Substantiate a minimum of 2 years of tank removal experience, including subcontractors and personnel employed on the project, and certification by the local authority having jurisdiction for tank removal work. Experience shall include removal, transportation, and disposal of underground tanks and associated piping, in conformance with the following:

a. API RP 1604

b. 40 CFR 280, State and local regulations and procedures.

c. Applicable safety rules and regulations.

d. Use of equipment and procedures for testing and vapor-freeing tanks.

e. Handling and disposal of types of wastes encountered in underground tank and pipe removal including disposal of underground tanks and associated piping.

f. Excavation, testing, and disposal of petroleum contaminated soils, liquids, and sludge.

g. Project titles, dates performed, owner's names, points of contact for each project with current contact phone numbers.

1.4.2 Laboratory Services

Submit documentation for laboratory services in accordance with Local Authority requirements .

1.4.3 Support Staff

Identify all staff involved for the various components, including personnel collecting and shipping samples, and detail staff member's qualifications.

1.4.4 Preconstruction Conference and Work Plan

Prior to the commencement of work, a preconstruction conference will be scheduled by the Contracting Officer. Prepare and submit a comprehensive Work Plan within 30 days of contract award. The work plan shall conform to the requirements of this specification, API RP 1604, API Std 2015, API RP 2003, API STD 2217A and API RP 2219. Allow 30 days in the schedule for the Government's review and approval. No adjustment for time or money will be made for re-submittals required as a result of noncompliance. No work at the site is allowed, with the exception of site inspections and mobilization, until the Work Plan is approved. As a minimum, include the following in the Work Plan:

1.4.4.1 Site Safety and Health Plan

Furnish detailed safety, health, and accident prevention provisions and develop a Site Safety and Health Plan (SSHP). Incorporate the requirements of 29 CFR 1910 and EM 385-1-1 into the SSHP. Include current training certification statement for personnel prior to entry into the work site. Do not commence work until the SSHP is approved by the Contracting Officer. As a minimum, include the following:

a. Health and safety organization, including discussion of distribution of functions and responsibilities.

b. Organization and components of the SSHP.

c. Physical and chemical site hazard identification.

d. Basic toxicology and toxicity information.

e. Discussion of the EZ and CRZ.

f. Protective clothing.

g. Respiratory protection.

h. Air quality monitoring.

i. Personnel exposure guidelines.

j. Decontamination procedures.

k. Basic first aid review.

l. Emergency response and contingency plan.

m. Site entry and exit procedures.

n. Sampling procedures.

1.4.4.2 Excavation and Material Handling Plan

Describe methods, means, equipment, sequence of operations and schedule to be employed in excavation, transport, handling, borrowing source and stockpiling of soil during underground tank removal. Include shoring requirements. Fifteen days before beginning tank removal work, submit to the Contracting Officer, for approval, a material handling plan that describes phases of dealing with the contaminated soil and water as it relates to the proposed tank and piping removal, including methods of excavating, a material handling plan for the contaminated material, soil testing requirements, and water pumping and collection requirements.

1.4.4.3 Field Sampling and Laboratory Testing Plan

Describe field sampling methods and quality control procedures. Identify laboratory and laboratory methods to be used for contamination testing. Include sample reports showing sample identification for location, date, time, sample method, contamination level, name of individual sampler, identification of laboratory, and quality control procedures.

1.4.4.4 Tank and Piping Removal and Disposal Plan

Describe methods, means, sequence of operations, and schedule to be employed in the testing, pumping, cleaning, de-vaporizing, inspecting, cutting and removal, and disposal of underground storage tanks and piping. Include methods to be employed for product, sludge, vapor, and pumpable liquid removal; purging and inerting; and storage methods proposed for control of surface water. Also address the following:

a. Treatment Options
b. Identification of waste, tank and contaminated soil transporters and means of transport.
c. Disposal and alternate facilities, disposal or remediation.
d. Decontamination procedures and coordination with SSHP.

1.4.4.5 Spill and Discharge Control Plan

Develop a comprehensive spill and discharge control plan. Consider and

provide contingency measures for potential spills and discharges from handling and transportation of contaminated soils and water. A possible source of guidance for assessment and remediation is API PUBL 1628.

1.4.4.6 Site Safety And Health Officer

Identify an individual to serve as the Site Safety and Health Officer (SSHO) to report problems and concerns regarding health and safety to the Contracting Officer. Provide documentation that the SSHO possesses working knowledge of local and Federal occupational safety and health regulations, and provide training, in accordance with 29 CFR 1910 to Contractor employees in air monitoring practices and techniques. The SSHO shall remain onsite to provide day to day industrial hygiene support, including air monitoring, training, and daily site safety inspections. The SSHO may be assigned other duties, such as project foreman or quality control manager.

1.4.5 Permits and Licenses

As required or as directed by the Contracting Officer, obtain local, state, or federal permits and licenses that directly impact the Contractor's ability to perform the work prior to commencing removal operations.

1.4.6 Statutes and Regulations

Perform tank closures, removal, and disposal in accordance with 40 CFR 280, 40 CFR 262, 40 CFR 264, and 40 CFR 265 as well as the applicable local, and Federal regulations.

1.5 PROJECT/SITE CONDITIONS

Notify the Installation Environmental Coordinator (IEC) and the Contracting Officer 30 days prior to tank removal. The Contractor is responsible for contacting the Local Authority Having Jurisdiction in accordance with the applicable reporting requirements.

PART 2 PRODUCTS

2.1 PLASTIC SHEETING

Provide plastic sheeting conforming to ASTM D4397.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Furnish labor, materials, necessary permits, laboratory tests, and reports and equipment to remove and dispose of products remaining in the underground tanks; clean and vapor free the underground tanks and connecting piping; excavate, remove underground tanks and associated piping, and backfill to the level of the adjacent ground; sample soil and water to determine if contaminated; dispose of tanks and associated piping, and petroleum contaminated soil and water.

3.1.1 Safety Guidelines

Comply with personnel safety guidelines specified by the Authority Having Jurisdiction, and conform to the guidelines as stipulated in the approved

SSHP.

3.1.2 Exclusion Zone (EZ) And Contamination Reduction Zone (CRZ)

Do not permit personnel, not directly involved with the project, to enter work zones, called the EZ and CRZ. The EZ is an area around the tank a minimum of 3 m from the limits of the tank excavation. At the perimeter of the EZ, establish a CRZ. Clean equipment and personnel within the CRZ, as stated in the paragraph titled "Personnel and Equipment Decontamination." Locate the Contractor's site office, parking area, and other support facilities outside the EZ and CRZ. Clearly mark and post boundaries of the EZ and CRZ. Include a site map, outlining the extent of work zones and location of support facilities, in the SSHP.

3.1.3 Onsite Training

Prior to starting onsite work, conduct a health and safety training class directed by the SSHO to discuss the implementation of the SSHP. Notify the Contracting Officer 24 hours prior to beginning the training class.

3.1.4 Personnel Protection

Furnish appropriate personal safety equipment and protective clothing to personnel and ensure that safety equipment and protective clothing is kept clean and well maintained. Furnish three clean sets of personal protective equipment and clothing for use by the Contracting Officer or official visitors as required for entry into the EZ.

3.1.5 Respiratory Protection Program

Fully employ respiratory protection program, addressing respirator usage and training, in accordance with 29 CFR 1910 and EM 385-1-1.

3.1.6 Decontamination

Decontaminate or properly dispose of personal protective equipment and clothing worn in contaminated areas at the end of the work day. The SSHO is responsible for ensuring that personal protective clothing and equipment are decontaminated before being reissued.

3.1.7 Emergency Response and First Aid Equipment

a. Prior to commencement of work, thoroughly review emergency response and contingency plan in accordance with 29 CFR 1910. In an emergency, take action to remove or minimize the cause of the emergency, alert the Contracting Officer, and institute necessary measures to prevent repetition of the emergency. Equip site-support vehicles with route maps providing directions to the medical treatment facility.

b. Provide appropriate emergency first aid equipment for treatment of exposure to site physical and chemical hazards. Provide and post a list of emergency phone numbers and points of contact for fire, hospital, police, ambulance, and other necessary contacts. Provide and post a route map detailing the directions to the nearest medical facility.

c. Notify the Contracting Officer of any unforeseen hazard or condition which becomes evident during work.

3.1.8 Burning and Explosives

Use of explosives or burning debris is not allowed. Do not permit ignition sources in the EZ and CRZ.

3.1.9 Protection of Existing Structures and Utilities

Take all necessary precautions to avoid damage to existing structures, their appurtenances, monitoring wells, or utilities that may be affected by work activities. Repair any damage to utilities and monitoring wells resulting from the Contractor's operations at no expense to the Government. Coordinate with the installation to locate underground utilities prior to beginning construction. Do not disturb utilities encountered which were not previously shown or otherwise located without approval from the Contracting Officer.

3.1.10 Shoring

Provide shoring in accordance with Local Authority requirements.

3.2 TANK CONTENTS VERIFICATION

Conduct sampling and analysis in accordance with the approved Sampling and Analysis Plan. Submit reports, including the chain-of-custody records.

3.2.1 Sampling

Sample tank product, pumpable liquids, tank coatings and sludge. If the data is not adequate, additional sampling and analysis to the extent required by the approved offsite facility receiving the material is the responsibility of the Contractor . Meeting all regulatory requirements, including the preparation of hazardous materials and waste for transportation, is the responsibility of the Contractor.

3.2.2 Analysis

Test tank contents for the parameters listed herein. Include total petroleum hydrocarbons (TPH), benzene, ethylbenzene, toluene and xylene (BETX) and lead in the analysis.

3.2.3 Characterization

Prior to removing any of the tank contents, characterize the contents to determine the type of required disposal: in a special manner based on local, state, and Federal disposal regulations. Characterize tank product, pumpable liquids, and sludge in accordance with 40 CFR 261 and 40 CFR 279. Submit the waste contents determination and accompanying test results for each phase present in the tank to the Contracting Officer.

3.3 CLEARING, GRUBBING AND REMOVALS

3.4 TOPSOIL

3.5 PREPARATIONS FOR EXCAVATION

Before excavating, remove residual liquids trapped in the product lines

and remove all product from the tank. Purge and vent the tank in accordance with API RP 1604, and as specified herein.

3.5.1 Removal of Product, Pumpable Liquids, and Sludge

Remove and dispose of tank product, pumpable liquids, and sludge. Use of Government facilities for permanent storage or disposal of the wastes is prohibited. Temporary storage on Government facilities will be allowed only until testing is complete, manifests (if necessary) are complete, and transportation is arranged. The Contractor is responsible for obtaining all required permits. Usable product shall be the property of the Contractor. Provide approved containers, vehicles, equipment, labor, signs, labels, placards and manifests and associated land disposal restriction notices and notifications, necessary for accomplishment of the work, including materials necessary for cleaning up spills that could occur from tank removal operations.

3.5.2 Contaminated Water Disposal

3.5.2.1 Sampling, Analysis, and Containment

Sample and analyze contaminated water both prior to and after treatment. Conform analysis of contaminated water to be taken to an offsite treatment facility to the requirements of the treatment facility, with documentation of all analyses performed furnished to the Contracting Officer in accordance with paragraph RECORDS. Contain, store onsite, and analyze contaminated water prior to transport to the approved treatment, storage and disposal facility and dispose of in accordance with applicable disposal regulations set by the Authority Having Jurisdiction. Provide approved containers, vehicles, equipment, labor, signs, labels, placards and manifests and associated land disposal notices and notifications, necessary for accomplishment of the work.

3.5.2.2 Treatment

Treat contaminated water onsite or offsite by oil water separation , or other means as approved by the Contracting Officer. If contaminated water is to be treated onsite, specify the proposed treatment in the Work Plan and submit for approval, including the chain-of-custody records. Install temporary storage and treatment equipment in the general vicinity of the tanks at a location approved by the Contracting Officer. Sample and analyze treated effluent and secure approval of results by the Contracting Officer before discharge to the surface . Treat and discharge effluent in accordance with the discharge permit.

3.6 PURGING AND INERTING

After the tank and piping contents have been removed, but prior to excavation beyond the top of the tank, disconnect all the piping (except the piping needed to purge or inert the tank). Purge flammable and toxic vapors from the tank or make the tank inert in accordance with API RP 1604, with the exception that filling with water is not permitted and, if dry ice is employed, use a minimum of 1.8 kg per 500 L of tank volume. Continuously monitor the tank atmosphere for combustible vapors if the tank is purged, or continuously monitor for oxygen, if the tank is inerted.

3.7 EXCAVATION

Mark all excavation areas, as well as work near roadways, in accordance

with the requirements of the Authority Having Jurisdiction.

3.7.1 Tank Excavation

a. Provide Contracting Officer with written documentation, no later than 30 days before work begins, that proper State or local authorities have been notified. Notify the Contracting Officer at least 48 hours prior to start of tank removal work. Stage operations to minimize the time that tank excavation is open and the time that contaminated soil is exposed to the weather. Provide protection measures around the excavation area to prevent water runoff and to contain the soil within the excavation area.

b. Perform excavation around the perimeter of the tank to limit the amount of potentially petroleum contaminated soil that could be mixed with previously uncontaminated soil. Segregate petroleum contaminated soil in separate stockpiles.

c. Maintain an excavation around the tank of sufficient size to allow workers ample room to complete the work, but also protect the workers from sliding or cave-ins. Install sheeting, bracing, or shoring in the absence of adequate side slopes if there is a need for workers to enter the excavated area. Divert surface water to prevent direct entry into the excavation.

d. Dewatering of the excavation may require a discharge permit by the State and shall be limited to allow adequate access to the tank and piping, to assure a safe excavation, and to ensure that compaction and moisture requirements are met during backfilling. Dewatering may result in the production of petroleum contaminated water and/or free product. Recover free product from the groundwater only as part of necessary dewatering.

e. Collect and test water generated by dewatering during excavation required for removal of tanks or piping, surface water collected in open excavation, or water used for washing equipment or existing concrete or bituminous surfaces, in accordance with EPA 530-R-97-007, EPA 600/4-79/020, EPA SW-846 and state or locally required analyses.

3.7.2 Temporary Containment of Excavated Soil

Provide temporary containment area near the excavated area. Cover containment area with 0.75 mm polyethylene sheeting. Place excavated soil on the impervious barrier and cover with 0.15 mm polyethylene sheeting. Provide straw bale berm around the outer limits of the containment area and cover with polyethylene sheets. Secure edges of sheets to keep the polyethylene sheeting in place.

3.7.3 Piping Excavation

Perform excavation as necessary to remove tank piping and ancillary equipment in accordance with paragraphs: Shoring, Tank Excavation, and Open Excavations.

3.7.4 Open Excavations

Secure open excavations and stockpile areas while awaiting confirmation test results from the soil beneath the tank. Backfill the excavation as soon as possible after tank and contaminated soil removals have been

completed and confirmation samples have been taken. Divert surface water around excavations to prevent water from directly entering into the excavation.

3.7.5 Hidden Structures

During excavation activities, if asphalt pavement, concrete slabs, or other hidden structures are encountered, remove and wash with high pressure water cleaning equipment. Remove and dispose of the pavement, concrete, and other structures as specified in Section 02 41 00 DEMOLITION.

3.7.6 Stockpiles

Uncontaminated excavated soil shall be stockpiled and used for backfill in the tank excavation prior to using borrow material. Petroleum contaminated soil, that is not a state-regulated hazardous waste, shall be disposed of offsite . Excavated material that is regulated by the state as a hazardous waste which is visibly stained and which has an obvious petroleum odor or as required by the Authority Having Jurisdiction is considered contaminated. Place in containers such as drums, roll-offs or dumpsters for sampling in accordance with paragraph Stockpiled Material Sampling. Separately stockpile uncontaminated soil from the contaminated soil, a safe distance away from, but adjacent to, the excavation. Locate the container cover to prevent rain or surface water from coming into contact with the contaminated soil, as well as limit the escape of the volatile constituents in the container .

3.7.7 Acceptable Levels of Contamination

Take further samples and test soils with OVA/FID readings of 10 ppm or greater for TPH and for BTEX in accordance with EPA SW-846 and EPA 600/4-79/020, and for toxicity characteristic leaching procedure (TCLP) for lead if leaded gasoline was stored in or near the underground tank being removed. For stockpiled soils, provide a minimum of one test for every 77 cubic meters for TPH, and one test for every 77 cubic meters for BTEX and TCLP. Soils that contain 50 ppm or more TPH, 10 ppm or more BTEX or have TCLP reading of 10 ppm lead or virgin petroleum products are considered contaminated materials. Soils which are less than the above may be used as clean fill. Furnish results to the Contracting Officer within 24 hours after the results are obtained.

3.8 REMOVAL OF PIPING, ANCILLARY EQUIPMENT, AND TANK

3.8.1 Piping and Ancillary Equipment

Disconnect all piping and ancillary equipment from the tank. Remove the piping completely (interior and exterior of the tank) or as directed by the Contracting Officer. Cap all tank ancillary equipment and piping connections, except those connections necessary to inert the tank within the excavation zone. Clean the piping exterior and ancillary equipment to remove all soil and inspect for signs of corrosion and leakage. Ensure no spillage of the piping contents occurs, as specified in the Work Plan, and as required in paragraph SPILLS. If the soil under and around the tank pad is contaminated, remove the tank pad and dispose of offsite at an approved waste facility.

3.8.2 Tank

Remove the tank from the excavation and clean the exterior to remove all

soil and inspect for signs of corrosion, structural damage, or leakage. Use only non-sparking type materials or equipment which comes into contact with the tank, or in the vicinity of the excavation such as shovels, slings and tools. After removal from the excavation, place the tank on a level surface adjacent to the tank excavation and secure it with wood blocks to prevent movement.

3.8.3 Contaminated Soil, Tank and Piping Excavation Examination

a. After the tank has been removed from the ground, examine and test the adjacent and underlying soil for any evidence of leakage. Visually inspect the soil for staining after removal of all obviously contaminated soil, then screen for the presence of volatile and/or semi-volatile contamination using a real time vapor monitoring instrument .

b. If tank is 6 m or less in length, take two samples. Take each sample 0.60 m from each end of the tank and 0.60 m below the bottom of the excavation.

d. Analyze samples for TPH, BTEX, and TCLP. Perform sampling and analysis conforming to standards specified above for stockpiled soils. Soils that contain 50 ppm or more TPH, 10 ppm or more BTEX, or have TCLP reading of 10 ppm of lead or virgin petroleum products are considered contaminated materials. Soils which are less than the above may be used as clean fill. Furnish results to the Contracting Officer within 24 hours after the results are obtained. Along with the results furnish a sketch showing underground tank, sampling location, and extent of excavations.

e. Stockpile onsite in accordance with paragraph Stockpiles uncontaminated soil or Transport offsite for disposalpetroleum contaminated soil not regulated by the state as hazardous waste. Stockpile contaminated soil or suspected contaminated soil, or, if the site is a RCRA-designated CAMU, containerized until further disposition.

f. The Contracting Officer will determine the extent of the contaminated soil to be removed from each site, not to exceed 25 per site. Report any evidence indicating that the amount of contaminated soil may exceed the individual site limit specified, to the Contracting Officer the same day it is discovered. If minimal additional excavation is required, the Contracting Officer may allow the Contractor to proceed. If extensive contamination is encountered, sample the excavation and backfill in accordance with paragraph BACKFILLING.

3.8.4 Testing Along Piping

For every 7.5 m of product delivery piping, for every change in direction, and at every mechanical joint take one soil sample and analyze for TPH, BTEX, and TCLP. Conform sampling and analysis of soil materials to EPA standards specified above.

3.9 TANK CLEANING

Provide clean and vapor free tank in accordance with API RP 1604.

b. Fuel Removal: All possible fuel will be pumped or otherwise removed from the tank by the Government. Consider remaining fuel contaminated or waste fuel; pump into 208 liters drums or other suitable containers for disposal in accordance with approved procedures meeting local, State, and Federal regulations . Dispose of remaining fuel emulsions in accordance with applicable local, State, and Federal regulations. Drums or tanks used for containerizing waste fuel will be furnished by the Contractor . Oil/water separator for fuel will be furnished by the Contractor .

3.9.1 Exterior

Remove soil from the exterior of the tank, piping, and associated equipment to eliminate soil deposition on roadways during transportation to a temporary storage area, ensure markings will adhere to the surfaces, and simplify tank cutting. Use non-sparking tools to remove soil. Recover removed uncontaminated soil and use them as backfill in the former tank excavation . Remove and containerize soil believed to be contaminated.

3.9.2 Temporary Storage

If the tank is stored after the tank exterior is cleaned and ancillary equipment is removed, and prior to being cut into sections, label the tank as directed in API RP 1604, place it on blocks, and temporarily store it on a flat area adjacent to the excavation . Prior to cleaning the tank interior, monitor the tank atmosphere for combustible vapors and purge or inert it if combustible vapors are detected. Provide warning labels as follows:

"TANK HAS CONTAINED LEADED GASOLINE

NOT VAPOR FREE

NOT SUITABLE FOR STORAGE OF FOOD OR LIQUIDS
INTENDED FOR HUMAN OR ANIMAL CONSUMPTION

DATE OF REMOVAL: MONTH/DAY/YEAR"

Make tank unusable for future use, then transport and dispose of tank in accordance with Federal and local regulations.

3.9.3 Interior

Clean tank interior using a high pressure (greater than 3.45 MPa), low volume (less than 0.13 L/s) water spray or Steam clean tank interior until all loose scale and sludge is removed, and contamination, in the form of a sheen, is no longer visible in the effluent stream. Also clean the interior surfaces of piping, to the extent possible, using the same method used for cleaning the tank. Contaminated water generated from interior cleaning operations (of both piping and tank) shall not exceed the following quantities for each UST cleaned:

UST VOLUME (LITERS)	PERCENT OF UST VOLUME
3,785 or less	5

Handle in accordance with paragraph Contaminated Water Disposal all contaminated water resulting from cleaning operations. Clean so as to eliminate, to the greatest extent possible, the need for personnel to enter the tank. Use specially designed tank cleaning equipment which allows the tank to be cleaned prior to cutting into sections without requiring personnel to enter the tank or, if less specialized equipment is used, the tank shall be partially dissected to overcome confined space entry hazards. Accomplish this work in accordance with the requirements of the Authority Having Jurisdiction.

3.10 SOIL EXAMINATION, TESTING, AND ANALYSIS

3.10.1 Tank Excavation Sampling Procedures

After soil known to be contaminated has been removed or after soil excavation is complete, sample the excavation with procedures, number, location, and methodology in accordance with state regulations.

3.10.2 Stockpiled Material Sampling

Sampling locations, number and specific procedures are as required by the Authority Having Jurisdiction and the disposal facility.

3.10.3 Analysis

Test soil samples from the excavation and stockpiled material in accordance with the approved Sampling and Analysis Plan for the following parameters: total petroleum hydrocarbon (TPH), benzene, ethylbenzene, toluene, xylene (BETX) and toxicity characteristic leaching procedure (TCLP). Submit copies of all test results, including the chain-of-custody records,.to the Contracting Officer.

3.11 BACKFILLING

a. Backfill the tank area and any other excavations only after the soil test results have been approved. Complete contaminated soil removal after approval by the Contracting Officer.

b. Dewater the excavation if necessary. Use stockpiled material, subjected to chemical confirmation testing as backfill, if it is found to conform to the requirements of clean fill in accordance with appropriate local regulations . Place clean backfill in layers with a maximum loose thickness of 200 mm, compacted to 90 percent maximum density for cohesive soils and 95 percent maximum density for

cohesionless soils. Perform density tests using an approved commercial testing laboratory or by facilities furnished by the Contractor. Attach test results to Contractor's Quality Control Report; submit 3 copies of the report for each UST site opened, prepared in a standard 3-ring binder, within 14 days of completing work at each site. Label each binder with contract number, project name, location and tank number; each binder shall be indexed. Furnish a copy of the report to the Installation Environmental Coordinator. Perform a minimum of 1 density test on each lift. Determine laboratory tests for moisture density relations in accordance with ASTM D1557, Method B, C, or D, or ASTM D6938. A mechanical tamper may be used, provided that the results are correlated with those obtained by the hand tamper. Determine field in-place density shall be in accordance with ASTM D1556/D1556M, ASTM D6938, or ASTM D2167.

3.12 DISPOSAL REQUIREMENTS

3.12.1 Treatment, Disposal, and Recycling

Perform disposal of hazardous or special wastes in accordance with all local, State, and Federal solid and hazardous waste laws and regulations; and conditions specified herein. This work includes all necessary personnel, labor, transportation, packaging, detailed analyses (if required for disposal, manifesting or completing waste profile sheets), equipment, and reports. Recycle product and pumpable liquids removed from the tank to the greatest extent practicable. Dispose of the tanks removed in a manner approved by the local jurisdiction. Provide manifest for each tank disposed of in this manner as required by the Authority Having Jurisdiction to document delivery and acceptance at the disposal facility.

3.12.2 Tank and Ancillary Equipment Disposal

After the tank, piping, and ancillary equipment have been removed from the excavation and the tank cleaned, cut the tank into sections with no dimension greater than 1500 mm. Dispose of tank and piping sections in a local approved offsite disposal facility. Perform tank cutting prior to being taken from the tank removal site. Do not sell the tank intact. Dispose of ancillary equipment at an approved offsite disposal facility Piping shall be disconnected from the tank and removed unless otherwise indicated.

3.12.3 Transportation of Wastes

Provide transportation in accordance with Department of Transportation (DOT) Hazardous Material Regulations and State and local requirements, including obtaining all necessary permits, licenses, and approvals. Submit evidence that a State licensed waste transporter is being used.

3.12.4 Salvage Rights

The Contractor retains the rights to salvage value of recycled or reclaimed product and metal not turned in to the DRMO or otherwise identified, so long as the requirements of 40 CFR 266 and 40 CFR 279, or the applicable State requirements are met. At the end of the contract, provide documentation on the disposition of salvaged materials.

3.12.5 Manifest Records

Maintain records of all waste determinations, including appropriate

results of analyses performed, substances and sample location, the time of collection, and other pertinent data as required by 40 CFR 280, Section 74 and 40 CFR 262 Subpart D. Also record transportation, treatment, disposal methods and dates, the quantities of waste, the names and addresses of each transporter and the disposal or reclamation facility, shall and available for inspection, as well as copies of the following documents:

a. Manifests.

b. Waste analyses or waste profile sheets.

c. Certifications of final treatment/disposal signed by the responsible disposal facility official.

d. Land disposal notification records required under 40 CFR 268for hazardous wastes.

3.12.6 Documentation of Treatment or Disposal

Take wastes, other than recyclable or reclaimable product or metal, to a treatment, storage, or disposal facility which has EPA or appropriate state permits and or special waste identification numbers and complies with the provisions of the disposal regulations. Furnish documentation of acceptance of special waste by a facility legally permitted to treat or dispose of those materials shall be furnished to the Contracting Officer not later than 5 working days following the delivery of those materials to the facility; and include a copy in the Tank Closure Report. Furnish a statement of agreement from the proposed treatment, storage or disposal facility and certified transporters to accept or special wastes in the Work Plan . If the Contractor selects a different facility than is identified in the Work Plan, provide documentation for approval to certify that the facility is authorized and meets the standards specified in 40 CFR 264.

3.13 SPILLS

Use appropriate vehicles and operating practices to prevent spillage or leakage of contaminated materials from occurring during operations. Inspect vehicles leaving the area of contamination to ensure that no contaminated materials adhere to the wheels or undercarriage. Take immediate containment actions as necessary to minimize effect of any spill or leak. Cleanup in accordance with applicable Federal, State, local laws and regulations, and district policy at no additional cost to the Government.

3.14 INSPECTIONS

Arrange for and perform required inspections. Provide copies of inspections to Contracting Officer.

3.15 TANK CLOSURE REPORT

Submit a Site Assessment/Tank Closure Report in a single binder notebook containing a collection of reports, records, starting and ending dates of reporting period, inspections, documentation, and data as follows:

a. Complete UST Notification Form (within 30 days of closure).

b. Description of work, including removal procedures, number of tanks removed, identification of tanks removed and disposed of (include site map showing location of tank and piping), cubic yards of excavated soil, location of disposal sites, and dates of excavation.

c. Site plan, including location of tanks and piping, limits of excavation, sampling points, results of excavation, and depths.

d. Laboratory and field testing reports, copies of data and test results from testing laboratory and the chain-of-custody records.

e. Tank disposal paperwork (3 copies of UST Notification Form and method of conditioning tank for disposal), contaminated soil disposal paperwork (include laboratory testing reports), and contaminated water disposal paperwork (include laboratory testing reports).

f. Certifications required by implementing agency.

g. Building permit, inspection permits, and other permits required for underground tank removal, notifications, and inspection reports.

h. Cumulative quantities of soil excavated, beginning with start date for each tank and associated piping.

3.16 COMPACTION, FINISH GRADING, and SEEDING

Provide backfill, compaction, grading, and seeding in accordance with Section 31 00 00 EXCAVATION. Line the excavation with two plastic sheets before backfilling.

-- End of Section --

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SECTION 02 81 00

TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. Department of Defense (DOD)

JEGS	(2022) Japan Environmental Governing Standards

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

1.2 DEFINITIONS

1.2.1 Hazardous Material

Any material that exhibits any of the characteristics of a physical hazard, a health hazard, a simple asphyxiant, combustible dust, or pyrophoric gas, or is regulated by the Government of Japan (GoJ). See JEGS.

1.2.2 Aqueous Film Forming Foam (AFFF)

A fire suppression agent used by DoD and non-DoD entities that may contain perfluoroalkyl substances (PFAS). AFFF will be treated as a hazardous material for the purposes of this specification.

1.2.3 Perfluoroalkyl substances (PFAS)

A chemical substance of environmental concern due its toxicity to humans and fauna, persistence in the environment, and bioaccumulation potential.

1.2.4 Perfluorooctanoic acid (PFOA) & Perfluorooctane sulfonate (PFOS)

Fluorocarbon surfactants which are PFAS that are added to AFFF as surface active agents that facilitate fire suppression. PFOS and its salts are listed in the JEGS as a hazardous substance, indicating that the material is capable of posing an unreasonable risk to health, safety, or the environment if improperly handled, stored, issued, transported, labeled, or disposed of. The JEGS do not list PFOS/PFOA as a hazardous waste nor do they exhibit the listed hazardous waste characteristics.

1.2.5 AFFF Concentrate

AFFF Concentrate liquid for incineration. Unused or > 10% AFFF product that is pumpable and presumed to contain PFAS. All AFFF Concentrate encountered during this project shall be destroyed by high temperature

incineration using facilities that are licensed or permitted by the GoJ and approved by the DoD Lead Environmental Component in accordance with the criteria listed in JEGS for the destruction of hazardous wastes (including PFAS containing wastes).

1.2.6 AFFF Solutions

AFFF rinsate/ water-diluted liquid for incineration. Used or > 90% water solution that is pumpable and presumed to contain PFAS. All AFFF Solutions encountered during this project shall be destroyed by high temperature incineration using facilities that are licensed or permitted by the GoJ and approved by the DoD Lead Environmental Component in accordance with the criteria listed in JEGS for the destruction of hazardous wastes (including PFAS containing wastes).

1.2.7 AFFF-Contaminated Incidental Waste

AFFF-contaminated solids, sludges, or debris (e.g. personal protective equipment, filter media, etc.) for incineration. May contain some free liquids, but not pumpable and presumed to contain PFAS. All AFFF-Contaminated Incidental Wastes encountered during this project shall be destroyed by high temperature incineration using facilities that are licensed or permitted by the GoJ and approved by the DoD Lead Environmental Component in accordance with the criteria listed in JEGS for the destruction of hazardous wastes (including PFAS containing wastes).

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Waste Management And Disposal Plan; G

SD-06 Test Reports

Spill Response

SD-07 Certificates

Shipping Documents and Packagings Certification; G

Certificates Of Disposal/ Destruction; G

SD-11 Closeout Submittals

AFFF Disposal Accountability Report; G

1.4 QUALITY ASSURANCE

1.4.1 Certification

The hazardous materials transporter and disposal facility must possess a current Certificate of Registration issued by the GoJ or local prefectural regulatory agency. Submit copies of the certificates with the Waste Management and Disposal Plan. The Contractor shall also comply with the

EMS program, including all base environmental plans, instructions, EM 385-1-1, and the Japan Environmental Governing Standards (JEGS).

1.4.2 Laws and Regulations Requirements

Comply with the JEGS, GoJ, prefectural, and local laws and regulations which are applicable. These requirements are amended frequently and compliance with amendments is required as they become effective. Notify the Contracting Officer immediately if compliance exceeds the scope of work or conflicts with specific requirements of the contract.

PART 2 PRODUCTS

2.1 MATERIALS

Provide all materials required for the packaging, labeling, marking, and transportation of hazardous materials in conformance with GoJ and local prefectural laws and regulations. Details in this specification must not be construed as establishing the limits of the Contractor's responsibility.

2.1.1 Packagings

Provide bulk and non-bulk containers, as appropriate, suitable for shipping AFFF concentrate, solutions, and contaminated incidental materials to the disposal facility. Consult with the disposal facility for specific packaging requirements.

2.1.2 Labeling

Provide primary and subsidiary labels for all containers. Labels must be durable weather-resistant and capable of withstanding a 180-day exposure to conditions reasonably expected to be encountered during container storage and transportation, without deterioration or substantial color change.

2.1.3 Spill Response Materials

Provide spill response materials including, but not limited to, containers, adsorbent, shovels, and personal protective equipment. Spill response materials must be available at all times when hazardous materials/wastes are being handled or transported. Spill response materials must be compatible with the type of material being handled.

2.2 EQUIPMENT AND TOOLS

Provide miscellaneous equipment and tools necessary to handle hazardous materials and hazardous wastes in a safe and environmentally sound manner. Comply with EM 385-1-1.

PART 3 EXECUTION

3.1 WASTE MANAGEMENT AND DISPOSAL PLAN

All AFFF concentrates and solutions shall become the property of the Contractor and the Contractor is solely responsible for all management and disposal requirements. There is no intent of US Government entities to accept any wastes for disposal. The Contractor shall prepare a Waste Management and Disposal Plan detailing the way Hazardous Materials, including AFFF concentrates, solutions, and contaminated incidental

wastes, will be managed and describing the types and volumes of these materials anticipated to be managed. The plan must address both onsite and offsite management. Describe the methods to be used to ensure accurate accountability of all hazardous materials encountered at the site; identify areas onsite where hazardous materials are to be handled and stored; describe waste minimization methods; identify and describe packaging and storage methods; identify transporters to be used and the haul route(s) to move hazardous materials from the site to the disposal facility; identify and describe facilities to be used for final treatment, storage, and disposal (TSD); and identify whether transfer facilities are to be used; and if so, how the materials will be tracked to ultimate disposal. Submit the plan to the Contracting Officer for approval prior to start of work.

3.2 OFFSITE HAZARDOUS WASTE MANAGEMENT

The Contractor is solely responsible for all management and disposal requirements. There is no intent of Government entities to accept any wastes for disposal. Coordinate the off-site transfer of all hazardous materials, including AFFF concentrates, solutions, and contaminated incidental wastes, with the installation environmental office and the Contracting Officer. Use disposal facilities that are licensed or permitted by the GoJ and approved by the DoD Lead Environmental Component in accordance with the criteria listed in the JEGS for the destruction of hazardous wastes (including PFAS containing wastes). Handling and transportation of such material shall be in accordance with Chapters 10 and 16 of the JEGS and GoJ or prefecture requirements, as applicable.

3.2.1 Treatment, Storage, and Disposal Facility and Transporter

Provide the Contracting Officer with the identity of licensed transporter(s) and a licensed disposal facility, by name, address, phone number, permit/ identification number, type of facility (treatment, storage, disposal), and permit expiration date. This information must be contained in the Waste Management and Disposal Plan and be approved by the Contracting Officer prior to waste disposal.

3.2.2 Shipping Documents and Packagings Certification

Prior to shipment of any hazardous material offsite and a minimum of 14 days prior to anticipated pickup, provide for review written certification to the Contracting Officer that hazardous materials have been properly packaged, labeled, and marked in accordance with Department of Transportation, JEGS, GoJ, and local prefectural requirements. Furnish designated disposal facility packaging assurances not later than 35 days after acceptance of the shipment. The Contractor's EM must also provide written certification regarding waste minimization efforts documenting that efforts have been taken to reduce the volume of waste to the degree economically practicable and that the method of treatment, storage, or disposal selected minimizes threats to human health and the environment.

Package, label, and mark hazardous materials using the specified materials and in accordance with the referenced authorizations. Ensure that each shipment of hazardous material sent offsite is accompanied by properly completed shipping documents. If necessary, prepare a bill of lading for each shipment of hazardous material which fulfills the shipping paper requirements. The bill of lading must satisfy the requirements of GoJ, prefectural, or local law or regulation, and must be submitted to the Contracting Officer for review and approval. Bill of ladings requiring

shipper's certifications must be signed by the Contractor.

3.3 TREATMENT AND DISPOSAL OF HAZARDOUS MATERIALS

The Contractor is solely responsible for the disposal of all hazardous materials, including AFFF concentrate, solutions, contaminated incidental materials, and metal components. There is no intent of Government entities to accept any wastes for disposal. AFFF concentrate shall be segregated from AFFF solutions (i.e. rinsate). All AFFF concentrate, solutions, contaminated incidental materials, and metal components shall be packaged in containers suitable for shipping to the disposal facility. Consult with the disposal facility for containerization requirements. Transport all AFFF concentrate, solutions, contaminated incidental materials, and metal components to the disposal facility in accordance with the JEGS and GoJ or prefecture requirements, as applicable.

Submit Certificates of Disposal/ Destruction documenting the ultimate destruction by incineration. The disposal certificate shall include:

- the identity of the disposal facility, by name, address, phone number, permit/ identification number, type of facility (treatment, storage, disposal), permit expiration date;
- types and quantities of material being destroyed (i.e., AFFF concentrate, AFFF solutions, AFFF systems components, location of origin of AFFF material);
- date AFFF material was accepted by the disposal facility; and
- a statement certifying the fact of incineration of the identified material, including the date(s) of disposal and process used.

Receipt of these certificates will be required for final payment.

3.3.1 AFFF Concentrate

Drain and collect for disposal all AFFF concentrate from atmospheric tanks, stationary bladder tanks, and associated piping containing concentrate from the tank to the AFFF proportioner. Dispose of all collected AFFF concentrate via high temperature incineration at disposal facilities that are licensed or permitted by the GoJ and approved by the Installation Environmental Component for the disposal of hazardous wastes (including PFAS containing wastes). The Contractor shall provide Certificates of Disposal/ Destruction (or processing) for all AFFF concentrate.

3.3.2 AFFF Solutions

Triple rinse all associated concentrate piping from the tank to the AFFF proportioner. Collect rinsate and dispose as AFFF solution. Triple rinsing of piping shall be comprised of filling the pipes completely with water free of known AFFF contamination (i.e., clean potable or non-potable water) and draining the rinse water from the piping and collect for disposal. The pipe rinsing process shall be repeated for a total of three separate rinses.

Triple rinse the interior of atmospheric tanks that contained AFFF. Collect rinsate and dispose as AFFF solution. Triple rinsing tanks shall be comprised of washing down the tank interior (sides, bottom, and top of tank) with a volume of water free of known AFFF contamination (i.e., clean potable or non-potable water) and draining the rinse water from the tank and collecting for disposal. The tank rinsing process shall be repeated

for a total of three separate rinses that shall generate a total rinsate volume of approximately 25% of the tank capacity (volume). Because of the nature of AFFF solutions, the potential for foaming shall be considered while rinsing tanks. Dispose of all collected AFFF solutions via high temperature incineration at disposal facilities that are licensed or permitted by the GoJ and approved by the Installation Environmental Component for the disposal of hazardous wastes (including PFAS containing wastes). The Contractor shall provide Certificates of Disposal/ Destruction (or processing) for all AFFF solutions.

3.3.3 AFFF-Contaminated Incidental Waste

Collect and dispose of all miscellaneous AFFF contaminated incidental waste produced while conducting fieldwork consisting of non-metallic system components (that is, other than steel tanks or metal system piping, etc.), wipes, absorbent pads, gloves, Tyvek suits, etc. Dispose of all collected miscellaneous AFFF contaminated incidental waste via high temperature incineration at disposal facilities that are licensed or permitted by the GoJ and approved by the Installation Environmental Component for the disposal of hazardous wastes (including PFAS containing wastes). The Contractor shall provide Certificates of Disposal/ Destruction (or processing) for all contaminated incidental wastes.

To meet these requirements while also safely handling ACM materials, AFFF contaminated ACM gaskets shall be treated using a high temperature process that destroys (incinerates) AFFF materials while containing ACM materials safely. The resulting slag waste shall be landfilled at a facility licensed or permitted by the GoJ and approved by the Installation Environmental Component. The Contractor shall provide Certificates of Disposal/ Destruction (or processing) for all slag wastes.

3.3.4 Metal Components Requiring Disposal

Metal components requiring disposal (e.g., system piping contaminated with AFFF) shall 1) be triple rinsed prior to disposal through recycling via smelting or 2) disposed of as PFOS contaminated industrial waste at a facility licensed or permitted by the GoJ. The Contractor shall provide Certificates of Disposal/ Destruction (or processing) for the smelted metal waste.

3.3.5 AFFF Disposal Accountability Report

The Contractor shall provide an AFFF Disposal Accountability Report for all AFFF concentrate, solutions (i.e., rinsate, shell water) volumes removed or generated by the Contractor (as for the case of tank rinsate), AFFF-Contaminated Incidental Waste, and metal components requiring disposal through final disposition (disposal). AFFF concentrate and solutions shall be accounted for at the originating location (i.e., building, etc.). Quantities of other AFFF contaminated system components requiring disposal shall also be accounted for. Disposal certificates for all materials destroyed by high temperature incineration shall indicate quantities of AFFF concentrate/solution (typically weights) or weights of solid components (i.e., bladders, etc.) treated, as applicable.

3.4 SPILL RESPONSE

In the event of a spill or release of a hazardous substance, or pollutant or contaminant, notify the Contracting Officer immediately. Direction from the Contracting Officer concerning a spill or release is not considered a

change under the contract. If the spill exceeds a reporting threshold, follow the pre-established procedures for immediate reporting to the Contracting Officer. Comply with applicable requirements of the installation Sill Prevention and Response Plan, JEGS, GoJ, prefectural, or local laws or regulations regarding any spill incident.

3.5 EMERGENCY CONTACTS

Whenever the Contractor ships hazardous materials, provide a 24 hr emergency response contact and phone number of a person knowledgeable about the hazardous materials being shipped and who has comprehensive emergency response and incident mitigation information for that material, or has immediate access to a person who possesses such knowledge and information. Always monitor the phone on a 24-hour basis when the hazardous materials are in transportation, including during storage incidental to transportation. Ensure that information regarding this emergency contact and phone number are placed on all hazardous material shipping documents. Designate an emergency coordinator and post the following information at areas in which hazardous wastes are managed:

a. The name of the emergency coordinator.

b. Phone number through which the emergency coordinator can be contacted on a 24 hour basis.

c. The telephone number of the local fire department.

d. The location of fire extinguishers and spill control materials.

-- End of Section --

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SECTION 02 82 00

ASBESTOS REMEDIATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE Z9.2	(2012) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

ASTM INTERNATIONAL (ASTM)

ASTM C732	(2006; R 2012) Aging Effects of Artificial Weathering on Latex Sealants
ASTM D2794	(1993; R 2010) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D4397	(2016) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D522/D522M	(2014) Mandrel Bend Test of Attached Organic Coatings
ASTM E119	(2018) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E1368	(2014) Visual Inspection of Asbestos Abatement Projects
ASTM E1494	(2012) Encapsulants for Spray- or Trowel-Applied Friable Asbestos-Containing Building Materials
ASTM E736/E736M	(2017) Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7	(2014) Compressed Air for Human Respiration; 6th Edition

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1	(2015) Occupational and Educational Personal Eye and Face Protection Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(2015) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH NMAM	(2016; 5th Ed) NIOSH Manual of Analytical Methods

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 560/5-85-024	(1985) Guidance for Controlling Asbestos-Containing Materials in Buildings (Purple Book)

U.S. DEPARTMENT OF DEFENSE (DOD)

JEGS	(Dec 2020) Japan Environmental Governing Standards

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1926.103	Respiratory Protection
29 CFR 1926.1101	Asbestos
29 CFR 1926.200	Accident Prevention Signs and Tags
29 CFR 1926.51	Sanitation
29 CFR 1926.59	Hazard Communication
40 CFR 61-SUBPART A	General Provisions
40 CFR 61-SUBPART M	National Emission Standard for Asbestos
40 CFR 763	Asbestos
42 CFR 84	Approval of Respiratory Protective Devices

49 CFR 107	Hazardous Materials Program Procedures
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

NAVFAC P-502	(2017) Asbestos Program Management
ND OPNAVINST 5100.23	(2005; Rev G) Navy Occupational Safety and Health (NAVOSH) Program Manual

UNDERWRITERS LABORATORIES (UL)

UL 586	(2009; Reprint Dec 2017) UL Standard for Safety High-Efficiency Particulate, Air Filter Units

1.2 DEFINITIONS

1.2.1 ACM

Asbestos Containing Materials.

1.2.2 Amended Water

Water containing a wetting agent or surfactant with a maximum surface tension of 2.9 Pa.

1.2.3 Area Sampling

Sampling of asbestos fiber concentrations which approximates the concentrations of asbestos in the theoretical breathing zone but is not actually collected in the breathing zone of an employee.

1.2.4 Asbestos

The term asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos and any of these minerals that has been chemically treated or altered. Materials are considered to contain asbestos if the asbestos content of the material is determined to be at least one tenth of one percent.

1.2.4.1 Asbestos-Containing Material (ACM)

Any materials containing more than one tenth of one percent (0.1%) asbestos.

1.2.5 Asbestos Control Area

That area where asbestos removal operations are performed which is isolated by physical boundaries which assist in the prevention of the uncontrolled release of asbestos dust, fibers, or debris.

1.2.6 Asbestos Fibers

Those fibers having an aspect ratio of at least 3:1 and longer than 5 micrometers as determined by National Institute for Occupational Safety and Health (NIOSH) Method 7400.

1.2.7 Asbestos Permissible Exposure Limit

0.1 fibers per cubic centimeter of air as an 8-hour time weighted average measured in the breathing zone as defined by 29 CFR 1926.1101 or other Federal legislation having legal jurisdiction for the protection of workers health.

1.2.8 Authorized Person

Any person authorized by the Contractor and required by work duties to be present in the regulated areas.

1.2.9 Background

The ambient airborne asbestos concentration in an uncontaminated area as measured prior to any asbestos hazard abatement efforts. Background concentrations for other (contaminated) areas are measured in similar but asbestos free locations.

1.2.10 Building Inspector

Individual who inspects buildings for asbestos and has EPA Model Accreditation Plan (MAP) "Building Inspector" training; accreditation required by 40 CFR 763, Subpart E, Appendix C, has EPA/State certification/license as a "Building Inspector".

1.2.11 Competent Person (CP)

A person meeting the requirements for competent person as specified in 29 CFR 1926.1101 including a person capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, and is specifically trained in a training course which meet the criteria of EPA's Model Accreditation Plan (40 CFR 763) for contractor/supervisor, and is AHERA certified as a contractor/supervisor.

1.2.12 Contractor

The Contractor is that individual, or entity under contract to perform the herein listed work.

1.2.13 Class I Asbestos Work

Activities defined by OSHA involving the removal of thermal system insulation (TSI) and surfacing ACM.

1.2.14 Class II Asbestos Work

Activities defined by OSHA involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos - containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic. Certain "incidental" roofing materials such as mastic, flashing and cements when they are still intact are excluded from Class II asbestos work. Removal of small amounts of these materials which would fit into a glovebag may be classified as a Class III job.

1.2.15 Class III Asbestos Work

Activities defined by OSHA that involve repair and maintenance operations, where ACM, including TSI and surfacing ACM, is likely to be disturbed. Operations may include drilling, abrading, cutting a hole, cable pulling, crawling through tunnels or attics and spaces above the ceiling, where asbestos is actively disturbed or asbestos-containing debris is actively disturbed.

1.2.16 Class IV Asbestos Work

Maintenance and custodial construction activities during which employees contact but do not disturb ACM and activities to clean-up dust, waste and debris resulting from Class I, II, and III activities. This may include dusting surfaces where ACM waste and debris and accompanying dust exists and cleaning up loose ACM debris from TSI or surfacing ACM following construction

1.2.17 Contractor/Supervisor

Individual who supervises asbestos abatement work and has EPA Model Accreditation Plan "Contractor/Supervisor" training; and is AHERA certified as a "Contractor/Supervisor".

1.2.18 Disposal Bag

A 0.15 mm thick, leak-tight plastic bag, pre-labeled in accordance with 29 CFR 1926.1101, used for transporting asbestos waste from containment to disposal site.

1.2.19 Disturbance

Activities that disrupt the matrix of ACM, crumble or pulverize ACM, or generate visible debris from ACM. Disturbance includes cutting away small amounts of ACM, no greater than the amount which can be contained in one standard sized glovebag or waste bag, not larger than 1.5 m in length and width in order to access a building component.

1.2.20 Encapsulation

The abatement of an asbestos hazard through the appropriate use of chemical encapsulants.

1.2.21 Encapsulants

Specific materials in various forms used to chemically or physically entrap asbestos fibers in various configurations to prevent these fibers from becoming airborne. There are four types of encapsulants as follows

which must comply with performance requirements as specified herein.

a. Removal Encapsulant (can be used as a wetting agent)

b. Bridging Encapsulant (used to provide a tough, durable surface coating to asbestos containing material)

c. Penetrating Encapsulant (used to penetrate the asbestos containing material encapsulating all asbestos fibers and preventing fiber release due to routine mechanical damage)

d. Lock-Down Encapsulant (used to seal off or "lock-down" minute asbestos fibers left on surfaces from which asbestos containing material has been removed).

1.2.22 Friable Asbestos Material

A term defined in the JEGS meaning any material which contains more than 0.1 percent asbestos, as determined using the method specified in the JEGS, that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

1.2.23 Glovebag Technique

Those asbestos removal and control techniques put forth in 29 CFR 1926.1101 utilizing a bag not more than 1.5 by 1.5 m impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which material and tools may be handled.

1.2.24 Government Consultant (GC)

That qualified person employed directly by the Government to monitor, sample, inspect the work or in some other way advise the Contracting Officer. The GC is normally a private consultant, but can be an employee of the Government.

1.2.25 HEPA Filter Equipment

High efficiency particulate air (HEPA) filtered vacuum and exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters must retain 99.97 percent of particles 0.3 microns or larger as indicated in UL 586.

1.2.26 Industrial Hygienist (IH)/Private Qualified Person (PQP)

A registered Architect, Professional Engineer (licensed), or U.S. Certified Industrial Hygienist who has successfully completed training in, and is accredited under a legitimate Model Accreditation Plan, as described in 40 CFR 763, as a certified Building Inspector, Contractor/Supervisor, and Project Designer. The IH/PQP shall have working knowledge of applicable U.S. Federal and Japanese occupational safety and health regulations for asbestos in construction.

The IH/PQP shall be considered a competent person as defined in 29 CFR 1926.1101. The IH/PQP shall be a third party Contractor and have no employee/employer relationship or financial relationship with the abatement Contractor, which could constitute a conflict of interest.

1.2.27 Industrial Hygiene Technician

The Industrial Hygiene Technician (IHT) shall be an employee of the IH/PQP or the testing laboratory, have a minimum of 2 years experience in the industrial hygiene field working under the direction of the IH/PQP, and have completed the following courses: "Contractor Supervisor Abatement Worker" and "Asbestos Project Designer".

1.2.28 Model Accreditation Plan (MAP)

USEPA training accreditation requirements for persons who work with asbestos as specified in 40 CFR 763.

1.2.29 Negative Initial Exposure Assessment

A demonstration by the Contractor to show that employee exposure during an operation is expected to be consistently below the OSHA Permissible Exposure Limits (PELs).

1.2.30 Negative Pressure Enclosure (NPE)

That engineering control technique described as a negative pressure enclosure in 29 CFR 1926.1101.

1.2.31 NESHAP

National Emission Standards for Hazardous Air Pollutants. The USEPA NESHAP regulation for asbestos is at 40 CFR 61-SUBPART M.

1.2.32 Nonfriable Asbestos Material

A term defined in the JEGS meaning a material that contains asbestos in which the fibers have been immobilized by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not normally release asbestos fibers during any appropriate use, handling, storage or transportation. It is understood that asbestos fibers may be released under other conditions such as demolition, removal, or mishap.

1.2.33 Permissible Exposure Limits (PELs)

1.2.33.1 PEL-Time Weighted Average(TWA)

Concentration of asbestos not in excess of 0.1 fibers per cubic centimeter of air (f/cc) as an 8-hour time weighted average (TWA).

1.2.33.2 PEL-Excursion Limit

An airborne concentration of asbestos not in excess of 1.0 f/cc of air as averaged over a sampling period of 30 minutes.

1.2.34 Personal Sampling

Air sampling which is performed to determine asbestos fiber concentrations within the breathing zone of a specific employee, as performed in accordance with 29 CFR 1926.1101.

1.2.35 Private Qualified Person (PQP)

That qualified person hired by the Contractor to perform the herein listed

tasks.

1.2.36 Qualified Person (QP)

A Registered Architect, Professional Engineer, Certified Industrial Hygienist, consultant or other qualified person who has successfully completed training and is therefore accredited under a legitimate Model Accreditation Plan as described in 40 CFR 763 as a Building Inspector and Contractor/Supervisor Abatement Worker; . The QP must be qualified to perform visual inspections as indicated in ASTM E1368.

1.2.37 Regulated Asbestos Containing Material

Friable asbestos material; Category I nonfriable ACM that has become friable; Category I nonfriable ACM that will be or has been subjected to sanding grinding, cutting, or abrading; or Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations.

1.2.38 TEM

Refers to Transmission Electron Microscopy.

1.2.39 Time Weighted Average (TWA)

The TWA is an 8-hour time weighted average airborne concentration of asbestos fibers.

1.2.40 Transite

A generic name for asbestos cement wallboard and pipe.

1.2.41 Wetting Agent

A chemical added to water to reduce the water's surface tension thereby increasing the water's ability to soak into the material to which it is applied. An equivalent wetting agent must have a surface tension of at most 2.9 Pa.

1.2.42 Worker

Individual (not designated as the Competent Person or a supervisor) who performs asbestos work and has completed asbestos worker training required by 29 CFR 1926.1101, to include EPA Model Accreditation Plan (MAP) "Worker" training; accreditation, if required by the OSHA Class of work to be performed.

1.3 REQUIREMENTS

1.3.1 Description of Work

The work covered by this section includes the handling and control of asbestos containing materials and describes some of the resultant procedures and equipment required to protect workers, the environment and occupants of the building or area, or both, from contact with airborne asbestos fibers. The work also includes the disposal of any asbestos containing materials generated by the work. More specific operational procedures must be outlined in the Asbestos Hazard Abatement Plan called

for elsewhere in this specification. The asbestos work includes the [demolition and removal][encapsulation] of [_____] located [_____] [which is governed by 40 CFR 763 and NAVFAC P-502].[Under normal conditions non-friable or chemically bound materials containing asbestos would not be considered hazardous; however, this material may release airborne asbestos fibers during demolition and removal and therefore must be handled in accordance with the removal and disposal procedures as specified herein and/or developed by the IH/PQP and pre-approved by the Government.] Provide techniques as outlined in this specification. The [building][work area] will be evacuated during the asbestos abatement work. A competent person must supervise asbestos removal work as specified herein.

1.3.1.1 Wallboard/Joint Compound

[Discrete samples of the components (wallboard and joint compound) have been tested and results are shown in the attached Hazardous Material Survey.

][Discrete samples of the wallboard were tested and found to contain [less than one tenth of one percent asbestos] [_____]. Discrete samples of the joint compound were tested and found to contain [greater than one tenth of one percent asbestos] [_____].

]1.3.2 Unexpected Discovery of Asbestos

The Contractor shall be responsible to review the available asbestos survey reports for this project, including, but not limited to:[insert title of report, Company who developed the report and the date of the report]

The Contractor's IH/PQP shall review the existing asbestos survey report(s) to develop the appropriate work response to ACM which may be disturbed as part of this project. Should the contract require the Contractor to perform any hazardous material survey, the Contractor shall provide a copy of all surveys/sampling activities and analytical results regarding asbestos to the Contracting Officer. The Asbestos Abatement Contractor shall also submit an Asbestos Hazard Abatement Plan, reviewed and certified by the IH/PQP, to the Contracting Officer for review before asbestos abatement work begins.

The Contractor shall review the existing Hazardous Material Reports and familiarize themselves on the specific homogeneous materials that were tested and all materials that were determined to be ACM. The Contractor shall be responsible for visually confirming the presence of these materials. The Contractor shall remove ACM which would otherwise be disturbed during normal work practices to execute the work required by this project:

The Contractor shall notify the Contracting Officer if any previously untested building components suspected to contain asbestos are discovered and will be impacted by the work. The material(s) in question shall not be disturbed until a response is received by the Contracting Officer. For any previously untested building components suspected to contain asbestos and located in areas impacted by the work, notify the Contracting Officer (CO) who will order up to [_____] bulk samples to be obtained at the Contractor's expense and delivered to a laboratory accredited under the National Institute of Standards and Technology (NIST) "National Voluntary Laboratory Accreditation Program (NVLAP)" and analyzed by PLM. The laboratory shall have a working definition of “Trace” amounts of asbestos,

and the laboratory shall report any detectable amount of asbestos in a bulk sample that is less than the PLM Limit of Quantification of 1% as a “Trace” concentration. If PLM does not detect the presence of asbestos (e.g. “non-detect”), the material shall be considered <0.1% asbestos. If PLM analysis detects asbestos in any discernible amount (to include “trace” or “less than 1%”), the material shall be considered >0.1% asbestos unless proven to be non-ACM by the use of quantification methods capable of achieving an analytical sensitivity of less than 0.1%, such as Transmission Electron Microscopy (TEM) or 1000 point counting. The CO will order up to [_____] samples to be analyzed further by TEM or 1000 point counting. Any additional components identified as ACM that have been approved by the CO for removal shall be removed and will be paid for by an equitable adjustment to the contract price under the CONTRACT CLAUSE titled "changes". Sampling shall be conducted by personnel who have successfully completed the EPA Model Accreditation Plan (MAP) "Building Inspector" training course and is EPA/State certified/licensed as a "Building Inspector".

1.3.3 Medical Requirements

Provide medical requirements including but not limited to medical surveillance and medical record keeping as listed in 29 CFR 1926.1101.

1.3.3.1 Medical Examinations

Before exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination as required by 29 CFR 1926.1101 or other pertinent local, prefectural or Government of Japan (GOJ) directives. This requirement must have been satisfied within the 12 months prior to the start of work on this contract. The same medical examination must be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. Specifically identify x-ray films of asbestos workers to the consulting radiologist and mark medical record jackets with the word "ASBESTOS."

1.3.3.2 Medical Records

Maintain complete and accurate records of employees' medical examinations, medical records, and exposure data for a period of [30 years][indefinite time] after termination of employment and make records of the required medical examinations and exposure data available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health (OSHA), or authorized representatives of them, and an employee's physician upon the request of the employee or former employee.

1.3.4 Employee Training

Submit certificates, prior to the start of work but after the main abatement submittal, signed by each employee indicating that the employee has received training in the proper handling of materials and wastes that contain asbestos in accordance with 40 CFR 763; understands the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limits of the respiratory equipment to be used; and understands the results of monitoring of airborne quantities of asbestos as related to health and respiratory equipment as indicated in 29 CFR 1926.1101 on an initial and annual basis. Organize certificates by individual worker, not grouped by type of certification.[Post appropriate evidence of compliance with the

training requirements of 40 CFR 763.] Train personnel involved in the asbestos control work in accordance with United States Environmental Protection Agency (USEPA) Asbestos Hazard Emergency Response Act (AHERA) training criteria. Document the training by providing: dates of training, training entity, course outline, names of instructors, and qualifications of instructors upon request by the Contracting Officer. Furnish each employee with respirator training and fit testing administered by the PQP as required by 29 CFR 1926.1101 and 29 CFR 1926.103. Fully cover engineering and other hazard control techniques and procedures.

1.3.5 Permits[, Licenses,] and Notifications

Prior to the start of work, obtain necessary permits[and licenses] in conjunction with asbestos removal, encapsulation, hauling, and disposition, and furnish notification of such actions required by local, prefectural and GOG regulations. Notify the Contracting Officer in writing [10] [20] [_____] working days prior to commencement of work in accordance with 40 CFR 61-SUBPART M and applicable laws, ordinances, criteria, rules, and regulations[_____]. In accordance with the JEGS, prior to demolition or renovation of a facility that involves removing or disturbing friable ACM, a written assessment of the action will be prepared and submitted to the installation commander via the Contracting Officer. Submit copies of all Notifications to the Contracting Officer.[Notify the local fire department 3 days prior to removing fire-proofing material from the building including notice that the material contains asbestos.]

1.3.6 Environment, Safety and Health Compliance

In addition to detailed requirements of this specification, comply with those applicable laws, ordinances, criteria, rules, and regulations of local prefectural and GOJ regulations regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of EM 385-1-1, 29 CFR 1926.1101, 40 CFR 61-SUBPART A, 40 CFR 61-SUBPART M, 40 CFR 763 and ND OPNAVINST 5100.23. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work. Where the requirements of this specification, applicable laws, rules, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirement as defined by the Government apply. The following laws, ordinances, criteria, rules and regulations regarding removal, handling, storing, transporting and disposing of asbestos materials apply:

a. [_____]

b. [_____]

c. [_____].

1.3.7 Respiratory Protection Program

Establish and implement a respirator program as required by 29 CFR 1926.1101, and 29 CFR 1926.103. Submit a written description of the program to the Contracting Officer. Submit a written program manual or operating procedure including methods of compliance with regulatory statutes.

1.3.7.1 Respirator Program Records

Submit records of the respirator program as required by 29 CFR 1926.103, and 29 CFR 1926.1101.

1.3.7.2 Respirator Fit Testing

The Contractor's PQP must conduct a qualitative or quantitative fit test conforming to 29 CFR 1926.103 for each worker required to wear a respirator, and any authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test must be performed prior to initially wearing a respirator and every 12 months thereafter. If physical changes develop that will affect the fit, a new fit test must be performed. Functional fit checks must be performed each time a respirator is put on and in accordance with the manufacturer's recommendation.

1.3.7.3 Respirator Selection and Use Requirements

Provide respirators, and ensure that they are used as required by 29 CFR 1926.1101 and in accordance with CGA G-7 and the manufacturer's recommendations. Respirators must be approved by the National Institute for Occupational Safety and Health NIOSH, under the provisions of 42 CFR 84, for use in environments containing airborne asbestos fibers. For air-purifying respirators, the particulate filter must be high-efficiency particulate air (HEPA)/(N-,R-,P-100). The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type must be made by the Contractor's Designated IH based on the measured or anticipated airborne asbestos fiber concentrations to be encountered.

1.3.8 Asbestos Hazard Control Supervisor

The Contractor must be represented on site by a supervisor, trained using the model Contractor accreditation plan as indicated in the Federal statutes for all portions of the herein listed work.

1.3.9 Hazard Communication

Adhere to all parts of 29 CFR 1926.59 and provide the Contracting Officer with a copy of the Safety Data Sheets (SDS) for all materials brought to the site.

1.3.10 Asbestos Hazard Abatement Plan

Submit a detailed plan of the safety precautions such as lockout, tagout, tryout, fall protection, and confined space entry procedures and equipment and work procedures to be used in the [encapsulation] [removal] [and demolition] of materials containing asbestos. The plan, not to be combined with other hazard abatement plans, must be prepared, signed, and sealed by the PQP. Provide a Table of Contents for each abatement submittal, which follows the sequence of requirements in the contract. The plan must include but not be limited to the precise personal protective equipment to be used including, but not limited to, respiratory protection, type of whole-body protection[and if reusable coveralls are to be employed decontamination methods (operations and quality control plan)], the location of asbestos control areas including clean and dirty areas, buffer zones, showers, storage areas, change rooms, [removal] [encapsulation] method, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent

and asbestos sealer to be used, locations of local exhaust equipment, planned air monitoring strategies, and a detailed description of the method to be employed in order to control environmental pollution. The plan must also include (both fire and medical emergency) response plans and an Activity Hazard Analyses (AHAs) in accordance with EM 385-1-1. The Asbestos Hazard Abatement Plan must be approved in writing prior to starting any asbestos work. The Contractor, Asbestos Hazard Control Supervisor,, CP and PQP must meet with the Contracting Officer prior to beginning work, to discuss in detail the Asbestos Hazard Abatement Plan, including work procedures and safety precautions. Once approved by the Contracting Officer, the plan will be enforced as if an addition to the specification. Any changes required in the specification as a result of the plan must be identified specifically in the plan to allow for free discussion and approval by the Contracting Officer prior to starting work.

1.3.11 Testing Laboratory

Submit the name, address, and telephone number of each testing laboratory selected for the[sampling,] analysis, and reporting of airborne concentrations of asbestos fibers along with[evidence that each laboratory selected holds the appropriate State license and permits and] certification that each laboratory is American Industrial Hygiene Association (AIHA) accredited and that persons counting the samples have been judged proficient by current inclusion on the AIHA Asbestos Analysis Registry (AAR) and successful participation of the laboratory in the Proficiency Analytical Testing (PAT) Program. Where analysis to determine asbestos content in bulk materials or transmission electron microscopy is required, submit evidence that the laboratory is accredited by the National Institute of Science and Technology (NIST) under National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis. The testing laboratory firm must be independent of the asbestos contractor and must have no employee or employer relationship which could constitute a conflict of interest.

1.3.12 Landfill Approval

Submit written evidence that the landfill is approved for asbestos disposal by local prefectural and GOJ regulatory agencies. Within three working days after delivery, submit detailed delivery tickets, prepared, signed, and dated by an agent of the landfill, certifying the amount of asbestos materials delivered to the landfill. Submit a copy of the waste shipment records within one day of the shipment leaving the project site.

1.3.12.1 Records

The Contractor shall maintain records of all waste sampling and test data. The data shall include results of analyses performed, sample locations, the time of collection, and other pertinent data as applicable during the life of the contract. Transportation, treatment, and disposal methods and dates; quantities of wastes; names and addresses of each transporter and the dispsoal or reclamation facility, shall also be recorded and made available for inspection, along with the following documents:

1. Asbestos Waste Shipment Records
2. Waste Analyses
3. Licenses
4. Permits
5. Scale Weight Measurements

6. Weight Bills and Delivery Tickets

1.3.13 Transporter Certification

Submit written evidence that the transporter is approved to transport asbestos waste in accordance with the DOT requirements of 49 CFR 171, 49 CFR 172 and 49 CFR 173 as well as registration requirements of 49 CFR 107 and all other GOJ and local prefectural regulatory agency requirements.

1.3.14 Medical Certification

Provide a written certification for each worker and supervisor, signed by a licensed physician indicating that the worker and supervisor has met or exceeded all of the medical prerequisites listed herein and in 29 CFR 1926.1101 and 29 CFR 1926.103 as prescribed by law. Submit certificates prior to the start of work but after the main abatement submittal.

1.4 SUBMITTALS

The Contractor's PQP shall, at a minimum, review and certify all submittals required under this section prior to submission to the Government. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Amended Water; G [, [_____]]

Safety Data Sheets (SDS) for All Materials; G [, [_____]]

Encapsulants; G [, [_____]]

Respirators; G [, [_____]]

Local Exhaust Equipment; G [, [_____]]

Pressure Differential Automatic Recording Instrument; G [, [_____]]

Vacuums; G [, [_____]]

[Glovebags; G [, [_____]]

] SD-06 Test Reports

Air Sampling Results; G [, [_____]]

Pressure Differential Recordings for Local Exhaust System; G [, [_____]]

[Encapsulation Test Patches; G [, [_____]]

] Clearance Sampling; G [, [_____]]

Asbestos Disposal Quantity Report; G [, [_____]]

SD-07 Certificates

Employee Training; G [, [_____]]

Notifications; G [, [_____]]

Respiratory Protection Program; G [, [_____]]

Asbestos Hazard Abatement Plan; G [, [_____]]

Testing Laboratory; G [, [_____]]

Landfill Approval; G [, [_____]]

Delivery Tickets; G [, [_____]]

Waste Shipment Records; G [, [_____]]

Transporter Certification; G [, [_____]]

Medical Certification; G [, [_____]]

Private Qualified Person Documentation; G [, [_____]]

Competent Person; G [, [_____]]

Worker's License; G [, [_____]]

Contractor's License; G [, [_____]]

Encapsulants; G [, [_____]]

Equipment Used to Contain Airborne Asbestos Fibers; G [, [_____]]

Water Filtration Equipment; G [, [_____]]

Vacuums; G [, [_____]]

Ventilation Systems;G [, [_____]]

SD-11 Closeout Submittals

Permits[and Licenses]; G [, [_____]]

Notifications; G [, [_____]]

Respirator Program Records; G [, [_____]]

][Protective Clothing Decontamination Facility Notification; G [, [_____]]

] Rental Equipment; G [, [_____]]

SD-11 Closeout Submittals

Records

1.5 QUALITY ASSURANCE

1.5.1 Additional Requirements

In addition to detailed requirements of this specification, work performed under this contract shall comply with the JEGS, EM 385-1-1, applicable federal, GOJ, and local laws, ordinances, criteria, rules and regulations regarding handling, storing, transporting, and disposing of asbestos waste materials. Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply. The following GOJ and local laws, rules and regulations regarding demolition, removal, encapsulation, construction alteration, repair, maintenance, renovation, spill/emergency cleanup, housekeeping, handling, storing, transporting and disposing of asbestos material apply:

Japan Environmental Governing Standards (JEGS), most recent version .

1.5.2 Private Qualified Person Documentation

Submit the name, address, telephone number, and resume of the Private Qualified Person (PQP) selected to prepare the Asbestos Hazard Abatement Plan, direct monitoring and training, direct air monitoring and assist the Contractor's Competent Person in implementing and ensuring that safety and health requirements are complied with during the performance of all required work, and documented evidence that the PQP has successfully completed training in and is accredited and where required is certified as, a Building Inspector and Contractor/Supervisor Abatement Worker. as described by 40 CFR 763. Submit certification to show that the PQP is a Registered Architect, Professional Engineer (licensed) or US Certified Industrial Hygienist determined and documented by the American Board of Industrial Hygiene (ABIH). A copy of the PQP's current valid ABIH certification and/or documentation that the PQP is a registered Architect or Professional Engineer shall be provided. The PQP and the asbestos contractor must not have an employee/employer relationship or financial relationship which could constitute a conflict of interest. The PQP must be a first tier subcontractor. The Designated IH/PQP shall [be onsite at all times] [visit the site at least [_____] per [month] [week]] for the duration of asbestos activities and shall be available for emergencies. In addition, submit resumes of additional IH/PQP's and industrial hygiene technicians (IHT) who will be assisting the Designated IH/PQP in performing onsite tasks. IH/PQPs and IHTs supporting the Designated IH/PQP shall have a minimum of [2 years] [_____] of practical onsite asbestos abatement experience. Indicate the formal reporting relationship between the Designated IH/PQP and the support IH/PQPs and IHTs, the Designated Competent Person, and the Contractor.

1.5.3 Competent Person Documentation

The Competent Person must be experienced in the administration and supervision of asbestos abatement projects including exposure assessment and monitoring, work practices, abatement methods, protective measures for personnel, setting up and inspecting asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, ACM generated waste containment and disposal procedures, decontamination units installation and maintenance

requirements, site safety and health requirements, notification of other employees onsite, [_____]. The Competent Person must be on-site at all times when asbestos abatement activities are underway. Submit training certification and a current EPA MAP "Contractor/Supervisor" training certificates.. Submit evidence that the Competent Person has a minimum of 2 years of comprehensive experience in planning and overseeing asbestos abatement activities and is experienced in the administration and supervision of asbestos abatement projects relevant to OSHA competent person requirements, including exposure assessment and monitoring, work practices, abatement methods, protective measures for personnel, setting up and inspecting asbestos abatement work areas, evaluating the integrity of containment barriers, placement and operation of local exhaust systems, ACM generated waste containment and disposal procedures, decontamination units installation and maintenance requirements, site safety and health requirements, notification of other employees onsite, etc. The Designated Competent Person shall be responsible for compliance with the JEGS, applicable U.S. federal, GOJ, and local requirements, the Contractor's Accident Prevention Plan (APP) and Asbestos Hazard Abatement Plan (AHAP).

1.5.4 Worker's License

Submit documentation that workers meet the requirements of 29 CFR 1926.1101, 40 CFR 61-SUBPART M and other applicable federal, GOJ, and local requirements. Worker training documentation shall be provided as required on the "Certificate of Workers Acknowledgment". Training documentation is required for each employee who will perform OSHA Class I, Class II, Class III, or Class IV asbestos abatement operations. Such documentation shall be submitted on a Contractor generated form titled "Certificate of Workers Acknowledgment", to be completed for each employee in the same format. Training course completion certificates (initial and most recent update refresher) required by the information checked on the form shall be attached..

1.5.5 Contractor's License

Submit a copy of the asbestos contractor's AHERA Asbestos Worker(s) certification. Submit the following certification along with the license: "I certify that the personnel I am responsible for during the course of this project fully understand the contents of 29 CFR 1926.1101, 40 CFR 61-SUBPART MEM 385-1-1, and the Federal, JEGS, GOJ and local prefecture requirement for those asbestos abatement activities that they will be involved in." This certification statement must be signed by the Company's President or Chief Executive.

1.5.6 Air Sampling Results

Complete fiber counting and provide results to the PQP for review within 16 hours of the "time off" of the sample pump. Notify the Contracting Officer immediately of any airborne levels of asbestos fibers in excess of the acceptable limits. Submit sampling results to the Contracting Officer and the affected Contractor employees where required by law within three working days, signed by the testing laboratory employee performing air sampling, the employee that analyzed the sample, and the PQP and GC. Notify the Contractor and the Contracting Officer immediately of any results in excess of 0.01 fibers per cubic centimeter or background whichever is higher. In no circumstance must levels exceed 0.1 fibers per cubic centimeter.

1.5.7 Pressure Differential Recordings for Local Exhaust System

Provide a local exhaust system that creates a negative pressure of at least 0.51 mm of water relative to the pressure external to the enclosure and operate it continuously, 24-hours a day, until the temporary enclosure of the asbestos control area is removed. Submit pressure differential recordings for each work day to the PQP and GC for review and to the Contracting Officer within 24-hours from the end of each work day. Notify the Contractor and the Contracting Officer immediately of any variance in the pressure differential which could cause adjacent unsealed areas to have asbestos fiber concentrations in excess of 0.01 fibers per cubic centimeter or background whichever is higher.

[1.5.8 Protective Clothing Decontamination Quality Control Records

Keep all records that document quality control for the decontamination of reusable outer protective clothing in the Environmental Records Binder, on the project site.

][1.5.9 Protective Clothing Decontamination Facility Notification

Submit written evidence that persons who decontaminate, store, or transport asbestos contaminated clothing used in the performance of this contract were duly notified in accordance with 29 CFR 1926.1101.

]1.5.10 GOJ, Prefectural or Local Citations on Previous Projects

Keep a statement, signed by an officer of the company, containing a record of any citations issued by GOJ, Prefectural or local regulatory agencies relating to asbestos activities within the last 5 years (including projects, dates, and resolutions); a list of penalties incurred through non-compliance with asbestos project specifications, including liquidated damages, overruns in scheduled time limitations and resolutions; and situations in which an asbestos-related contract has been terminated (including projects, dates, and reasons for terminations) in the Environmental Records Binder on the project site. If there are none, a negative declaration signed by an officer of the company must be placed in the binder.

1.5.11 Preconstruction Conference

Conduct a safety preconstruction conference to discuss the details of the Asbestos Hazard Abatement Plan reviewed and certified by the Contractor's PQP, Accident Prevention Plan (APP) including the AHAs required in specification Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS [_____]. The safety preconstruction conference must include the Contractor and their Designated Competent Person, Designated IH and Project Supervisor and the Contracting Officer. Deficiencies in the APP will be discussed. Onsite work must not begin until the APP has been accepted. [_____]

1.6 SECURITY

[
[Twenty-four hour security guard] [Fenced and locked security area] [[_____] shall be provided for each regulated area.] A log book must be kept documenting entry into and out of the regulated area. Entry into regulated areas must only be by personnel authorized by the Contractor and the Contracting Officer. Personnel authorized to enter regulated areas must be trained, medically evaluated, and wear the required personal protective equipment.

1.7 EQUIPMENT

1.7.1 Rental Equipment

Provide a copy of the written notification to the rental company concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

PART 2 PRODUCTS

2.1 ENCAPSULANTS

Encapsulants must conform to current USEPA requirements, contain no toxic or hazardous substances as defined in 29 CFR 1926.59, and conform to the following performance requirements. Submit certificates stating that encapsulants meet the applicable specified performance requirements.

2.1.1 Removal Encapsulants

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	ASTM E84
Life Expectancy - 20 years	ASTM C732 Accelerated Aging Test
Permeability - Minimum 0.4 perms	ASTM E96/E96M
Fire Resistance - Negligible affect on fire resistance rating over 3 hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E119
Impact Resistance - Minimum 245.5 mm/N	ASTM D2794 Gardner Impact Test
Flexibility - no rupture or cracking	ASTM D522/D522M Mandrel Bend Test

2.1.2 Bridging Encapsulant

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	ASTM E84
Life Expectancy - 20 years	ASTM C732 Accelerated Aging Test
Permeability - Minimum 0.4 perms	ASTM E96/E96M

Requirement	Test Standard
Fire Resistance - Negligible affect on fire resistance rating over 3-hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E119
Impact Resistance - Minimum 245.5 mm/N	ASTM D2794 Gardner Impact Test
Flexibility - no rupture or cracking	ASTM D522/D522M Mandrel Bend Test

2.1.3 Penetrating Encapsulant

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	ASTM E84
Life Expectancy - 20 years	ASTM C732 Accelerated Aging Test
Permeability - Minimum 0.4 perms	ASTM E96/E96M
Cohesion/Adhesion Test - 729.5 N of force/meter	ASTM E119
Fire Resistance - Negligible affect on fire resistance rating over 3-hour test (Classified by UL for use over fibrous and cementitious sprayed fireproofing)	ASTM E119
Impact Resistance - Minimum 245.5 mm/N	ASTM D2794 Gardner Impact Test
Flexibility - no rupture or cracking	ASTM D522/D522M Mandrel Bend Test

2.1.4 Lock-down Encapsulant

Requirement	Test Standard
Flame Spread - 25, Smoke Emission - 50	ASTM E84
Life Expectancy - 20 years	ASTM C732 Accelerated Aging Test

Requirement	Test Standard
Permeability - Minimum 0.4 perms	ASTM E96/E96M
Fire Resistance - Negligible affect on fire resistance rating over 3-hour test (Tested with fireproofing over encapsulant applied directly to steel member)	ASTM E119
Bond Strength: 1459 N of force/meter	ASTM E736/E736M
(Tests compatibility with cementitious and fibrous fireproofing)	

[2.2 ENCASEMENT PRODUCTS

Encasement must consist of primary cellular polymer coat, polymer finish coat, and any other finish coat as approved by the Contracting Officer.

]2.3 DUCT TAPE

Industrial grade duct tape of appropriate widths suitable for bonding sheet plastic and disposal container.

2.4 DISPOSAL CONTAINERS

Leak-tight (defined as solids, liquids, or dust that cannot escape or spill out) disposal containers must be provided for ACM wastes as required by 29 CFR 1926.1101. Disposal containers can be in the form of:

a. Disposal Bags

b. Fiberboard Drums

c. Cardboard Boxes

2.5 SHEET PLASTIC

Sheet plastic must be polyethylene of 0.15 mm minimum thickness and must be provided in the largest sheet size necessary to minimize seams[, as indicated on the project drawings]. Film must be [clear][frosted][or][black] and conform to ASTM D4397, except as specified below

2.5.1 Flame Resistant

Where a potential for fire exists, flame-resistant sheets must be provided. Film must be [frosted][or][black] and must conform to the requirements of NFPA 701.

2.5.2 Reinforced

Reinforced sheets must be provided where high skin strength is required, such as where it constitutes the only barrier between the regulated area and the outdoor environment. The sheet stock must consist of translucent,

nylon-reinforced or woven-polyethylene thread laminated between 2 layers of polyethylene film. Film must meet flame resistant standards of NFPA 701.

2.6 MASTIC REMOVING SOLVENT

Mastic removing solvent must be nonflammable and must not contain methylene chloride, glycol ether, or halogenated hydrocarbons. Solvents used onsite must have a flash point greater than 60 degrees C.

2.7 LEAK-TIGHT WRAPPING

Two layers of 0.15 mm minimum thick polyethylene sheet stock must be used for the containment of removed asbestos-containing components or materials such as large tanks, boilers, insulated pipe segments and other materials. Upon placement of the ACM component or material, each layer must be individually leak-tight sealed with duct tape.

2.8 VIEWING INSPECTION WINDOW

Where feasible, a minimum of one clear, 3 mm thick, acrylic sheet,450 by 610 mm, must be installed as a viewing inspection window at eye level on a wall in each containment enclosure. The windows must be sealed leak-tight with industrial grade duct tape.

2.9 WETTING AGENTS

Removal encapsulant (a penetrating encapsulant) must be provided when conducting removal abatement activities that require a longer removal time or are subject to rapid evaporation of amended water. The removal encapsulant must be capable of wetting the ACM and retarding fiber release during disturbance of the ACM greater than or equal to that provided by amended water. Performance requirements for penetrating encapsulants are specified in paragraph ENCAPSULANTS above.

PART 3 EXECUTION

3.1 EQUIPMENT

Provide the Contracting Officer or the Contracting Officer's Representative, with at least [two] [_____] complete sets of personal protective equipment [including decontaminating reusable coveralls]as required for entry to and inspection of the asbestos control area. Provide equivalent training to the Contracting Officer or a designated representative as provided to Contractor employees in the use of the required personal protective equipment. Provide manufacturer's certificate of compliance for all equipment used to contain airborne asbestos fibers.

3.1.1 Air Monitoring Equipment

The Contractor's PQP must approve air monitoring equipment. The equipment must include, but must not be limited to:

a. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to 16 liters per minute.

b. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute, and a self-contained rechargeable power pack

capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps must also be equipped with an automatic flow control unit which must maintain a constant flow, even as filter resistance increases due to accumulation of fiber and debris on the filter surface.

c. Single use standard 25 mm diameter cassette, open face, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands for personal air sampling.

[d. Single use standard 25 mm diameter cassette, open face, 0.45 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive cowl, and shrink bands when conducting environmental area sampling using NIOSH NMAM Methods 7400 and 7402, (and the transmission electric microscopy method specified at 40 CFR 763 if required).

] e. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 20 to plus 60 degrees C and traceable to a NIST primary standard.

3.1.2 Respirators

Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

3.1.2.1 Respirators for Handling Asbestos

Provide personnel engaged in pre-cleaning, cleanup, handling, [encapsulation][removal][and][or][demolition] of asbestos materials with respiratory protection as indicated in 29 CFR 1926.1101 and 29 CFR 1926.103. Breathing air must comply with CGA G-7.

3.1.3 Exterior Whole Body Protection

3.1.3.1 Outer Protective Clothing

Provide personnel exposed to asbestos with disposable "non-breathable,"[or reusable "non-breathable"] whole body outer protective clothing, head coverings, gloves, and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but must not be used alone. Make sleeves secure at the wrists, make foot coverings secure at the ankles, and make clothing secure at the neck by the use of tape.[Reusable whole body outer protective clothing must be either disposed of as asbestos contaminated waste upon exiting from the asbestos regulated work area or be properly decontaminated.]

3.1.3.2 Work Clothing

Provide cloth work clothes for wear under the outer protective clothing and foot coverings and either dispose of or properly decontaminate them as recommended by the [GC][PQP] after each use.

3.1.3.3 Personal Decontamination Unit

Provide a temporary, negative pressure unit with a separate

decontamination locker room and clean locker room with a shower that complies with 29 CFR 1926.51(f)(4)(ii) through (V) in between for personnel required to wear whole body protective clothing. Provide two separate lockers for each asbestos worker, one in each locker room. Keep street clothing and street shoes in the clean locker. HEPA vacuum and remove asbestos contaminated disposable protective clothing while still wearing respirators at the boundary of the asbestos work area and seal in impermeable bags or containers for disposal.[HEPA vacuum and remove asbestos contaminated reusable protective clothing while still wearing respirators at the boundary of the asbestos work area, seal in two impermeable bags, label outer bag as asbestos contaminated waste, and transport for decontamination.] Do not wear work clothing between home and work. Locate showers between the decontamination locker room and the clean locker room and require that all employees shower before changing into street clothes. Collect used shower water and filter with approved water filtration equipment to remove asbestos contamination. Wastewater filters must be installed in series with the first stage pore size [20] [_____] microns and the second stage pore size of [5] [_____] microns. Dispose of filters and residue as asbestos waste. Discharge clean water to the sanitary system. Dispose of asbestos contaminated work clothing as asbestos contaminated waste[or properly decontaminate as specified in the Contractor's Asbestos Hazard Abatement Plan]. Keep the floor of the decontamination unit's clean room dry and clean at all times. Proper housekeeping and hygiene requirements must be maintained. Provide soap and towels for showering, washing and drying. Cloth towels provided must be disposed of as ACM waste or must be laundered in accordance with 29 CFR 1926.1101. Physically attach the decontamination units to the asbestos control area. Construct both a personnel decontamination unit and an equipment decontamination unit onto and integral with each asbestos control area.

[3.1.3.4 Decontamination of Reusable Outer Protective Clothing

When reusable outer protective clothing is used, transport the double bagged clothing to a previously notified commercial/industrial decontamination facility for decontamination. Perform non-destructive testing to determine the effectiveness of asbestos decontamination. If representative sampling is used, ensure the statistical validity of the sampling results. If representative sampling is used, reject any entire batch in which any of the pieces exceed 40 fibers per square millimeter. Inspect reusable protective clothing prior to use to ensure that it will provide adequate protection and is not or is not about to become ripped, torn, deteriorated, or damaged, and that it is not visibly contaminated. Notify, in writing, all personnel involved in the decontamination of reusable outer protective clothing as indicated in 29 CFR 1926.1101.

]3.1.3.5 Eye Protection

Provide eye protection that complies with ANSI/ISEA Z87.1 when operations present a potential eye injury hazard. Provide goggles to personnel engaged in asbestos abatement operations when the use of a full face respirator is not required.

3.1.4 Regulated Areas

All Class I, II, and III asbestos work must be conducted within regulated areas. The regulated area must be demarcated to minimize the number of persons within the area and to protect persons outside the area from exposure to airborne asbestos. Control access to regulated areas, ensure

that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

3.1.5 Load-out Unit

Provide a temporary load-out unit that is adjacent and connected to the regulated area[and][access tunnel]. Attach the load-out unit in a leak-tight manner to each regulated area.

3.1.6 Warning Signs and Labels

Provide bilingual warning signs printed in English and Japanese at all approaches to asbestos control areas. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to the requirements are acceptable

3.1.6.1 Warning Sign

Provide vertical format conforming to 29 CFR 1926.200, and 29 CFR 1926.1101 minimum 500 by 355 mm displaying the following legend in the lower panel:

Legend	Notation
DANGER	25 mm Sans Serif Gothic or Block
ASBESTOS	25 mm Sans Serif Gothic or Block
MAY CAUSE CANCER	25 mm Sans Serif Gothic or Block
CAUSES DAMAGE TO LUNGS	6 mm Sans Serif Gothic or Block
AUTHORIZED PERSONNEL ONLY	6 mm Sans Serif Gothic or Block
[WEAR RESPIRATORY PROTECTION AND PROTECTIVE CLOTHING IN THIS AREA]	6 mm Sans Serif Gothic or Block

Spacing between lines must be at least equal to the height of the upper of any two lines.

3.1.6.2 Warning Labels

Provide labels conforming to 29 CFR 1926.1101 of sufficient size to be clearly legible, displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST AVOID CREATING DUST

3.1.7 Local Exhaust System

Provide a local exhaust system in the asbestos control area in accordance with ASSE/SAFE Z9.2 and 29 CFR 1926.1101 that will provide at least four air changes per hour inside of the negative pressure enclosure. Local exhaust equipment must be operated 24-hours per day, until the asbestos control area is removed and must be leak proof to the filter and equipped with HEPA filters. Maintain a minimum pressure differential in the control area of minus 0.51 mm of water column relative to adjacent, unsealed areas. Provide continuous 24-hour per day monitoring of the pressure differential with a pressure differential automatic recording instrument. The building ventilation system must not be used as the local exhaust system for the asbestos control area. Filters on exhaust equipment must conform to ASSE/SAFE Z9.2 and UL 586. Terminate the local exhaust system out of doors and remote from any public access or ventilation system intakes.

3.1.8 Tools

Vacuums must be leak proof to the filter and equipped with HEPA filters. Filters on vacuums must conform to ASSE/SAFE Z9.2 and UL 586. Do not use power tools to remove asbestos containing materials unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation systems. Remove all residual asbestos from reusable tools prior to storage or reuse. Reusable tools must be thoroughly decontaminated prior to being removed from the regulated areas.

3.1.9 Rental Equipment

If rental equipment is to be used, furnish written notification to the rental agency concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

[3.1.10 Glovebags

Submit written manufacturers proof that glovebags will not break down under expected temperatures and conditions. The glovebag assembly shall be 0.15 mm thick plastic, prefabricated and seamless at the bottom with preprinted OSHA warning label.

]3.1.11 Single Stage Decontamination Area

A decontamination area (equipment room/area) must be provided for Class I work involving less than 7.5 m or 0.9 square meters of TSI or surfacing ACM, and for Class II and Class III asbestos work operations where exposures exceed the PELs or where there is no negative exposure assessment. The equipment room or area must be adjacent to the regulated area for the decontamination of employees, material, and their equipment

which could be contaminated with asbestos. The area must be covered by an impermeable drop cloth on the floor or horizontal working surface. The area must be of sufficient size to accommodate cleaning of equipment and removing personal protective equipment without spreading contamination beyond the area.

3.1.12 Decontamination Area Exit Procedures

Ensure that the following procedures are followed:

a. Before leaving the regulated area, remove all gross contamination and debris from work clothing using a HEPA vacuum.

b. Employees must remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers for disposal or laundering.

c. Employees must not remove their respirators until showering.

d. Employees must shower prior to entering the clean room. If a shower has not been located between the equipment room and the clean room or the work is performed outdoors, ensure that employees engaged in Class I asbestos jobs: a) Remove asbestos contamination from their work suits in the equipment room or decontamination area using a HEPA vacuum before proceeding to a shower that is not adjacent to the work area; or b) Remove their contaminated work suits in the equipment room, without cleaning worksuits, and proceed to a shower that is not adjacent to the work area.

3.2 WORK PROCEDURE

Perform asbestos related work in accordance with the JEGS, 29 CFR 1926.1101, 40 CFR 61-SUBPART M, NAVFAC P-502, and as specified herein. Use [[wet][or][if given prior EPA approval, dry] removal procedures][appropriate encapsulation procedures as listed in the asbestos hazard abatement plan] and [negative pressure enclosure] [_____] techniques. Wear and utilize protective clothing and equipment as specified herein. No eating, smoking, drinking, chewing gum, tobacco, or applying cosmetics is permitted in the asbestos work or control areas. Personnel of other trades not engaged in the [encapsulation][removal and demolition] of asbestos containing material must not be exposed at any time to airborne concentrations of asbestos unless all the personnel protection and training provisions of this specification are complied with by the trade personnel.[Seal all roof top penetrations, except plumbing vents, prior to asbestos roofing work.] Shut down the building heating, ventilating, and air conditioning system, cap the openings to the system, [and provide temporary [heating,][and][ventilation,][and][air conditioning]] prior to the commencement of asbestos work. Power to the regulated area must be locked-out and tagged in accordance with 29 CFR 1910.147.[Disconnect electrical service when [encapsulation][wet removal] is performed and provide temporary electrical service with verifiable ground fault circuit interrupter (GFCI) protection prior to the use of any [water][encapsulant].] All electrical work must be performed by a licensed electrician. Stop abatement work in the regulated area immediately when the airborne total fiber concentration: (1) equals or exceeds 0.01 f/cc, or the pre-abatement concentration, whichever is greater, outside the regulated area; or (2) equals or exceeds 1.0 f/cc inside the regulated area. Correct the condition to the satisfaction of the PQP , including visual inspection and air sampling. Work must resume

only upon notification by the Contracting Officer once the PQP has certified that the condition has been corrected. Corrective actions must be documented. If an asbestos fiber release or spill occurs[outside of the asbestos control area], stop work immediately, correct the condition to the satisfaction of the PQP. Submit the documents certified by the PQP to the Contracting Officer including clearance sampling,and obtain the Contracting Officer's approval prior to resumption of work.

3.2.1 Building Ventilation System and Critical Barriers

Building ventilation system supply and return air ducts in a regulated area must be[shut down and isolated by lockable switch or other positive means in accordance with 29 CFR 1910.147.][isolated by airtight seals to prevent the spread of contamination throughout the system.] The airtight seals must consist of [air-tight rigid covers for building ventilation supply and exhaust grills where the ventilation system is required to remain in service during abatement][2 layers of polyethylene]. Edges to wall, ceiling and floor surfaces must be sealed with industrial grade duct tape.

a. A Competent Person must supervise the work.

b. For indoor work, critical barriers must be placed over all openings to the regulated area.

c. Impermeable dropcloths must be placed on surfaces beneath all removal activity.

3.2.2 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent work. Where such work is damaged or contaminated as verified by the Contracting Officer using visual inspection or sample analysis, it must be restored to its original condition or decontaminated by the Contractor at no expense to the Government as deemed appropriate by the Contracting Officer. This includes inadvertent spill of dirt, dust, or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, stop work immediately. Then clean up the spill. When satisfactory visual inspection and air sampling results are obtained from the [PQP][GC] work may proceed at the discretion of the Contracting Officer.

3.2.3 Furnishings

[Furniture [,(_____)] and equipment will be removed from the area of work by the Government before asbestos work begins.

][Furniture [,(_____)] and equipment will remain in the building. Cover and seal furnishings with 0.15 mm plastic sheet or remove from the work area and store in a location on site approved by the Contracting Officer.

][Furnishings listed below and located in the work area are considered to be contaminated with asbestos fibers. Transfer these items to an area on site approved by the Contracting Officer, decontaminate (wet methods where possible), and then store until the room from which they came is declared clean and safe for entry.[Carpets, draperies, and other items with porous, non-solid surfaces can not be suitably cleaned and must be properly disposed of as contaminated waste.] At the conclusion of the asbestos removal work and cleanup operations, transfer all objects so removed and cleaned back to the area from which they came and re-install

them. Base bids on decontaminating:

a. [_____] Desks

b. [_____] Filing cabinets

c. [_____] Linear meters of shelving

d. [_____] Cubic meters of books, papers, files, [_____].

e. [_____].

]3.2.4 Precleaning

Wet wipe and HEPA vacuum all surfaces potentially contaminated with asbestos prior to establishment of an enclosure.

3.2.5 Asbestos Control Area Requirements

3.2.5.1 Negative Pressure Enclosure

Removal of [asbestos contaminated acoustical ceiling tiles,] [spray applied fireproofing,] [thermal system insulation,] [gypsum wallboard/joint compound] [_____] require the use of a negative pressure enclosure. Block and seal openings in areas where the release of airborne asbestos fibers can be expected. Establish an asbestos negative pressure enclosure with the use of curtains, portable partitions, or other enclosures in order to prevent the escape of asbestos fibers from the contaminated asbestos work area. Negative pressure enclosure development must include protective covering of uncontaminated walls, and ceilings with a continuous membrane of two layers of minimum 0.15 mm plastic sheet sealed with tape to prevent water or other damage. Provide two layers of 0.15 mm plastic sheet over floors and extend a minimum of 300 mm up walls. Seal all joints with tape. Provide local exhaust system in the asbestos control area. Openings will be allowed in enclosures of asbestos control areas for personnel and equipment entry and exit, the supply and exhaust of air for the local exhaust system and the removal of properly containerized asbestos containing materials. Replace local exhaust system filters as required to maintain the efficiency of the system.

3.2.5.2 Glovebag

If the construction of a negative pressure enclosure is infeasible for the [removal] [encapsulation] of [_____] located [_____]. Use alternate techniques as indicated in 29 CFR 1926.1101. Establish designated limits for the asbestos regulated area with the use of rope or other continuous barriers, and maintain all other requirements for asbestos control areas. The PQP must conduct personal samples of each worker engaged in asbestos handling (removal, disposal, transport and other associated work) throughout the duration of the project. If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers at any time exceeds background or 0.01 fibers per cubic centimeter whichever is greater, stop work, evacuate personnel in adjacent areas or provide personnel with approved protective equipment at the discretion of the Contracting Officer. This sampling may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those obtained by the Contractor, the Government will determine which results predominate. If adjacent areas are contaminated as determined by the Contracting Officer, clean the

contaminated areas, monitor, and visually inspect the area as specified herein.

3.2.5.3 Regulated Area for Class II Removal

Removal of [asbestos containing floor tile/mastic,] [carpet/mastic,] [sealants,] [_____] are Class II removal activities. Establish designated limits for the asbestos regulated work area with the use of red barrier tape; install critical barriers, splash guards and signs, and maintain all other requirements for asbestos control area except local exhaust. Place impermeable dropcloths on surfaces beneath removal activity extending out 3 feet in all directions. A detached decontamination system may be used. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If workers the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.6 Removal Procedures

Wet asbestos material with a fine spray of [amended water][a specific wetting agent such as light oil] during removal, cutting, or other handling so as to reduce the emission of airborne fibers. Remove material and immediately place in 0.15 mm plastic disposal bags. Remove asbestos containing material in a gradual manner, with continuous application of the amended water or wetting agent in such a manner that no asbestos material is disturbed prior to being adequately wetted. Where unusual circumstances prohibit the use of 0.15 mm plastic bags, submit an alternate proposal for containment of asbestos fibers to the Contracting Officer for approval. For example, in the case where both piping and insulation are to be removed, the Contractor may elect to wet the insulation, wrap the pipes and insulation in plastic and remove the pipe by sections. Containerize asbestos containing material while wet. Do not allow asbestos material to accumulate or become dry. Lower and otherwise handle asbestos containing material as indicated in 40 CFR 61-SUBPART M.

3.2.6.1 Sealing Contaminated Items Designated for Disposal

Remove contaminated architectural, mechanical, and electrical appurtenances such as venetian blinds, full-height partitions, carpeting, duct work, pipes and fittings, radiators, light fixtures, conduit, panels, and other contaminated items designated for removal by completely coating the items with an asbestos lock-down encapsulant at the demolition site before removing the items from the asbestos control area. These items need not be vacuumed. The asbestos lock-down encapsulant must be tinted a contrasting color and spray-applied by airless method. Thoroughness of sealing operation must be visually gauged by the extent of colored coating on exposed surfaces. Lock-down encapsulants must comply with the performance requirements specified herein.

3.2.6.2 Exposed Pipe Insulation Edges

Contain edges of asbestos insulation to remain that are exposed by a removal operation. Wet and cut the rough ends true and square with sharp tools and then encapsulate the edges with a 6 mm thick layer of non-asbestos containing insulating cement troweled to a smooth hard finish. When cement is dry, lag the end with a layer of non-asbestos lagging cloth, overlapping the existing ends by at least 100 mm. When

insulating cement and cloth is an impractical method of sealing a raw edge of asbestos, take appropriate steps to seal the raw edges as approved by the Contracting Officer.

3.2.7 Methods of Compliance

3.2.7.1 Mandated Practices

The specific abatement techniques and items identified must be detailed in the Contractor's AHAP. Use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

a. Vacuum cleaners equipped with HEPA filters.

b. Wet methods or wetting agents except where it can be demonstrated that the use of wet methods is unfeasible due to the creation of electrical hazards, equipment malfunction, and in roofing.

c. Prompt clean-up and disposal.

d. Inspection and repair of polyethylene.

e. Cleaning of equipment and surfaces of containers prior to removing them from the equipment room or area.

3.2.7.2 Control Methods

Use the following control methods:

a. Local exhaust ventilation equipped with HEPA filter;

b. Enclosure or isolation of processes producing asbestos dust;

c. Where the feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PELs, use them to reduce employee exposure to the lowest levels attainable and must supplement them by the use of respiratory protection.

3.2.7.3 Unacceptable Practices

The following work practices must not be used:

a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.

b. Compressed air used to remove asbestos containing materials, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.

c. Dry sweeping, shoveling, or other dry clean up.

d. Employee rotation as a means of reducing employee exposure to asbestos.

3.2.8 Class I Work Procedures

In addition to requirements of paragraphs MANDATED PRACTICES and CONTROL METHODS, the following engineering controls and work practices must be used:

a. A Competent Person must supervise the installation and operation of the control methods.

b. For jobs involving the removal of more than 7.5 m or 0.9 square m of TSI or surfacing material, place critical barriers over all openings to the regulated area.

c. HVAC systems must be isolated in the regulated area by sealing with a double layer of plastic or air-tight rigid covers.

d. Impermeable dropcloths (0.15 mm or greater thickness) must be placed on surfaces beneath all removal activity.

e. Where a negative exposure assessment has not been provided or where exposure monitoring shows the PEL was exceeded, the regulated area must be ventilated with a HEPA unit and employees must use PPE.

3.2.9 Specific Control Methods for Class I Work

Use Class I work procedures, control methods and removal methods for the following ACM:

a. Spray Applied Fireproofing

b. Gypsum Wallboard and Joint Compound

c. Thermal System Insulation and Mudded Pipe Fittings

d. Plaster and Textured Ceilings and Walls

e. Vermiculite

3.2.9.1 Negative Pressure Enclosure (NPE) System

The system must provide at least four air changes per hour inside the containment. The local exhaust unit equipment must be operated 24-hours per day until the containment is removed. The NPE must be smoke tested for leaks at the beginning of each shift and be sufficient to maintain a minimum pressure differential of minus 0.5 mm of water column relative to adjacent, unsealed areas. Pressure differential must be monitored continuously, 24-hours per day, with an automatic manometric recording instrument and Records must be provided daily on the same day collected to the Contracting Officer. The Contracting Officer must be notified immediately if the pressure differential falls below the prescribed minimum. The building ventilation system must not be used as the local exhaust system for the regulated area. The NPE must terminate outdoors unless an alternate arrangement is allowed by the Contracting Officer. All filters used must be new at the beginning of the project and must be periodically changed as necessary and disposed of as ACM waste.

3.2.9.2 Glovebag Systems

Glovebags must be used without modification, smoke-tested for leaks, and completely cover the circumference of pipe or other structures where the work is to be done. Glovebags must be used only once and must not be moved. Glovebags must not be used on surfaces that have temperatures exceeding 66 degrees C. Prior to disposal, glovebags must be collapsed using a HEPA vacuum. Before beginning the operation, loose and friable

material adjacent to the glovebag operation must be wrapped and sealed in 2 layers of plastic or otherwise rendered intact. At least two persons must perform glovebag removal. Asbestos regulated work areas must be established for glovebag abatement. Designated boundary limits for the asbestos work must be established with rope or other continuous barriers and all other requirements for asbestos control areas must be maintained, including area signage and boundary warning tape.

a. Attach HEPA vacuum systems to the bag to prevent collapse during removal of ACM.

b. The negative pressure glove boxes must be fitted with gloved apertures and a bagging outlet and constructed with rigid sides from metal or other material which can withstand the weight of the ACM and water used during removal. A negative pressure must be created in the system using a HEPA filtration system. The box must be smoke tested for leaks prior to each use.

3.2.9.3 Mini-Enclosure

[Single bulkhead containment][Double bulkhead containment][or][Mini-containment (small walk-in enclosure)] to accommodate no more than two persons, may be used if the disturbance or removal can be completely contained by the enclosure. The mini-enclosure must be inspected for leaks and smoke tested before each use. Air movement must be directed away from the employee's breathing zone within the mini-enclosure.

3.2.9.4 Wrap and Cut Operation

Prior to cutting pipe, the asbestos-containing insulation must be wrapped with polyethylene and securely sealed with duct tape to prevent asbestos becoming airborne as a result of the cutting process. The following steps must be taken: install glovebag, strip back sections to be cut 150 mm from point of cut, and cut pipe into manageable sections.

3.2.9.5 Class I Removal Method

Class I ACM must be removed using a control method described above. Prepare work area as previously specified. Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area. Spread one layer of 0.15 mm seamless plastic sheeting on the floor below the work area.[Remove asbestos containing spray applied fireproofing using a scraper and wet methods and immediately place into 0.15 mm thickness disposal bag. After removal of the material use a wire brush to clean the exposed substrate to remove residual material. Continue wet cleaning until surfaces are free of visible debris.][Cut manageable sections of gypsum wallboard and joint compound and immediately place into a 0.15 mm minimum thickness disposal bag or other approved container. Make every effort to keep the material from falling to the floor of the work area. Use a wire brush and wet clean to remove residual material from studs. Continue wet cleaning until the surface is clean of visible material and encapsulate stud walls.][Remove ACM thermal system insulation and mudded pipe fittings using mechanical means and wet methods and immediately place into 0.15 mm thickness disposal bag. Continue wet cleaning until surfaces are free of visible debris.][Remove ACM plaster ceilings or walls using mechanical means and adequately wet methods and immediately place into 0.15 mm thickness disposal bag. Make every effort to keep the material from falling to the floor of the work area. Continue

wet cleaning until surfaces are free of visible debris.][Remove ACM textured ceiling finish using a scraper and wet methods and immediately place into 0.15 mm thickness disposal bag. Floors are considered contaminated from fallen textured ceiling finish. Clean up debris on floor and dispose of [carpet]as asbestos contaminated material. After removal of the material use a wire brush to clean the exposed [concrete]ceiling to remove residual material. Continue wet cleaning until surfaces are free of visible debris.][Remove ACM vermiculite using mechanical means and adequately wet methods and immediately place into 0.15 mm thickness disposal bag. Make every effort to keep the material from falling to the floor of the work area. Continue wet cleaning until surfaces are free of visible debris.] Bag all asbestos debris which has fallen to the floor as asbestos-containing debris. Place all debris in plastic disposal bags of 0.15 mm minimum thickness. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 0.15 mm minimum thickness disposal bag. Containerize asbestos containing waste while wet. Lower and otherwise handle asbestos containing materials as indicated in 40 CFR 61-SUBPART M. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers or the designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work, and immediately correct the situation.

3.2.10 Class II Work Procedures

In addition to the requirements of paragraphs MANDATED PRACTICES and CONTROL METHODS, the following engineering controls and work practices must be used:

a. A Competent Person must supervise the work.

b. For indoor work, critical barriers must be placed over all openings to the regulated area.

c. Impermeable dropcloths must be placed on surfaces beneath all removal activity.

3.2.11 Specific Control Methods for Class II Work

3.2.11.1 [Vinyl and Asphaltic Flooring Materials] [Carpet and Mastic]

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. A detached decontamination system may be used. When removing [vinyl floor tile and mastic][carpet and mastic] which contains ACM, use the following practices. Remove [floor tile and mastic][carpet and mastic] using adequately wet methods. Remove [floor tiles][carpet and mastic] intact (if possible).[Wetting is not required when floor tiles are heated and removed intact.] Do not sand flooring or its backing. Scrape residual adhesive and backing using wet methods. Mechanical chipping is prohibited unless performed in a negative pressure enclosure. Dry sweeping is prohibited. Use vacuums equipped with HEPA filter, disposable dust bag, and metal floor tool (no brush) to clean floors. Place debris into a 0.15

mm minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 0.15 mm minimum thickness disposal bag. Containerize asbestos containing waste while wet. Lower and otherwise handle asbestos containing materials as indicated in 40 CFR 61-SUBPART M. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If workers the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.11.2 Sealants and Mastic

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers and signs, and maintain all other requirements for asbestos control area except local exhaust. Spread 0.15 mm plastic sheeting on the ground around the perimeter of the work area extending out in all directions. Using adequately wet methods, carefully remove the ACM sealants and mastics using a scraper of knife blade. As it is removed place the material into a disposal bag. Make every effort to keep the asbestos material from falling to the ground or work area floor below. Dry sweeping is prohibited. Use vacuums equipped with HEPA filter and disposable dust bag. Place debris into a 0.15 mm minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 0.15 mm minimum thickness disposal bag. Containerize asbestos containing waste while wet. Lower and otherwise handle asbestos containing materials as indicated in 40 CFR 61-SUBPART M. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or at designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.11.3 Suspect Fire Doors

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. A detached decontamination system may be used. Spread 0.15 mm plastic sheeting on the ground beneath the work area and around the perimeter of the work area extending out in all directions. Remove door intact from hinges and wrap with 6-mil plastic sheeting. Inspect the interior areas of the door to determine if ACM is present. If ACM is not present the door may be disposed of as general construction debris. If ACM is present place whole door in enclosed container for disposal. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the

situation.

3.2.11.4 Roofing Materials

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. When removing roofing materials which contain ACM as described in 29 CFR 1926.1101(g)(8)(ii), use the following practices. Roofing material must be removed in an intact state. Wet methods must be used to remove roofing materials that are not intact, or that will be rendered not intact during removal, unless such wet methods are not feasible or will create safety hazards. When removing built-up roofs, with asbestos-containing roofing felts and an aggregate surface, using a power roof cutter, all dust resulting from the cutting operations must be collected by a HEPA dust collector, or must be HEPA vacuumed by vacuuming along the cut line. Asbestos-containing roofing material must not be dropped or thrown to the ground, but must be lowered to the ground via covered, dust-tight chute, crane, hoist or other method approved by the Contracting Officer. Any ACM that is not intact must be lowered to the ground as soon as practicable, but not later than the end of the work shift. While the material remains on the roof it must be kept wet or placed in an impermeable waste bag or wrapped in plastic sheeting. Intact ACM must be lowered to the ground as soon as practicable, but not later than the end of the work shift. Unwrapped material must be transferred to a closed receptacle. Critical barriers must be placed over roof level heating and ventilation air intakes. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.11.5 Cementitious Siding and Shingles or Transite Panels

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. When removing cementitious asbestos-containing siding, shingles or Transite panels use the following work practices. Intentionally cutting, abrading or breaking is prohibited. Each panel or shingle must be sprayed with amended water prior to removal. Nails must be cut with flat, sharp instruments. Unwrapped or unbagged panels or shingles must be immediately lowered to the ground via covered dust-tight chute, crane or hoist, or placed in an impervious waste bag or wrapped in plastic sheeting and lowered to the ground no later than the end of the work shift. Place debris into a 0.15 mm minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 0.15 mm minimum thickness disposal bag. Containerize asbestos containing waste while wet. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.11.6 Gaskets

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. Gaskets must be thoroughly wetted with amended water prior to removal and immediately placed in a disposal container. If a gasket is visibly deteriorated and unlikely to be removed intact, removal must be undertaken within a glovebag. Any scraping to remove residue must be performed wet. Place debris into a 0.15 mm minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 0.15 mm minimum thickness disposal bag. Containerize asbestos containing waste while wet. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

[3.2.12 Encapsulation Procedures

3.2.12.1 Preparation of Test Patches

Install [three] [_____] test patches of encapsulant in [_____], as indicated. Use airless spray at the lowest pressure and as recommended by the encapsulant manufacturer. Follow exactly the manufacturer's instructions for thinning recommendations, application procedures and rates. Curing time must be not less than five days or that recommended by the manufacturer, whichever is more. A test patch must be 0.8 square meter in size.

3.2.12.2 Field Testing

Field test the encapsulation test patches in accordance with ASTM E1494, paragraph "Required Field Test," in the presence of the Contracting Officer. Keep a written record of the testing procedures and test results. Upon successful testing of the encapsulant, submit a signed statement to the Contracting Officer certifying that the encapsulant is suitable for installation on the particular asbestos containing material.

3.2.12.3 Large-Scale Application

Apply encapsulant using the same equipment and procedures as employed for the test patches. Keep the encapsulant material stirred to prevent settling. Keep a clean work area. Change pre-filters in the ventilation equipment as soon as they appear clogged by encapsulant aerosol or pressure differential drops below 0.02 Hg.

]3.2.13 Abatement of Asbestos Contaminated Soil

Establish designated limits for the asbestos regulated work area with the use of red barrier tape, critical barriers, signs, and maintain all other requirements for asbestos control area except local exhaust. Asbestos contaminated soil must be removed from areas to a minimum depth of [50]

[_____] mm. Soil must be thoroughly dampened with amended water and then removed by manual shoveling into labeled containers. Place debris into a 0.15 mm minimum thickness disposal bag or other approved container. Once the material is in the disposal bag, apply additional water as needed to achieve "adequately wet" conditions for NESHAP compliance. Place bagged asbestos waste under negative pressure with the use of a HEPA vacuum, goose neck and duck tape to seal the bag, wash to remove any visible contamination and place into a second 0.15 mm minimum thickness disposal bag. Containerize asbestos containing waste while wet. Conduct area monitoring of airborne fibers during the work shift at the designated limits of the asbestos work area and conduct personal samples of each worker engaged in the work. If the airborne fiber concentration of the workers or designated limits at any time exceeds background or 0.01 fibers per cubic centimeter, whichever is greater, stop work immediately and correct the situation.

3.2.14 Air Sampling

Perform sampling of airborne concentrations of asbestos fibers in accordance with 29 CFR 1926.1101, the Contractor's air monitoring plan and as specified herein. Sampling performed in accordance with 29 CFR 1926.1101 must be performed by the PQP.[Sampling performed for environmental and quality control reasons must be performed by the [PQP][GC].] Unless otherwise specified, use NIOSH Method 7400 for sampling and analysis. Monitoring may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those results obtained by the Contractor, the Government will determine which results predominate. Results of breathing zone samples must be posted at the job site and made available to the Contracting Officer. Submit all documentation regarding initial exposure assessments, negative exposure assessments, and air-monitoring results.

3.2.14.1 Sampling Prior to Asbestos Work

Provide area air sampling and establish the baseline one day prior to the masking and sealing operations for each [demolition] [removal] [encapsulation] site. Establish the background by performing area sampling in similar but uncontaminated sites in the building.

3.2.14.2 Sampling During Asbestos Work

[The PQP must provide personal and area sampling as indicated in 29 CFR 1926.1101 and governing environmental regulations. Breathing zone samples must be taken for at least 25 percent of the workers in each shift, or a minimum of two, whichever is greater. Air sample fiber counting must be completed and results provided within 24-hours (breathing zone samples), and [_____] hours (environmental/clearance monitoring) after completion of a sampling period. In addition, provided the same type of work is being performed, provide area sampling at least once every work shift close to the work inside the enclosure, outside the clean room entrance to the enclosure, and at the exhaust opening of the local exhaust system. If sampling outside the enclosure shows airborne levels have exceeded background or 0.01 fibers per cubic centimeter, whichever is greater, stop all work, correct the condition(s) causing the increase, and notify the Contracting Officer immediately.[Where alternate methods are used, perform personal and area air sampling at locations and frequencies that will accurately characterize the evolving airborne asbestos levels.] The written results must be signed by testing laboratory analyst, testing

laboratory principal and the [Contractor's PQP][GC]. The air sampling results must be documented on a Contractor's daily air monitoring log.

][The PQP must provide personal sampling as indicated in 29 CFR 1926.1101. Breathing zone samples must be taken for at least 25 percent of the workers in each shift, or a minimum of two, whichever is greater. Breathing zone samples must be taken for at least 25 percent of the workers in each shift, or a minimum of two, whichever is greater. Air sample fiber counting must be completed and results provided within 24-hours (breathing zone samples), and [_____] hours (environmental/clearance monitoring) after completion of a sampling period. At the same time the GC will provide area sampling close to the work inside the enclosure, outside the clean room entrance to the enclosure, and at the exhaust opening of the local exhaust system. In addition, provided the same type of work is being performed, the GC will provide area sampling once every work shift close to the work inside the enclosure, outside the clean room entrance to the enclosure, and at the exhaust opening of the local exhaust system. If sampling outside the enclosure shows airborne levels have exceeded background or 0.01 fibers per cubic centimeter, whichever is greater, stop all work, correct the condition(s) causing the increase, and notify the Contracting Officer immediately.[Where alternate methods are used, perform personal and area air sampling at locations and frequencies that will accurately characterize the evolving airborne asbestos levels.] The written results must be signed by testing laboratory analyst, testing laboratory principal and the [Contractor's PQP][GC]. The air sampling results must be documented on a Contractor's daily air monitoring log.

]3.2.14.3 Final Clearance Requirements, NIOSH PCM Method

For PCM sampling and analysis using NIOSH NMAM Method 7400, the fiber concentration inside the abated regulated area, for each airborne sample, must be less than 0.01 f/cc. The abatement inside the regulated area is considered complete when every PCM final clearance sample is below the clearance limit. If any sample result is greater than 0.01 total f/cc, the asbestos fiber concentration (asbestos f/cc) must be confirmed from that same filter using NIOSH NMAM Method 7402 (TEM) at Contractor's expense. If any confirmation sample result is greater than 0.01 asbestos f/cc, abatement is incomplete and cleaning must be repeated at the Contractor's expense. Upon completion of any required recleaning, resampling with results to meet the above clearance criteria must be done at the Contractor's expense.

3.2.14.4 Final Clearance Requirements, EPA TEM Method

For EPA TEM sampling and analysis, using the EPA Method specified in 40 CFR 763, abatement inside the regulated area is considered complete when the arithmetic mean asbestos concentration of the five inside samples is less than or equal to 70 structures per square millimeter (70 S/mm). When the arithmetic mean is greater than 70 S/mm, the three blank samples must be analyzed. If the three blank samples are greater than 70 S/mm, resampling must be done. If less than 70 S/mm, the five outside samples must be analyzed and a Z-test analysis performed. When the Z-test results are less than 1.65, the decontamination must be considered complete. If the Z-test results are more than 1.65, the abatement is incomplete and cleaning must be repeated. Upon completion of any required recleaning, resampling with results to meet the above clearance criteria must be done at the Contractor's expense.

3.2.14.5 Sampling After Final Clean-Up (Clearance Sampling)

The Contractor must perform any Clearance Sampling utilizing a third-party independent person who has no ties to the Contractor (except as being a subcontractor), the Asbestos Abatement Subcontractor, and the IH/PQP for the project. Provide area sampling of asbestos fibers[using aggressive air sampling techniques as defined in the EPA 560/5-85-024] and establish an airborne asbestos concentration of less than 0.01 fibers per cubic centimeter after final clean-up but before removal of the enclosure or the asbestos work control area. After final cleanup and the asbestos control area is dry but prior to clearance sampling, the [PQP][and][GC] must perform a visual inspection in accordance with ASTM E1368 to ensure that the asbestos control and work area is free of any accumulations of dirt, dust, or debris.[Prepare a written report signed and dated by the PQP documenting that the asbestos control area is free of dust, dirt, and debris and all waste has been removed.][Perform at least [_____] samples.][Use transmission electron microscopy (TEM) to analyze clearance samples and report the results in accordance with current NIOSH criteria.] The asbestos fiber counts from these samples must be less than 0.01 fibers per cubic centimeter or be not greater than the background, whichever is greater. Should any of the final samples indicate a higher value take appropriate actions to re-clean the area and repeat the sampling and [TEM] analysis at the Contractor's expense.

3.2.14.6 Air Clearance Failure

If clearance sampling results fail to meet the final clearance requirements, pay all costs associated with the required recleaning, resampling, and analysis, until final clearance requirements are met.

3.2.15 Lock-Down

Prior to removal of plastic barriers and after pre-clearance clean up of gross contamination, the [PQP][GC] must conduct a visual inspection of all areas affected by the [removal][encapsulation] in accordance with ASTM E1368. Inspect for any visible fibers[, and to ensure that encapsulants were applied evenly and appropriately].[Spray apply a post removal (lock-down) encapsulant to ceiling, walls, floors and other areas exposed in the removal area. The exposed areaincludes but is not limited to plastic barriers, furnishings and articles to be discarded as well as dirty change room, air locks for bag removal and decontamination chambers.]

3.2.16 Site Inspection

While performing asbestos engineering control work, the Contractor must be subject to on-site inspection by the Contracting Officer who may be assisted by or represented by safety or industrial hygiene personnel. If the work is found to be in violation of this specification, the Contracting Officer or his representative will issue a stop work order to be in effect immediately and until the violation is resolved. All related costs including standby time required to resolve the violation must be at the Contractor's expense.

3.3 CLEAN-UP AND DISPOSAL

3.3.1 Housekeeping

Essential parts of asbestos dust control are housekeeping and clean-up procedures. Maintain surfaces of the asbestos control area free of

accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the general area. Use HEPA filtered vacuum cleaners. DO NOT BLOW DOWN THE SPACE WITH COMPRESSED AIR. When asbestos removal is complete, all asbestos waste is removed from the work-site, and final clean-up is completed, the Contracting Officer will attest that the area is safe before the signs can be removed. After final clean-up and acceptable airborne concentrations are attained but before the HEPA unit is turned off and the enclosure removed, remove all pre-filters on the building HVAC system and provide new pre-filters. Dispose of filters as asbestos contaminated materials. Reestablish HVAC mechanical, and electrical systems in proper working order. The Contracting Officer will visually inspect all surfaces within the enclosure for residual material or accumulated dust or debris. The Contractor must re-clean all areas showing dust or residual materials. If re-cleaning is required, air sample and establish an acceptable asbestos airborne concentration after re-cleaning. The Contracting Officer must agree that the area is safe in writing before unrestricted entry will be permitted. The Government must have the option to perform monitoring to determine if the areas are safe before entry is permitted.

3.3.2 Title to Materials

All waste materials, except as specified otherwise, become the property of the Contractor and must be disposed of as specified in accordance with the JEGS, applicable U.S. Federal, GOJ, and local regulations. The Contractor shall be licensed to both transport and to dispose of asbestos waste in accordance with the JEGS and the Japanese Waste Law. Copies of these licenses shall be provided to the Contracting Officer.

3.3.3 Disposal of Asbestos

3.3.3.1 Procedure for Disposal

Coordinate all waste disposal manifests with the Contracting Officer and NAVFAC EV. Collect asbestos waste, contaminated waste water filters, asbestos contaminated water, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing which may produce airborne concentrations of asbestos fibers and place in sealed fiber-proof, waterproof, non-returnable containers (e.g. double plastic bags 0.15 mm thick, cartons, drums or cans). Wastes within the containers must be adequately wet in accordance with 40 CFR 61-SUBPART M. Affix a warning and Department of Transportation (DOT) label to each container including the bags or use at least 0.15 mm thick bags with the approved warnings and DOT labeling preprinted on the bag. Clearly indicate on the outside of each container the name of the waste generator and the location at which the waste was generated. Prevent contamination of the transport vehicle (especially if the transport vehicle is a rented truck likely to be used in the future for non-asbestos purposes). These precautions include lining the vehicle cargo area with plastic sheeting (similar to work area enclosure) and thorough cleaning of the cargo area after transport and unloading of asbestos debris is complete. Dispose of waste asbestos material at an Environmental Protection Agency (EPA) approved asbestos landfill off Government property. For temporary storage, store sealed impermeable bags in asbestos waste drums or skids. An area for interim storage of asbestos waste-containing drums or skids will be assigned by the Contracting Officer or his authorized representative. Comply with 40 CFR 61-SUBPART M, GOJ, regional, and local standards for hauling and disposal. Sealed plastic bags may be dumped from drums into the burial

site unless the bags have been broken or damaged. Damaged bags must remain in the drum and the entire contaminated drum must be buried. Uncontaminated drums may be recycled. Workers unloading the sealed drums must wear appropriate respirators and personal protective equipment when handling asbestos materials at the disposal site.

3.3.3.2 Asbestos Disposal Quantity Report

[Direct the PQP to record and report, to the Contracting Officer, the amount of asbestos containing material removed and released for disposal. Deliver the report for the previous day at the beginning of each day shift with amounts of material removed during the previous day reported in linear meters or square meters as described initially in this specification and in cubic meters for the amount of asbestos containing material released for disposal.

][Allow the GC to inspect, record and report the amount of asbestos containing material removed and released for disposal on a daily basis.

] -- End of Section --

SECTION 02 83 00

LEAD REMEDIATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE Z9.2	(2012) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

ASTM INTERNATIONAL (ASTM)

ASTM E1613	(2012) Standard Test Method for Determination of Lead by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Flame Atomic Absorption Spectrometry (FAAS), or Graphite Furnace Atomic Absorption Spectrometry (GFAAS) Techniques
ASTM E1644	(2017) Standard Practice for Hot Plate Digestion of Dust Wipe Samples for the Determination of Lead
ASTM E1726	(2001; R 2009) Preparation of Soil Samples by Hotplate Digestion for Subsequent Lead Analysis
ASTM E1727	(2016) Standard Practice for Field Collection of Soil Samples for Subsequent Lead Determination
ASTM E1728	(2016) Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Lead Determination
ASTM E1792	(2003; R 2016) Standard Specification for Wipe Sampling Materials for Lead in Surface Dust

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701	(2015) Standard Methods of Fire Tests for Flame Propagation of Textiles and Films

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. DEPARTMENT OF DEFENSE (DOD)

JEGS	(Dec 2020) Japan Environmental Governing Standards

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD 6780	(1995; Errata Aug 1996;Rev Ch. 7 - 1997) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.103	Respiratory Protection
29 CFR 1926.1126	Chromium
29 CFR 1926.1127	Cadmium
29 CFR 1926.21	Safety Training and Education
29 CFR 1926.33	Access to Employee Exposure and Medical Records
29 CFR 1926.55	Gases, Vapors, Fumes, Dusts, and Mists
29 CFR 1926.59	Hazard Communication
29 CFR 1926.62	Lead
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 745	Lead-Based Paint Poisoning Prevention in Certain Residential Structures
49 CFR 172	Hazardous Materials Table, Special

	Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 178	Specifications for Packagings

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

ND OPNAVINST 5100.23	(2005; Rev G) Navy Occupational Safety and Health (NAVOSH) Program Manual

UNDERWRITERS LABORATORIES (UL)

UL 586	(2009; Reprint Dec 2017) UL Standard for Safety High-Efficiency Particulate, Air Filter Units

1.2 DEFINITIONS

1.2.1 Abatement

Measures defined in 40 CFR 745, Section 223, designed to permanently eliminate lead-based paint hazards.

1.2.2 Action Level

Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period; to an airborne concentration of cadmium of 2.5 micrograms per cubic meter of air averaged over an 8-hour period; to an airborne concentration of chromium (VI) of 2.5 micrograms per cubic meter of air averaged over an 8-hour period.

1.2.3 Area Sampling

Sampling of lead, cadmium, chromium concentrations within the lead, cadmium, chromium control area and inside the physical boundaries which is representative of the airborne lead, cadmium, chromium concentrations but is not collected in the breathing zone of personnel (approximately 1.5 to 1.8 meters above the floor).

1.2.4 Cadmium Permissible Exposure Limit (PEL)

Five micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.1127. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

PEL (micrograms/cubic meter of air) = 40/No. hrs worked per day

1.2.5 Child-Occupied Facility

Real property which is a building or portion of a building constructed prior to 1978 visited regularly by the same child, six-years of age or under, on at least two different days within any week (Sunday through Saturday period), provided that each day's visit lasts at least 3-hours, and the combined annual visits last at least 60-hours. Child-occupied facilities include but are not limited to, day-care centers, preschools and kindergarten classrooms.

1.2.6 Chromium Permissible Exposure Limit (PEL)

Five micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.1126. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

PEL (micrograms/cubic meter of air) = 40/No. hrs worked per day

1.2.7 Competent Person (CP)

As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead, cadmium and chromium hazards in accordance with current U.S. federal, GOJ national, prefectural, and local regulations and has the authority to take prompt corrective actions to control the lead, cadmium and chromium hazard. The Contractor may provide more than one CP as required to supervise and monitor the work. The CP must be a Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene or a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals or a licensed lead-based paint abatement Supervisor/Project Designer.

1.2.8 Contaminated Room

Refers to a room for removal of contaminated personal protective equipment (PPE).

1.2.9 Decontamination Shower Facility

That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.

1.2.10 Deleading

Activities conducted by a person who offers to eliminate lead-based paint or lead-based paint hazards or paints containing cadmium/chromium or to plan such activities in commercial buildings, bridges or other structures.

1.2.11 Eight-Hour Time Weighted Average (TWA)

Airborne concentration of lead, cadmium, chromium to which an employee is exposed, averaged over an 8-hour workday as indicated in 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

1.2.12 High Efficiency Particulate Air (HEPA) Filter Equipment

HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead, cadmium, chromium contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.

1.2.13 Industrial Hygienist/Private Qualified Person (IH/PQP)

The IH/PQP shall have demonstratable experience in lead air monitoring techniques and in the establishment of a respiratory protection program for employees. The IH/PQP shall have working knowledge of applicable Federal and Japanese regulations occupational safety and health regulations for lead in construction. The IH/PQP shall have attended and

completed Lead Abatement Supervision and Monitoring training and shall be considered a competent person as defined in 29 CFR 1926.62. The IH/PQP shall be a registered Architect, Professional Engineer, or Certified Industrial Hygienist, who has successfully completed training and is therefore accredited under a legitimate Model Accreditation Plan. The IH/PQP must be qualified to perform visual inspections.

1.2.14 Industrial Hygiene Technician (IHT)

The Industrial Hygiene Technician (IHT) shall be an employee of the IH/PQP or the testing laboratory and shall have a minimum of 2 years experience in the industrial hygiene field working under the direction of the IH/PQP and has completed the following course: Lead Abatement Supervision and Monitoring - Covering practices and procedures in lead abatement, lead air sampling and abatement monitoring.

1.2.15 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds. The use of the term Lead in this section also refers to paints which contain detectable concentrations of Cadmium and Chromium. For the purposes of the section lead-based paint (LBP) and paint with lead (PWL) also contains cadmium and chromium.

1.2.16 Lead-Based Paint (LBP)

Paint or other surface coating that contains lead in excess of 1.0 milligrams per centimeter squared or 0.5 percent by weight.

1.2.17 Lead-Based Paint Activities

In the case of target housing or child occupied facilities, lead-based paint activities include; a lead-based paint inspection, a risk assessment, or abatement of lead-based paint hazards.

1.2.18 Lead-Based Paint Hazards

Paint-lead hazard, dust-lead hazard or soil-lead hazard as identified in 40 CFR 745, Section 65. Any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, lead-based paint that is deteriorated or present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects.

1.2.18.1 Lead Containing Paint

Paint or other surface coating that contains lead in excess of 0.009 percent by weight (90 PPM) and up to 0.5 percent by weight (5,000 ppm).

1.2.19 Lead, Cadmium, Chromium Control Area

A system of control methods to prevent the spread of lead, cadmium, chromium dust, paint chips or debris to adjacent areas that may include temporary containment, floor or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

1.2.20 Lead Permissible Exposure Limit (PEL)

Fifty micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than 8-hours in a work day, determine the PEL by the following formula:

PEL (micrograms/cubic meter of air) = 400/No. hrs worked per day

1.2.21 Material Containing Lead/Paint with Lead (MCL/PWL)

Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. The requirements of this section does not apply if no detectable levels of lead are found using a quantitative method for analyzing paint or MCL using laboratory instruments with specified limits of detection (usually 0.01 percent). An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

1.2.22 Personal Sampling

Sampling of airborne lead, cadmium, chromium concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Samples must be representative of the employees' work tasks. Breathing zone must be considered an area within a hemisphere, forward of the shoulders, with a radius of 150 to 225 mm and centered at the nose or mouth of an employee.

1.2.23 Physical Boundary

Area physically roped or partitioned off around lead, cadmium, chromium control area to limit unauthorized entry of personnel.

1.2.24 Target Housing

Residential real property which is housing constructed prior to 1978, except housing for the elderly or persons with disabilities (unless any one or more children age 6-years or under resides or is expected to reside in such housing for the elderly or persons with disabilities) or any zero bedroom dwelling.

1.3 DESCRIPTION

Construction activities impacting PWL or material containing lead, cadmium, chromium which are covered by this specification include the demolition or removal of material containing lead, cadmium, chromium in [_____] condition, located [_____] and as indicated on the drawings. [_____] The work covered by this section includes work tasks and the precautions specified in this section for the protection of building occupants and the environment during and after the performance of the hazard abatement activities.

The Contractor shall assume that all coatings will contain some level of lead, cadmium, and Chromium. The Contractor shall review existing Lead Paint survey data, if available.

1.3.1 Protection of Existing Areas To Remain

Project work including, but not limited to, lead, cadmium, chromium hazard abatement work, storage, transportation, and disposal must be performed

without damaging or contaminating adjacent work and areas. Where such work or areas are damaged or contaminated, restore work and areas to the original condition.

1.3.2 Coordination with Other Work

Coordinate with work being performed in adjacent areas to ensure there are no exposure issues. Explain coordination procedures in the Lead, Cadmium, Chromium Compliance Plan and describe how the Contractor will prevent lead, cadmium and chromium exposure to other contractors and Government personnel performing work unrelated to lead, cadmium and chromium activities.

1.3.3 Sampling and Analysis

Submit a log of the analytical results from sampling conducted during the abatement. Keep the log of results current in the Environmental Records Binder and brief the results to the Contracting Officer as analytical results are reported.

1.3.3.1 Dust Wipe Materials, Sampling and Analysis

Sampling must conform to [[ASTM E1728][ASTM E1792]].[Analysis must conform to ASTM E1613 and ASTM E1644.]

1.3.3.2 Soil Sampling and Analysis

Sampling must conform to ASTM E1727.[Analysis must conform to ASTM E1613 and ASTM E1726.]

1.3.3.3 Clearance Monitoring

a. Collect dust wipe samples inside the lead, cadmium and chromium hazard control area after the final visual inspection in the quantities and at the locations specified.

   (1) Floors [_____].
   (2) Interior Window Sills [_____].
   (3) Window Troughs [_____].

b. Collect exterior bare soil samples inside the lead, cadmium and chromium hazard control area after the final visual inspection in the quantities and at the locations specified.

   (1) Near the building foundation [_____].
   (2) Nearby Play areas [_____].

1.3.4 Clearance Requirements

Target housing and child occupied facilities clearance levels.

   (1) Floors [_____].
   (2) Interior Window Sills [_____].
   (3) Window Troughs [_____].
   (4) Bare soils in play areas accessible by children [_____].
   (5) Bare soils in all other areas [_____].

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Occupational and Environmental Assessment Data Report; G [, [_____]]

Medical Examinations; G [, [_____]]

Lead, Cadmium, Chromium Waste Management Plan; G [, [_____]]

Licenses, Permits and Notifications; G [, [_____]]

Occupant Protection Plan; G [, [_____]]

[Initial Sample Results; G [, [_____]]

] Written Evidence of TSD Approval; G [, [_____]]

Lead, Cadmium, Chromium Compliance Plan; G [, [_____]]

SD-03 Product Data

Respirators; G [, [_____]]

Vacuum Filters; G [, [_____]]

Negative Air Pressure System; G [, [_____]]

Materials and Equipment; G [, [_____]]

Expendable Supplies; G [, [_____]]

Local Exhaust Equipment; G [, [_____]]

Pressure Differential Automatic Recording Instrument; G [, [_____]]

Pressure Differential Log; G [, [_____]]

SD-06 Test Reports

Occupational and Environmental Assessment Data Report; G [, [_____]]

Sampling Results; G [, [_____]]

Pressure Differential Recordings For Local Exhaust System; G [, [_____]]

SD-07 Certificates

[Occupant Notification; G [, [_____]]

][Notification of the Commencement of [LBP] Hazard Abatement; G [, [_____]]
]
Clearance Certification; G [, [_____]]

SD-11 Closeout Submittals

Hazardous Waste Manifest; G [, [_____]]

[Turn-In Documents or Weight Tickets; G [, [_____]]

]1.5 QUALITY ASSURANCE

1.5.1 Qualifications

1.5.1.1 Competent Person (CP)

Include in the Lead, Cadmium, Chromium Compliance plan, the name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph COMPETENT PERSON (CP) RESPONSIBILITIES. Provide documented construction project-related experience with implementation of OSHA's Lead in Construction standard (29 CFR 1926.62), Chromium standard (29 CFR 1926.1126), Cadmium standard (29 CFR 1926.1127) which shows ability to assess occupational and environmental exposure to lead, cadmium, chromium; experience with the use of respirators, personal protective equipment and other exposure reduction methods to protect employee health. Demonstrate a minimum of [3][5][_____] years experience implementing OSHA's Lead in Construction standard (29 CFR 1926.62), Chromium standard (29 CFR 1926.1126), and Cadmium standard (29 CFR 1926.1127). Submit proper documentation that the CP is trained [and licensed][and certified] in accordance with U.S. federal, GOJ national, prefectural[_____] and local laws.[The competent person must be a trained and certified lead-based paint abatement Supervisor/Project Designer].

1.5.1.2 Training Certification

Include in the Lead, Cadmium, Chromium Compliance plan, a certificate for each worker and supervisor, signed and dated by the[accredited] training provider, stating that the employee has received the required lead, cadmium and chromium training specified in 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 [40 CFR 745][and is certified to perform or supervise deleading, lead removal or demolition activities].

1.5.1.3 Testing Laboratory

Include in the Lead, Cadmium, Chromium Compliance plan, the name, address, and telephone number of the testing laboratory selected to perform the air[soil][and wipe] analysis, testing, and reporting of airborne concentrations of lead, cadmium and chromium. Use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead

analysis must be OSHA approved.

[1.5.1.4 Third Party Consultant Qualifications

Include in the Lead, Cadmium, Chromium Compliance plan, the name, address and telephone number of the third party consultant selected to perform the wipe sampling for determining concentrations of lead, cadmium and chromium in dust. Submit proper documentation that the consultant is trained and certified as an inspector technician or inspector/risk assessor by the USEPA authorized certification and accreditation program.

]1.5.1.5 Certified Risk Assessor

The Certified Risk Assessor must be certified pursuant to 40 CFR 745, Section 226 and be responsible to perform the clearance sampling, clearance sample data evaluation and summarize clearance sampling results in a section of the abatement report. The risk assessor must sign the abatement report to indicate clearance requirements for the contract have been met.

1.5.2 Requirements

1.5.2.1 Competent Person (CP) Responsibilities

a. Verify training meets all U.S. federal, GOJ national, prefectural, and local requirements.

b. Review and approve Lead, Cadmium, Chromium Compliance Plan for conformance to the applicable referenced standards.

c. Continuously inspect LBP/PWL or MCL work for conformance with the approved plan.

d. Perform (or oversee performance of) air sampling. Recommend upgrades or downgrades (whichever is appropriate based on exposure) on the use of PPE (respirators included) and engineering controls.

e. Ensure work is performed in strict accordance with specifications at all times.

f. Control work to prevent hazardous exposure to human beings and to the environment at all times.

g. Supervise final cleaning of the lead, cadmium, chromium control area, take clearance wipe samples if necessary; review clearance sample results and make recommendations for further cleaning.

h. Certify the conditions of the work as called for elsewhere in this specification.

i. The CP must be certified pursuant to 40 CFR 745, Section 226 and is responsible for development and implementation of the occupant protection plan, the abatement report and supervise lead, cadmium and chromium hazard abatement work activities.

1.5.2.2 Lead, Cadmium, Chromium Compliance Plan

The purpose of the plan for this project is to verify that the Contractor understands that they will encounter paint with lead (PWL), cadmium and

Chromium. The Contractor shall assume that all coatings will contain some level of lead, cadmium and chromium. The Contractor's LCCCP shall identify the Contractor's process to comply with all applicable regulations depending on the method of work the Contractor choose when encountering paints and coatings.

The Lead, Cadmium, Chromium Compliance Plan shall be reviewed and approved (with signature, date of approval, and certification number) by the IH/PQP.

Submit a detailed job-specific plan of the work procedures to be used in the disturbance of lead, cadmium and chromium, LBP/PWL or MCL. Include in the plan a sketch showing the location, size, and details of lead, cadmium, chromium control areas, critical barriers, physical boundaries, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, work practices, controls and job responsibilities for each activity from which lead, cadmium, chromium is emitted. Include in the plan, eating, drinking, smoking, hygiene facilities and sanitary procedures, interface of trades, sequencing of lead, cadmium, chromium related work, collected waste water and dust containing lead, cadmium, chromium and debris, air sampling, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead, cadmium, chromium is not released outside of the lead, cadmium, chromium control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental sampling, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors on multicontractor worksites to inform affected employees and to clarify responsibilities to control exposures.

The plan shall also include the requirements of paragraphs 1.5.1.1 through [1.5.1.4][1.5.1.5].

[The plan must be developed and signed by the IH/PQP . The plan must include the name, certificate, and certification number of the person signing the plan.

][In occupied buildings, the plan must also include an occupant protection program that describes the measures that will be taken during the work to[notify and] protect the building occupants.

]1.5.2.3 Occupational and Environmental Assessment Data Report

If initial monitoring is necessary, submit occupational and environmental sampling results to the Contracting Officer within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.

[In order to reduce the full implementation of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 the Contractor must provide documentation. Submit a report that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62,29 CFR 1926.1126, 29 CFR 1926.1127 and supporting the Lead, Cadmium, Chromium Compliance Plan.

] a. The initial monitoring must represent each job classification, or if working conditions are similar to previous jobs by the same employer,

provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62,29 CFR 1926.1126, 29 CFR 1926.1127. The data must represent the worker's regular daily exposure to lead, cadmium, chromium for stated work.

b. Submit worker exposure data gathered during the task based trigger operations of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 with a complete process description. This includes manual demolition, manual scraping, manual sanding, heat gun, power tool cleaning, rivet busting, cleanup of dry expendable abrasives, abrasive blast enclosure removal, abrasive blasting, welding, cutting and torch burning where lead, cadmium and chromium containing coatings are present.

c. The initial assessment must determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead, cadmium, chromium compliance plan per 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

1.5.2.4 Medical Examinations

Submit pre-work blood lead levels and post-work blood lead levels for all workers performing lead, cadmium, chromium activities during the execution of the work. Initial medical surveillance as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 must be made available to all employees exposed to lead, cadmium, chromium at any time (one day) above the action level. Full medical surveillance must be made available to all employees on an annual basis who are or may be exposed to lead, cadmium and chromium in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Adequate records must show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and 29 CFR 1926.103. Provide medical surveillance to all personnel exposed to lead, cadmium, chromium as indicated in 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Maintain complete and accurate medical records of employees for the duration of employment plus 30 years.

1.5.2.5 Training

Train each employee performing work that disturbs lead, cadmium, chromium, who performs LBP/MCL/PWL disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127, 40 CFR 745 and GOJ and local regulations where appropriate.

1.5.2.6 Respiratory Protection Program

a. Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

b. Establish and implement a respiratory protection program as required by 29 CFR 1926.103, 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and 29 CFR 1926.55.

1.5.2.7 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

1.5.2.8 Lead, Cadmium, Chromium Waste Management

The Lead, Cadmium, Chromium Waste Management Plan must comply with applicable requirements of the JEGS. U.S federal, GOJ National, prefectural, and local hazardous waste regulations and address:

a. Identification and classification of wastes associated with the work.

b. Estimated quantities of wastes to be generated and disposed of.

c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location[and operator] and a 24-hour point of contact. Furnish two copies of local hazardous waste permits.

d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.

e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.

f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.

g. Work plan and schedule for waste containment, removal and disposal. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers. Clean up and containerize wastes daily.

h. Include any process that may alter or treat waste rendering a hazardous waste non hazardous.

i. Unit cost for hazardous waste disposal according to this plan.

1.5.2.9 Environmental, Safety and Health Compliance

In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of the JEGS, U.S. federal, GOJ national, prefectural, and local authorities regarding lead, cadmium and chromium. Comply with the applicable requirements of the current issue of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127, ND OPNAVINST 5100.23, andEM 385-1-1. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirements apply. The following local laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing of lead, cadmium and chromium-contaminated materials apply:

a. [JEGS] [_____]

b. [Waste Disposal and Public Cleaning Law - licensing and certification in accordance with Japanese law][_____]

c. [_____]

[[Licensing][and certification] in the state of [_____] is required.

]1.5.3 Pressure Differential Recordings for Local Exhaust System

Provide a local exhaust system that creates a negative pressure of at least 0.51 mm of water relative to the pressure external to the enclosure and operate it continuously, 24-hours a day, until the temporary enclosure of the lead, cadmium, chromium control area is removed. Submit pressure differential recordings for each work day to the [PQP][and][GC] for review and to the Contracting Officer within 24-hours from the end of each work day.

1.5.4 Licenses, Permits and Notifications

Certify and submit in writing to the Contracting Officer at least [10] [_____] days prior to the commencement of work that [_____] licenses, permits and notifications have been obtained. All associated fees or costs incurred in obtaining the licenses, permits and notifications are included in the contract price.

1.5.5 Occupant Protection Plan

The certified project designer must develop and implement an Occupant Protection Plan describing the measures and management procedures to be taken during lead, cadmium and chromium hazard abatement activities to protect the building occupants/building facilities and the outside environment from exposure to any lead, cadmium and chromium contamination while lead, cadmium and chromium hazard abatement activities are performed.

1.5.6 Pre-Construction Conference

Along with the CP, meet with the Contracting Officer to discuss in detail the Lead, Cadmium, Chromium Waste Management Plan and the Lead, Cadmium, Chromium Compliance Plan, including procedures and precautions for the work.

1.6 EQUIPMENT

1.6.1 Respirators

Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead, cadmium and chromium dust, fume and mist. Respirators must comply with the requirements of 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127, and any other GOJ and local prefectural requirements on respirators.

1.6.2 Special Protective Clothing

Personnel exposed to lead, cadmium, chromium contaminated dust must wear proper [disposable] [uncontaminated, reusable] protective whole body clothing, head covering, gloves, eye, and foot coverings as required by 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.

1.6.3 Rental Equipment Notification

If rental equipment is to be used during PWL or MCL handling and disposal, notify the rental agency in writing concerning the intended use of the equipment.

1.6.4 Vacuum Filters

UL 586 labeled HEPA filters.

1.6.5 Equipment for Government Personnel

Furnish the Contracting Officer with [two] [_____] complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the lead, cadmium and chromium removal work within the lead, cadmium and chromium controlled area. Personal protective equipment must include disposable whole body covering, including appropriate foot, head, eye, and hand protection. PPE remains the property of the Contractor. The Government will provide respiratory protection for the Contracting Officer.

1.6.6 Abrasive Removal Equipment

The use of powered machine for vibrating, sanding, grinding, or abrasive blasting is prohibited unless equipped with local exhaust ventilation systems equipped with high efficiency particulate air (HEPA) filters.

1.6.7 Negative Air Pressure System

1.6.7.1 Minimum Requirements

Do not proceed with work in the area until containment is set up and HEPA filtration systems are in place. The negative air pressure system must meet the requirements of ASSE/SAFE Z9.2 including approved HEPA filters in accordance with UL 586. Negative air pressure equipment must be equipped with new HEPA filters, and be sufficient to maintain a minimum pressure differential of minus 0.005 kPa relative to adjacent, unsealed areas. Negative air pressure system minimum requirements are listed as follows:

a. The unit must be capable of delivering its rated volume of air with a clean first stage filter, an intermediate filter and a primary HEPA filter in place.

b. The HEPA filter must be certified as being capable of trapping and retaining mono-disperse particles as small as 0.3 micrometers at a minimum efficiency of 99.97 percent.

c. The unit must be capable of continuing to deliver no less than 70 percent of rated capacity when the HEPA filter is 70 percent full or measures 0.625 kPa static pressure differential on a magnehelic gauge.

d. Equip the unit with a manometer-type negative pressure differential monitor with minor scale division of 0.005 kPa and accuracy within plus or minus 1.0 percent. The manometer must be calibrated daily as recommended by the manufacturer.

e. Equip the unit with a means for the operator to easily interpret the readings in terms of the volumetric flow rate of air per minute moving through the machine at any given moment.

f. Equip the unit with an electronic mechanism that automatically shuts the machine off in the event of a filter breach or absence of a filter.

g. Equip the unit with an audible horn that sounds an alarm when the

machine has shut itself off.

h. Equip the unit with an automatic safety mechanism that prevents a worker from improperly inserting the main HEPA filter.

1.6.7.2 Auxiliary Generator

Provide an auxiliary generator with capacity to power a minimum of 50 percent of the negative air machines at any time during the work. When power fails, the generator controls must automatically start the generator and switch the negative air pressure system machines to generator power. The generator must not present a carbon monoxide hazard to workers.

1.6.8 Vacuum Systems

Vacuum systems must be suitably sized for the project, and filters must be capable of trapping and retaining all mono-disperse particles as small as 0.3 micrometers (mean aerodynamic diameter) at a minimum efficiency of 99.97 percent. Properly dispose of used filters that are being replaced.

1.6.9 Heat Blower Guns

Heat blower guns must be flameless, electrical, paint-softener type with controls to limit temperature to 590 degrees C. Heat blower must be (grounded) 120 volts ac, and must be equipped with cone, fan, glass protector and spoon reflector nozzles.

1.7 PROJECT/SITE CONDITIONS

1.7.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better as determined by the Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Keep materials and equipment needed to complete the project available and on the site. Submit a description of the materials and equipment required; including Safety Data Sheets (SDSs) for material brought onsite to perform the work.

2.1.1 Expendable Supplies

Submit a description of the expendable supplies required.

2.1.1.1 Polyethylene Bags

Disposable bags must be polyethylene plastic and be a minimum of 0.15 mm thick (0.1 mm thick if double bags are used) or any other thick plastic material shown to demonstrate at least equivalent performance; and capable of being made leak-tight. Leak-tight means that solids, liquids or dust cannot escape or spill out.

2.1.1.2 Polyethylene Leak-tight Wrapping

Wrapping used to wrap lead, cadmium, chromium contaminated debris must be

polyethylene plastic that is a minimum of 0.15 mm thick or any other thick plastic material shown to demonstrate at least equivalent performance.

2.1.1.3 Polyethylene Sheeting

Sheeting must be polyethylene plastic with a minimum thickness of 0.15 mm, or any other thick plastic material shown to demonstrate at least equivalent performance; and be provided in the largest sheet size reasonably accommodated by the project to minimize the number of seams. Where the project location constitutes an out of the ordinary potential for fire, or where unusual fire hazards cannot be eliminated, provide flame-resistant polyethylene sheets which conform to the requirements of NFPA 701.

2.1.1.4 Tape and Adhesive Spray

Tape and adhesive must be capable of sealing joints between polyethylene sheets and for attachment of polyethylene sheets to adjacent surfaces. After dry application, tape or adhesive must retain adhesion when exposed to wet conditions, including amended water. Tape must be minimum 50 mm wide, industrial strength.

2.1.1.5 Containers

When used, containers must be leak-tight and be labeled in accordance with EPA, DOT, GOJ, local prefecture, and OSHA standards.

2.1.1.6 Chemical Paint Strippers

Chemical paint strippers must not contain methylene chloride and be formulated to prevent stain, discoloration, or raising of the substrate materials.

2.1.1.7 Chemical Paint Stripper Neutralizer

Neutralizers for paint strippers must be compatible with the substrate and suitable for use with the chemical stripper that has been applied to the surface.

2.1.1.8 Detergents and Cleaners

Detergents or cleaning agents must not contain trisodium phosphate and have demonstrated effectiveness in lead, cadmium and chromium control work using cleaning techniques specified by HUD 6780 guidelines.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

3.1.1.1 Notification

a. Notify the Contracting Officer [20] [_____] days prior to the start of any lead, cadmium and chromium work.

[b. Occupant Notification

Submit occupant written acknowledgment of the delivery of lead hazard

information pamphlet (EPA 747-K-99-001 "Protect Your Family From Lead in Your Home") prior to commencing the renovation work for each affected unit using language provided in 40 CFR 745 Subpart E.

][c. Notification of the Commencement of [LBP] Hazard Abatement

[Submit a copy of the notification of the commencement of[LBP] hazard abatement to [_____] according to the procedures established by [_____].

]]3.1.1.2 Lead, Cadmium, Chromium Control Area

a. Physical Boundary - Provide physical boundaries around the lead, cadmium, chromium control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that lead, cadmium and chromium will not escape outside of the lead, cadmium and chromium control area. Prohibit the general public from accessing the lead, cadmium, chromium control areas.

b. Warning Signs - Provide bilingual warning signs in English and Japanese at approaches to lead, cadmium, chromium control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs must comply with the requirements of 29 CFR 1926.62.

3.1.1.3 Furnishings

[The Government will remove furniture and equipment from the building before lead, cadmium and chromium work begins.

][Furniture [_____] and equipment will remain in the [building][lead, cadmium, chromium control area]. Protect and cover furnishings or remove furnishings from the work area and store in a location approved by the Contracting Officer.

][Existing [furniture][and][equipment] is lead, cadmium and chromium contaminated, [decontaminate][dispose of as lead, cadmium, chromium contaminated waste].

]3.1.1.4 Heating, Ventilating and Air Conditioning (HVAC) Systems

Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead, cadmium, chromium control areas. Seal intake and exhaust vents in the lead, cadmium, chromium control area with 0.15 mm plastic sheet and tape. Seal seams in HVAC components that pass through the lead, cadmium, chromium control area.[Provide temporary HVAC system for areas in which HVAC has been shut down outside the lead, cadmium, chromium control area.]

3.1.1.5 Local Exhaust System

Provide a local exhaust system in the lead, cadmium, chromium control area in accordance with ASSE/SAFE Z9.2, 29 CFR 1926.62, 29 CFR 1926.1126 and 29 CFR 1926.1127 that will provide at least [4][_____] air changes per hour inside of the negative pressure enclosure. Local exhaust equipment must be operated 24-hours per day, until the lead, cadmium, chromium control area is removed and must be leak proof to the filter and equipped with HEPA filters. Maintain a minimum pressure differential in the lead,

cadmium, chromium control area of minus 0.51 mm of water column relative to adjacent, unsealed areas. Provide continuous 24-hour per day monitoring of the pressure differential with a pressure differential automatic recording instrument. The building ventilation system must not be used as the local exhaust system for the lead, cadmium, chromium control area. Filters on exhaust equipment must conform to ASSE/SAFE Z9.2 and UL 586. Terminate the local exhaust system out of doors and remote from any public access or ventilation system intakes.

3.1.1.6 Negative Air Pressure System Containment

a. Operate the negative air pressure systems to provide at least [4][10][_____] air changes per hour inside the containment. Operate the local exhaust unit equipment continuously until the containment is removed. Smoke test the negative air pressure system for leaks at the beginning of each shift. The certified supervisor is responsible to continuously monitor and keep a pressure differential log with an automatic manometric recording instrument. Notify the Contracting Officer immediately if the pressure differential falls below the prescribed minimum. Submit the continuously monitored pressure differential log, as specified. Do not use the building ventilation system as the local exhaust system. Terminate the local exhaust system out of doors unless the Contracting Officer allows an alternate arrangement. All filters must be new at the beginning of the project and be periodically changed as necessary to maintain specified pressure differential and disposed of as lead, cadmium and chromium contaminated waste.

b. Discontinuing Negative Air Pressure System. Operate the negative air pressure system continuously during abatement activities unless otherwise authorized by the Contracting Officer. At the completion of the project, units must be run until full cleanup has been completed and final clearance testing requirements have been met. Dismantling of the negative air pressure systems must [conform to written decontamination procedures] [be approved by the Contracting Officer] be as presented in the Lead, Cadmium, Chromium Compliance Plan. Seal the HEPA filter machine intakes with polyethylene to prevent environmental contamination.

3.1.1.7 Decontamination Shower Facility

Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

3.1.1.8 Eye Wash Station

Provide suitable facilities within the work area for quick drenching or flushing of the eyes where eyes may be exposed to injurious corrosive materials.

3.1.1.9 Mechanical Ventilation System

a. Use adequate ventilation to control personnel exposure to lead, cadmium and chromium in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127. To the extent feasible, use local exhaust ventilation or other collection systems, approved by the CP. Evaluate and maintain local exhaust ventilation systems in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127.

b. Vent local exhaust outside the building and away from building ventilation intakes or ensure system is connected to HEPA filters.

c. Use locally exhausted, power actuated tools or manual hand tools.

3.1.1.10 Personnel Protection

Personnel must wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead, cadmium, chromium control area. No one will be permitted in the lead, cadmium, chromium control area unless they have been appropriately trained and provided with protective equipment.

3.2 ERECTION

3.2.1 Lead, Cadmium, Chromium Control Area Requirements

[Establish a lead, cadmium, chromium control area by completely establishing barriers and physical boundaries around the area or structure where PWL or MCL removal operations will be performed.
]
[Full containment - Contain removal operations by the use of[critical barriers][and HEPA filtered exhaust][a negative pressure enclosure system with decontamination facilities and with HEPA filtered exhaust if required by the CP]. For containment areas larger than 100 square meters install a minimum of two 450 mm square viewing ports. Locate ports to provide a view of the required work from the exterior of the enclosed contaminated area. Glaze ports with laminated safety glass.

]3.3 APPLICATION

3.3.1 Lead, Cadmium, Chromium Work

Perform lead, cadmium, chromium work in accordance with approved Lead, Cadmium, Chromium Compliance Plan. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead, cadmium, chromium when the work is performed in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127[or 40 CFR 745], and as specified herein. Dispose of all PWL or MCL and associated waste in compliance with the JEGS. U.S. federal, GOJ national, prefectural laws and regulations, and local requirements.

3.3.2 Paint with Lead, Cadmium, Chromium or Material Containing Lead, Cadmium, Chromium Removal

[Manual or power sanding or grinding of lead, cadmium, chromium surfaces or materials is not permitted unless tools are equipped with HEPA attachments or wet methods. The dry sanding or grinding of surfaces that contain lead, cadmium, chromium is prohibited.]Provide methodology for removing lead, cadmium, chromium in the Lead, Cadmium, Chromium Compliance Plan. Select lead, cadmium, chromium removal processes to minimize contamination of work areas outside the control area with lead, cadmium, chromium contaminated dust or other lead, cadmium, chromium contaminated debris or waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead, cadmium, chromium. Describe this removal process in the Lead, Cadmium, Chromium Compliance Plan. [_____]

[Avoid [flash rusting][deterioration] of the substrate. Provide surface

preparations for painting in accordance with Section 09 90 00 PAINTS AND COATINGS.

]

Provide methodology for lead, cadmium and chromium, LBP/PWL [removal][abatement/control] and processes to minimize contamination of work areas outside the control area with lead, cadmium, chromium contaminated dust or other lead, cadmium, chromium contaminated debris/waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead, cadmium, chromium. Describe this lead,, cadmium and chromium, LBP/PWL removal/control process in the Lead, Cadmium, Chromium Compliance Plan. [_____]

3.3.2.1 Paint with Lead, Cadmium, Chromium or Material Containing Lead, Cadmium, Chromium - Indoor Removal

Perform [manual][mechanical] removal[and thermal cutting] in the lead, cadmium, chromium control areas using enclosures, barriers or containments[and powered locally exhausted tools equipped with HEPA filters]. Collect residue and debris for disposal in accordance with the JEGS, U.S. federal, GOJ national, prefectural, and local requirements.

3.3.2.2 Paint with Lead, Cadmium, Chromium or Material Containing Lead, Cadmium, Chromium - Outdoor Removal

Perform outdoor removal as indicated in the JEGS, U.S. federal, GOJ national, prefectural, and local regulations and in the Lead, Cadmium, Chromium Compliance Plan. The worksite preparation (barriers or containments) must be job dependent and presented in the Lead, Cadmium, Chromium Compliance Plan.

3.3.3 Personnel Exiting Procedures

Whenever personnel exit the lead, cadmium, chromium controlled area, they must perform the following procedures and must not leave the work place wearing any clothing or equipment worn in the control area:

a. Vacuum all clothing before entering the contaminated change room.

b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.

[c. Shower.

][c. Wash hands and face at the site, don appropriate disposable or uncontaminated reusable clothing, move to an appropriate shower facility, shower.

] d. Change to clean clothes prior to leaving the clean clothes storage area.

3.4 FIELD QUALITY CONTROL

3.4.1 Tests

3.4.1.1 Air and Wipe Sampling

Conduct sampling for lead, cadmium, chromium in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and as specified herein. Air and wipe sampling must be directed or performed by the CP.

a. The CP must be on the job site directing the air and wipe sampling and inspecting the PWL or MCL removal work to ensure that the requirements of the contract have been satisfied during the entire PWL or MCL operation.

b. Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least twenty-five percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.

c. Submit results of air samples, signed by the CP, within 72-hours after the air samples are taken.

d. Conduct area air sampling daily, on each shift in which lead, cadmium and chromium and lead-based paint removal operations are performed, in areas immediately adjacent to the lead, cadmium and chromium control area. Conduct sufficient area monitoring to ensure unprotected personnel are not exposed at or above 30 micrograms of lead per cubic meter of air or 2.5 micrograms of cadmium/chromium per cubic meter of air. If 30 micrograms of lead per cubic meter of air or 2.5 micrograms of cadmium/chromium per cubic meter of air is reached or exceeded, stop work, correct the conditions(s) causing the increased levels. Notify the Contracting Officer immediately. Determine if condition(s) require any further change in work methods. Resume removal work only after the CP and the Contracting Officer give approval.

[e. Before any work begins,[a third party consultant must] collect and analyze baseline wipe[and soil] samples in accordance with methods defined by the JEGS, U.S. federal, GOJ national, prefectural, and local standards inside and outside of the physical boundary to assess the degree of dust contamination in the facility prior to lead, cadmium and chromium disturbance or removal. Provide Initial Sample Results to the Contracting Officer before work begins.
]
[f. Surface Wipe Samples - Collect surface wipe samples on floors at a location no greater than 3 m outside the lead, cadmium, chromium control area at a frequency of once per day while lead, cadmium, chromium removal work is conducted in occupied buildings. Surface wipe samples or Micro Vacuum surface sample results must meet criteria in paragraph CLEARANCE CERTIFICATION.

]3.4.1.2 Sampling After Removal

After the visual inspection,[conduct soil sampling if bare soil is present during external removal operations and] collect wipe[and soil] samples according to the HUD protocol contained in HUD 6780 to determine the lead, cadmium and chromium content of settled dust in micrograms per square meter foot of surface area[and micrograms per gram (ug/g) for soil].

[3.4.1.3 Testing of Material Containing Lead, Cadmium, Chromium Residue

Test residue in accordance with 40 CFR 261 for hazardous waste.

]3.5 CLEANING AND DISPOSAL

3.5.1 Cleanup

Maintain surfaces of the lead, cadmium, chromium control area free of accumulations of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use pressurized air to clean up the area. At the end of each shift and when the lead, cadmium, chromium operation has been completed, clean the controlled area of all visible contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the Lead, Cadmium, Chromium Compliance Plan. Reclean areas showing dust or debris. After visible dust and debris is removed, wet wipe and HEPA vacuum all surfaces in the controlled area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP must then certify in writing that the area has been cleaned of lead, cadmium and chromium contamination before clearance testing.

3.5.1.1 Clearance Certification

The CP must certify in writing that air samples collected outside the lead, cadmium, chromium control area during paint removal operations are less than 30 micrograms of lead per cubic meter of air and less than 2.5 micrograms of cadmium/chromium per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127; and that there were no visible accumulations of material and dust containing lead, cadmium, chromium left in the work site. Do not remove the lead, cadmium, chromium control area or roped off boundary and warning signs prior to the Contracting Officer's acknowledgement of receipt of the CP certification.

[The third party consultant must certify surface wipe sample results collected inside and outside the work area are[less than 40 micrograms of lead per 0.1 square meter on floors, less than 250 micrograms of lead per 0.1 square meter on interior window sills and less than 400 micrograms of lead per 0.1 square meter on window troughs][not significantly greater than the initial surface loading determined prior to work].

][The third party consultant must certify surface wipe sample or Micro Vacuum surface sample results collected inside and outside the work area are less than 200 micrograms of lead per 0.1 square meter on floors or horizontal surfaces. Micro Vacuum technique should be used on rough or porous surfaces which are difficult to achieve clearance by the wipe sampling methodology.

][Certify surface wipe samples are not significantly greater than the initial surface loading determined prior to work.

][Clear the lead, cadmium, chromium control area in industrial facilities of all visible dust and debris.

][For exterior work, soil samples taken at the exterior of the work site must be used to determine if soil lead, cadmium, chromium levels have increased at a statistically significant level (significant at the 95 percent confidence limit) from the soil lead, cadmium, chromium levels prior to the operation. If soil lead, cadmium, chromium levels either show a statistically significant increase above soil lead, cadmium,

chromium levels prior to work or soil lead, cadmium, chromium levels above any applicable JEGS, U. S. federal, GOJ national, prefectural, or local standard for lead, cadmium, chromium in soil, the soil must be remediated.

][For lead, cadmium and chromium-based paint hazard abatement work, surface wipe and soil sampling must be conducted and clearance determinations made according to the work practice standards presented in 40 CFR 745.227.

]3.5.2 Disposal

a. Dispose of material, whether hazardous or non-hazardous in accordance with all laws and provisions and all JEGS, U.S. federal, GOJ national, prefectural laws and regulations or local regulations. Ensure all waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.

b. Contractor is responsible for segregation of waste. Collect lead, cadmium, chromium contaminated waste, scrap, debris, bags, containers, equipment, and lead, cadmium, chromium contaminated clothing that may produce airborne concentrations of lead, cadmium, chromium particles. Label the containers in accordance with the JEGS, 29 CFR 1926.62, 29 CFR 1926.1126, 29 CFR 1926.1127 and 40 CFR 261, 40 CFR 262 and corresponding state regulations.

c. Dispose of lead, cadmium, chromium contaminated material classified as hazardous waste at a locally approved hazardous waste treatment, storage, or disposal facility off Government property.

d. Accumulate waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums or appropriately sized container for smaller volumes. Properly label each drum to identify the type of hazardous material (49 CFR 172). For hazardous waste, the collection container requires marking/labeling in accordance with the JEGS, 40 CFR 262 and corresponding GOJ national and local prefectural regulations during the accumulation/collection timeframe. The Contracting Officer or an authorized representative will assign an area for accumulation of waste containers. Coordinate authorized accumulation volumes and time limits with the host installation environmental function.

e. Handle, store, transport, and dispose lead, cadmium, chromium or lead, cadmium, chromium contaminated waste in accordance with the JEGS, 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.

f. All lead, cadmium, and chromium waste generation, management,and disposal will be coordinated with the host installation environmental function.

3.5.2.1 Disposal Documentation

Coordinate all disposal or off-site shipments of lead, cadmium, and chromium waste with the host installation environmental function. Submit written evidence of TSD approval to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead, cadmium, chromium disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest,

signed and dated by the initial transporter in accordance with 40 CFR 262, JEGS, GOJ National, prefectural laws and local regulations. Provide a certificate that the waste was accepted by the disposal facility.[Provide turn-in documents or weight tickets for non-hazardous waste disposal.]

3.5.2.2 Payment for Hazardous Waste

Payment for disposal of hazardous and non-hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility is received and approved by the Contracting Officer. The manifest must detail and certify the amount of lead, cadmium, chromium containing materials or non-hazardous waste delivered to the treatment or disposal facility.

-- End of Section --

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SECTION 02 84 16

HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBS AND MERCURY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPAN MINISTRY OF THE ENVIRONMENT(MOE)

Act No. 137	(1970, Amended 1991 and 2006) Waste Management and Public Cleansing Law

U.S. DEPARTMENT OF DEFENSE (DOD)

JEGS	(Dec 2020) Japan Environmental Governing Standards

1.2 REQUIREMENTS

Removal and disposal of PCB containing lighting ballasts and associated mercury-containing lamps. Contractor may encounter leaking PCB ballasts. PCB ballasts and/or mercury containing lighting fixtures or other equipment may be encountered in additional locations not listed in the drawings or the project Hazardous Materials Inspection Report(s). Inspect, confirm, and identify all PCB-containing ballasts and any other PCB-containing, mercury-containing, or otherwise hazardous material as part of project work.

1.3 DEFINITIONS

1.3.1 IH/PQP

Industrial Hygienist/Private Qualified Person required by the Contractor.

1.3.2 Leak

Leak or leaking means any instance in which a PCB article, PCB container, or PCB equipment has any PCBs on any portion of its external surface.

1.3.3 Lamps

Lamp is defined as the bulb or tube portion of an electric lighting device. A lamp is specifically designed to produce radiant energy, most often in the ultraviolet, visible, and infra-red regions of the electromagnetic
spectrum. Examples of common universal waste electric lamps include, but are not limited to, fluorescent, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps.

1.3.4 Polychlorinated Biphenyls (PCBs)

PCBs as used in this specification shall mean the same as PCBs, PCB containing lighting ballast, and PCB container, as defined in JEGS,

Chapter 14, Polychlorinated Biphenyls

1.3.5 Spill

Spill means both intentional and unintentional spills, leaks, and other uncontrolled discharges when the release results in any quantity of PCBs running off or about to run off the external surface of the equipment or other PCB source, as well as the contamination resulting from those releases.

1.4 QUALITY ASSURANCE

1.4.1 Regulatory Requirements

Perform PCB related work in accordance with JEGS, Act No. 137, and other applicable US Federal, GOJ, and local laws and regulations. Perform mercury-containing lamps storage and transport in accordance with JEGS, Act No. 137, and other applicable US Federal, GOJ, and local laws and regulations.

1.4.1.1 PCB and Lamp Management and Disposal Plan

Prior to handling any PCB items, the Contractor shall submit a PCB and Lamp Management and Disposal Plan. The submitted plan shall include the PCB and Lamp Removal and Disposal Work Plan, [PCB and Lamp Disposal Plan], Qualifications of the IH/PQP, and Japan Industrial Waste Collection and Transport Permit.

1.4.2 Training

Industrial Hygienist/Private Qualified Person (IH/PQP) shall instruct and certify the training of all persons involved in the removal of PCB containing lighting ballasts and mercury-containing lamps. The instruction shall include: The dangers of PCB and mercury exposure, decontamination, safe work practices, and applicable OSHA and EPA, JEGS, GOJ, and prefectural regulations.

The IH/PQP shall review and approve the PCB and Mercury-Containing Lamp Removal Work Plans and temporary on-site Storage Plans.

1.4.3 Regulation Documents

Maintain at all times one copy each at the office and one copy each in view at the job site of pertinent JEGS Chapter 6, Hazardous Waste and Chapter 14, Polychlorinated Biphenyls, JEGS Appendix 1, and a copy of the Contractor PCB and Lamp Removal and Disposal Work Plan.

1.4.4 Qualifications of IH/PQP

[An industrial hygienist/private qualified person (IH/PQP) hired by the Contractor shall be a registered Architect, Professional Engineer (licensed), or US Certified Industrial Hygienist and having demonstratable experience in hazardous materials management (i.e. lighting ballasts and lamps containing PCBs or mercury), who is trained in the recognition and control of hazardous chemical related hazards, and has the authority to take prompt corrective actions to control the hazard. An IH/PQP must have working knowledge of applicable GOJ, Federal, local prefecture, and JEGS regulations as well as occupational safety and health regulations and shall be capable of recognizing chemical hazards associated with lighting

ballasts, lamps, and other similar building equipment or materials.][An individual with certification as an Industrial Hygienist (IH) or a Private Qualified Person (PQP) having demonstrable experience in hazardous materials management (i.e., lighting ballasts and lamps containing PCBs and Mercury), who is trained in the recognition and control of hazardous chemical related hazards, and has the authority to take prompt corrective actions to control the hazard.]

[Submit, as an attachment to the PCB and Lamp Management and Disposal Plan, the name, address, and telephone number of the Industrial Hygienist/Private Qualified Person selected to perform the duties in paragraph entitled "Industrial Hygienist/Private Qualified Person (IH/PQP)." Submit training certification that the Industrial Hygienist/Private Qualified Person is qualified, including certification number and date of certification or re certification.][The IH/PQP shall have at least 2 years of on the job experience in hazardous materials and hazardous waste management and have working knowledge of the JEGS, GOJ, as well as US and Japanese occupational safety and health regulations. The IH/PQP shall have knowledge in detecting, identifying, and evaluating existing or potential hazardous conditions related to PCB-containing light ballasts and mercury-containing lamps and other similar building equipment or materials. The IH/PQP may be considered qualified if he/she is either a certified Industrial Hygienist or is a Private Qualified Person with adequate prerequisite experience and knowledge as listed in this section.]

1.4.5 PCB and Lamp Removal and Disposal Work Plan

Submit a job-specific plan to be incorporated within the PCB and Lamp Management and Disposal Plan within [20] [14][_____] calendar days after [receipt of Notice to Proceed][prior to removal work] explaining the work procedures to be used in the removal, packaging, and storage of PCB-containing lighting ballasts and associated mercury-containing lamps.

Include in the plan: Requirements for Personal Protective Equipment (PPE), spill cleanup procedures and equipment, eating, smoking and restroom procedures.

The Plan shall comply with applicable requirements of Federal, JEGS, GOJ and prefectural PCB and mercury-related regulations. The plan shall be approved and signed by the IH/PQP. Obtain approval of the plan by the Contracting Officer prior to the start of PCB and/or lamp removal work.

All US-made ballasts, even those marked “NO-PCB” shall be turned in to the 718 CES/CEIE PCB Storage section. Call DSN 634-2600 5-days prior to delivery to schedule a drop off.

The plan shall address:

a. Estimate the quantity of ballasts to be delivered to Bldg 3625.

b. Estimate the quantity of mercury-containing lamps to be disposed or recycled at a certified commercial facility.

c. List the names and qualifications of each Contractor that will be transporting, storing, recycling and disposing of the toxic wastes.

d. Furnish a copy of current prefecture-issued waste permit showing that each company is certified by the prefecture to transport and dispose/recycle mercury-containing lamps or other waste.

e. Names and qualifications (experience and training) of personnel who will be working on-site with PCB and mercury-containing lamp wastes.

f. Spill prevention, containment, and cleanup contingency measures to be implemented.

g. Schedule for PCB and mercury-containing lamp waste removal, containment, storage, transportation, disposal and or recycling. Wastes shall be cleaned up and containerized daily.

h. When submitting the Environmental Protection Plan (EPP) in accordance with Section 01 57 19.01 TEMPORARY ENVIRONMENTAL CONTROLS, under the paragraphs pertaining to PCBs, state that the PCB and Lamp Removal and Disposal Work Plan will be submitted separately.

[1.4.6 PCB and Lamp Disposal Plan

Submit a PCB and lamp Disposal Plan to be incorporated within the PCB and Lamp Management and Disposal Plan, within [45] [_____] calendar days after [receipt of Notice to Proceed][prior to removal work]. The PCB and Lamp Disposal Plan shall comply with applicable requirements of the JEGS and applicable U.S. federal, GOJ, and local prefecture and JEGS PCB regulations and address:

a. Estimated quantities of wastes to be generated, disposed of, and recycled.

b. Names and qualifications of each Contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location. Furnish two copies of PCB and mercury-containing lamp waste permit applications and pertinent identification numbers, as required.

c. Names and qualifications (experience and training) of personnel who will be working on-site with PCB and mercury-containing lamp wastes.

d. Spill prevention, containment, and cleanup contingency measures to be implemented.

e. Work plan and schedule for PCB and mercury-containing lamp waste removal, containment, storage, transportation, disposal and or recycling. Wastes shall be cleaned up and containerized daily.

]1.4.7 Notification

Notify the Contracting Officer 20 days prior to the start of PCB removal work.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Notification

PCB and Lamp Management and Disposal Plan; G [, [_____]]

SD-11 Closeout Submittals

[Transporter certification ; G[, [_____]]

Certification of Decontamination]

Copy E of the Japan Hazardous Waste Manifest; G. Submit to the Government before application for payment within 30 days of the date that the disposal of the PCB and mercury-containing lamp waste identified on the manifest was completed.

[Disposal Request Form]
][
Signed Ballast Turn-in (at Bldg 3625) Sheet

]1.6 ENVIRONMENTAL REQUIREMENTS

Use special clothing:

a. Disposable gloves (polyethylene)

b. Eye protection

c. PPE as required by IH/PQP

1.7 SCHEDULING

Notify the Contracting Officer 20 days prior to the start of PCB and mercury-containing lamp removal work.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 WORK PROCEDURE

Furnish labor, materials, services, and equipment necessary for the removal of PCB containing lighting ballasts, associated mercury-containing fluorescent lamps, and high intensity discharge (HID) lamps in accordance with the JEGS, applicable GOJ and local, prefectural regulations. Do not expose PCBs to open flames or other high temperature sources since toxic decomposition by-products may be produced. Do not break mercury containing fluorescent lamps or high intensity discharge lamps.

3.1.1 Work Operations

Ensure that work operations or processes involving PCB or PCB-contaminated materials are conducted in accordance with the JEGS, applicable U.S. Federal, GOJ, and local laws and regulations, and the applicable requirements of this section, including but not limited to:

a. Obtaining suitable PCB and mercury-containing lamp storage sites.

b. Notifying Contracting Officer prior to commencing the operation.

c. Reporting leaks and spills to the Contracting Officer.

d. Cleaning up spills.

e. Inspecting PCB and PCB-contaminated items and waste containers for leaks and forwarding copies of inspection reports to the Contracting Officer.

f. Maintaining inspection, inventory and spill records.

3.2 PCB SPILL CLEANUP REQUIREMENTS

3.2.1 PCB Spills

. The Contractor shall respond to spills of PCB-containing materials by following Attachment 02 84 16-A. Immediately report to the Contracting Officer any PCB spills. The Contractor is responsible to keep emergency spill kits kept within walking distance from the job site in accordance to requirements in Attachment 02 84 16-B.

3.2.2 PCB Spill Control Area

Rope off an area around the edges of a PCB leak or spill and post a bilingual "PCB Spill Authorized Personnel Only" caution sign in English and Japanese. Immediately transfer leaking items to a drip pan or other container.

3.2.3 PCB Spill Cleanup

Initiate cleanup of spills as soon as possible, but no later than 24 hours of its discovery. [Mop up the liquid with rags or other conventional absorbent. The cleanup materials such as absorbents shall be properly contained and turned over as PCB waste with the ballasts.][Mop up the liquid with rags or other conventional absorbent. The spent absorbent shall be properly contained and turned over to the MCB Butler Environmental Support Team (EST) as solid PCB waste. Follow all requirements in Attachment 02 84 16-B.]

[3.2.4 Records and Certification

Document the cleanup with records of decontamination in accordance with the JEGS Chapter 14, Polychlorinated Biphenyls and applicable US Federal, GOJ, and prefectural requirements for PCB Spill Cleanup. Provide test results of cleanup and certification of decontamination.

]3.3 REMOVAL

3.3.1 Ballasts

[For removed ballasts that are not leaking, up to 300 ballasts may be stored on wooden or plastic pallets on-site for up to 30 days prior to delivery.

Ballasts that are leaking must be immediately stored in leak-proof drip pans, buckets, or double bagged in nitrile bags and stored in a secure

area that is not exposed to rainfall. Mark the storage area in English and Japanese in accordance with JEGS and Japan national and prefectural regulation.

Any PCB oil that has contaminated the ballast mount or other fixtures must be cleaned or removed and turned in with the ballasts. Prior to transport for disposal, the contractor shall segregate Japanese ballasts from US ballasts.

All non-Japanese ballasts, including those with a "NO PCB" label shall be assumed to contain as high as 49 ppm and shall be handled, stored, transported, and disposed of as PCB ballasts. The contractor shall deliver all non-Japanese ballasts to the 718 CES/CEIE Environmental Office at Bldg 3625. Ballasts may be delivered between 0800 and 1200 on any Friday except for federal holidays. Call DSN 634-2600 a minimum of 5-days prior to delivery to request forklift unloading assistance.

For Japanese-made ballasts, the Contractor shall segregate regulated PCB ballasts from non-regulated ballasts according to GOJ and prefectural regulations. Information to discriminate between regulated and non-regulated ballasts can be obtained from:
https://www.env.go.jp/recycle/poly/
https://www.env.go.jp/recycle/poly/law/no_14091618.pdf

Regulated PCB ballasts shall be delivered to the 718 CES/CEIE Environmental Office at Bldg 3625. Non-regulated Japanese ballasts become property of the contractor and shall be disposed of in accordance with GOJ and prefectural regulations. In the submitted PCB and Lamp Removal & Disposal Work Plan, clearly state how non-regulated Japanese ballasts will be disposed.

A copy of the Signed Ballast Turn-in (at Bldg 3625) Sheet shall be submitted to the COR.]

[Light ballasts may still contain PCBs even where a "No PCB" label exists on the ballast due to regulatory differences between U.S. and GOJ definitions for "PCB Free". [Regardless of PCB concentration, manufacturer, country of origin, all light ballasts shall be removed, containerized, and turned into the Installation Environmental Division, in accordance with Attachment 02 84 16-B.] PCB abatement or handling shall be in accordance with JEGS Chapter 14 and Attachment 02 84 16-B.

The Contractor shall identify all project ballasts that contain and do not contain PCBs or are suspect to contain PCBs. The Contractor shall submit the PCB ballast list (to include suspect PCB ballasts) to the Contracting Officer Representative (COR). PCB containing ballasts and suspect PCB containing ballasts shall be segregated by country of manufacture.

The following procedures for US manufactured and Japan manufactured ballasts shall be used in the identification of PCB ballasts and described in this section.]

3.3.1.1 For US Manufactured Ballasts

US manufactured ballasts shall not be mixed with Japan manufactured ballasts. The Contractor shall segregate and palletize US manufactured ballasts separately from Japan manufactured ballasts at the point of generation for subsequent turn in to the MCB Butler EST (HW/PCB Program Manager, 098-970-3139 or 098-970-5790). All ballasts, including "No PCB"

labeled ballasts and non-PCB containing ballasts, shall be containerized and turned into the MCB Butler EST.

3.3.1.2 For Japan Manufactured Ballasts

The Contractor shall carefully examine the ballast to identify the manufacturer name and year made. Consult with the manufacturer to identify any presence of PCBs. If absence of PCB cannot be confirmed, assume and treat the ballast as a PCB item.

Japan manufactured ballasts shall not be mixed with US manufactured ballasts. The Contractor shall segregate and palletize Japan manufactured ballasts separately from US manufactured ballasts at the point of generation for subsequent turn in to the MCB Butler EST (HW/PCB Program Manager, 098-970-3139 or 098-970-5790).

3.3.1.3 For Unmarked/Unlabeled Ballasts

The Contractor shall treat all unmarked/unlabeled ballasts as suspect PCB-containing materials and deliver to Bldg 3625. Segregate unmarked/unlabeled ballasts from other US or Japanese manufactured items. The Contractor shall contact the MCB Butler EST (HW/PCB Program Manager, 098-970-3139 or 098-970-5790) to establish proper procedures for the management of unmarked/unlabeled ballasts.

3.3.2 [Fluorescent Light Tubes (Bulbs)][Fluorescent Lamps]

[The Contractor shall carefully remove and store fluorescent light bulbs in a manner such that they remain intact. Fluorescent light tubes suspect for containing mercury shall be handled and disposed of by the Contractor in accordance to all GOJ, Federal, local prefectural laws and regulations and the JEGS. In the event of a lighting tube/lamp breaking, sweep and place waste in double plastic taped bags and dispose of as appropriate to GOJ, Federal, local prefecture laws and regulations and the JEGS.]

[Remove lighting lamps from the lighting fixture and carefully place into appropriate containers in accordance with JEGS, GOJ, and prefecture regulations. In the event of a lighting lamp breakage, sweep and place waste in double plastic taped bags, place in appropriate containers, and dispose together with the lamps.]

3.4 STORAGE FOR DISPOSAL

3.4.1 Storage Containers for PCBs

[Store PCB in containers as required by JEGS and applicable US Federal, GOJ, and local requirements for PCBs and/or PCB related materials][Store ballasts in accordance with JEGS and this section. Ballasts must be in secondary containment that is not exposed to rainfall].

3.4.2 Storage Containers for Lamps

[Store mercury containing lamps in appropriate containers. The boxes shall be stored and labeled for transport in accordance with JEGS, Act No. 137, the MOE Waste Management, and Public Cleansing Law, and applicable US Federal, GOJ, and local requirements.][Store and mark containers for lamps in accordance with JEGS, GOJ, and prefecture regulation.]

3.4.3 Labeling of Waste Containers

In accordance with JEGS, Chapter 14, prominently label in both English and Japanese with the following:

a. Date the item was placed in storage and the name of the cognizant activity/building.

b. Identification of items, warning against improper disposal and handling, and phone number in case of spills, conforming to JEGS. Affix labels to PCB waste containers.

c. Label mercury-containing lamp waste in accordance with JEGS and Act No. 137, the MOE Waste Management and Public Cleansing Law. Affix labels to all lighting waste containers.

3.5 DISPOSAL [PERMITS][/TURNOVER]

3.5.1 Japan Specially Controlled Hazardous Waste Disposal Permit

In the submitted PCB and Lamp Management and Disposal plan, include a copy of the Japan Specially Controlled Industrial Waste (SCIW) Permit (“Tokubetsu Kanri Haikibutsu Shobungyou Kyoka”) for the disposal or recycling facility where the mercury-containing lamps will be disposed. The permit must specifically say that the firm is authorized to accept mercury.

3.5.2 Japan Industrial Waste Collection and Transport Permit

In the submitted PCB and Lamp Management and Disposal plan, include a copy of the Japan Industrial Waste Collection and Transport Permit (“Sangyou Haikibutsu Shuushuu Unpangyou Kyoka”) for the transportation of mercury-contaminated wastes from the installation.

3.5.3 Japan Hazardous Waste Manifest (JHWM)

A minimum of 5-days prior to the scheduled transportation of mercury containing lamps or other PCB containing ballasts from the installation, contact the [718 CES/CEIE Environmental Section 634-2600] to schedule a pre-transportation inspection. A government representative will inspect, annotate the (JHWM), and authorize the shipment. No toxic wastes shall be transported off the installation without the approval of a US government representative.

Within 60-days after the date of transportation of hazardous waste from the installation, submit Copy E of the Japan Hazardous Waste Manifest bearing the signature/stamp of the final mercury waste disposal/recycling facility as an SD-11 closeout submittal.

For SCIW shipments to disposal facilities outside the prefecture, the manifest must be the "tsumikae" type manifest to allow multiple Chain of Custody entries.

Contract final payment will not be approved by the COR until the Copy E is submitted.

Contractors failing to submit Copy E of the JHWM may be reported to United States Forces Japan (USFJ) and the Ministry of the Environment.]

[Turn in mercury-containing lamps, ballasts, and other PCB or mercury-containing materials to the Installation Environmental Division. Contact Installation Environmental Division at [phone number] at least [5] working days in advance to make arrangements for delivery of these materials to the storage site.

Do not dispose of mercury or PCB related materials at an off Government facility. Do not consider US manufactured light ballasts with "No PCBs" labeling to contain PCBs less than Japan regulatory limits and always acquire PCB content related information from the manufacturer. All ballasts, regardless of PCB or non-PCB containing types, shall be turned into the Installation Environmental Division per the turnover procedures stated in paragraph TURNOVER PROCEDURES.

3.5.4 Turnover Procedures

a. Segregate ballasts by manufacturer.

b. Visit the websites of the manufacturers to verify if the ballasts contain PCB or not by product model number, product color, etc. Certificates shall be obtained stating that the ballast does not contain PCB.

c. Sort the ballast in cardboard cases by Non-PCB, PCB containing, unknown for each manufacturer.

d. Bring ballasts to the Installation Environmental Division with certificates and supporting documents.

[3.5.5 Transporter Certification

Comply with disposal and transportation requirements outlined in the JEGS. Before transporting the PCB waste, prepare a Disposal Request Form for acknowledgement of acceptance of the PCB waste from the Government. Return a duly signed copy to the Government before leaving the Installation Environmental Division. Ensure that the Disposal Request Form accompanies the PCB or mercury-containing waste at all times.

]3.5.6 Disposal by the Government

Comply with disposal and transportation requirements outlined in the JEGS Chapter 6 and Chapter 14. Load and haul PCBs to the Installation Environmental Division.

3.5.6.1 Delivery

Contact Installation Environmental Division at [phone number]at least [5] working days in advance to make arrangements for delivery of PCB or mercury-containing items to the storage site.

[3.5.6.2 DD Form 1348-1

Prepare Disposal Request Form , which will accompany the PCB to the storage site. Contact Installation Environmental Division for a copy of the latest Disposal Request Form version. Ensure that a responsible person from the activity that owns the PCB signs the Disposal Request Form.]

] -- End of Section --

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SECTION 02 84 33

REMOVAL AND DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCBs)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPAN MINISTRY OF THE ENVIRONMENT(MOE)

Act No. 137	(1970, Amended 1991 and 2006) Waste Management and Public Cleansing Law

U.S. DEPARTMENT OF DEFENSE (DOD)

JEGS	(Dec 2020) Japan Environmental Governing Standards

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.145	Specifications for Accident Prevention Signs and Tags
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 174	Carriage by Rail
49 CFR 175	Carriage by Aircraft
49 CFR 176	Carriage by Vessel
49 CFR 177	Carriage by Public Highway
49 CFR 178	Specifications for Packagings
49 CFR 179	Specifications for Tank Cars

1.2 REQUIREMENTS

The work includes the removal and disposal of [_____][Removal and disposal

of PCB containing [ballasts][and][transformers].. The Contractor shall inspect, confirm and identify all PCB-containing items prior to commencement of work.Perform work in accordance with 40 CFR 761, JEGS, and the requirements specified herein.

1.3 DEFINITIONS

1.3.1 IH/PQP

An Industrial hygienist/private qualified person required by the Contractor.

1.3.2 Leak

Leak or leaking means any instance in which a PCB Article, PCB Container, or PCB Equipment has any PCBs on any portion of its external surface.

[1.3.3 Lamps

Lamp is defined as the bulb or tube portion of an electric lighting device. A lamp is specifically designed to produce radiant energy, most often in the ultraviolet, visible, and infra-red regions of the electromagnetic
spectrum. Examples of common universal waste electric lamps include, but are not limited to, fluorescent, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps.

]1.3.4 PCBs

PCBs as used in this specification shall mean the same as PCBs, PCB Article, PCB Article Container, PCB Container, PCB Equipment, PCB Item, PCB Transformer, PCB-Contaminated Electrical Equipment, as defined in the JEGS.

1.3.5 Spill

Spill means both intentional and unintentional spills, leaks, and other uncontrolled discharges when the release results in any quantity of PCBs running off or about to run off the external surface of the equipment or other PCB source, as well as the contamination resulting from those releases.

1.4 QUALITY ASSURANCE

1.4.1 PCB and Lamp Management and Disposal Plan

Prior to handling any PCB items, the Contractor shall submit a PCB and Lamp Management and Disposal Plan. The submitted plan shall include the PCB and Lamp Removal and Disposal Work Plan, [PCB and Lamp Disposal Plan], Qualifications of the IH/PQP, and Japan Industrial Waste Collection and Transport Permit.

1.4.2 Regulatory Requirements

Perform PCB related work in accordance with the JEGS, Act No. 137, and other applicable US Federal, GOJ, and local laws and regulations. Perform hazardous material-containing lamps storage and transport in accordance with the JEGS, Act No. 137, and other applicable US Federal, GOJ, and local laws and regulations.

1.4.2.1 No Smoking

Smoking is not permitted within 15 m of the PCB control area. Provide "No Smoking" signs as directed by the Contracting Officer.

1.4.2.2 Work Operations

Ensure that work operations or processes involving PCB or PCB-contaminated materials are conducted in accordance with 40 CFR 761 and the applicable requirements of this section, including but not limited to:

a. Obtaining advance approval of PCB storage sites.

b. Notifying Contracting Officer prior to commencing the operation.

c. Reporting leaks and spills to the Contracting Officer.

d. Cleaning up spills.

e. Maintaining an access log of employees working in a PCB control area and providing a copy to the Contracting Officer upon completion of the operation.

f. Inspecting PCB and PCB-contaminated items and waste containers for leaks and forwarding copies of inspection reports to the Contracting Officer.

g. Maintaining a spill kit as specified in paragraph entitled "PCB Spill Kit."

h. Maintaining inspection, inventory and spill records.

1.4.3 Training

Industrial Hygienist/Private Qualified Person (IH/PQP) shall instruct and certify the training of all persons involved in the removal of PCB containing materials/equipment and lamps containing hazardous substances. The instruction shall include: The dangers of PCB and hazardous material exposure, decontamination, safe work practices, and applicable OSHA and EPA, JEGS, GOJ, and prefectural regulations.

The IH/PQP shall review and approve the PCB and hazardous material-Containing Lamp Removal Work Plans and temporary on-site Storage Plans.

1.4.4 Regulation Documents

Maintain at all times one copy each at the office and one copy each in view at the job site of pertinent JEGS and a copy of the Contractor PCB and Lamp Removal and Disposal Work Plan.

1.4.5 Qualifications of IH/PQP

[Include within the PCB and Lamp Management and Disposal Plan, the name, address, and telephone number of the Industrial Hygienist/Private Qualified Person selected to perform the duties in paragraph entitled "Industrial Hygienist/Private Qualified Person (IH/PQP)." Submit Qualifications of IH/PQP that the Industrial Hygienist/Private Qualified

Person is qualified, including certification number and date of certification or re certification.][The IH/PQP shall have at least 2 years of on the job experience in hazardous materials and hazardous waste management and have working knowledge of the JEGS, GOJ, as well as US and Japanese occupational safety and health regulations. The IH/PQP shall have knowledge in detecting, identifying, and evaluating existing or potential hazardous conditions related to PCB-containing light ballasts and hazardous material-containing lamps and other similar building equipment or materials. The IH/PQP may be considered qualified if he/she is either a certified Industrial Hygienist or is a Private Qualified Person with adequate prerequisite experience and knowledge as listed in this section.]

1.4.6 PCB and Lamp Removal and Disposal Work Plan

Include within the PCB and Lamp Management and Disposal Plan, a job-specific plan within [20][14] calendar days after [receipt of Notice to Proceed][prior to removal work] explaining the work procedures to be used in the removal, packaging, and storage of PCB-containing lighting ballasts and associated hazardous material-containing lamps.

Submit a detailed job-specific plan of the work procedures to be used in the removal of PCB-containing materials, not to be combined with other hazardous abatement plans. Provide a Table of Contents for each abatement submittal which shall follow the sequence of requirements in the contract. The plan shall include a sketch showing the location, size, and details of PCB control areas[, location and details of decontamination rooms, change rooms, shower facilities, and mechanical ventilation system]. Include in the plan, eating, drinking, smoking and restroom procedures, interface of trades, sequencing of PCB related work, PCB disposal plan, respirators, protective equipment, and a detailed description of the method of containment of the operation to ensure that PCB contamination is not spread or carried outside of the control area. [Include provisions to ensure that airborne PCB concentrations of 0.50 milligrams per cubic meter of air are not exceeded outside of the PCB control area. Include air sampling, training and strategy, sampling methodology, frequency, duration of sampling, and qualifications of air monitoring personnel in the air sampling portion of the plan.] Obtain approval of the plan prior to the start of PCB removal work. Include in the plan: Requirements for Personal Protective Equipment (PPE), spill cleanup procedures and equipment, eating, smoking and restroom procedures.

The Plan shall comply with applicable requirements of Federal, JEGS, GOJ and prefectural PCB and hazardous material-related regulations. The plan shall be approved and signed by the IH/PQP. Obtain approval of the plan by the Contracting Officer prior to the start of PCB and/or lamp removal work.

All US-made ballasts, even those marked “NO-PCB” shall be turned in to the 718 CES/CEIE PCB Storage section. Call DSN 634-2600 5-days prior to delivery to schedule a drop off.

The plan shall address:

a. Estimate the quantity of ballasts and other PCB containing equipment to be delivered to Bldg 3625.

b. Estimate the quantity of hazardous material-containing lamps to be disposed or recycled at a certified commercial facility.

c. List the names and qualifications of each Contractor that will be transporting, storing, recycling and disposing of the toxic wastes.

d. Furnish a copy of current prefecture-issued waste permit showing that each company is certified by the prefecture to transport and dispose/recycle hazardous material-containing lamps or other waste.

e. Names and qualifications (experience and training) of personnel who will be working on-site with PCB and hazardous material-containing lamp wastes.

f. Spill prevention, containment, and cleanup contingency measures to be implemented.

g. Schedule for PCB and hazardous material-containing lamp waste removal, containment, storage, transportation, disposal and or recycling. Wastes shall be cleaned up and containerized daily.

h. When submitting the Environmental Protection Plan (EPP) in accordance with Section 01 57 19.01 TEMPORARY ENVIRONMENTAL CONTROLS, under the paragraphs pertaining to PCBs, state that the PCB and Lamp Removal and Disposal Work Plan will be submitted separately.

[1.4.7 PCB and Lamp Disposal Plan

Include within the PCB and Lamp Management and Disposal Plan, a PCB and lamp Disposal Plan within [45] [_____] calendar days after [receipt of Notice to Proceed][prior to removal work]. The PCB and Lamp Disposal Plan shall comply with applicable requirements of the JEGS and applicable U.S. federal, GOJ, and local prefecture and JEGS PCB regulations and address:

a. Identification of PCB wastes associated with the work.

b. Estimated quantities of wastes to be generated, disposed of, and recycled.

c. Names and qualifications of each Contractor personnel who will be working on-site with PCB and hazardous material-containing lamp wastes and that will be transporting, storing, treating, and disposing of the wastes. Include the facility location. Include a 24-hour point of contact. Furnish two copies of PCB and hazardous material-containing lamp waste permit applications and pertinent identification numbers, as required.

d. Spill prevention, containment, and cleanup contingency measures to be implemented.

e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.

f. Work plan and schedule for PCB and hazardous material-containing lamp waste removal, containment, storage, transportation, disposal and or recycling. Wastes shall be cleaned up and containerized daily.

]1.4.8 Training Certification

Submit certificates, prior to the start of work but after the main abatement submittals, signed and dated by the CIH and by each employee

stating that the employee has received training. Certificates shall be organized by individual worker, not grouped by type of certificates.

1.4.9 Notification

Notify the Contracting Officer 20 days prior to the start of PCB removal work.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

*PCB and Lamp Removal and Disposal Work Plan; G[, [_____]]

*PCB and Lamp Disposal Plan; G[, [_____]]

*PCB And Lamp Management And Disposal Plan; G[, [_____]]

SD-07 Certificates

*Qualifications of IH/PQP; G[, [_____]]

Training certification

Japan Specially Controlled Hazardous Waste Disposal Permit (Submit separate SCIW Disposal Permits if lamps and PCB items are to be disposed of at separate disposal sites.); G

*Japan Industrial Waste Collection And Transport Permit; G

Copy E of the Japanese Hazardous Waste Manifest

Notification

[Certification of Decontamination for PCB Spill]

[Post cleanup sampling data]

1.6 EQUIPMENT

1.6.1 Special Clothing

Work clothes shall consist of PPE as required by OSHA regulations, including, but not limited to the following:

a. Disposable coveralls

b. Gloves (Disposable rubber gloves may be worn under these)

c. Disposable foot covers (polyethylene)

d. Chemical safety goggles

e. Half mask cartridge respirator.

1.6.2 Special Clothing for Government Personnel

Provide PPE specified in paragraph entitled "Special Clothing" to the Contracting Officer as required for inspection of the work.

1.6.3 PCB Spill Kit

Assemble a spill kit to include the following items:

ITEM	MINIMUM QUANTITY
1. Disposable gloves (polyethylene)	6 prs
2. Gloves with a high degree of impermeability to PCB	6 prs
3. Disposable coveralls with permeation resistance to PCB	4 ea
4. Chemical safety goggles	2 ea
5. Disposable foot covers (polyethylene)	6 prs
6. PCB Caution Sign: "PCB Spill--Authorized Personnel Only"	2 ea
7. Banner guard or equivalent banner material	30 m
8. Absorbent material	
9. Blue polyethylene waste bags	5 bags
10. Cloth backed tape	5 ea
11. Area access logs, blank	1 roll
12. Brattice cloth, 2 m x 2 m	10 ea
13. Rags	1 piece
14. Ball point pens	20 ea
15. Herculite, 1.5 m x 1.5 m and 3 m x 3 m	2 ea and 1 ea
16. Blank metal signs and grease pencils	

17. Waste containers 208 liters drum, may be used as container for kit	2 ea [1] [_____] ea

1.7 SCHEDULING

Notify the Contracting Officer 20 days prior to the start of PCB and hazardous material-containing lamp removal work.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 WORK PROCEDURE

Furnish labor, materials, services, and equipment necessary for the removal of PCB containing lighting ballasts, associated mercury-containing fluorescent lamps, and high intensity discharge (HID) lamps in accordance with the JEGS, applicable GOJ and local, prefectural regulations. Do not expose PCBs to open flames or other high temperature sources since toxic decomposition by-products may be produced. Do not break mercury containing fluorescent lamps or high intensity discharge lamps.

3.1.1 Protection

a. Provide material and labor for construction of a decontamination room, a clean room, and shower facilities. Provide rooms with doors and attach to the exit ways of PCB work areas. Rooms shall be of sufficient size to accommodate the Contractor's operation within. [Existing facilities with water closets, urinals, wash basins and showers may be used if available to the Contractor.] [Provide portable toilet and shower facilities. Locate shower facilities between the clean room and decontamination room.] Provide separate clothing lockers or containers in each room to prevent contamination of street and work clothes.

b. Remove PCB-contaminated PPE in the decontamination room. Workers shall then proceed to showers. Workers shall shower before lunch and at the end of each day's work. Hot water, towels, soap, and hygienic conditions are the responsibility of the Contractor.

3.1.2 PCB Control Area

Isolate PCB control area by physical boundaries to prevent unauthorized entry of personnel. Food, drink and smoking materials shall not be permitted in areas where PCBs are handled or PCB items are stored.

3.1.3 Personnel Protection

Workers shall wear and use PPE, as recommended by the Industrial Hygienist, upon entering a PCB control area. If PPE is not required per the CIH, specify in the PCB removal work plan.

3.1.4 Footwear

Work footwear shall remain inside work area until completion of the job.

3.1.5 Permissible Exposure Limits (PEL)

PEL for PCBs is 0.5 mg/m3 on an 8-hour time weighted average basis.

3.1.6 Special Hazards

a. PCBs shall not be exposed to open flames or other high temperature sources since toxic decomposition by-products may be produced.

b. PCBs shall not be heated to temperatures of 55 degrees C or higher without Contracting Officer's concurrence.

3.1.7 PCB Caution Label

40 CFR 761, Subpart C. Affix labels to PCB waste containers and other PCB-contaminated items. Provide label with sufficient print size to be clearly legible, with bold print on a contrasting background, displaying the following: CAUTION: Contains PCBs (Polychlorinated Biphenyls).

3.1.8 PCB Caution Sign

29 CFR 1910.145. Provide signs at approaches to PCB control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area.

3.2 PCB TRANSFORMERS

3.2.1 Draining of Transformer Liquid

Perform work in accordance with the JEGS, 49 CFR 171, 49 CFR 172, 49 CFR 173, 49 CFR 174, 49 CFR 175, 49 CFR 176, 49 CFR 177, 49 CFR 178, and 49 CFR 179, Subchapter C and as specified herein. Drain the transformer, switches, and regulators of free flowing liquid prior to transportation. Place the drained liquids in DOT Spec 17E drums. The drums shall not contain more than 190 liters of oil. If the equipment cannot be drained, then place it in DOT Spec 17C drums.

3.2.2 Markings

Provide drums and drained PCB-contaminated electrical equipment with caution label markings as specified in paragraph entitled "PCB Caution Label" in both Japanese and English.

3.2.3 Laboratory Analysis

All transformers shall have a laboratory analysis for turn-in. DRMO prefers a gas chromatograph test. The only two exceptions to this rule are:

a. The transformer is hermetically sealed (solder sealed or fusion sealed. No access ports or openings).

b. The name plate states that the transformer contains pyranol, interteen, etc.

Attach a copy of the lab analysis to both the DD 1348-1 and the transformer itself.

3.2.4 Markings

3.2.4.1 Transformers, Less Than 0.5ppm

Add absorbent material to absorb residue oil remaining after draining. Write the date drained on the transformer. Turn in transformers to the DRMO Scrapyard. Telephone 471-3636 to schedule appointment for turn-in.

3.2.4.2 Transformers, Greater Than 0.5 ppm

Stencil date drained on the transformer. Turn in transformer to [include specific installation information].

3.2.4.3 Drums

Stencil on DOT-approved 208 liter drums containing PCB liquid the following (in English and Japanese):

a. ppm

b. Date drum filled

c. Serial number of transformer liquid came from

d. National Stock Number

(1) "9999-00-OIL" for <50 ppm

(2) "9999-00-CONPCB" for 50-499 ppm

(3) "9999-00-PCBOIL" for >500 ppm

Do not mix different ppms in the same drum. Drums must have a 50 mm ullage space from the top of the drum.

3.3 PCB REMOVAL

Select PCB removal procedure to minimize contamination of work areas with PCB or other PCB-contaminated debris/waste. Handle PCBs such that no skin contact occurs. PCB removal process should be described in the work plan.

3.3.1 Confined Spaces

As feasible, do not carry out PCB handling operations in confined spaces. A confined space shall mean a space having limited means of egress and inadequate cross ventilation.

3.3.2 Control Area

Establish a PCB control area around the PCB item as specified in paragraph entitled "PCB Control Area." Only personnel briefed on the elements in the paragraph entitled "Training" and on the handling precautions shall be allowed into the area.

3.3.3 Exhaust Ventilation

If used, exhaust ventilation for PCB operations shall discharge to the outside and away from personnel.

3.3.4 Temperatures

As feasible, handle PCBs at ambient temperatures and not at elevated temperatures.

3.3.5 Solvent Cleaning

Clean contaminated tools, containers, etc., after use by rinsing three times with an appropriate solvent or by wiping down three times with a solvent wetted rag. Suggested solvents are stoddard solvent or hexane.

3.3.6 Drip Pans

Drip pans are required under portable PCB transformers and rectifiers in use or stored for use. The pans shall have a containment volume of at least one and one-half times the internal volume of PCBs in the item.

3.3.7 Evacuation Procedures

Procedures shall be written for evacuation of injured workers. Aid for a seriously injured worker shall not be delayed for reasons of decontamination.

3.4 PCB SPILL CLEANUP REQUIREMENTS

3.4.1 PCB Spills

Immediately report to the Contracting Officer any PCB spills on the ground or in the water, PCB spills in drip pans, or PCB leaks.

3.4.2 PCB Spill Control Area

Rope off an area around the edges of a PCB leak or spill and post a "PCB Spill Authorized Personnel Only" caution sign. Immediately transfer leaking items to a drip pan or other container.

3.4.3 PCB Spill Cleanup

40 CFR 761, Subpart G. Initiate cleanup of spills as soon as possible, but no later than 48 hours of its discovery. [To clean up spills, personnel shall wear the PPE prescribed in paragraph entitled "Special Clothing" of this section.] If misting, elevated temperatures or open flames are present, or if the spill is situated in a confined space, notify the Contracting Officer. Mop up the liquid with rags or other conventional absorbent. The spent absorbent shall be properly contained and disposed of as solid PCB waste. The spent absorbent shall be properly contained and turned over to the MCB Butler Environmental Support Team (EST) as solid PCB waste. Follow all requirements in Attachment 02 84 16-B.

3.4.4 Records and Certification

Document the cleanup with records of decontamination in accordance with the JEGS and applicable US Federal, GOJ and prefectural requirements for PCB Spill Cleanup. Provide certification of decontamination.

3.4.5 Sampling Requirements

Perform post cleanup sampling as required by 40 CFR 761, Section 130,

Sampling Requirements. Do not remove boundaries of the PCB control area until site is determined satisfactorily clean by the Contracting Officer.

3.5 STORAGE FOR DISPOSAL

3.5.1 Storage Containers for PCBs

49 CFR 178. Store liquid PCBs in Department of Transportation (DOT) Specification 17E containers. Store nonliquid PCB mixtures, articles, or equipment in DOT Specification 5, 5B, or 17C containers with removable heads.

3.5.2 Waste Containers

Label with the following:

a. "Solid (or Liquid) Waste Polychlorinated Biphenyls"

b. The PCB Caution Label, paragraph entitled "PCB Caution Label"

c. The date the item was placed in storage and the name of the cognizant activity/building.

3.5.3 PCB Articles and PCB-Contaminated Items

Label with items b. through c. above.

3.5.4 Approval of Storage Site

Obtain in advance Contracting Officer approval using the following criteria without exception.

a. Adequate roof and walls to prevent rainwater from reaching the stored PCBs.

b. An adequate floor which has continuous curbing with a minimum 150 mm high curb. Such floor and curbing shall provide a containment volume equal to at least two times the internal volume of the largest PCB article or PCB container stored therein or 25 percent of the total internal volume of all PCB equipment or containers stored therein, whichever is greater.

c. No drain valves, floor drains, expansion joints, sewer lines, or other openings that would permit liquids to flow from the curbed area.

d. Floors and curbing constructed of continuous smooth and impervious materials such as portland cement, concrete or steel to prevent or minimize penetrations of PCBs.

e. Not located at a site which is below the 100-year flood water elevation.

f. Each storage site shall be posted with the PCB Caution Sign, paragraph entitled "PCB Caution Sign."

3.6 CLEANUP

Maintain surfaces of the PCB control area free of accumulations of PCBs. Restrict the spread of dust and debris; keep waste from being distributed

over work area.

Do not remove the PCB control area and warning signs prior to thContracting Officer's approval. Reclean areas showing residual PCBs.

3.7 DISPOSAL [PERMITS][/TURNOVER]

[Turn in hazardous material-containing lamps, ballasts, and other PCB or hazardous material-containing materials to the Installation Environmental Division. Contact Installation Environmental Division at [phone number] at least [5] working days in advance to make arrangements for delivery of these materials to the storage site.

Do not dispose of mercury or PCB related materials at an off Government facility. Do not consider US manufactured light ballasts with "No PCBs" labeling to contain PCBs less than Japan regulatory limits and always acquire PCB content related information from the manufacturer. All ballasts, regardless of PCB or non-PCB containing types, shall be turned into the Installation Environmental Division per the turnover procedures as follows.

3.8 Ballasts

[For removed ballasts that are not leaking, up to 300 ballasts may be stored on wooden or plastic pallets on-site for up to 30 days prior to delivery.

Ballasts that are leaking must be immediately stored in leak-proof drip pans, buckets, or double bagged in nitrile bags and stored in a secure area that is not exposed to rainfall. Mark the storage area in English and Japanese in accordance with the JEGS and Japan national and prefectural regulation.

Any PCB oil that has contaminated the ballast mount or other fixtures must be cleaned or removed and turned in with the ballasts. Prior to transport for disposal, the contractor shall perform the following:

a. Segregate ballasts by manufacturer.

b. Visit the websites of the manufacturers to verify if the ballasts contain PCB or not by product model number, product color, etc. Certificates shall be obtained stating that the ballast does not contain PCB.

c. Sort the ballast in cardboard cases by Non-PCB, PCB containing, unknown for each manufacturer.

d. Bring ballasts to the Installation Environmental Division with certificates and supporting documents.

All non-Japanese ballasts, including those with a "NO PCB" label shall be assumed to contain as high as 49 ppm and shall be handled, stored, transported, and disposed of as PCB ballasts. The contractor shall deliver all non-Japanese ballasts to the 718 CES/CEIE Environmental Office at Bldg 3625. Ballasts may be delivered between 0800 and 1200 on any Friday except for federal holidays. Call DSN 634-2600 a minimum of 5-days prior to delivery to request forklift unloading assistance.

For Japanese-made ballasts, the Contractor shall segregate regulated PCB

ballasts from non-regulated ballasts according to GOJ and prefectural regulations. Information to discriminate between regulated and non-regulated ballasts can be obtained from:
https://www.env.go.jp/recycle/poly/
https://www.env.go.jp/recycle/poly/law/no_14091618.pdf

Regulated PCB ballasts shall be delivered to the 718 CES/CEIE Environmental Office at Bldg 3625. Non-regulated Japanese ballasts become property of the contractor and shall be disposed of in accordance with GOJ and prefectural regulations. In the submitted PCB and Lamp Removal & Disposal Work Plan, clearly state how non-regulated Japanese ballasts will be disposed.

A copy of the Signed Ballast Turn-in (at Bldg 3625) Sheet shall be submitted to the COR.]

[Light ballasts may still contain PCBs even where a "No PCB" label exists on the ballast due to regulatory differences between U.S. and GOJ definitions for "PCB Free". [Regardless of PCB concentration, manufacturer, country of origin, all light ballasts shall be removed, containerized, and turned into the Installation Environmental Division, in accordance with Attachment 02 84 16-B.] PCB abatement or handling shall be in accordance with the JEGS and Attachment 02 84 16-B.

The Contractor shall identify all project ballasts that contain and do not contain PCBs or are suspect to contain PCBs. The Contractor shall submit the PCB ballast list (to include suspect PCB ballasts) to the Contracting Officer Representative (COR). PCB containing ballasts and suspect PCB containing ballasts shall be segregated by country of manufacture.

The following procedures for US manufactured and Japan manufactured ballasts shall be used in the identification of PCB ballasts and described in this section.]

3.8.1 For US Manufactured Ballasts

US manufactured ballasts shall not be mixed with Japan manufactured ballasts. The Contractor shall segregate and palletize US manufactured ballasts separately from Japan manufactured ballasts at the point of generation for subsequent turn in to the MCB Butler EST (HW/PCB Program Manager, 098-970-3139 or 098-970-5790). All ballasts, including "No PCB" labeled ballasts and non-PCB containing ballasts, shall be containerized and turned into the MCB Butler EST.

3.8.2 For Japan Manufactured Ballasts

The Contractor shall carefully examine the ballast to identify the manufacturer name and year made. Consult with the manufacturer to identify any presence of PCBs. If absence of PCB cannot be confirmed, assume and treat the ballast as a PCB item.

Japan manufactured ballasts shall not be mixed with US manufactured ballasts. The Contractor shall segregate and palletize Japan manufactured ballasts separately from US manufactured ballasts at the point of generation for subsequent turn in to the MCB Butler EST (HW/PCB Program Manager, 098-970-3139 or 098-970-5790).

3.8.3 For Unmarked/Unlabeled Ballasts

The Contractor shall treat all unmarked/unlabeled ballasts as suspect PCB-containing materials and deliver to Bldg 3625. Segregate unmarked/unlabeled ballasts from other US or Japanese manufactured items. The Contractor shall contact the MCB Butler EST (HW/PCB Program Manager, 098-970-3139 or 098-970-5790) to establish proper procedures for the management of unmarked/unlabeled ballasts.

3.8.4 [Fluorescent Light Tubes (Bulbs)][Fluorescent Lamps]

[The Contractor shall carefully remove and store fluorescent light bulbs in a manner such that they remain intact. Fluorescent light tubes suspect for containing mercury shall be handled and disposed of by the Contractor in accordance to all GOJ, Federal, local prefectural laws and regulations and the JEGS. In the event of a lighting tube/lamp breaking, sweep and place waste in double plastic taped bags and dispose of as appropriate to GOJ, Federal, local prefecture laws and regulations and the JEGS.]

[Remove lighting lamps from the lighting fixture and carefully place into appropriate containers in accordance with JEGS, GOJ, and prefecture regulations. In the event of a lighting lamp breakage, sweep and place waste in double plastic taped bags, place in appropriate containers, and dispose together with the lamps.]

3.9 Japan Specially Controlled Hazardous Waste Disposal Permit

In the submitted plan, include a copy of the Japan Specially Controlled Industrial Waste (SCIW) Permit (“Tokubetsu Kanri Haikibutsu Shobungyou Kyoka”) for the disposal or recycling facility where the hazardous material-containing lamps will be disposed. The permit must specifically say that the firm is authorized to accept hazardous material.

3.10 Japan Industrial Waste Collection and Transport Permit

Include a copy of the Japan Industrial Waste Collection and Transport Permit (“Sangyou Haikibutsu Shuushuu Unpangyou Kyoka”) for the transportation of hazardous material-contaminated wastes from the installation within the PCB and Lamp Management and Disposal Plan.

3.11 Japan Hazardous Waste Manifest (JHWM)

A minimum of 5-days prior to the scheduled transportation of hazardous material containing lamps or other PCB containing ballasts from the installation, contact the [718 CES/CEIE Environmental Section 634-2600] to schedule a pre-transportation inspection. A government representative will inspect, annotate the (JHWM), and authorize the shipment. No toxic wastes shall be transported off the installation without the approval of a US government representative.

Within 60-days after the date of transportation of hazardous waste from the installation, submit Copy E of the Japanese Hazardous Waste Manifest bearing the signature/stamp of the final hazardous material waste disposal/recycling facility as an SD-11 closeout submittal.

For SCIW shipments to disposal facilities outside the prefecture, the manifest must be the "tsumikae" type manifest to allow multiple Chain of Custody entries.

Contract final payment will not be approved by the COR until the Copy E is submitted.

Contractors failing to submit Copy E of the JHWM may be reported to United States Forces Japan (USFJ) and the Ministry of the Environment.

-- End of Section --

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 301	(2016) Specifications for Structural Concrete
ACI 302.1R	(2015) Guide for Concrete Floor and Slab Construction
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI SP-2	(2007; Abstract: 10th Edition) ACI Manual of Concrete Inspection

ASTM INTERNATIONAL (ASTM)

ASTM A970/A970M	(2018) Standard Specification for Headed Steel Bars for Concrete Reinforcement
ASTM C1012/C1012M	(2018b) Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
ASTM E1155	(2014) Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers

JAPANESE ARCHITECTURAL STANDARD SPECIFICAITONS(JASS)

JASS 5	(2015) Reinforced Concrete Work
JASS 6	(2015) Structural Steelwork Specification for Building Construction

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1101	(2014) Method of Test for Slump of Concrete
JIS A 1107	(2014) Method of Sampling and Testing for Compressive Strength of Drilled Cores of Concrete

JIS A 1108	(2018) Method of Test for Compressive Strength of Concrete
JIS A 1115	(2014) Method of Sampling Fresh Concrete
JIS A 1116	(2005) Method of Test for Unit Mass and Air Content of Fresh Concrete by Mass Method
JIS A 1118	(2017) Method of Test for Air Content of Fresh Concrete by Volumetric Method
JIS A 1128	(2014) Method of Test for Air Content of Fresh Concrete by Pressure Method
JIS A 1132	(2014) Method of Making and Curing Concrete Specimens
JIS A 1146	(2017) Method of Test for Alkali-Silica Reactivity of Aggregates by Mortar-bar Method
JIS A 1154	(2012) Method of Test for Chloride Ion Content in Hardened Concrete
JIS A 1804	(2009) Methods of Test for Production Control of Concrete - Method of Rapid Test for Identification of Alkali-Silica Reactivity of Aggregate
JIS A 5005	(2009) Crushed Stone and Manufactured Sand for Concrete
JIS A 5011	(2013) Slag Aggregate for Concrete
JIS A 5308	(2014) Ready-Mixed Concrete
JIS A 5758	(2016) Sealants for Sealing and Glazing in Buildings
JIS A 6201	(2015) Fly Ash for Use in Concrete
JIS A 6204	(2011) Chemical Admixtures for Concrete
JIS A 8652	(1995) Metal Panels for Concrete Form
JIS A 9521	(2017) Thermal Insulation Materials for Buildings
JIS G 3101	(2017) Rolled Steels for General Structure (Amendment 1)
JIS G 3112	(2010) Steel Bars for Concrete Reinforcement
JIS G 3444	(2016) Carbon Steel Tubes for General Structure
JIS G 3551	(2005) Welded Wire Mesh and Rebar Grid

JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS K 6251	(2017) Rubber, Vulcanized or Thermoplastic-Determination of Tensile Stress-Strain Properties
JIS K 6253	(2012) Rubber, Vulcanized or Thermoplastic - Determination of Hardness
JIS K 6258	(2016) Rubber, Vulcanized or Thermoplastic - Determination of the Effect of Liquids
JIS K 6773	(1999) Polyvinylchloride Waterstop
JIS K 7124-1	(1999) Plastics Film and Sheeting - Determination of Impact Resistance by the Free-falling Dart Method - Part 1: Staircase Methods
JIS K 7127	(1999) Plastics - Determination of Tensile Properties - Part 3: Test Conditions for Films and Sheets
JIS K 7129-2	(2019) Plastics Film and Sheeting - Determination of Water Vapor Transmission Rate - Part 2: Infrared Detection Sensor Method
JIS Q 1011	(2009) Conformity Assessment – Conformity Assessment for Japanese Industrial Standards – Guidance on Third-party Certification System for Ready-mixed Concrete Products
JIS Q 17011	(2005) Conformity Assessment - General Requirements for Accreditation Bodies Accrediting Conformity Assessment Bodies
JIS Q 17025	(2005) General Requirements for the Competence of Testing and Calibration Laboratories
JIS R 5210	(2009) Portland Cement
JIS R 5211	(2019) Portland Blast-Furnace Slag Cement
JIS R 5212	(2019) Portland Pozzolan Cement
JIS R 5213	(2019) Portland Fly Ash Cement
JIS Z 3881	(2014) Standard Qualification Procedure for Gas Pressure Welding Technique of Steel Bars for Concrete Reinforcement

JAPAN ROAD ASSOCIATION (JRA)

JRA PDCG	(2019) Pavement Design and Construction Guidelines

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT-SS Chapter 6	MLIT Architectural Standard Specifications, Chapter 6 Concrete

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED NC	(2009) Leadership in Energy and Environmental Design(tm) New Construction Rating System

1.2 DEFINITIONS

a. "Cementitious material" as used herein must include all portland cement, pozzolan, fly ash, and slag cement.

b. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the building. A public location is accessible to persons not responsible for operation or maintenance of the building.

c. "Chemical admixtures" are materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.

d. "Supplementary cementing materials" (SCM) include coal fly ash, slag cement, natural or calcined pozzolans, and ultra-fine coal ash when used in such proportions to replace the portland cement that result in improvement to sustainability and durability and reduced cost.

e. "Design strength" (f'c) is the specified compressive strength of concrete at time(s) specified in this section to meet structural design criteria.

f. "Mass Concrete" is any concrete system that approaches a maximum temperature of 70 degrees C within the first 72 hours of placement. In addition, it includes all concrete elements with a section thickness of 1 meter or more regardless of temperature.

g. "Mixture proportioning" is the process of designing concrete mixture proportions to enable it to meet the strength, service life and constructability requirements of the project while minimizing the initial and life-cycle cost.

h. "Mixture proportions" are the masses or volumes of individual ingredients used to make a unit measure (cubic meter or cubic yard) of concrete.

i. "Pozzolan" is a siliceous or siliceous and aluminous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.

j. "Workability (or consistence)" is the ability of a fresh (plastic) concrete mix to fill the form/mould properly with the desired work (vibration) and without reducing the concrete's quality. Workability

depends on water content, chemical admixtures, aggregate (shape and size distribution), cementitious content and age (level of hydration).

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

[Concrete Curing Plan

] Quality Control Plan; G[, [_____]]

Laboratory Accreditation; G[, [_____]]

SD-02 Shop Drawings

[Formwork

] Reinforcing Steel; G[, [_____]]

SD-03 Product Data

Formwork Materials

Reinforcement; (LEED NC)

Liquid Chemical Floor Hardeners and Sealers

Mechanical Reinforcing Bar Connectors

[Pumping Concrete

][Finishing Plan

] SD-04 Samples

[Slab Finish Sample

][Surface Finish Samples

] SD-05 Design Data

Concrete Mix Design; G[, [_____]]

SD-06 Test Reports

Concrete Mix Design; G[, [_____]]

Fly Ash

Pozzolan

Slag Cement

Aggregates

[Tolerance Report

] Compressive Strength Tests; G[, [_____]]

[Unit Weight of Structural Concrete

][Chloride Ion Concentration
]
[Air Content

] Slump Tests

Water

SD-07 Certificates

Reinforcing Bars

Welder Qualifications

[VOC Content for Form Release Agents, Curing Compounds, and Concrete Penetrating Sealers

] Safety Data Sheets

Field Testing Technician and Testing Agency

SD-08 Manufacturer's Instructions

Liquid Chemical Floor Hardeners and Sealers

Joint Sealants; (LEED NC)

[Curing Compound

]1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with JASS 5 and MLIT-SS Chapter 6 or ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

1.5 DELIVERY, STORAGE, AND HANDLING

Follow JASS 5 and MLIT-SS Chapter 6, requirements and recommendations. Do not deliver concrete until vapor retarder, [vapor barrier,] forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. Do not store concrete curing compounds or sealers with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions, including [_____]. Do not store concrete curing compounds or sealers in occupied spaces.

1.5.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or

racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

1.6 QUALITY ASSURANCE

1.6.1 Design Data

1.6.1.1 Concrete Mix Design

Sixty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, supplementary cementitious materials, [fibers], and admixtures; and applicable reference specifications. Submit mill test and all other test for cement, supplementary cementitious materials, aggregates, and admixtures. Provide documentation of maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained verses sieve size. Provide mix proportion data using at least three different water-cementitious material ratios for each type of mixture, which produce a range of strength encompassing those required for each type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Resubmit data on concrete components if the qualities or source of components changes. For previously approved concrete mix designs used within the past twelve months, the previous mix design may be re-submitted without further trial batch testing if accompanied by material test data conducted within the last six months. Obtain mix design approval from the contracting officer prior to concrete placement.

1.6.2 Shop Drawings

1.6.2.1 Reinforcing Steel

Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars. Reproductions of contract drawings are unacceptable.

1.6.3 Control Submittals

[#### 1.6.3.1 Concrete Curing Plan

Submit proposed materials, methods and duration for curing concrete elements in accordance with JASS 5 and MLIT-SS Chapter 6.

][#### 1.6.3.2 Pumping Concrete

Submit proposed materials and methods for pumping concrete. Submittal must include mix designs, pumping equipment including type of pump and size and material for pipe, and maximum length and height concrete is to be pumped.

][1.6.3.3 Finishing Plan

Submit proposed material and procedures to be used in obtaining the finish for the [_____] floors. Include qualification of person to be used for obtaining floor tolerance measurement, description of measuring equipment to be used, and a sketch showing lines and locations the measuring equipment will follow.

][1.6.3.4 VOC Content for form release agents, curing compounds, and concrete penetrating sealers

Submit certification for the form release agent, curing compounds, and concrete penetrating sealers that indicate the VOC content of each product.

]1.6.3.5 Safety Data Sheets

Submit Safety Data Sheets (SDS) for all materials that are regulated for hazardous health effects. SDS must be readily accessible during each work shift to employees when they are at the construction site.

1.6.4 Test Reports

1.6.4.1 Fly Ash and Pozzolan

Submit test results in accordance with JIS A 6201 for fly ash and pozzolan. Submit test results performed within 6 months of submittal date.

1.6.4.2 Slag Cement

Submit test results in accordance with JIS R 5211 for slag cement. Submit test results performed within 6 months of submittal date.

1.6.4.3 Aggregates

Submit test results in accordance with JIS A 5005, JIS A 1146 and JIS A 1804 as required in the paragraph titled ALKALI-AGGREGATE REACTION.

1.6.5 Field Samples

[1.6.5.1 Slab Finish Sample

Install minimum of 3000 mm by 3000 mm slab. Slab finish sample must not be part of the final project. Finish as required by specification.

][1.6.5.2 Surface Finish Samples

Provide a minimum of three sample concrete panels for each finish for each mix design, 1000 mm by 1000 mm, 75 mm thick. Use the approved concrete mix design(s). Provide sample panels on-site at locations directed. Once approved, each set of panels must be representative of each of the finishes specified and of the workmanship and finish(es) required. Do not remove or destroy samples until directed by the Contracting Officer.

]1.6.6 Quality Control Plan

Develop and submit for approval a concrete quality control program in accordance with the guidelines of JASS 5 and MLIT-SS Chapter 6 and as specified herein. The plan must include approved laboratories. Provide direct oversight for the concrete qualification program inclusive of

associated sampling and testing. All quality control reports must be provided to the Contracting Officer, Quality Manager and Concrete Supplier.

1.6.7 Quality Control Personnel Certifications

The Contractor must submit for approval the responsibilities of the various quality control personnel, including the names and qualifications of the individuals in those positions and a quality control organizational chart defining the quality control hierarchy and the responsibility of the various positions. Quality control personnel must be employed by the Contractor.

Submit Japan Concrete Institute (JCI) or American Concrete Institute (ACI) certification for the following:

a. CQC personnel responsible for inspection of concrete operations.

b. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews.

c. Field Testing Technicians: ACI Concrete Field Testing Technician, Grade I or equivalent Japan Concrete Institute (JCI) Concrete Field Testing Technician.

1.6.7.1 Quality Manager Qualifications

The quality manager must hold a current license as a First Class Kenchikushi architect registered under standard law of Japan with experience on at least five similar projects. Evidence of extraordinary proven experience may be considered by the Contracting Officer as sufficient to act as the Quality Manager.

1.6.7.2 Field Testing Technician and Testing Agency

Submit data on qualifications of proposed testing agency and technicians for approval by the Contracting Officer prior to performing testing on concrete.

a. Work on concrete under this contract must be performed by an ACI Concrete Field Testing Technician Grade 1 qualified in accordance with ACI SP-2 or equivalent JCI Concrete Field Testing Technician. Equivalent certification programs must include requirements for written and performance examinations as stipulated in ACI SP-2.

b. Testing agencies that perform testing services on concrete materials including reinforcing steel must meet the requirements of JASS 5, JIS Q 1011, JIS Q 17011 and JIS Q 17025.

1.6.8 Laboratory Qualifications for Concrete Qualification Testing

The concrete testing laboratory must have the necessary equipment and experience to accomplish required testing. The laboratory must meet the requirements of JASS 5, JIS Q 1011, JIS Q 17011 and JIS Q 17025.

1.6.9 Laboratory Accreditation

Laboratory and testing facilities must be provided by and at the expense of the Contractor. The laboratories performing the tests must be accredited in accordance with JIS Q 17011 and JIS Q 17025. The

accreditation must be current and must include the required test methods, as specified. Furthermore, the testing must comply with the following requirements:

a. Aggregate Testing and Mix Proportioning: Aggregate testing and mixture proportioning studies must be performed by an accredited laboratory and under the direction of a Chief Concrete Engineer or Concrete Engineer authorized by the Japan Concrete Institute or First Class Kenchikushi who is competent in concrete materials and must sign all reports and designs.

b. Acceptance Testing: Furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Furnish and maintain boxes or other facilities suitable for storing and curing the specimens at the site while in the mold within the temperature range stipulated by JIS A 1132.

c. Contractor Quality Control: All sampling and testing must be performed by an approved, onsite, independent, accredited laboratory.

1.7 ENVIRONMENTAL REQUIREMENTS

Provide space ventilation according to material manufacturer recommendations, at a minimum, during and following installation of concrete curing compound and sealer. Maintain one of the following ventilation conditions during the curing period or for 72 hours after installation:

a. Supply 100 percent outside air 24 hours a day.

b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 13 degrees C and 29 degrees C and humidity is between 30 percent and 60 percent.

c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

1.7.1 Submittals for Environmental Performance

a. Provide SDS product information data showing that form release agents meet any environmental performance goals such as using vegetable and soy based products.

b. Provide SDS product information data showing that concrete adhesives meet any environmental performance goals including low emitting, low volatile organic compound products.

1.8 QUALIFICATIONS FOR WELDING WORK

Welding procedures must be in accordance with JASS 6.

Verify that Welder qualifications are in accordance with JIS Z 3881 for welding of reinforcement or under an equivalent qualification test approved in advance. Welders are permitted to do only the type of welding for which each is specifically qualified.

PART 2 PRODUCTS

2.1 FORMWORK MATERIALS

a. Form-facing material in contact with concrete must be [lumber,] [plywood,] [tempered concrete-form-grade hardboard,] [metal,] [plastic,] or [treated paper that creates specified appearance and texture of concrete surface]. Submit product information on proposed form-facing materials if different from that specified herein.

b. Design formwork, shores, reshores, and backshores to support all vertical and lateral loads transmitted to them and to comply with applicable building code requirements.

c. Design formwork and shoring for load redistribution resulting from stressing of post-tensioned reinforcement. Ensure that formwork allows movement resulting from application of prestressing force.

d. Design formwork to withstand pressure resulting from placement and vibration of concrete and to maintain specified tolerances.

e. Design formwork to accommodate waterstop materials in joints at locations indicated in Contract Documents.

f. Provide temporary openings in formwork if needed to facilitate cleaning and inspection.

g. Design formwork joints to inhibit leakage of mortar.

h. Limit deflection of facing materials for concrete surfaces exposed to view to [1/240][1/400][____] of center-to-center spacing of facing supports.

[i. Do not use earth cuts as forms for vertical or sloping surfaces.

] j. Submit product information on proposed form-facing materials if different from that specified herein.

[k. Submit shop drawings for formwork, shoring, reshoring, and backshoring. Shop drawings must be signed and sealed by a licensed design engineer or First Class Kenchikushi.

] l. Submit procedure for reshoring and backshoring, including drawings signed and sealed by a First Class Kenchikushi. Include on shop drawings the formwork removal procedure and magnitude of construction loads used for design of reshoring or backshoring system. Indicate in procedure the magnitude of live and dead loads assumed for required capacity of the structure at time of reshoring or backshoring.

m. Submit manufacturer's product data on form liner proposed for use with each formed surface.

2.1.1 Wood Forms

Provide lumber that is square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Provide plywood that complies with Japan Agricultural Standard concrete form panels or better or hardboard for smooth form lining.[Submit data verifying that composite wood products contain no urea formaldehyde resins.]

2.1.1.1 Concrete Form Plywood (Standard Rough)

Provide plywood that conforms to Japan Agricultural Standard concrete form, not less than 16 mm thick.

2.1.1.2 Overlaid Concrete Form Plywood (Standard Smooth)

Provide plywood that conforms to Japan Agricultural Standard high density form overlay, not less than 16 mm thick.

2.1.2 Steel Forms

Provide JIS A 8652 steel form surfaces that do not contain irregularities, dents, or sags.

2.2 FORMWORK ACCESSORIES

a. Use commercially manufactured formwork accessories, including ties and hangers.

b. Form ties and accessories must not reduce the effective cover of the reinforcement.

2.2.1 Form Ties

a. Use form ties with ends or end fasteners that can be removed without damage to concrete.

b. Where indicated in Contract Documents, use form ties with integral water barrier plates or other acceptable positive water barriers in walls.

c. The breakback distance for ferrous ties must be at least [50 mm] [19 mm] [_____] for Surface Finish-2.0 or Surface Finish-3.0, as defined in ACI 301.

[d. If the breakback distance is less than 19 mm, use coated or corrosion-resistant ties.

] e. Submit manufacturer's data sheet on form ties.

2.2.2 Waterstops

Submit manufacturer's data sheet on waterstop materials and splices.

2.2.2.1 PVC Waterstop

Polyvinylchloride waterstops must conform to JIS K 6773.

2.2.2.2 Rubber Waterstop

Rubber waterstops must conform to JIS K 6773.

2.2.2.3 Thermoplastic Elastomeric Rubber Waterstop

Thermoplastic elastomeric rubber waterstops must conform to JIS K 6258.

2.2.2.4 Hydrophilic Waterstop

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water must conform to the following requirements when tested in accordance to JIS K 6251: Tensile strength 2.9 MPa minimum; ultimate elongation 600 percent minimum. Hardness must be 50:[40] minimum on the type A durometer when tested in accordance with JIS K 6253 and the volumetric expansion ratio in distilled water at 20 degrees C must be 3 to 1 minimum.

2.2.3 Biodegradable Form Release Agent

a. Provide form release agent that is colorless, biodegradable, and [rapeseed oil-based] [soy oil-based] [water-based], with a [low (maximum of 55 grams/liter (g/l))] [zero] VOC content.[A minimum of [85][_____] percent of the total product must be biobased material.]

b. Provide product that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

c. Provide form release agent that reduces formwork moisture absorption, and does not contain diesel fuel, petroleum-based lubricating oils, waxes, or kerosene. Submit documentation indicating type of biobased material in product and biobased content. Indicate relative dollar value of biobased content products to total dollar value of products included in project.

d. Submit manufacturer's product data on formwork release agent for use on each form-facing material.

2.2.4 Chamfer Materials

Use lumber materials with dimensions of 20 x 20 mm.

2.2.5 Construction and movement joints

a. Submit details and locations of construction joints in accordance with the requirements herein.

b. Locate construction joints within middle one-third of spans of slabs, beams, and girders. If a beam intersects a girder within the middle one-third of girder span, the distance between the construction joint in the girder and the edge of the beam must be at least twice the width of the larger member.

c. For members with post-tensioning tendons, locate construction joints where tendons pass through centroid of concrete section.

d. Locate construction joints in walls and columns at underside of slabs, beams, or girders and at tops of footings or slabs.

e. Make construction joints perpendicular to main reinforcement.

f. Provide movement joints where indicated in Contract Documents or in accepted alternate locations.

g. Submit location and detail of movement joints if different from those indicated in Contract Documents.

h. Submit manufacturer's data sheet on expansion joint materials.

i. Provide keyways where indicated in Contract Documents.[Longitudinal keyways indicated in Contract Documents must be at least 40 mm deep, measured perpendicular to the plane of the joint.]

2.2.6 Perimeter Insulation

Perimeter insulation must be expanded polystyrene conforming to JIS A 9521 meeting the following performance requirements:

a. Density: 300 kg/3^3 minimum.

b. Compressive Strength at yield or 10 percent deformation: 104 kPa, min.

c. Thermal Resistance of 25 mm thickness: 0.70 K·m^2/W

d. Flexural Strength: 240 kPa, min.

e. Water Absorption by total immersion, volume percent: 3 percent maximum.

f. Dimensional Stability (change in dimensions): 2 percent maximum.

g. Water Vapor Permeance of 25 mm thickness: 200 ng/Pa·s·m^2, maximum.

Comply with EPA requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING

2.2.7 Other Embedded items

Use sleeves, inserts, anchors, and other embedded items of material and design indicated in Contract Documents.

2.3 CONCRETE MATERIALS

2.3.1 Cementitious Materials

2.3.1.1 Portland Cement

a. Unless otherwise specified, provide cement that conforms to JIS R 5210, Ordinary Portland Cement [and meets [low alkali content requirements][_____].]

b. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

c. Submit information along with evidence demonstrating compliance with referenced standards. Submittals must include types of cementitious materials, manufacturing locations, shipping locations, and certificates showing compliance.

d. Cementitious materials must be stored and kept dry and free from contaminants.

[2.3.1.2 Blended Cements

Blended cements must conform to [JIS R 5211, Type [A] [B] [C]], [JIS R 5212,

Type [A] [B] [C]], [JIS R 5213, Type [A] [B] [C]].

]2.3.2 Water

a. Water or ice must comply with the requirements of JIS A 5308, Annex C.

b. Minimize the amount of water in the mix. Improve workability by adjusting the grading of the aggregate and using admixture rather than by adding water.

c. Water must be [potable] [from rainwater collection] [from graywater] [from recycled water]; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete.

d. Protect mixing water and ice from contamination during storage and delivery.

e. Submit test report showing water complies with JIS A 5308, Annex C.

[f. When nonpotable source is proposed for use, submit documentation on effects of water on strength and setting time in compliance with JIS A 5308, Annex C.

]2.3.3 Aggregate

2.3.3.1 Normal-Weight Aggregate

a. Aggregates must conform to JIS A 5005 [unless otherwise specified in the Contract Documents or approved by the contracting officer][_____].

b. Aggregates used in concrete must be obtained from the same sources and have the same size range as aggregates used in concrete represented by submitted field test records or used in trial mixtures.

c. Store and handle aggregate in a manner that will avoid segregation and prevents contamination by other materials or other sizes of aggregates. Store aggregates in locations that will permit them to drain freely. Do not use aggregates that contain frozen lumps.

d. Submit types, pit or quarry locations, producers' names, aggregate supplier statement of compliance with JIS A 5005 and JIS A 1804 expansion data not more than 18 months old.

2.3.4 Admixtures

a. Chemical admixtures must conform to JIS A 6204.

b. Air-entraining admixtures must conform to JIS A 6204.

c. Chemical admixtures for use in producing flowing concrete must conform to JIS A 6204.

d. Do not use calcium chloride admixtures[.][unless approved by the contracting officer.]

e. Admixtures used in concrete must be the same as those used in the concrete represented by submitted field test records or used in trial mixtures.

f. Protect stored admixtures against contamination, evaporation, or damage.

g. To ensure uniform distribution of constituents, provide agitating equipment for admixtures used in the form of suspensions or unstable solutions. Protect liquid admixtures from freezing and from temperature changes that would adversely affect their characteristics.

h. Submit types, brand names, producers' names, manufacturer's technical data sheets, and certificates showing compliance with standards required herein.

2.4 MISCELLANEOUS MATERIALS

2.4.1 Concrete Curing Materials

Provide concrete curing material in accordance with JASS 5 and MLIT-SS Chapter 6. Submit product data for concrete curing compounds. Submit manufactures instructions for placement of curing compound.

2.4.2 Nonshrink Grout

Packaged dry, hydraulic cement non-shrink grout, that is non-metallic, non-corrosive, non-bleed, with the following performance requirements when prepared using the highest water-to-solids ratio, maximum flow, or most fluid consistency at 23.0 plus or minus 2.0 degrees C:

a. Minimum compressive strengths: 7.0 MPa at 1 day; 17.0 MPa at 3 day; 24.0 MPa at 7 day; and 34.0 MPa at 28 day.

b. Early height change (maximum percent at time of final setting): plus 4.0 percent.

c. Height change of moist cured hardened grout: 0.0 to plus or minus 0.3 percent at 1-day, 3-day, 14-day and 28-day.

2.4.3 Floor Finish Materials

2.4.3.1 Liquid Chemical Floor Hardeners and Sealers

a. Hardener must be a colorless aqueous solution containing a blend of inorganic silicate or siliconate material and proprietary components combined with a wetting agent; that penetrates, hardens, and densifies concrete surfaces. Submit manufactures instructions for placement of liquid chemical floor hardener.

b. Use concrete penetrating sealers with a low (maximum 100 grams/liter, less water and less exempt compounds) VOC content. Submit manufactures instructions for placement of sealers.

2.4.4 Expansion/Contraction Joint Filler

Preformed, bituminous joint fiber filler for concrete paving and structural concrete construction. Provide joint filler meeting the following performance requirements:

a. Density: 300 kg/m^3 minimum.

b. Compression: The load required to compress the test specimen to 50 percent of its thickness before test shall not be less than 690 kPa and not more than 5100 kPa. If the nominal thickness of the specimen is less than 13 mm a maximum load of 8600 kPa is permitted.

c. Extrusion/Protrusion: Test specimen shall be compressed to 50 percent of its thickness before test with three edges restrained. The amount of extrusion/protrusion of the free edge shall not exceed 6 mm.

d. Recovery: The test specimen shall be compressed to 50 percent of its thickness before test. The load shall be released immediately after application. At the end of 10 minutes after release of the applied load, the specimen shall have recovered to at least 70 percent of its thickness before test.

e. Water Absorption: The test specimen when submerged under 25 mm of water shall absorb not more than 15 percent by volume in 24 hours for 10 mm thickness and over.

Material must be 13 mm thick[, unless otherwise indicated]. [and of a width applicable for the joint formed]. [Backer material shall be closed cell, polyethylene foam material with a density between 20-45 kg/m^3; Greater than 95 percent compression recovery; compression deflection 38 kPa; Greater than 160kPa tensile strength; and 200 degrees C heat resistance for hot applied sealants].

2.4.5 Joint Sealants and Seals

[Submit manufacturer's product data, indicating VOC content.] [Joint sealants conforming to the requirements of Section 07 92 00 JOINT SEALANTS].

2.4.5.1 Horizontal Surfaces, 3 Percent Slope, Maximum

JIS A 5758, multi-component sealant, Class 25, traffic [non-traffic]. [Hot-applied joint sealant for sealing cracks in concrete and asphalt pavements shall be in conformance with the applicable requirements of the JRA PDCG - Pavement Design and Construction Guidelines.]

2.4.5.2 Vertical Surfaces Greater Than 3 Percent Slope

JIS A 5758, multi-component sealant, non-sag, Class 25, traffic [non-traffic].

2.4.6 Vapor Retarder [and Vapor Barrier]

Preformed, flexible polyethylene sheeting to be used as vapor retarder in contact with soil or granular fill under concrete slabs, minimum 0.25 mm [0.38 mm] thickness or other equivalent material meeting the following performance requirements:

a. Water Vapor Permeance, JIS K 7129-2 or equivalent test procedure: 2.28 ng/(m^2·s ·Pa), max.

b. Water Vapor Permeance after wetting, drying and soaking [, after heat conditioning] [, after low temperature conditioning] [, after soil organism conditioning], JIS K 7129-2 or equivalent test procedure: 2.28 ng/(m^2·s ·Pa), max.

c. Tensile Strength, JIS K 7127: 2.4 kN/m [5.3 kN/m] [7.9 kN/m], min.

d. Puncture Resistance, JIS K 7124-1: 475 g [1700 g] [2200 g], min.

[Preformed, flexible polyethylene sheeting to be used as vapor barrier in contact with soil or granular fill under concrete slabs, minimum 0.38 mm thickness or other equivalent material with the following performance requirements:

a. Water Vapor Permeance, JIS K 7129-2 or equivalent test procedure: 0.57 ng/(m^2·s ·Pa), max.

b. Water Vapor Permeance after wetting, drying and soaking [, after heat conditioning] [, after low temperature conditioning] [, after soil organism conditioning], JIS K 7129-2 or equivalent test procedure: 0.57 ng/(m^2·s ·Pa), max.

c. Tensile Strength, JIS K 7127: 7.9 kN/m, min.

d. Puncture Resistance, JIS K 7124-1: 2200 g, min.]

Consider plastic vapor retarders and vapor barriers and adhesives with a high recycled content, low toxicity low VOC (Volatile Organic Compounds) levels.

2.5 CONCRETE MIX DESIGN

2.5.1 Properties and Requirements

a. Use materials and material combinations listed in this section and the contract documents.

b. Cementitious material content must be adequate for concrete to satisfy the specified requirements for strength, w/cm, durability, and finishability described in this section and the contract documents.

[The minimum cementitious material content for concrete used in floors must meet the following requirements:

Nominal maximum size of aggregate, mm	**Minimum cementitious material content, kg per cubic meter**
37.5	280
25	310
19	320
9.5	360

]

c. Selected target slump must meet the requirements this section, the contract documents, and must not exceed 230 mm. Concrete must not show visible signs of segregation.

d. The target slump must be enforced for the duration of the project. Determine the slump by JIS A 1101. Slump tolerances must meet the

requirements of JASS 5 and MLIT-SS Chapter 6.

e. The nominal maximum size of coarse aggregate for a mixture must not exceed three-fourths of the minimum clear spacing between reinforcement, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

f. Concrete must be air entrained for members assigned to Exposure Class F1, F2, or F3. The total air content must be in accordance with the requirements of the paragraph titled DURABILITY.

g. Measure air content at the point of delivery in accordance with JIS A 1118 or JIS A 1128.

h. Concrete for slabs to receive a hard-troweled finish must not contain an air-entraining admixture or have a total air content greater than 3 percent.

i. Concrete properties and requirements for each portion of the structure are specified in the table below. Refer to the paragraph titled DURABILITY for more details on exposure categories and their requirements.

	Minimum *f'c* MPa	**Exposure Categories^**	**Miscellaneous Requirements**
Footings	[36] [21] [_____] at 28 days	[S0] [S1] [S2] [S3]; [C0] [C1] [C2]; [W0] [W1]; [F0] [F1] [F2] [F3]	[Max. slump: [15 cm] [_____]] [Nominal maximum aggregate size must be [12.5 mm][19 mm][25 mm] [_____]]
Columns and walls	[36] [21] [_____] at 28 days	[S0] [S1] [S2] [S3]; [C0] [C1] [C2]; [W0] [W1]; [F0] [F1] [F2] [F3]	[Nominal maximum aggregate size must be [12.5 mm][19 mm][25 mm] [_____]]
Beams and elevated slabs	[36] [21] [_____] at 28 days	[S0] [S1] [S2] [S3]; [C0] [C1] [C2]; [W0] [W1]; [F0] [F1] [F2] [F3]	[Nominal maximum aggregate size must be [12.5 mm][19 mm][25 mm] [_____]]
Slabs-on-ground	[36] [21] [_____] at 28 days	[S0] [S1] [S2] [S3]; [C0] [C1] [C2]; [W0] [W1]; [F0] [F1] [F2] [F3]	

	Minimum *f'c* MPa	**Exposure Categories^**	**Miscellaneous Requirements**
Concrete Toppings	[36] [21] [_____] at 28 days	[S0] [S1] [S2] [S3]; [C0] [C1] [C2]; [W0] [W1]; [F0] [F1] [F2] [F3]	[Max. slump: [15 cm] [_____]]

2.5.2 Durability

2.5.2.1 Alkali-Aggregate Reaction

Do not use any aggregate susceptible to alkali-carbonate reaction (ACR) to reduce the potential of alkali-silica reaction (ASR). For each aggregate used in qualifying concrete mixtures, the expansion result of the aggregate and cementitious materials combination determined in accordance with JIS A 1146 must not exceed 0.10 percent at an age of 16 days.

2.5.2.2 Freezing and Thawing Resistance

a. Provide concrete meeting the following requirements based on exposure class assigned to members for freezing-and-thawing exposure in Contract Documents:

Exposure class	**Maximum *w/cm****	**Minimum *f'c*, MPa**	**Air content**	**Additional Requirements**
F0	N/A	18	N/A	
F1	0.55	24	Depends on aggregate size	N/A
F2	0.45	30	Depends on aggregate size	See limits on maximum cementitious material by mass
F3	0.40	36	Depends on aggregate size	See limits on maximum cementitious material by mass
F3 plain concrete	0.45	30	Depends on aggregate size	See limits on maximum cementitious material by mass

*The maximum *w/cm* limits do not apply to lightweight concrete.

b. Concrete must be air entrained for members assigned to Exposure Class

F1, F2, or F3. The total air content must meet the requirements of the following table:

Nominal maximum aggregate size, mm	Total air content, percent*^	
	Exposure Class F2 and F3	Exposure Class F1
9.5	7.5	6.0
12.5	7.0	5.5
19.0	6.0	5.0
25.0	6.0	4.5
37.5	5.5	4.5
50	5.0	4.0
75	5.5	3.5

*Tolerance on air content as delivered must be plus/minus 1.5 percent.
^For f'c greater than 36 MPa psi, reducing air content by 1.0 percentage point is acceptable.

c. Submit documentation verifying compliance with specified requirements.

d. For sections of the structure that are assigned Exposure Class F3, submit certification on cement composition verifying that concrete mixture meets the requirements of the following table:

Cementitious material	Maximum percent of total cementitious material by mass*
Fly ash or other pozzolans conforming to JIS A 6201	25
Slag cement conforming to JIS A 5011	50

*Total cementitious material also includes JIS R 5210, fly ash, other pozzolans, and slag cement. The maximum percentages above must include:

i. Fly ash or other pozzolans present in Type IP JIS R 5212 blended cement.

ii. Slag cement present in Type IS JIS R 5211 blended cement.

^Fly ash or other pozzolans must constitute no more than 25 percent of the total mass of the cementitious materials.

2.5.2.3 Corrosion and Chloride Content

a. Provide concrete meeting the requirements of the following table based on the exposure class assigned to members requiring protection against reinforcement corrosion in Contract Documents.

b. Submit documentation verifying compliance with specified requirements.

c. Water-soluble chloride ion content contributed from constituents including water, aggregates, cementitious materials, and admixtures must be determined for the concrete mixture by JIS A 1154 at age between 28 and 42 days.

d. The maximum water-soluble chloride ion (Cl-) content in concrete, percent by mass of cement is as follows:

Exposure class	**Maximum *w/cm****	**Minimum f'c, MPa**	**Maximum water-soluble chloride ion (CL-) content in concrete, percent by mass of cement**
Reinforced concrete			
C0	N/A	18	1.00
C1	N/A	18	0.30
C2	0.4	36	0.15
Prestressed concrete			
C0	N/A	18	0.06
C1	N/A	18	0.06
C2	0.4	36	0.06

*The maximum w/cm limits do not apply to lightweight concrete.

2.5.2.4 Sulfate Resistance

a. Provide concrete meeting the requirements of the following table based on the exposure class assigned to members for sulfate exposure.

Exposure class	**Maximum *w/cm****	Minimum f'c MPa	**Required cementitious materials-types**		**Calcium chloride admixture**
			JIS R 5210	JIS R 5211, JIS R 5212	
S0	N/A	17	N/A	N/A	No restrictions

Exposure class	**Maximum *w/cm****	Minimum f'c MPa	**Required cementitious materials-types**		**Calcium chloride admixture**
			JIS R 5210	JIS R 5211, JIS R 5212	
S1	0.50	28	II (moderate sulfate resistant)*^	IP, portland pozzolan cement (moderate sulfate resistant); IS, portland blast furnace slag cement (<70) (moderate sulfate resistant)	No restrictions
S2	0.45	31	IV (low heat of hydration)*^	IP, portland pozzolan cement (high sulfate resistant); IS, portland blast furnace slag cement (<70) (high sulfate resistant)	Not permitted
S3	0.45	31	V (high sulfate resistant) + pozzolan or slag cement **	IP, portland pozzolan cement (high sulfate resistant) + pozzolan or slag cement^; IS, portland blast furnace slag cement (<70) (high sulfate resistant) + pozzolan or slag cement *	Not permitted

* For seawater exposure, other types of portland cements with tricalcium aluminate (C3A) contents up to 10 percent are acceptable if the w/cm does not exceed 0.40.

** The amount of the specific source of the pozzolan or slag cement to be used shall be at least the amount determined by test or service record to improve sulfate resistance when used in concrete containing Type V cement. Alternatively, the amount of the specific source of the pozzolan or slag used shall not be less than the amount tested in accordance with ASTM C1012/C1012M and meeting the requirements maximum expansion requirements listed herein.

^ Other available types of cement, such as Type III or Type I, are acceptable in exposure classes S1 or S2 if the C3A contents are less than 8 or 5 percent, respectively.

b. The maximum w/cm limits for sulfate exposure do not apply to

lightweight concrete.

c. Alternative combinations of cementitious materials of those listed in this paragraph are acceptable if they meet the maximum expansion requirements listed in the following table:

Exposure class	Maximum expansion when tested using ASTM C1012/C1012M		
	At 6 months	At 6 months	At 18 months
S1	0.10 percent	N/A	N/A
S2	0.05 percent	0.10 percent^	N/A
S3	N/A	N/A	0.10 percent

^The 12-month expansion limit applies only when the measured expansion exceeds the 6-month maximum expansion limit.

2.5.2.5 Concrete Temperature

The temperature of concrete as delivered must not exceed [35 degrees C] [_____].

2.5.2.6 Concrete Permeability

a. Provide concrete meeting the requirements of the following table based on exposure class assigned to members requiring low permeability in the Contract Documents.

Exposure class	Maximum *w/cm**	Minimum f'c, MPa	Additional minimum requirements
W0	N/A	18	None
W1	0.5	27	None

*The maximum w/cm limits do not apply to lightweight concrete.

b. Submit documentation verifying compliance with specified requirements.

2.5.3 Trial Mixtures

Trial mixtures must be in accordance to JASS 5 and MLIT-SS Chapter 6.

2.5.4 Ready-Mix Concrete

Provide concrete that meets the requirements of JIS A 5308.

Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by JIS A 5308:

a. Type and brand cement

b. Cement and supplementary cementitious materials content in 43-kilogram bags per cubic meter of concrete

c. Maximum size of aggregate

d. Amount and brand name of admixtures

e. Total water content expressed by water cementitious material ratio

2.6 REINFORCEMENT

a. Bend reinforcement cold. Fabricate reinforcement in accordance with fabricating tolerances of JASS 5 and MLIT-SS Chapter 6.

b. When handling and storing coated reinforcement, use equipment and methods that do not damage the coating. If stored outdoors for more than 2 months, cover coated reinforcement with opaque protective material.

c. Submit manufacturer's certified test report for reinforcement.

d. Submit placing drawings showing fabrication dimensions and placement locations of reinforcement and reinforcement supports. Placing drawings must indicate locations of splices, lengths of lap splices, and details of mechanical and welded splices.

e. Submit request with locations and details of splices not indicated in Contract Documents.

f. Submit request to place column dowels without using templates.

[g. Submit request and procedure to field-bend or straighten reinforcing bars partially embedded in concrete at locations not indicated in Contract Documents. Field bending or straightening of reinforcing bars is permitted [where indicated in the Contract Documents][in the following locations: [_____]]

] h. Submit request for field cutting, including location and type of bar to be cut and reason field cutting is required.

2.6.1 Reinforcing Bars

a. Reinforcing bars must be deformed, except spirals, load-transfer dowels, and welded wire reinforcement, which may be plain.

b. JIS G 3112, grades and sizes as indicated. [Cold drawn wire used for spiral reinforcement must conform to JIS G 3551.]

[Provide reinforcing bars that contain a minimum of [100][_____] percent recycled content.][See Section 01 33 29 SUSTAINABILITY REPORTING for cumulative total recycled content requirements.]

c. [Reinforcing bars may contain post-consumer or post-industrial recycled content.] [Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.]

d. Submit mill certificates for reinforcing bars.

2.6.1.1 Headed Reinforcing Bars

Headed reinforcing bars must conform to ASTM A970/A970M including Annex A1, and other specified requirements.

2.6.1.2 Bar Mats

a. Bar mats must conform to JIS G 3551.

2.6.2 Mechanical Reinforcing Bar Connectors

a. Provide 125 percent minimum yield strength of the reinforcement bar.

b. Mechanical splices for galvanized reinforcing bars must be galvanized or coated with dielectric material.

c. Mechanical splices used with epoxy-coated or dual-coated reinforcing bars must be coated with dielectric material.

d. Submit data on mechanical splices demonstrating compliance with this paragraph.

2.6.3 Wire

a. [Provide wire reinforcement that contains a minimum of [100] [_____] percent recycled content.][See Section 01 33 29 SUSTAINABILITY REPORTING for cumulative total recycled content requirements. Wire reinforcement may contain post-consumer or post-industrial recycled content.]Provide flat sheets of welded wire reinforcement for slabs and toppings.

b. Plain or deformed steel wire must conform to JIS G 3551.

2.6.4 Welded Wire Reinforcement

a. Use welded wire reinforcement specified in Contract Documents and conforming to one or more of the specifications given herein.

b. Plain welded wire reinforcement must conform to JIS G 3551, with welded intersections spaced no greater than 300 mm apart in direction of principal reinforcement.

c. Deformed welded wire reinforcement must conform to JIS G 3551, with welded intersections spaced no greater than 400 mm apart in direction of principal reinforcement.

d. Zinc-coated (galvanized) welded wire reinforcement must conform to JIS H 8641. Coating damage incurred during shipment, storage, handling, and placing of zinc-coated (galvanized) welded wire reinforcement must be repaired in accordance with JASS 6. If damaged area exceeds 2 percent of surface area in each linear foot of each wire or welded wire reinforcement, the sheet containing the damaged area must not be used. The 2 percent limit on damaged coating area shall include repaired areas damaged before shipment.

2.6.5 Reinforcing Bar Supports

a. Provide reinforcement support types within structure as required by

Contract Documents. Reinforcement supports must conform to JASS 5 and MLIT-SS Chapter 6.

b. Legs of supports in contact with formwork must be hot-dip galvanized, or plastic coated after fabrication, or stainless-steel bar supports.

c. [Minimum [5][10][_____] percent post-consumer recycled content, or minimum [20][40][_____] percent post-industrial recycled content.] [See Section 01 33 29 SUSTAINABILITY REPORTING for cumulative total recycled content requirements. Plastic and steel may contain post-consumer or post-industrial recycled content.]

2.6.6 Dowels for Load Transfer in Floors

Provide greased dowels for load transfer in floors of the type, design, weight, and dimensions indicated. Provide dowel bars that are plain-billet steel conforming to JIS G 3112, Grade SD295. Provide dowel pipe that is steel conforming to JIS G 3444 STK400.

[Plate dowels must conform to JIS G 3101 SS400, and must be of size and spacing indicated. Plate dowel system must minimize shrinkage restraint by [using a tapered shape] [or] [formed void] [or] [by having compressible material on the vertical faces with a thin bond breaker on the top and bottom dowel surfaces.]

]2.6.7 Welding

a. Provide weldable reinforcing bars that conform to JIS G 3112, grades and sizes as indicated. The maximum carbon content shall not exceed 0.55 percent with carbon not exceeding 0.30 percent and manganese not exceeding 1.5 percent.

b. Comply with JIS Z 3881 unless otherwise specified. Do not tack weld reinforcing bars.

c. Welded assemblies of steel reinforcement produced under factory conditions, such as welded wire reinforcement, bar mats, and deformed bar anchors, are allowed.

PART 3 EXECUTION

3.1 EXAMINATION

a. Do not begin installation until substrates have been properly constructed; verify that substrates are level.

b. If substrate preparation is the responsibility of another installer, notify Contracting Officer of unsatisfactory preparation before processing.

c. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Contracting Officer and wait for instructions before beginning installation.

3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete

before the concrete is poured.

3.2.1 General

a. Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.

b. Remove standing water without washing over freshly deposited concrete. Divert flow of water through side drains provided for such purpose.

3.2.2 Subgrade Under Foundations and Footings

a. When subgrade material is semi-porous and dry, sprinkle subgrade surface with water as required to eliminate suction at the time concrete is deposited, or seal subgrade surface by covering surface with specified vapor retarder.

b. When subgrade material is porous, seal subgrade surface by covering surface with specified vapor retarder.

3.2.3 Subgrade Under Slabs on Ground

a. Before construction of slabs on ground, have underground work on pipes and conduits completed and approved.

b. Previously constructed subgrade or fill must be cleaned of foreign materials

c. Finish surface of capillary water barrier under interior slabs on ground must not show deviation in excess of 6 mm when tested with a 3000 mm straightedge parallel with and at right angles to building lines.

d. Finished surface of subgrade or fill under exterior slabs on ground must not be more than 6 mm above or 30 mm below elevation indicated.

3.2.4 Edge Forms and Screed Strips for Slabs

a. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment.

b. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.

3.2.5 Reinforcement and Other Embedded Items

a. Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.

b. When concrete is placed, reinforcement must be free of materials deleterious to bond. Reinforcement with rust, mill scale, or a combination of both will be considered satisfactory, provided minimum nominal dimensions, nominal weight, and minimum average height of deformations of a hand-wire-brushed test specimen are not less than applicable ASTM specification requirements.

3.3 FORMS

a. Provide forms, shoring, and scaffolding for concrete placement. Set forms mortar-tight and true to line and grade.

b. Chamfer above grade exposed joints, edges, and external corners of concrete [20 mm]. Place chamfer strips in corners of formwork to produce beveled edges on permanently exposed surfaces.[Do not bevel reentrant corners or edges of formed joints of concrete.]

c. Provide formwork with clean-out openings to permit inspection and removal of debris.

d. Inspect formwork and remove foreign material before concrete is placed.

e. At construction joints, lap form-facing materials over the concrete of previous placement. Ensure formwork is placed against hardened concrete so offsets at construction joints conform to specified tolerances.

f. Provide positive means of adjustment (such as wedges or jacks) of shores and struts. Do not make adjustments in formwork after concrete has reached initial setting. Brace formwork to resist lateral deflection and lateral instability.

g. Fasten form wedges in place after final adjustment of forms and before concrete placement.

h. Provide anchoring and bracing to control upward and lateral movement of formwork system.

i. Construct formwork for openings to facilitate removal and to produce opening dimensions as specified and within tolerances.

j. Provide runways for moving equipment. Support runways directly on formwork or structural members. Do not support runways on reinforcement. Loading applied by runways must not exceed capacity of formwork or structural members.

k. Position and support expansion joint materials, waterstops, and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with removable material to prevent concrete entry into voids.

l. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign materials before concrete placement.

3.3.1 Coating

a. Cover formwork surfaces with an acceptable material that inhibits bond with concrete.

b. If formwork release agent is used, apply to formwork surfaces in accordance with manufacturer's recommendations before placing reinforcement. Remove excess release agent on formwork prior to concrete placement.

c. Do not allow formwork release agent to contact reinforcement or

hardened concrete against which fresh concrete is to be placed.

3.3.2 Reshoring

a. Do not allow structural members to be loaded with combined dead and construction loads in excess of loads indicated in the accepted procedure.

b. Install and remove reshores or backshores in accordance with accepted procedure.

c. For floors supporting shores under newly placed concrete, either leave original supporting shores in place, or install reshores or backshores. Shoring system and supporting slabs must resist anticipated loads. Locate reshores and backshores directly under a shore position or as indicated on formwork shop drawings.

d. In multistory buildings, place reshoring or backshoring over a sufficient number of stories to distribute weight of newly placed concrete, forms, and construction live loads.

3.3.3 Reuse

a. Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised.

b. Wood forms must not be clogged with paste and must be capable of absorbing high water-cementitious material ratio paste.

c. Remove leaked mortar from formwork joints before reuse.

3.3.4 Forms for Standard Rough Form Finish

Provide formwork in accordance with JASS 5 and MLIT-SS Chapter 6 with a surface finish, ACI 301 SF-1.0, for formed surfaces that are to be concealed by other construction.

3.3.5 Forms for Standard Smooth Form Finish

Provide formwork in accordance with JASS 5 and MLIT-SS Chapter 6 with a surface finish, ACI 301 SF-3.0, for formed surfaces that are exposed to view.[Do not provide mockup of concrete surface appearance and texture.]

3.3.6 Form Ties

a. For post-tensioned structures, do not remove formwork supports until stressing records have been accepted by the Contracting Officer.

b. After ends or end fasteners of form ties have been removed, repair tie holes in accordance with JASS 5 and MLIT-SS Chapter 6.

3.3.7 Tolerances for Form Construction

a. Construct formwork so concrete surfaces conform to tolerances in JASS 5 and MLIT-SS Chapter 6.

b. Position and secure sleeves, inserts, anchors, and other embedded items such that embedded items are positioned within JASS 5 and MLIT-SS Chapter 6 tolerances.

c. To maintain specified elevation and thickness within tolerances, install formwork to compensate for deflection and anticipated settlement in formwork during concrete placement. Set formwork and intermediate screed strips for slabs to produce designated elevation, camber, and contour of finished surface before formwork removal. If specified finish requires use of vibrating screeds or roller pipe screeds, ensure that edge forms and screed strips are strong enough to support such equipment.

3.3.8 Removal of Forms and Supports

a. If vertical formed surfaces require finishing, remove forms as soon as removal operations will not damage concrete.

b. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform repairs and finishing operations required. If forms are removed before end of specified curing period, provide curing and protection.

c. Do not damage concrete during removal of vertical formwork for columns, walls, and sides of beams. Perform needed repair and finishing operations required on vertical surfaces. If forms are removed before end of specified curing period, provide curing and protection.

[d. Leave formwork and shoring in place to support construction loads and weight of concrete in beams, slabs, and other structural members until in-place required strength of concrete is reached.

] e. Form-facing material and horizontal facing support members may be removed before in-place concrete reaches specified compressive strength if shores and other supports are designed to allow facing removal without deflection of supported slab or member.

3.3.9 Strength of Concrete Required for Removal of Formwork

If removal of formwork, reshoring, or backshoring is based on concrete reaching a specified in-place strength, mold and field-cure cylinders in accordance with JIS A 1132. Test cylinders in accordance with JIS A 1108.

3.4 WATERSTOP INSTALLATION AND SPLICES

a. Provide waterstops in construction joints as indicated.

b. Install formwork to accommodate waterstop materials. Locate waterstops in joints where indicated in Contract Documents. Minimize number of splices in waterstop. Splice waterstops in accordance with manufacturer's written instructions. Install factory-manufactured premolded mitered corners.

c. Install waterstops to form a continuous diaphragm in each joint. Make adequate provisions to support and protect waterstops during progress of work. Protect waterstops protruding from joints from damage.

3.4.1 PVC Waterstop

Make splices by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically

designed for waterstop welding. Reform waterstops at splices with a remolding iron with ribs or corrugations to match the pattern of the waterstop. The spliced area, when cooled, must show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

3.4.2 Rubber Waterstop

Rubber waterstops must be spliced using cold bond adhesive as recommended by the manufacturer.

3.4.3 Thermoplastic Elastomeric Rubber Waterstop

Fittings must be shop made using a machine specifically designed to mechanically weld the waterstop. A portable power saw must be used to miter or straight cut the ends to be joined to ensure good alignment and contact between joined surfaces. Maintain continuity of the characteristic features of the cross section of the waterstop (for example ribs, tabular center axis, and protrusions) across the splice.

3.4.4 Hydrophilic Waterstop

Miter cut ends to be joined with sharp knife or shears. The ends must be adhered with adhesive.

3.5 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

a. Unless otherwise specified, placing reinforcement and miscellaneous materials must be in accordance to JASS 5 and MLIT-SS Chapter 6. Provide bars, welded wire reinforcement, wire ties, supports, and other devices necessary to install and secure reinforcement.

b. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

c. Nonprestressed cast-in-place concrete members must have concrete cover for reinforcement given in the following table:

Concrete Exposure	**Member**	**Reinforcement**	**Specified cover, mm**
Cast against and permanently in contact with ground	All	All	75

Concrete Exposure	Member	Reinforcement	Specified cover, mm
Exposed to weather or in contact with ground	All	D19 through D51 bars	50
		D16, 16 mm diameter smooth, or 16 mm diameter deformed wire, and smaller	40
Not exposed to weather or in contact with ground	Slabs, joists, and walls	D38, D41 and D51 bars	40
		D35 bar and smaller	20
	Beams, columns, pedestals, and tension ties	Primary reinforcement, stirrups, ties, spirals, and hoops	40

d. Cast-in-place prestressed concrete members must have concrete cover for reinforcement, ducts, and end fittings given in the following table:

Concrete Exposure	Member	Reinforcement	Specified cover, mm
Cast against and permanently in contact with ground	All	All	75
Exposed to weather or in contact with ground	Slabs, joists, and walls	All	25
	All other	All	40
Not exposed to weather or in contact with ground	Slabs, joists, and walls	All	20
	Beams, columns, and tension ties	Primary reinforcement	40
		Stirrups, ties, spirals, and hoops	25

e. Precast nonprestressed or prestressed concrete members manufactured under plant conditions must have concrete cover for reinforcement, ducts, and end fittings given in the following table:

Concrete Exposure	**Member**	**Reinforcement**	**Specified cover, mm**
Exposed to weather or in contact with ground	Walls	D38, D41 and D51 bars; tendons larger than 40 mm diameter	40
		D35 bars and smaller; 16 mm diameter smooth, or 16 mm diameter deformed wire, and smaller; tendons and strands 40 mm and smaller	20
	All other	D38, D41 and D51 bars; tendons and strands larger than 40 mm diameter	50
		D19 through D35 bars; tendons and strands larger than 16 mm diameter through 40 mm	40
		D16 bar, 16 mm diameter smooth, or 16 mm diameter deformed wire, and smaller; tendons and strands 16 mm diameter and smaller	30

Concrete Exposure	Member	Reinforcement	Specified cover, mm
Not exposed to weather or in contact with ground	Slabs, joists, and walls	D38, D41 and D51 bars; tendons larger than 40 mm diameter	30
		Tendons and strands 40 mm diameter and smaller	20
		D35, 16 mm diameter smooth, or 16 mm diameter deformed wire, and smaller	16
	Beams, columns, pedestals, and tension ties	Primary reinforcement	Greater of bar diameter and 16 and need not exceed 40
		Stirrups, ties, spirals, and hoops	10

3.5.1 General

Provide details of reinforcement that are in accordance with the Contract Documents.

3.5.2 Vapor Retarder [and Vapor Barrier]

a. Level and compact base material and install vapor retarder [vapor barrier] with the longest dimension parallel with the direction of concrete pour and face laps away from direction of pour whenever possible. Extend vapor retarder [vapor barrier] over footings, and seal to foundation wall, grade beam, or slab at an elevation consistent with the top of the slab or terminate at impediments such as dowels or water stops. Seal around all penetrations such as utilities and columns with vapor retarder [vapor barrier] material and seal tape. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 300 mm and tape. [Extend vapor retarder [vapor barrier] over the tops of pile caps and grade beams to a distance acceptable to the contracting officer and terminate as recommended by the manufacturer.]

b. Protect vapor retarder [vapor barrier] from damage during installation of reinforcing steel, utilities and concrete. Provide reinforcing bar supports with base section that minimize the potential for puncture of vapor retarder [vapor barrier]. Avoid use of stakes driven through the vapor retarder [vapor barrier].

c. Inspect installation of vapor retarder [vapor barrier] including sealing of joints and penetrations and mark all areas of damage and insufficient installation in advance of concrete placement such that

deficiencies are corrected before concrete is placed. Remove torn, punctured or damaged vapor retarder [vapor barrier] and repair damaged areas prior to concrete placement with vapor retarder [vapor barrier] material lapped and sealed a minimum of 150 mm beyond damaged area or as instructed by the manufacturer.

[d. Place a 50 mm layer of clean concrete sand on vapor retarder [vapor barrier] before placing concrete.]

3.5.3 Perimeter Insulation

Install perimeter insulation at locations indicated. Adhesive must be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

3.5.4 Reinforcement Supports

Provide reinforcement support in accordance with JASS 5 and MLIT-SS Chapter 6. Supports for coated or galvanized bars must also be coated with electrically compatible material for a distance of at least 50 mm beyond the point of contact with the bars.

3.5.5 Splicing

Lap slice lengths and locations as indicated in the Contract Documents. For splice locations not indicated follow JASS 5 and MLIT-SS Chapter 6, at no additional cost to the Government and subject to approval. Splicing must be by lapping, by gas pressure welding, or by mechanical or welded connection, except that lap splices must not be used for bars larger than D35. Do not splice at points of maximum stress and stagger splices a minimum of [600][1200][_____] mm or as otherwise indicated so no more than half of the bars are spliced at any one section.

Overlap welded wire reinforcement the spacing of the cross wires, plus 50 mm.

Approve welded splices prior to use.

3.5.6 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Provide bolt threads that match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt is installed.

3.5.7 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement and support against displacement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

3.5.8 Fabrication

Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

a. Provide fabrication tolerances that are in accordance with JASS 5 and

MLIT-SS Chapter 6.

b. Provide hooks and bends that are in accordance with the Contract Documents.

Reinforcement must be bent cold to shapes as indicated. Bending must be done in the shop. Rebending of a reinforcing bar that has been bent incorrectly is not be permitted. Bending must be in accordance with standard approved practice and by approved machine methods.

Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

Do not use reinforcement that has any of the following defects:

a. Bar lengths, depths, and bends beyond specified fabrication tolerances

b. Bends or kinks not indicated on drawings or approved shop drawings

c. Bars with reduced cross-section due to rusting or other cause

Replace defective reinforcement with new reinforcement having required shape, form, and cross-section area.

3.5.9 Placing Reinforcement

Place reinforcement in accordance with JASS 5 and MLIT-SS Chapter 6.

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire reinforcement on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

For slabs other than on grade, supports for which any portion is less than 25 mm from concrete surfaces that are exposed to view or to be painted must be of precast concrete units, plastic-coated steel, or stainless steel protected bar supports. Precast concrete units must be wedge shaped, not larger than 90 by 90 mm, and of thickness equal to that indicated for concrete protection of reinforcement. Provide precast units that have cast-in galvanized tie wire hooked for anchorage and blend with concrete surfaces after finishing is completed.

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

a. Provide supports for reinforcing bars that are sufficient in number and have sufficient strength to carry the reinforcement they support, and in accordance with JASS 5 and MLIT-SS Chapter 6. Do not use supports to support runways for concrete conveying equipment and similar construction loads.

b. Equip supports on ground and similar surfaces with sand-plates.

c. Support welded wire reinforcement as required for reinforcing bars.

d. Secure reinforcements to supports by means of tie wire. Wire must be

black, soft iron wire, not less than 1.6 mm.

e. Reinforcement must be accurately placed, securely tied at intersections, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to the Contract Documents.

f. Bending of reinforcing bars partially embedded in concrete is permitted only as specified in the Contract Documents.

3.5.10 Spacing of Reinforcing Bars

a. Spacing must be as indicated in the Contract Documents.

b. Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to preapproval by the Contracting Officer.

3.5.11 Concrete Protection for Reinforcement

Additional concrete protection must be in accordance with the Contract Documents.

3.5.12 Welding

Welding must be in accordance with JASS 6. Welders shall be certified in accordance with JIS Z 3881 for gas pressure welding. Welded joint connections shall develop 125 percent of the specified yield strength of the reinforcing bar and 100 percent of the specified tensile strength of the reinforcing bar.

3.6 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

In accordance with JIS A 5308, JASS 5 and MLIT-SS Chapter 6, except as modified herein. Batching equipment must be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

3.6.1 Measuring

Make measurements at intervals as specified in paragraphs SAMPLING and TESTING.

3.6.2 Mixing

a. Mix concrete in accordance with JIS A 5308, JASS 5 and MLIT-SS Chapter 6.

b. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 29 degrees C.

c. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 29 degrees C except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and submitted water-cementitious material ratio are not exceeded and the required concrete strength is still met. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required.

d. [If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits.]Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch. Do not reconstitute concrete that has begun to solidify.

3.6.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

3.7 PLACING CONCRETE

Place concrete in accordance with JASS 5 and MLIT-SS Chapter 6.

[3.7.1 Footing Placement

Concrete for footings may be placed in excavations without forms upon inspection and approval by the Contracting Officer. Excavation width must be a minimum of 100 mm greater than indicated.

][3.7.2 Pumping

JASS 5 and MLIT-SS Chapter 6. Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed 50 mm at discharge/placement. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of course aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well-rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

]3.7.3 Cold Weather

Cold weather concrete must meet the requirements of JASS 5 and MLIT-SS Chapter 6 unless otherwise specified. Do not allow concrete temperature to decrease below 10 degrees C. Obtain approval prior to placing concrete when the ambient temperature is below 4 degrees C or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 10 degrees C minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 3 degrees C in any 1 hour and 10 degrees C per 24 hours after heat application.

3.7.4 Hot Weather

[Hot weather concrete must meet the requirements of JASS 5 and

MLIT-SS Chapter 6 unless otherwise specified.]Maintain required concrete temperature using Figure 4.2 in ACI 305R to prevent the evaporation rate from exceeding 1 kg per square meter of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

3.7.5 Bonding

Surfaces of set concrete at joints, must be roughened and cleaned of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, nor damaged concrete at the surface.

Obtain bonding of fresh concrete that has set as follows:

a. At joints between footings and walls or columns, between walls or columns and the beams or slabs they support, and elsewhere unless otherwise specified; roughened and cleaned surface of set concrete must be dampened, but not saturated, immediately prior to placing of fresh concrete.

b. At joints in exposed-to-view work; at vertical joints in walls; at joints near midpoint of span in girders, beams, supported slabs, other structural members; in work designed to contain liquids; the roughened and cleaned surface of set concrete must be dampened but not saturated and covered with a cement grout coating.

c. Provide cement grout that consists of equal parts of portland cement and fine aggregate by weight with not more than 22.5 liters of water per sack of cement. Apply cement grout with a stiff broom or brush to a minimum thickness of 1.6 mm. Deposit fresh concrete before cement grout has attained its initial set.

3.8 WASTE MANAGEMENT

Provide as specified in the Waste Management Plan and as follows.

3.8.1 Mixing Equipment

Before concrete pours, designate[Contractor-owned site meeting environmental standards][on-site area to be paved later in project] for cleaning out concrete mixing trucks. Minimize water used to wash equipment.

3.8.2 Hardened, Cured Waste Concrete

[Crush and reuse hardened, cured waste concrete as fill or as a base course for pavement.][Use hardened, cured waste concrete as aggregate in concrete mix if approved by Contracting Officer.]

3.8.3 Reinforcing Steel

Collect reinforcing steel and place in designated area for recycling.

3.8.4 Other Waste

Identify concrete manufacturer's or supplier's policy for collection or return of construction waste, unused material, deconstruction waste, and/or packaging material.[Return excess cement to supplier.][Institute deconstruction and construction waste separation and recycling for use in manufacturer's programs. When such a program is not available, seek local recyclers to reclaim the materials.]

3.9 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

3.9.1 Defects

Repair surface defects in accordance with JASS 5 and MLIT-SS Chapter 6.

3.9.2 Not Against Forms (Top of Walls)

Surfaces not otherwise specified must be finished with wood floats to even surfaces. Finish must match adjacent finishes.

3.9.3 Formed Surfaces

3.9.3.1 Tolerances

Tolerances in accordance with JASS 5 and MLIT-SS Chapter 6 and as indicated.

3.9.3.2 As-Cast Rough Form

Provide for surfaces not exposed to public view a surface finish SF-1.0. Patch holes and defects in accordance with ACI 301 or JASS 5 and MLIT-SS Chapter 6.

3.9.3.3 Standard Smooth Finish

Provide for surfaces exposed to public view a surface finish SF-3.0. Patch holes and defects in accordance with ACI 301 or JASS 5 and MLIT-SS Chapter 6.

3.9.4 [Smooth-Rubbed][Grout-Cleaned Rubbed][Cork-Floated][Exposed Aggregate] Finish

[Provide a smooth-rubbed finish per ACI 301 Section 5 in the locations indicated.][Provide a grout-cleaned rubbed finish per ACI 301 Section 5 in the locations indicated.][Provide a cork-floated finish per ACI 301 Section 5 in the locations indicated.][Provide an exposed aggregate finish per ACI 301 Section 5 in the locations indicated.]

3.10 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

In accordance with JASS 5 and MLIT-SS Chapter 6, unless otherwise specified. Slope floors uniformly to drains where drains are provided.[Depress the concrete base slab where quarry tile, ceramic tile, [or] [_____] are indicated.][Steel trowel and fine-broom finish concrete

slabs that are to receive quarry tile, ceramic tile, or paver tile [_____].] Where straightedge measurements are specified, Contractor must provide straightedge.

3.10.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater.

3.10.1.1 Scratched

Use for surfaces intended to receive bonded applied cementitious applications. Finish concrete in accordance with ACI 301 Section 5 for a scratched finish.

3.10.1.2 Floated

Use for [surfaces to receive [roofing,] [waterproofing membranes,] [sand bed terrazzo,]] [_____] [and] [exterior slabs where not otherwise specified.] Finish concrete in accordance with ACI 301 Section 5 for a floated finish.

3.10.1.3 Steel Troweled

Use for floors intended as walking surfaces[,] [and] for reception of floor coverings[, and] [_____]. Finish concrete in accordance with ACI 301 Section 5 for a steel troweled finish.

[3.10.1.4 Nonslip Finish

Use on surfaces of exterior platforms, steps, and landings; and on exterior and interior pedestrian ramps. Finish concrete in accordance with ACI 301 Section 5 for a dry-shake finish. After the selected material has been embedded by the two floatings, complete the operation with a [broomed] [floated] [troweled] finish.

]3.10.1.5 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Finish concrete in accordance with ACI 301 Section 5 for a broomed finish.

3.10.1.6 Pavement

Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straightedge to check slope and flatness; correct and refloat as necessary. Obtain final finish by [belting. Lay belt flat on the concrete surface and advance with a sawing motion; continue until a uniform but gritty nonslip surface is obtained.] [a burlap drag. Drag a strip of clean, wet burlap from 900 to 3000 mm wide and 600 mm longer than the pavement width across the slab. Produce a fine, granular, sandy textured surface without disfiguring marks.] Round edges and joints with an edger having a radius of 3 mm.

3.10.1.7 Chemical-Hardener Treatment

[Apply liquid-chemical floor hardener where indicated after curing and drying concrete surface. Dilute liquid hardener with water and apply in three coats. First coat must be one-third strength, second coat one-half strength, and third coat two-thirds strength. Apply each coat evenly and allow to dry 24 hours between coats.

Approved proprietary chemical hardeners must be applied in accordance with manufacturer's printed directions.

]3.10.2 Flat Floor Finishes

ACI 302.1R. Construct in accordance with one of the methods recommended in Table 7.15.3, "Typical Composite Ff/FL Values for Various Construction Methods." ACI 117 for tolerance tested by ASTM E1155.

a. Specified Conventional Value:

Floor Flatness (Ff)	[20] [_____]	[13] [_____]	minimum
Floor Levelness (FL)	[15] [_____]	[10] [_____]	minimum

b. Specified Industrial:

Floor Flatness (Ff)	[30] [_____]	[15] [_____]	minimum
Floor Levelness (FL)	[20] [_____]	[10] [_____]	minimum

3.10.2.1 Measurement of Floor Tolerances

Test slab within 24 hours of the final troweling. Provide tests to Contracting Officer within 12 hours after collecting the data. Floor flatness inspector is required to provide a tolerance report which must include:

a. Key plan showing location of data collected.

b. Results required by ASTM E1155.

3.10.2.2 Remedies for Out of Tolerance Work

Contractor is required to repair and retest any floors not meeting specified tolerances. Prior to repair, Contractor must submit and receive approval for the proposed repair, including product data from any materials proposed. Repairs must not result in damage to structural integrity of the floor. For floors exposed to public view, repairs must prevent any uneven or unusual coloring of the surface.

3.10.3 Concrete Walks

Provide 100 mm thick minimum unless otherwise indicated. Provide contraction joints spaced every 1500 lineal mm unless otherwise indicated. Cut contraction joints 25 mm deep, or one fourth the slab thickness whichever is deeper, with a jointing tool after the surface has been finished. Provide 13 mm thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every 15 m maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of 1/48. Limit variation in cross section to 6 mm in 1500 mm.

3.10.4 Pits and Trenches

Place bottoms and walls monolithically or provide waterstops and keys.

3.10.5 Curbs[and Gutters]

Provide contraction joints spaced every 3 m maximum unless otherwise indicated. Cut contraction joints 20 mm deep with a jointing tool after the surface has been finished. Provide expansion joints 13 mm thick and spaced every 30 m maximum unless otherwise indicated. Perform pavement finish.

[3.10.6 Splash Blocks

Provide at outlets of downspouts emptying at grade. Splash blocks may be precast concrete, and must be 600 mm long, 300 mm wide and 100 mm thick, unless otherwise indicated, with smooth-finished countersunk dishes sloped to drain away from the building.

]3.11 JOINTS

3.11.1 Construction Joints

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Joints must be perpendicular to main reinforcement. Reinforcement must be continued and developed across construction joints. Locate construction joints as follows:

3.11.1.1 Maximum Allowable Construction Joint Spacing

a. In walls at not more than 18.0 meter in any horizontal direction.

b. In slabs on ground, so as to divide slab into areas not in excess of 110 square meter.

3.11.1.2 Construction Joints for Constructability Purposes

a. In walls, at top of footing; at top of slabs on ground; at top and bottom of door and window openings or where required to conform to architectural details; and at underside of deepest beam or girder framing into wall.

b. In columns or piers, at top of footing; at top of slabs on ground; and at underside of deepest beam or girder framing into column or pier.

c. Near midpoint of spans for supported slabs, beams, and girders unless a beam intersects a girder at the center, in which case construction joints in girder must offset a distance equal to twice the width of the beam. Make transfer of shear through construction joint by use of inclined reinforcement.

Provide keyways at least 40 mm deep in construction joints in walls and slabs and between walls and footings; approved bulkheads may be used for slabs.

3.11.2 Isolation Joints in Slabs on Ground

a. Provide joints at points of contact between slabs on ground and

vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

b. Fill joints with premolded joint filler strips 13 mm thick, extending full slab depth. Install filler strips at proper level below finish floor elevation with a slightly tapered, dress-and-oiled wood strip temporarily secured to top of filler strip to form a groove not less than 20 mm in depth where joint is sealed with sealing compound and not less than 6 mm in depth where joint sealing is not required. Remove wood strip after concrete has set. Contractor must clean groove of foreign matter and loose particles after surface has dried.

3.11.3 Contraction Joints in Slabs on Ground

a. Provide joints to form panels as indicated.

b. Under and on exact line of each control joint, cut 50 percent of welded wire reinforcement before placing concrete.

c. Sawcut contraction joints into slab on ground in accordance with ACI 301 Section 5.

[d. Joints must be 4 mm wide by 1/5 to 1/4 of slab depth and formed by inserting hand-pressed fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured for at least 7 days, the Contractor must remove inserts and clean groove of foreign matter and loose particles.
]
[e. Sawcutting will be limited to within 12 hours after set and at 1/4 slab depth.

]3.11.4 Sealing Joints in Slabs on Ground

a. Contraction and control joints which are to receive finish flooring material must be sealed with joint sealing compound after concrete curing period. Slightly underfill groove with joint sealing compound to prevent extrusion of compound. Remove excess material as soon after sealing as possible.

b. Sealed groove must be left ready to receive filling material that is provided as part of finish floor covering work.

3.12 CONCRETE FLOOR TOPPING

3.12.1 Standard Floor Topping

Provide topping for treads and platforms of metal steel stairs and elsewhere as indicated.

3.12.1.1 Preparations Prior to Placing

a. When topping is placed on a green concrete base slab, screed surface of base slab to a level not more than 40 mm nor less than 25 mm below required finish surface. Remove water and laitance from surface of base slab before placing topping mixture. As soon as water ceases to rise to surface of base slab, place topping.

b. When topping is placed on a hardened concrete base slab, remove dirt, loose material, oil, grease, asphalt, paint, and other contaminants

from base slab surface, leaving a clean surface. Prior to placing topping mixture, 64 mm minimum, slab surface must be dampened and left free of standing water. Immediately before topping mixture is placed, broom a coat of neat cement grout onto surface of slab. Do not allow cement grout to set or dry before topping is placed.

c. When topping is placed on a metal surface, such as metal pans for steel stairs, remove dirt, loose material, oil, grease, asphalt, paint, and other contaminants from metal surface.

3.12.1.2 Placing

Spread standard topping mixture evenly on previously prepared base slab or metal surface, brought to correct level with a straightedge, and struck off. Topping must be consolidated, floated, checked for trueness of surface, and refloated as specified for float finish.

3.12.1.3 Finishing

Give trowel finish standard floor topping surfaces.

Give other finishes standard floor topping surfaces as indicated.

3.13 CURING AND PROTECTION

Curing and protection in accordance with JASS 5 and MLIT-SS Chapter 6, unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by blasting, pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer, hardener, or epoxy coating. Allow curing compound/sealer installations to cure prior to the installation of materials that adsorb VOCs, including [_____].

3.13.1 Curing Periods

JASS 5 and MLIT-SS Chapter 6, except 10 days for retaining walls, pavement or chimneys. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Contracting Officer.

3.13.2 Curing Formed Surfaces

Accomplish curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, accomplish final curing of

formed surfaces by any of the curing methods specified above, as applicable.

3.13.3 Curing Unformed Surfaces

a. Accomplish initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, by membrane curing.

[b. Accomplish final curing of unformed surfaces by any of curing methods specified, as applicable.

] c. Accomplish final curing of concrete surfaces to receive liquid floor hardener of finish flooring by moisture-retaining cover curing.

3.13.4 Temperature of Concrete During Curing

When temperature of atmosphere is 5 degrees C and below, maintain temperature of concrete at not less than 13 degrees C throughout concrete curing period or 7 degrees C when the curing period is measured by maturity. When necessary, make arrangements before start of concrete placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 27 degrees C and above or during other climatic conditions which cause too rapid drying of concrete, make arrangements before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete must be uniform and not exceed 3 degrees C in any 1 hour nor 27 degrees C in any 24-hour period.

3.13.5 Protection from Mechanical Injury

During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

3.13.6 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

3.14 FIELD QUALITY CONTROL

3.14.1 Sampling

JIS A 1115. Collect samples of fresh concrete to perform tests specified. JIS A 1132 for making test specimens.

3.14.2 Testing

3.14.2.1 Slump Tests

JIS A 1101. Take concrete samples during concrete placement/discharge. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cementitious material ratio is not exceeded. Perform tests at commencement of concrete placement, when

test cylinders are made, and for each batch (minimum) or every 16 cubic meters (maximum) of concrete.

3.14.2.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 10 degrees C and above 27 degrees C) for each batch (minimum) or every 16 cubic meters (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

3.14.2.3 Compressive Strength Tests

JIS A 1108. Make [six] [eight] 150 mm by 300 mm [100 mm by 200 mm] test cylinders for each set of tests in accordance with JIS A 1132, JIS A 1115 and applicable requirements of JASS 5 and MLIT-SS Chapter 6. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, [two cylinders at 56 days] [two cylinders at 90 days] [_____] and hold two cylinder in reserve. Take samples for strength tests of each [mix design of] [and for] [_____] concrete placed each day not less than once a day, nor less than once for each 75 cubic meters of concrete for the first 380 cubic meters, then every 380 cubic meters thereafter, nor less than once for each 500 square meters of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days[56 days] [90 days] [_____]. Concrete compressive tests must meet the requirements of this section, the Contract Document, and JASS 5 and MLIT-SS Chapter 6. Retest locations represented by erratic core strengths. Where retest does not meet concrete compressive strength requirements submit a mitigation or remediation plan for review and approval by the contracting officer. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

[3.14.2.4 Air Content

JIS A 1118 or JIS A 1128 for normal weight concrete. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

][3.14.2.5 Unit Weight of Structural Concrete

JIS A 1116. Determine unit weight of normal weight concrete. Perform test for every 15 cubic meters maximum.

][3.14.2.6 Chloride Ion Concentration

Chloride ion concentration must meet the requirements of the paragraph titled CORROSION AND CHLORIDE CONTENT. Determine water soluble ion concentration in accordance with JIS A 1154. Perform test once for each mix design.

]3.14.2.7 Strength of Concrete Structure

The strength of the concrete structure will be considered to be deficient if any of the following conditions are identified:

a. Failure to meet compressive strength tests as evaluated.

b. Reinforcement not conforming to requirements specified.

c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.

d. Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified.

e. Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration.

f. Poor workmanship likely to result in deficient strength.

Where the strength of the concrete structure is considered deficient submit a mitigation or remediation plan for review and approval by the contracting officer.

3.14.2.8 Non-Conforming Materials

Factors that indicate that there are non-conforming materials include (but not limited to) excessive compressive strength, inadequate compressive strength, excessive slump, excessive voids and honeycombing, concrete delivery records that indicate excessive time between mixing and placement, or excessive water was added to the mixture during delivery and placement. Any of these indicators alone are sufficient reason for the Contracting Officer to request additional sampling and testing.

Investigations into non-conforming materials must be conducted at the Contractor's expense. The Contractor must be responsible for the investigation and must make written recommendations to adequately mitigate or remediate the non-conforming material. The Contracting Officer may accept, accept with reduced payment, require mitigation, or require removal and replacement of non-conforming material at no additional cost to the Government.

3.14.2.9 Testing Concrete Structure for Strength

When there is evidence that strength of concrete structure in place does not meet specification requirements or there are non-conforming materials, make cores drilled from hardened concrete for compressive strength determination in accordance with JIS A 1107, and as follows:

a. Take at least three representative cores from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by the Contracting Officer.

b. Test cores after moisture conditioning in accordance with JIS A 1107 if concrete they represent is more than superficially wet under service.

c. Air dry cores, (16 to 27 degrees C with relative humidity less than 60 percent) for 7 days before test and test dry if concrete they represent is dry under service conditions.

d. Strength of cores from each member or area are considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive strength of the class of concrete.

[e. Core specimens will be taken and tested by the Government. If the results of core-boring tests indicate that the concrete as placed does not conform to the drawings and specification, the cost of such tests and restoration required must be borne by the Contractor.
]

Fill core holes solid with patching mortar and finished to match adjacent concrete surfaces.

Correct concrete work that is found inadequate by core tests in a manner approved by the Contracting Officer.

3.15 REPAIR, REHABILITATION AND REMOVAL

Before the Contracting Officer accepts the structure the Contractor must inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. A report documenting these defects must be prepared which includes recommendations for repair, removal or remediation must be submitted to the Contracting Officer for approval before any corrective work is accomplished.

[3.15.1 Crack Repair

Prior to final acceptance, all cracks in excess of 0.50 mm wide must be documented and repaired. The proposed method and materials to repair the cracks must be submitted to the Contracting Officer for approval. The proposal must address the amount of movement expected in the crack due to temperature changes and loading.

]3.15.2 Repair of Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Concrete surfaces with weak surfaces less than 6 mm thick must be diamond ground to remove the weak surface. Surfaces containing weak surfaces greater than 6 mm thick must be removed and replaced or mitigated in a manner acceptable to the Contracting Officer.

3.15.3 Failure of Quality Assurance Test Results

Proposed mitigation efforts by the Contractor must be approved by the Contracting Officer prior to proceeding.

-- End of Section --

SECTION 05 05 23.13 10

ULTRASONIC INSPECTION OF WELDMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

JAPANESE ARCHITECTURAL STANDARD SPECIFICAITONS (JASS)

JASS 6	(2015) Structural Steelwork Specification for Building Construction

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS Z 2305	(2013) Non-destructive Testing - Qualification and Certification of Personnel
JIS Z 2345	(2015) Standard Test Blocks for Ultrasonic Testing
JIS Z 3060	(2015) Method of Ultrasonic Testing for Welds of Ferritic Steel

1.2 DEFINITIONS

1.2.1 A Scan

Method of data presentation on an electronic screen using rectangular coordinates in which a horizontal base line indicates elapsed time when reading from left to right. A vertical deflection in the base line indicates reflect signal amplitude.

1.2.2 Acoustically Similar Material

Material the same as that to be inspected; or another material proven to have acoustical velocity within plus or minus 3 percent and an attenuation within plus or minus 0.009843 dB/mm of the inspected material for the inspection frequency and wave mode, using the same mode as that to be used for inspection.

1.2.3 Amplitude

When referring to an indication in A scan presentation, amplitude is the vertical height of the indication measured from peak-to-peak for radio frequency indications and trace-to-peak for video indications.

1.2.4 Attenuation

Dissipation or loss of energy as ultrasonic vibrations travel through the material. Attenuation is caused almost entirely by scattering of the ultrasonic vibrations generated by the search unit.

1.2.5 Back Reflection or End Reflection

Reflection from the opposite side, end, or boundary of the material into which the ultrasonic energy was introduced.

1.2.6 Calibration

Process of comparing an instrument or device with a standard to determine accuracy or produce a scale.

1.2.7 Couplant

Any material, usually a liquid or semiliquid, used between the search unit and the inspection surface to exclude air and to convey the ultrasonic vibrations between the search unit and the material being inspected.

1.2.8 Digital Display

Display capable of presenting multi-function a-scan, b-scan, c-scan or s-scan responses. This also includes instruments settings and parameters.

1.2.9 Decibel (dB)

Units for the logarithmic expression of the ratio of power levels. Power levels can be functions of voltage, current, or impedance, for example. Decibel units having no values of their own are only significant when a reference is stated, as 10 dB above one reference level or 6 dB below another reference level.

1.2.10 Discontinuity

Anything within a material that causes a detectable interruption in an ultrasonic beam.

1.2.11 Examination

Within the context of this specification, examination is equivalent to the word "inspection."

1.2.12 Hertz

One complete set of recurrent values of a periodic quantity comprises a cycle. In other words, any one set of periodic variations starting at one condition and returning once to the same condition is a cycle.

1.2.13 Immersion Techniques

Test methods in which the part to be tested and the search units are immersed in water or other suitable liquid couplant. A mechanical device is used to firmly hold and direct the wave angle of the search unit. The search unit does not contact the item being inspected.

1.2.14 Indication

Visual presentation on the digital display screen resulting from a sound beam reflection from a boundary surface or discontinuity.

1.2.15 Linearity

Property of an instrument revealed by a linear change in reflected signal or displacement. The vertical linearity is determined by plotting the change in ratios of signal amplitude from two adjacent reflections from an area of known size. The horizontal linearity is determined by plotting the distance the signal is displaced along the sweep against the change in material thickness or by noting the spacing of multiple back reflections.

1.2.16 Longitudinal or Compressional Waves

Simple compression-rare-fraction waves in which particle motion within a material is linear and in the direction of wave propagation. Also called straight beams, or compressional or normal waves.

1.2.17 Longitudinal Wave Inspection

Ultrasonic technique, normally using straight beam methods, in which longitudinal waves are the dominant form.

1.2.18 Mid-Screen Reflection

Reflection whose amplitude is equal to one-half the useable screen height on the digital display.

1.2.19 Megahertz (MHz)

One million hertz per second frequency.

1.2.20 Pulse Repetition Rate

Number of spaced pulses of sound per second sent into the material being inspected.

1.2.21 Reflector

Boundary, consisting of an opposite side, crack, or separation, or a distinct change in material such as slag or porosity that reflects the ultrasonic energy the same as a mirror reflects light.

1.2.22 Refracted Waves

Waves that have undergone change of velocity and direction by passing from one material to another material with different acoustical properties. Refraction occurs wherever the angle of the incident wave to the interface is other than perpendicular.

1.2.23 Resolution

Ability to clearly distinguish signals obtained from two reflective surfaces with a minimum separation distance. Near-surface resolution is the ability to clearly distinguish a signal from a reflector at a minimum distance under the contact or near surface without interference from the initial pulse signal. Far-surface resolution is the ability to clearly

distinguish signals from reflectors displaced at minimum distances from the far or back surface when the sound beam is normal to that back surface.

1.2.24 Search Unit

Device containing a piezoelectric material used for introducing vibrations into a material to be inspected or for receiving the vibrations reflected from the material. The active element of the search unit is defined as the effective transmitting area. Search units are also called transducers or probes. They may be single or dual and contain one or two piezoelectric elements, respectively, for transmission and reception. The single search unit is sometimes enclosed in a transducer wheel or search unit wheel. The search unit may be manually handled and placed in direct contact with the material to be inspected or may be held in a fixture for immersion techniques.

1.2.25 Sensitivity

Measure of the ultrasonic equipment's ability to detect discontinuities. Quantitatively, it is the level of amplification of the receiver circuit in the ultrasonic instrument necessary to produce the required indication on the scope from the reference hole in the reference block. Also see "Standard Reference Level."

1.2.26 Shear Waves

Waves in which the particles within the material vibrate perpendicularly to the direction in which the wave travels or propagates. Also called transverse waves.

1.2.27 Standard Reference Level

Mid-screen height reflection when beaming at the 1.50 mm hole in the primary reference block or the reference hole in the secondary standard.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Personnel Qualification; G

Procedure description; G

SD-03 Product Data

Equipment and accessories

SD-06 Test Reports

Equipment Qualifications

Inspection Test Reports

1.4 QUALITY ASSURANCE

1.4.1 Personnel Qualification

The three levels of responsibility associated with ultrasonic inspection are defined in JIS Z 2305. Personnel performing NDT should be level II or Level I with direct supervision. For qualification to perform ultrasonic inspection, certify personnel in accordance with JIS Z 2305 within a period of 1 year before the date of contract. Submit inspector qualifications per JIS Z 2305. Other qualification or certification may be accepted at the Contracting Officer's discretion. Personnel with only an operator or inspector trainee certification will not be considered qualified to pass judgment on the acceptability of inspected items, but may work under the direct supervision of a qualified ultrasonic inspector. Qualified ultrasonic inspectors must be able to judge the acceptability of the item in accordance with paragraph ACCEPTANCE-REJECTION CRITERIA. Only serialized NIST traceable calibration standards are to be used. The procedures to be used for personnel and equipment qualification, equipment calibration, and inspection, at least 30 days prior to their intended use. Approval by the Government will in no way affect the obligation of the Contractor to employ qualified personnel, equipment, and procedures, and to perform the inspection as specified.

1.4.2 Examinations

If the Contracting Officer doubts an individual's ability as an operator, inspector, or supervisor, recertify the individual in accordance with JIS Z 2305, using the practical exam. At the option of the Government, the Contracting Officer may witness the examination and in evaluating the results.

1.4.3 Reference Standards

Use reference standards to calibrate the inspection equipment, test its operating condition, and record the sensitivity or response of the equipment during the inspection in accordance with paragraph EQUIPMENT QUALIFICATIONS. The standards comprise a standard reference block and reference specimens as noted below.

a. Provide the standard reference block or primary standard consisting of the IIW block in AWS D1.1/D1.1M, Clause 6, Part F or JIS Z 2345. Also use the standard reference block in any reinspection on the same basis as the original inspection, even though the reinspection is to be performed by other ultrasonic instruments and accessories.

b. As an option, use other recognized working standards detailed with the IIW block in AWS D1.1/D1.1M such as the Sensitivity Calibration (SC) block. However, reference such blocks to the IIW block as noted in paragraph EQUIPMENT CALIBRATION. Include details of their use in the submitted procedure description. These blocks are the secondary standards. They must be of acoustically similar material to the welds to be inspected. The secondary standards must be suited for the applicable tests specified in paragraph EQUIPMENT QUALIFICATIONS and are used as follows, except where the IIW block is specifically required:

(1) To assure adequate penetration of the base material.

(2) To provide a secondary field standard.
(3) To calibrate the equipment and establish the standard reference level.

1.4.4 Resolution Test Block

Furnish a resolution test block in accordance with the details shown in AWS D1.1/D1.1M, Clause 6, Part F or JIS Z 2345.

1.4.5 Equipment Qualifications

Calibrate and recalibrate all NDT equipment in accordance with AWS D1.1/D1.1M requirements.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Procedures and Methods

Use the pulse echo contact method with an A scan presentation for the ultrasonic inspection of welded joints, except that immersion techniques may be used for some applications when approved by the Contracting Officer. Use the procedures, methods, standards, and description of equipment specified herein for inspection of weldments. Include the following in the submitted procedure description:

a. Couplant.

b. Search unit characteristics including angle, size, shape, nominal frequency, type designation.

c. Method and type of wave.

d. Equipment and accessories including manufacturer, model number, date of manufacture, last date of calibration, and the manufacturer's electrical, physical, and performance specifications.

e. Decibel (dB) compensation system for distance-amplitude correction.

2.1.2 Wave Types

The types of waves and the conditions under which they are used are specified below. Unless conditions prohibit, use shear waves. A longitudinal wave procedure may be used instead, if approved by the Contracting Officer.

2.1.2.1 Shear Waves

Use refracted waves between 40 degrees and 70 degrees except where different angles are indicated in approved procedures, such as for materials less than 13 mm thick, for materials with sound velocities greater than in steel, when the weldments are not readily accessible, or when existing backing rings or backing strips are not removed. For inspection of weldments containing backing rings or backing strips, adjust the instrument and select the refracted angles in a way to separate the weldment and the backing ring reflections. Establish the search unit angle and the resulting shear wave angle in the material to be inspected for each application and include this information in the procedure

submitted for approval.

2.1.2.2 Longitudinal Waves

Specifically develop the procedure to suit the application and attain the prior approval of the Contracting Officer.

2.1.3 Changes in Procedure

Should application of an approved procedure not provide for good resolution or adequate ultrasonic penetration in the items to be inspected (see paragraph EQUIPMENT QUALIFICATIONS), make changes in procedure or equipment such as frequency, pulse repetition rate, angle of search unit, couplant, or oscilloscope. Demonstrate adequacy of the new procedure to the Contracting Officer. The Government reserves the right to require a change in test equipment during these tests if any of the following test system characteristics fall below the levels listed in paragraph EQUIPMENT QUALIFICATIONS: sensitivity, amplitude and distance linearity, signal-to-noise ratio, entry and back surface resolution and penetration.

2.1.4 Ultrasonic Equipment

Provide ultrasonic equipment conforming to the requirements listed in AWS D1.1/D1.1M Clause 6, Part F or JIS Z 3060, with the following exceptions:

a. The ultrasonic test instruments must be able to generate, receive, and to present pulses in the frequency range from 1 to 10 megahertz (MHz).

b. Measure the horizontal linearity of the ultrasonic instrument in accordance with paragraph EQUIPMENT QUALIFICATIONS.

c. In addition to the resolution test specified in AWS D1.1/D1.1M, Clause 6, Part F or JIS Z 3060, conduct both near- and far-surface resolution tests in accordance with the tests specified for these characteristics in the paragraph EQUIPMENT QUALIFICATIONS.

PART 3 EXECUTION

3.1 PREPARATION OF MATERIALS FOR INSPECTION

Surfaces must be free of the following:

3.1.1 Weld Spatter

Remove spattering or any roughness that interferes with free movement of the search unit or impairs transmission of the ultrasonic vibrations.

3.1.2 Irregularities

Those which could mask or be confused with defect indications.

3.1.3 Weld Backing Strips

Remove strips that are not to remain in place and eliminate all sharp edges and valleys by grinding or other mechanical means.

3.1.4 Dirt

Remove all loose scale, rust, paint, and dirt from the coupling surface.

3.2 EQUIPMENT CALIBRATION

Calibrate equipment in accordance with AWS D1.1/D1.1M, Clause 6, Part F.

3.3 INSPECTION PROCEDURE

Inspect all welds in accordance with JASS 6 and JIS Z 3060.

3.4 ACCEPTANCE - REJECTION CRITERIA

In accordance with AWS D1.1/D1.1M, Table [6.2] [or 6.3].

3.4.1 Inspection Test Reports

Submit test reports containing the following information:

3.4.1.1 Identification and Location of Inspection

Connection identification and location of the inspected item, the person performing the inspection, and the date of inspection.

3.4.1.2 Detail of Inspections

Details of methods, types of waves used, search units, frequencies, inspection equipment identification, and calibration data with enough information to permit duplication of the inspection at a later date.

3.4.1.3 Identification of Unacceptable Areas

Locations, dimensions, types, and area of unacceptable defects and discontinuities giving reflections over 50 percent of the reject/repair line. Note on a sketch or marked-up drawing.

3.4.1.4 Record of Repair Areas

A record of repaired areas must be furnished as well as test results for the repaired areas.

3.4.2 Inspection of Repairs

All repairs undergo the same inspection procedure that originally revealed the discontinuities. Before acceptance, the welds must meet the standards required for the original weld.

-- End of Section --

SECTION 05 05 23.16

STRUCTURAL WELDING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360	(2016) Specification for Structural Steel Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2012) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel
AWS D1.3/D1.3M	(2018) Structural Welding Code - Sheet Steel
AWS D1.4/D1.4M	(2011) Structural Welding Code - Reinforcing Steel
AWS D1.8/D1.8M	(2016) Structural Welding Code—Seismic Supplement

JAPANESE ARCHITECTURAL STANDARD SPECIFICAITONS (JASS)

JASS 6	(2015) Structural Steelwork Specification for Building Construction

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS Z 2305	(2013) Non-destructive Testing - Qualification and Certification of Personnel
JIS Z 2320	(2007) Non-destructive Testing - Magnetic Particle Testing
JIS Z 2343	(2001) Non-destructive Testing - Penetrant Testing
JIS Z 3021	(2016) Welding and Allied Processes - Symbolic Representation
JIS Z 3400	(2013) Quality Requirements for Fusion Welding of Metallic Materials

JIS Z 3420	(2003) Specification and Approval of Welding Procedures for Metallic Materials - General Rules
JIS Z 3801	(2018) Standard Qualification Test and Acceptance Requirements for Manual Welding Technique
JIS Z 3841	(2018) Test Method and Criteria in Semi-Automatic Welding Technology Certification
JIS Z 3881	(2014) Standard Qualification Procedure for Gas Pressure Welding Technique of Steel Bars for Concrete Reinforcement

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT-SS Chapter 7	(2019) Public Building Construction Standard Specifications - Ch.7 Steel Frame Work

JAPAN WELDING ENGINEERING SOCIETY (JWES)

WES 9009	(2007) Safety and Health in Welding, Thermal Cutting, and Allied Processes Parts 1 through 6

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Welding Quality Assurance Plan; G

SD-03 Product Data

Welding Procedure Qualifications; G

Welder, Welding Operator, and Tacker Qualification

Previous Qualifications

Pre-Qualified Procedures; G

Welding Electrodes and Rods

SD-06 Test Reports

Nondestructive Testing

Weld Inspection Log

SD-07 Certificates

Certified Welding Inspector

Nondestructive Testing Personnel

1.3 QUALITY ASSURANCE

Except for pre-qualified (in accordance with JASS 6 and JIS Z 3420) and previously qualified procedures, each Contractor performing welding must record in detail and qualify the welding procedure specification for any welding procedure followed in the fabrication of weldments. Conform welding procedure qualifications to AWS D1.1/D1.1M[, AWS D1.8/D1.8M] or JASS 6 and JIS Z 3420 and to the specifications in this section. Submit for approval copies of the welding procedure specification and the procedure qualification records for each type of welding being performed. Submission of the welder, welding operator, or tacker qualification test records is also required. Approval of any procedure, however, does not relieve the Contractor of the sole responsibility for producing a finished structure meeting all the specified requirements. Submit this information on the forms in Annex M of AWS D1.1/D1.1M or in accordance with JIS Z 3420. Individually identify and clearly reference on the detail drawings and erection drawings all welding procedure specifications, or suitably key them to the contract drawings. In case of conflict between this specification and AWS D1.1/D1.1M or JASS 6 and JIS Z 3420, this specification governs.

1.3.1 General Requirements

Fabricate work in MLIT Certified Fabrication Plant. Erect work by MLIT Certified Erector.

a. For Structural Projects, provide documentation of the following:

(1) Component Thickness 3 mm and greater: Qualification documents (WPS, PQR, and WPQ) in accordance with JASS 6 and JIS Z 3420 [and AWS D1.8/D1.8M].

(2) Component Thickness Less than 3 mm: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.3/D1.3M or JASS 6 and JIS Z 3420.

(3) Reinforcing Steel: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.4/D1.4M or JASS 6 and JIS Z 3881.

1.3.2 Previous Qualifications

Welding procedures previously qualified by test in accordance with JASS 6, may be accepted for this contract without re-qualification, upon receipt of the test results, if the following conditions are met:

a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.3.3 Pre-qualified Procedures

Welding procedures which are considered pre-qualified as specified in JASS 6 will be accepted without further qualification. Submit for approval a listing or an annotated drawing to indicate the joints not pre-qualified. Procedure qualification is mandatory for these joints. [No pre-qualified welding procedures are allowed. Qualify the welding procedures and welders by tests prescribed in the applicable code or specification not withstanding the fact the code or specification may allow pre-qualified procedures.]

1.3.4 Welder, Welding Operator, and Tacker Qualification

Each welder, welding operator, and tacker assigned to work on this contract must be qualified in accordance with the applicable requirements of JASS 6, JIS Z 3801 and JIS Z 3841, [AWS D1.8/D1.8M] and as specified in this section. Welders, welding operators, and tackers who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used within the applicable essential variables for welder qualification.

1.3.4.1 Previous Personnel Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tackers qualified by test within the previous 6 months may be accepted for this contract without re-qualification if all the following conditions are met:

a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder, welding operator, and tacker qualification test records are submitted and approved in accordance with the specified requirements for detail drawings.

b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

1.3.4.2 Certificates

Before assigning any welder, welding operator, or tacker to work under this contract, submit the names and certification that each individual is qualified as specified. State in the certification the type of welding and positions for which the welder, welding operator, or tacker is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests. Keep the certification current, on file, and furnish 3 copies.

1.3.4.3 Renewal of Qualification

Re-qualification of a welder or welding operator is required under any of

the following conditions:

a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.

b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.

c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract, and a qualification test has not been taken within the past 12 months. Submit as evidence of conformance all records showing periods of employment, name of employer where welder, or welding operator, was last employed, and the process for which qualified.

d. A tacker who passes the qualification test is considered eligible to perform tack welding indefinitely in the positions and with the processes for which he/she is qualified, unless there is some specific reason to question the tacker's ability or there has been a gap greater than 6 months since he/she last used the process. In such a case, the tacker is required to pass the prescribed tack welding test.

1.3.5 Inspector Qualification

Submit certificates indicating that certified welding inspectors meet the requirements of JASS 6. Submit qualifications for nondestructive testing personnel in accordance with the requirements of JIS Z 2305 Levels 1 or 2 in the applicable nondestructive testing method. Level I inspectors must have direct supervision of a Level II inspector.

1.3.6 Symbols and Safety

Use symbols in accordance with AWS A2.4 or JIS Z 3021, unless otherwise indicated. Follow safe welding practices and safety precautions during welding in conformance with WES 9009.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

[Conform the design of welded connections to AISC 360, unless otherwise indicated or specified.]Material with welds will not be accepted unless the welding is specified or indicated on the drawings, in conformance to JASS 6 or MLIT-SS Chapter 7, or otherwise approved. Perform welding as specified in this section, except where additional requirements are shown on the drawings or are specified in other sections. Do not commence welding until welding procedures, inspectors, nondestructive testing personnel, welders, welding operators, and tackers have been qualified and the submittals approved by the Contracting Officer. Perform all testing at or near the work site. Maintain records of the test results obtained in welding procedure, welder, welding operator, and tacker performance qualifications.

2.1.1 Pre-erection Conference

Hold a pre-erection conference prior to the start of the field welding, to bring all affected parties together and to gain a naturally clear understanding of the project and the Welding Procedure Specifications

(WPS) (submitted for all welding, including welding done using pre-qualified procedures). Mandatory attendance is required by all Contractor's welding production and inspection personnel and appropriate Government personnel. Include as items for discussion: responsibilities of various parties; welding procedures and processes to be followed; welding sequence (both within a joint and joint sequence within the building); inspection requirements and procedures, both visual and nondestructive testing; welding schedule; and other items deemed necessary by the attendees.

2.2 WELDING EQUIPMENT AND MATERIALS

Provide all welding equipment, welding electrodes and rods, welding wire, and fluxes capable of producing satisfactory welds when used by a qualified welder or welding operator. [Use [_____] welding electrodes.] [Perform welding using the [_____] process.] Provide welding equipment and materials that comply with the applicable requirements of AWS D1.1/D1.1M or JASS 6[and AWS D1.8/D1.8M]. Submit product data on welding electrodes and rods.

PART 3 EXECUTION

3.1 WELDING OPERATIONS

3.1.1 Requirements

Conform workmanship and techniques for welded construction to the requirements of JASS 6 and JIS Z 3400[, AWS D1.8/D1.8M and AISC 360]. [When JASS 6 and JIS Z 3400, AWS D1.8/D1.8M and AISC 360 specification conflict, the requirements of AISC 360 and AWS D1.8/D1.8M govern.]

3.1.2 Identification

Identify all welds in one of the following ways:

a. Submit written records to indicate the location of welds made by each welder, welding operator, or tacker.

b. Identify all work performed by each welder, welding operator, or tacker with an assigned number, letter, or symbol to identify welds made by that individual. The Contracting Officer may require welders, welding operators, and tackers to apply their symbol next to the weld by means of rubber stamp, felt-tipped marker with waterproof ink, or other methods that do not cause an indentation in the metal. Place the identification mark for seam welds adjacent to the weld at 1 m intervals. Identification with die stamps or electric etchers is not allowed.

3.2 QUALITY CONTROL

Perform testing using an approved inspection or testing laboratory or technical consultant; or if approved, the Contractor's inspection and testing personnel may be used instead of the commercial inspection or testing laboratory or technical consultant. A Certified Welding Inspector must perform visual inspection on 100 percent of all welds. Document this inspection in the Visual Weld Inspection Log. Test [50][_____] percent of CJP welds using ultrasonic testing per Table [6.2] [or 6.3] of AWS D1.1/D1.1M. Randomly test [50][_____] percent of all PJP and fillet welds or as indicated by magnetic particle or dye penetrant testing.

Verify the welds conform to paragraph STANDARDS OF ACCEPTANCE. Conform procedures and techniques for inspection with applicable requirements of JASS 6[, AWS D1.8/D1.8M], JIS Z 2343, and JIS Z 2320. Submit a Welding Quality Assurance Plan and records of tests and inspections.

3.3 STANDARDS OF ACCEPTANCE

Conform dimensional tolerances for welded construction, details of welds, and quality of welds with the applicable requirements of JASS 6[, AWS D1.8/D1.8M] and the contract drawings. Submit all records of nondestructive testing.

3.3.1 Nondestructive Testing

The welding is subject to inspection and tests in the mill, shop, and field. Inspection and tests in the mill or shop do not relieve the Contractor of the responsibility to furnish weldments of satisfactory quality. When materials or workmanship do not conform to the specification requirements, the Government reserves the right to reject material or workmanship or both at any time before final acceptance of the structure containing the weldment. Any indication of a defect is regarded as a defect, unless re-evaluation by nondestructive methods or by surface conditioning shows that no unacceptable defect is present. Submit all records of nondestructive testing in accordance with paragraph STANDARDS OF ACCEPTANCE.

3.3.2 Destructive Tests

Make all repairs when metallographic specimens are removed from any part of a structure. Employ only qualified welders or welding operators, and use the proper joints and welding procedures, including peening or heat treatment if required, to develop the full strength of the members and joints cut and to relieve residual stress.

3.4 GOVERNMENT INSPECTION AND TESTING

In addition to the inspection and tests performed by the Contractor for quality control, the Government will perform inspection and testing for acceptance to the extent determined by the Contracting Officer. The work may be performed by the Government's own forces or under a separate contract for inspection and testing. The Government reserves the right to perform supplemental nondestructive and destructive tests to determine compliance with paragraph STANDARDS OF ACCEPTANCE.

3.5 CORRECTIONS AND REPAIRS

If inspection or testing indicates defects in the weld joints, repair defective welds using a qualified welder or welding operator as applicable. Conduct corrections in accordance with the requirements of AWS D1.1/D1.1M or JASS 6[, AWS D1.8/D1.8M] and the specifications. Repair all defects in accordance with the approved procedures. Repair defects discovered between passes before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, blend the affected area into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before re-welding, examine the area by suitable methods to ensure that the defect has been eliminated. Repaired welds must meet the inspection requirements for the original welds.

-- End of Section --

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303	(2016) Code of Standard Practice for Steel Buildings and Bridges
AISC 325	(2017) Steel Construction Manual
AISC 341	(2016) Seismic Provisions for Structural Steel Buildings
AISC 360	(2016) Specification for Structural Steel Buildings
AISC 420	(2010) Certification Standard for Shop Application of Complex Protective Coating Systems

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2012) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel
AWS D1.8/D1.8M	(2016) Structural Welding Code—Seismic Supplement

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B46.1	(2009) Surface Texture, Surface Roughness, Waviness and Lay

ASTM INTERNATIONAL (ASTM)

ASTM A143/A143M	(2007; R 2014) Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
ASTM B695	(2004; R 2016) Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

ASTM F3125/F3125M	(2015a) Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 830 MPa and 1040 MPa Minimum Tensile Strength, Metric Dimensions
ASTM F959/F959M	(2017a) Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Metric Series

CRANE MANUFACTURERS ASSOCIATION OF AMERICA (CMAA)

CMAA 70	(2015) Specification for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes

JAPANESE ARCHITECTURAL STANDARD SPECIFICAITONS (JASS)

JASS 6	(2015) Structural Steelwork Specification for Building Construction

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 1048	(2007) Fasteners - Hot Dip Galvanized Coatings
JIS B 1180	(2014) Hexagon Head Bolts and Hexagon Head Screws
JIS B 1181	(2014) Hexagon Nuts and Hexagon Thin Nuts
JIS B 1186	(2013) Sets of High Strength Hexagon Bolt, Hexagon Nut and Plain Washers for Friction Grip Joints
JIS B 1198	(2011) Headed Studs
JIS B 1220	(2015) Set of Anchor Bolt for Structures
JIS G 3106	(2017) Rolled Steels for Welded Structure (Amendment 1)
JIS B 1256	(2008) Plain Washers
JIS G 3136	(2012) Rolled Steel for Building Structures
JIS G 3192	(2014) Dimensions, Mass and Permissible Variations of Hot Rolled Steel Sections
JIS G 3193	(2008) Dimensions, Mass and Permissible Variations of Hot Rolled Steel Plates, Sheets, and Strips
JIS G 3444	(2016) Carbon Steel Tubes for General Structure
JIS G 3466	(2015) Carbon Steel Square and Rectangular Tubes for General Structure

JIS G 4321	(2000) Stainless Steel for Building Structure
JIS Z2305	(2013) Non-destructive Testing - Qualification and Certification of Personnel
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS K 5674	(2019) Lead-Free, Chromium-Free Anticorrosive Paints
JIS Z 3021	(2016) Welding and Allied Processes - Symbolic Representation
JIS Z 3060	(2015) Method of Ultrasonic Testing for Welds of Ferritic Steel

JAPANESE SOCIETY OF STEEL CONSTRUCTION (JSS)

JSS II 09	(2015) Sets of Torshear Type High Strength Bolt, Hexagonal Nut and Plain Washer for Structural Joints

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT-SS Chapter 7	(2019) Public Building Construction Standard Specifications - Ch.7 Steel Frame Work

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
SSPC SP 3	(1982; E 2004) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2019) Structural Engineering

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR Part 1926, Subpart R	Steel Erection

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Erection and Erection Bracing Drawings; G[, [_____]]

SD-02 Shop Drawings

Fabrication Drawings Including Details of Connections; G[, [_____]]

SD-03 Product Data

Shop Primer

Welding Electrodes and Rods

Direct Tension Indicator Washers

Non-Shrink Grout

Tension Control Bolts

SD-05 Design Data

[Shoring and Temporary Bracing; G[, [_____]]

] SD-06 Test Reports

Class B Coating

Weld Inspection Reports

Direct Tension Indicator Washer Inspection Reports

Bolt Testing Reports

[Embrittlement Test Reports

] SD-07 Certificates

][MLIT Structural Steel Fabricator Quality Certification

][MLIT Structural Steel Erector Quality Certification

] Welding Procedure Specifications (WPS)

[Overhead, Top Running Crane Rail Beam

][1.3 MLIT QUALITY CERTIFICATION

Work must be fabricated by MLIT Structural Steel Fabricator, Category M [R] [H]. Submit MLIT Structural Steel Fabricator quality certification.

Work must be erected by MLIT Structural Steel Certified Erector. Submit MLIT Structural Steel erector quality certification.

][1.4 SEISMIC PROVISIONS

Provide the structural steel system in accordance with AISC 341, Chapter J as amended by UFC 3-301-01.

]1.5 QUALITY ASSURANCE

1.5.1 Preconstruction Submittals

1.5.1.1 Erection and Erection Bracing Drawings

Submit for record purposes. Indicate the sequence of erection, temporary shoring and bracing. The erection drawings must conform to JASS 6 and MLIT-SS Chapter 7.[Erection drawings must be reviewed, stamped and sealed by a registered professional engineer.]

1.5.2 Fabrication Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with JASS 6 and MLIT-SS Chapter 7. Fabrication drawings must not be reproductions of contract drawings.[Sign and seal fabrication drawings by a registered professional engineer.] Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Use AWS A2.4 or JIS Z 3021 standard welding symbols.[Shoring and temporary bracing must be designed and sealed by a registered professional engineer and submitted for record purposes[, with calculations,] as part of the drawings.] Clearly highlight any deviations from the details shown on the contract drawings highlighted on the fabrication drawings. Explain the reasons for any deviations from the contract drawings.

1.5.3 Certifications

1.5.3.1 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests.[If the qualification date of the welder or welding operator is more than 6 months old, the welding operator's qualification certificate must be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.]

Conform to all requirements specified in JASS 6 [and AWS D1.8/D1.8M].

[1.5.3.2 Overhead, Top Running Crane Rail Beam

Submit written field survey results for overhead, top running crane rail beam verifying tolerance requirements per CMAA 70.

]PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

[Conform the design of structural steel system to AISC 360, AISC 303, AISC 341, and UFC 3-301-01.]

Provide the structural steel system, including [shop primer] [galvanizing], complete and ready for use. Provide structural steel systems including materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing in accordance with JASS 6 and MLIT-SS Chapter 7, except as modified in this contract.

2.2 STEEL

2.2.1 Structural Steel

Wide flange and WT shapes, JIS G 3136, SN490B, 325 MPa. Angles and Channels JIS G 3106, SM400, 235 MPa. Plates, JIS G 3136, SN400B, 235 MPa [SN490B, 325 MPa], unless otherwise indicated on contract drawings.[Provide structural steel containing a minimum of [80][_____] percent recycled content.]

2.2.2 Structural Steel Tubing

JIS G 3466, STKR400, 245MPa.[Provide structural steel tubing containing a minimum of [25][90][_____] percent recycled content.]

2.2.3 Steel Pipe

JIS G 3444, STK 400 and 235 MPa.[Provide steel pipe containing a minimum of [50][_____] percent recycled content.]

2.3 BOLTS, NUTS, AND WASHERS

Submit the certified manufacturer's mill reports which clearly show the applicable JIS mechanical and chemical requirements together with the actual test results for the supplied fasteners.

2.3.1 Common Grade Bolts

2.3.1.1 Bolts

JIS B 1180 with 420 MPa minimum tensile strength, plain finish [hot dipped zinc coating in accordance with JIS B 1048]. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by JIS or JASS 6 specifications.

2.3.1.2 Nuts

Heavy hex style JIS B 1181, plain finish [hot dipped zinc coating in accordance with JIS B 1048].

[2.3.1.3 Self-Locking Nuts

Provide nuts with a locking pin set in the nut. The locking pin must slide along the bolt threads, and by reversing the direction of the locking pin, the nut can be removed without damaging the nut or bolt. Provide stainless steel locking pins.

]2.3.1.4 Washers

JIS B 1256, plain finish [hot dipped zinc coating in accordance with JIS B 1048].

2.3.2 High-Strength Bolts

High strength bolts and nuts must be shipped together in the same shipping container. Fasteners indicated to be galvanized shall be tested by the supplier to show that the galvanized nut with the supplied lubricant

provided may be rotated from the snug tight condition well in excess of the rotation required for pretentioned installation without stripping. The supplier shall supply nuts that have been lubricated and tested with the supplied bolts.

2.3.2.1 Bolts

JIS B 1186, Type F10T.

[JIS B 1186, Type F8T hot dipped zinc coating] [MLIT certified 12G SHTB hot dipped zinc coating].

2.3.2.2 Nuts

JIS B 1186, F10 [hot dipped zinc coating].

2.3.2.3 Direct Tension Indicator Washers

ASTM F959/F959M.[Provide ASTM B695, Class 55, Type 1 galvanizing.] Submit product data for direct tension indicator washers.

2.3.2.4 Washers

JIS B 1186, F35, plain carbon steel [hot dipped zinc coating].

2.3.3 Tension Control Bolts

MLIT approved JSS II 09, JIS B 1186 S10T twistoff style assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon steel nuts, and hardened carbon steel washers. Assembly finish must be [plain]. Submit product data for tension control bolts.

2.3.4 Foundation Anchorage

2.3.4.1 Anchor Rods

JIS B 1220 ABR 400 [ABR490] [hot dipped galvanized]. [Stainless steel JIS B 1220, ABR520SUS.] [Stainless steel JIS B 1220, ABR520SUS conforming to JIS G 4321, Type SUS316A.]

2.3.4.2 Anchor Nuts

Hexagon nuts JIS B 1220 ABR 400 [ABR490] [hot dipped galvanized]. [Stainless steel JIS B 1220, ABR520SUS.] [Stainless steel JIS B 1220, ABR520SUS conforming to JIS G 4321, Type SUS316A.]

2.3.4.3 Anchor Washers

JIS B 1220 ABR 400 [ABR490] [hot dipped galvanized]. [Stainless steel JIS B 1220, ABR520SUS.] [Stainless steel G 4321 Type SUS316A conforming to JIS B 1220].

2.3.4.4 Anchor Plate Washers

JIS B 1220 ABR 400 [ABR490] [hot dipped galvanized]. [Stainless steel JIS G 4321 Type SUS304A [Type SUS316A] conforming to JIS B 1220].

2.4 STRUCTURAL STEEL ACCESSORIES

2.4.1 Welding Electrodes and Rods

AWS D1.1/D1.1M or JASS 6[and AWS D1.8/D1.8M]. Submit product data for welding electrodes and rods.

2.4.2 Non-Shrink Grout

Packaged dry, hydraulic cement non-shrink grout, that is non-metallic, non-corrosive, non-bleed, with the following performance requirements when prepared using the highest water-to-solids ratio, maximum flow, or most fluid consistency at 23.0 plus/minus 2.0 degrees C:

a. Minimum compressive strengths: 7.0 MPa at 1 day; 17.0 MPa at 3 day; 24.0 MPa at 7 day; and 34.0 MPa at 28 day.

b. Early height change (maximum percent at time of final setting): + 4.0 percent.

c. Height change of moist cured hardened grout: 0.0 to + 0.3 percent at 1-day, 3-day, 14-day and 28-day.

2.4.3 Welded Shear Stud Connectors

JIS B 1198 [,450MPa minimum ultimate tensile strength] [and 350MPa minimum yield strength].

[2.5 GALVANIZING

JIS B 1048 for threaded parts or JIS H 8641 for structural steel members, as applicable, unless specified otherwise galvanize after fabrication where practicable.

]2.6 FABRICATION

Fabrication must be in accordance with the applicable provisions of AISC 325and JASS 6. Fabrication and assembly must be done in the shop to the greatest extent possible. Punch, subpunch and ream, or drill bolt [and pin] holes perpendicular to the surface of the member.

Compression joints depending on contact bearing must have a surface roughness not in excess of 13 micrometer as determined by ASME B46.1, and ends must be square within the tolerances for milled ends specified in JIS G 3192, JIS G 3193, and JASS 6.

Shop splices of members between field splices will be permitted only where indicated on the Contract Drawings. Splices not indicated require the approval of the Contracting Officer.

[Do not splice truss top and bottom chords except as approved by the Contracting Officer. Provide chord splices at panel joints at approximately the third point of the span. The center of gravity lines of truss members must intersect at panel points unless otherwise approved by the Contracting Officer. When the center of gravity lines do not intersect at a panel point, make provisions for the stresses due to eccentricity. Camber of trusses must be 3 mm in 3.0 meters unless otherwise indicated.

]2.6.1 Markings

Prior to erection, identify members by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections must be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations.[Affix embossed tags to hot-dipped galvanized members.]

2.6.2 Shop Primer

Shop prime structural steel, JIS K 5674 lead Free, chromium Free, anticorrosive paint, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, galvanized surfaces,[surfaces to receive sprayed-on fireproofing,] [surfaces to receive epoxy coatings,] [surfaces designed as part of a composite steel concrete section,] [slip critical surfaces of high strength bolted connections,] or surfaces within 13 mm of the toe of the welds prior to welding (except surfaces on which metal decking and shear studs are to be welded). If flash rusting occurs, re-clean the surface prior to application of primer. Apply primer [in accordance with endorsement "SPE-P1" ["SPE-P2"] ["SPE-P3"] of AISC 420 or approved equal NACE or SSPC certification] [_____]to a minimum dry film thickness of 0.05 mm. Submit shop primer product data.

Prime slip critical surfaces with a Class B coating in accordance with AISC 325. Submit test report for Class B coating.

Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 7 degrees C or over 35 degrees C; or when the primer may be exposed to temperatures below 4 degrees C within 48 hours after application, unless approved otherwise by the Contracting Officer. Repair damaged primed surfaces with an additional coat of primer.

2.6.2.1 Cleaning

SSPC SP 6/NACE No.3, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

[2.6.3 [Fireproofing] [and] [Epoxy] Coated Surfaces

Clean and prepare surfaces to receive [sprayed-on fireproofing] [epoxy] coatings in accordance with the manufacturer's recommendations, and as specified in Section 07 81 00 SPRAY-APPLIED FIREPROOFING.

][2.6.4 Surface Finishes

ASME B46.1 maximum surface roughness of 125 for pin, pinholes, and sliding bearings, unless indicated otherwise.

]2.7 DRAINAGE HOLES

Drill adequate drainage holes to eliminate water traps. Hole diameter must be 13 mm and location indicated on the detail drawings. Hole size and locations must not affect the structural integrity.

PART 3 EXECUTION

3.1 ERECTION

a. Erection of structural steel must be in accordance with the applicable provisions of AISC 325, AISC 303 and 29 CFR Part 1926, Subpart R or MLIT-SS Chapter 7 and JASS 6.

After final positioning of steel members, provide full bearing under base plates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions or MLIT-SS Chapter 7 and JASS 6.

3.1.1 STORAGE

Store the material out of contact with the ground in such manner and location as to minimize deterioration.

3.2 CONNECTIONS

Except as modified in this section, design connections indicated in accordance with AISC 360. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Holes must not be cut or enlarged by burning. Bolts, nuts, and washers must be clean of dirt and rust, and lubricated immediately prior to installation.

3.2.1 Common Grade Bolts

Tighten JIS B 1180 bolts to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

3.2.2 High-Strength Bolts

Provide direct tension indicator washers in all JIS B 1186 bolted connections. Bolts must be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, fully tension bolts, progressing from the most rigid part of a connection to the free edges.

Fastener components shall be protected from dirt and moisture in closed containers at the site of the installation. Fastener components that are not incorporated into the work shall be returned to protected storage at the end of the work shift.

3.2.2.1 Installation of Direct Tension Indicator Washers (DTIW)

Where possible, install the DTIW under the bolt head and tighten the nut. If the DTIW is installed adjacent to the turned element, provide a flat washer between the DTIW and nut when the nut is turned for tightening, and between the DTIW and bolt head when the bolt head is turned for tightening. In addition to the DTIW, provide flat washers under both the bolt head and nut when JIS Bolts equivalent to ASTM F3125/F3125M, Grade A490M bolts are used.

3.2.3 Tension Control Bolts

Bolts must be installed in connection holes and initially brought to a snug tight fit. After the initial tightening procedure, fully tension bolts, progressing from the most rigid part of a connection to the free edges.

3.3 GAS CUTTING

Use of gas-cutting torch in the field for correcting fabrication errors is not permitted on any major member in the structural framing. Use of a gas cutting torch will be permitted on minor members not under stress only after approval has been obtained from the Contracting Officer.

3.4 WELDING

Welding must be in accordance with JASS 6[and AWS D1.8/D1.8M].[Grind exposed welds smooth as indicated.] Provide JASS 6 qualified welders, welding operators, and tackers.

Develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Submit for approval all WPS, whether prequalified or qualified by testing.

3.4.1 Removal of Temporary Welds, Run-Off Plates, and Backing Strips

[Removal is not required][Remove only from finished areas].[Remove backing strips from bottom flange of moment connections, backgouge the root pass to sound weld metal and reinforce with a 8 mm fillet weld minimum.]

3.5 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

3.5.1 Field Priming

Field prime steel exposed to the weather, or located in building areas without HVAC for control of relative humidity. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat must be cleaned and primed with paint of the same quality as that used for the shop coat.

[3.6 GALVANIZING REPAIR

Repair damage to galvanized coatings using JASS 6 zinc rich paint for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces to which repair paint has been applied.

]3.7 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing[, except that electric power for field tests will be furnished as set forth in Division 1]. Notify the Contracting Officer in writing of defective welds, bolts, nuts, and washers within 7 working days of the date of the inspection.

3.7.1 Welds

3.7.1.1 Visual Inspection

Perform in accordance with JASS 6. Furnish the services of certified welding inspectors for fabrication and erection inspection and testing and verification inspections. A Certified Welding Inspector must perform visual inspection on 100 percent of all welds. Document this inspection in the Visual Weld Inspection Log. Submit certificates indicating that certified welding inspectors meet the requirements of Japanese Welding Engineering Society (JWES) and JASS 6.

[Inspect proper preparation, size, gaging location, and acceptability of all welds; identification marking; operation and current characteristics of welding sets in use.

]3.7.1.2 Nondestructive Testing

Nondestructive testing must be in accordance with JASS 6 and JIS Z 3060[and AWS D1.8/D1.8M]. Ultrasonic testing must be performed in accordance with Table [6.2] [or 6.3] of AWS D1.1/D1.1M. Test locations must be [as indicated][selected by the Contracting Officer]. All personnel performing NDT must be certified in accordance with JIS Z2305 in the method of testing being performed. Submit certificates showing compliance with JIS Z2305 for all NDT technicians. If more than [20] [_____] percent of welds made by a welder contain defects identified by testing, then all groove welds made by that welder must be tested by ultrasonic testing, and all fillet welds made by that welder must be inspected by magnetic particle testing (MT) or dye penetrant testing (PT) as approved by the Contracting Officer. When groove welds made by an individual welder are required to be tested, magnetic particle or dye penetrant testing may be used only in areas inaccessible to ultrasonic testing. Retest all repaired areas. Submit weld inspection reports.

Testing frequency: Provide the following types and number of tests:

Test Type	Number of Tests
Ultrasonic	[_____]50 percent of CJP Welds
Magnetic Particle	[_____]50 percent of PJP and Fillet Welds
Dye Penetrant	[_____]50 percent of PJP and Fillet Welds
[_____]	[_____]

3.7.2 Direct Tension Indicator Washers

3.7.2.1 Direct Tension Indicator Washer Compression

Test direct tension indicator washers in place to verify that they have been compressed sufficiently to provide the 0.38 mm gap, as required by ASTM F959/F959M. Submit direct tension indicator washer inspection reports.

[3.7.2.2 Direct Tension Indicator Gaps

In addition to the above testing, an independent testing agency as approved by the Contracting Officer, must test in place the direct tension

indicator gaps on 20 percent of the installed direct tension indicator washers to verify that the ASTM F959/F959M direct tension indicator gaps have been achieved. If more than 10 percent of the direct tension indicators tested have not been compressed sufficiently to provide the average gaps required by ASTM F959/F959M, test all in place direct tension indicator washers to verify that the ASTM F959/F959M direct tension indicator gaps have been achieved. Test locations must be selected by the Contracting Officer.

]3.7.3 High-Strength Bolts

3.7.3.1 Testing Bolt, Nut, and Washer Assemblies

Test a minimum of [3] [_____] bolt, nut, and washer assemblies from each mill certificate batch in a tension measuring device at the job site prior to the beginning of bolting start-up. Demonstrate that the bolts and nuts, when used together, can develop tension not less than the provisions specified in AISC 360, depending on bolt size and grade. The bolt tension must be developed by tightening the nut. A representative of the manufacturer or supplier must be present to ensure that the fasteners are properly used, and to demonstrate that the fastener assemblies supplied satisfy the specified requirements. Submit bolt testing reports.

3.7.3.2 Inspection

Inspection procedures must be in accordance with JASS 6 and MLIT-SS Chapter 7. As a minimum, high-strength bolting inspection tasks shall be in accordance with Section 01 45 35 SPECIAL INSPECTION. Confirm and report to the Contracting Officer that the materials meet the project specification and that they are properly stored. Confirm that the faying surfaces have been properly prepared before the connections are assembled. Observe the specified job site testing and calibration, and confirm that the procedure to be used provides the required tension. Monitor the work to ensure the testing procedures are routinely followed on joints that are specified to be fully tensioned.

[Inspect calibration of torque wrenches for high-strength bolts.

]3.7.3.3 Testing

The Government has the option to perform nondestructive tests on [5] [_____] percent of the installed bolts to verify compliance with pre-load bolt tension requirements. Provide the required access for the Government to perform the tests. The nondestructive testing will be done in-place using an ultrasonic measuring device or any other device capable of determining in-place pre-load bolt tension. The test locations must be selected by the Contracting Officer. If more than [10] [_____] percent of the bolts tested contain defects identified by testing, then all bolts used from the batch from which the tested bolts were taken, must be tested at the Contractor's expense. Retest new bolts after installation at the Contractor's expense.

[3.7.4 Testing for Embrittlement

ASTM A143/A143M for steel products hot-dip galvanized after fabrication. Submit embrittlement test reports.

]3.7.5 Inspection and Testing of Steel Stud Welding

Perform verification inspection and testing of steel stud welding conforming to the requirements of JASS 6, Stud Welding Clause. The Contracting Officer will serve as the verification inspector. Bend test studs that do not show a full 360 degree weld flash or have been repaired by welding as required by JASS 6, Stud Welding Clause. Studs that crack under testing in the weld, base metal or shank will be rejected and replaced by the Contractor at no additional cost.

-- End of Section --

SECTION 05 30 00

STEEL DECKS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
FM DS 1-28R	(1998) Data Sheet: Roof Systems

JAPANESE ARCHITECTURAL STANDARD SPECIFICAITONS (JASS)

JASS 6	(2015) Structural Steelwork Specification for Building Construction

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 1198	(2011) Headed Studs
JIS G 3106	(2017) Rolled Steels for Welded Structure (Amendment 1)
JIS G 3352	(2014) Deck Plate
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS K 5552	(2010) Zinc Rich Primer
JIS K 5553	(2006) Thick Film Zinc Rich Paint
JIS Z 3801	(2018) Standard Qualification Test and Acceptance Requirements for Manual Welding Technique

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code

STEEL DECK INSTITUTE (SDI)

ANSI/SDI C	(2017) Standard for Composite Steel Floor Deck - Slabs

ANSI/SDI NC	(2017) Standard for Non-Composite Steel Floor Deck
ANSI/SDI QA/QC	(2017) Standard for Quality Control and Quality Assurance for Installation of Steel Deck
ANSI/SDI RD	(2017) Standard for Steel Roof Deck
SDI DDM04	(2015; Errata 1-3 2016; Add 1 2015; Add 2 20162006) Diaphragm Design Manual; 4th Edition
SDI DDP	(1987; R 2000) Deck Damage and Penetrations
SDI MOC3	(2016) Manual of Construction with Steel Deck (3rd Edition)

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2019) Structural Engineering

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926	Safety and Health Regulations for Construction

UNDERWRITERS LABORATORIES (UL)

UL 209	(2011; Reprint May 2016) UL Standard for Safety Cellular Metal Floor Raceways and Fittings
UL 580	(2006; Reprint Nov 2018) UL Standard for Safety Tests for Uplift Resistance of Roof Assemblies
UL Fire Resistance	(2014) Fire Resistance Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor QC approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings; G[, [_____]]

SD-04 Samples

Metal Roof Deck Units

Cellular Metal Floor Deck Units

Acoustical Material

SD-05 Design Data

Deck Units; G[, [_____]]

SD-07 Certificates

Welder Qualifications

Welding Procedures

Fire Safety

Wind Storm Resistance

Manufacturer's Certificate

Stud Manufacture's Certification

Stud Manufacture's Test Reports

1.3 QUALITY ASSURANCE

1.3.1 Deck Units

Furnish deck units and accessory products from a manufacturer regularly engaged in manufacture of steel decking. Provide manufacturer's certificates attesting that the decking material meets the specified requirements.

1.3.2 Qualifications for Welding Work

Follow Welding Procedures of JASS 6 for sheet steel and for stud welding.

Submit qualified Welder Qualifications in accordance with JASS 6 and JIS Z 3801 for sheet steel and JASS 6 for stud welding, or under an equivalent approved qualification test. Perform tests on test pieces in positions and with clearances equivalent to those actually encountered. [Test specimens shall be made in the presence of Contracting Officer and shall be tested by an approved testing laboratory at the Contractor's expense.] If a test weld fails to meet requirements, perform an immediate retest of two test welds until each test weld passes. Failure in the immediate retest will require the welder be retested after further practice or training, performing a complete set of test welds.

Submit manufacturer's catalog data for Welding Equipment and Welding Rods and Accessories.

1.3.3 Regulatory Requirements

1.3.3.1 Fire Safety

Test roof deck as a part of a roof deck construction assembly of the type used for this project, listing as fire classified in the UL Fire Resistance, or listing as Class I construction in the FM APP GUIDE, and so labeled.

1.3.3.2 Wind Storm Resistance

Provide roof construction assembly capable of withstanding a nominal

uplift pressure of [3] [5] [_____] kPa when tested in accordance with the uplift pressure test described in the FM DS 1-28R or as described in UL 580 and in general compliance with UFC 3-301-01.

1.3.4 Fabrication Drawings

Show type and location of units, location and sequence of connections, bearing on supports, methods of anchoring, attachment of accessories, adjusting plate details, cant strips, ridge and valley plates, metal closure strips, size and location of holes to be cut and reinforcement to be provided, the manufacturer's erection instructions and other pertinent details.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver deck units to the site in a dry and undamaged condition. Store and handle steel deck in a manner to protect it from corrosion, deformation, and other types of damage. Do not use decking for storage or as working platform until units have been fastened into position. Exercise care not to damage material or overload decking during construction. The maximum uniform distributed storage load must not exceed the design live load. Stack decking on platforms or pallets and cover with weathertight ventilated covering. Elevate one end during storage to provide drainage. Maintain deck finish at all times to prevent formation of rust. Repair deck finish using touch-up paint. Replace damaged material.

1.5 DESIGN REQUIREMENTS FOR ROOF DECKS

1.5.1 Properties of Sections

Properties of metal roof deck sections must comply with engineering design width as limited by the provisions of JIS G 3352.

1.5.2 Allowable Loads

Indicate total uniform dead and live load for detailing purposes.

PART 2 PRODUCTS

2.1 DECK UNITS

Submit manufacturer's design calculations, or applicable published literature for the structural properties of the proposed deck units.

Provide products with an average recycled content of steel products so postconsumer recycled content plus one half of preconsumer recycled content not less than [25] [_____] percent.

2.1.1 Roof Deck

Conform to JIS G 3352-SDP2G for deck used in conjunction with insulation and built-up roofing. Fabricate roof deck units of [[0.80] [_____] mm design thickness or thicker steel] [the steel design thickness required by the design drawings] and [shop painted] [galvanized] [painted with an epoxy coating or equivalent applied to prime-coating in accordance with manufacturer's standard] [zinc-coated in conformance with JIS G 3352 -SDP2G, Z27 coating class.Furnish sample of Metal Roof Deck Units used to illustrate actual cross section dimensions and configurations.]

2.1.2 Composite Deck

[Conform to JIS G 3352-SDP2G for composite deck assembly. Fabricate deck used as the tension reinforcing in composite deck of [0.80] [_____] mm design thickness or thicker steel with integrally embossed or raised pattern ribs.] [The steel design thickness required by the design drawings. Zinc-coat in conformance with JIS G 3352-SDP2G, Z27 coating class.] [Shore composite deck until the concrete has reached [75][_____] percent of its specified strength.]

2.1.3 Cellular Metal Floor Deck Units

Provide decking as wire raceways conforming to NFPA 70. Conform to [JIS G 3352-SDP2G, SS, Grade 230 Z27]; for formed [cellular] [and] [non-cellular] decking and accessories. Provide nominal thickness of the steel sheets, before galvanizing, a minimum 1.2 millimeter for the upper element of the floor deck unit, and a minimum 1.6 millimeter for the lower element of the floor deck unit [as required by the design drawings]. [Furnish one sample of each type of Metal Floor Deck Units used to illustrate the actual cross section dimensions and configuration.]

2.1.4 Form Deck

Conform to JIS G 3352-SDP2G for deck used as formwork for concrete. Fabricate form deck of[[0.80] [_____] mm design thickness or thicker steel.] [the steel design thickness required by the design drawings.] [Paint with one coat of manufacture's standard paint.] [Zinc-coat in conformance with JIS G 3352-SDP2G, Z27 coating class.]

Provide sufficient welds, forming the steel sheets into the cellular floor deck unit, to develop the full horizontal shear at the plane where the steel sheets are joined.

Cellular metal floor deck units must be fluted section cells combined [on a flat plate][with a matching fluted bottom section] having interlocking type sidelaps. Provide depth, width of unit, number of cells per unit, and width of cells as indicated.

Use panels of maximum possible lengths to minimize end laps. Fabricate deck units in lengths to span 3 or more supports with flush, telescoped, or nested 50 mm laps at ends, and interlocking, or nested side laps, unless otherwise indicated. [Factory apply a standard, phosphatized and painted, baked-on enamel finish to underside of steel decking.] [[Floor] [and] [Roof] deck system design is based on shored construction.]

2.1.5 Length of Deck Units

Provide deck units of sufficient length to span three or more spacings where possible.

[2.1.6 Shop Priming

Shop prime accessories and [underside of] deck at the factory after coating. Clean surfaces in accordance with the manufacturer's standard procedure followed by a spray, dip or roller coat of rust-inhibitive primer, oven cured.

]2.1.7 Touch-Up Paint

Maintain finish of deck units and accessories by using touch-up paint whenever necessary to prevent the formation of rust. The method and extent of surface preparation and dry film thickness shall be approved by the Contracting Officer.

Provide touch-up paint for shop-painted units [of the same type used for the shop painting] [_____], and touch-up paint for zinc-coated units of [an approved galvanizing repair paint with a high-zinc content, JIS K 5552] [_____]. Provide touch-up paint at all welds in steel deck with a high zinc-dust content paint conforming to JIS K 5552 or JIS K 5553 and JASS 6. Remove all weld flux residue and weld splatter by wire brushing or mechanical means.

Surfaces to receive touch-up paints containing zinc dust shall be clean, dry and free of oil, grease, preexisting paint, and corrosion by-products. Spray or brush-apply the paints containing zinc dust to the prepared area in accordance with manufacturer’s instructions.

2.2 ACCESSORIES

Provide accessories of same material as deck, unless specified otherwise. Provide manufacturer's standard type accessories, as specified.

2.2.1 Adjusting Plates

Provide adjusting plates, or segments of deck units, of same thickness and configuration as deck units in locations too narrow to accommodate full size units. Provide factory cut plates of predetermined size where possible.

2.2.2 End Closures

Fabricated of sheet metal by the deck manufacturer. Provide end closures minimum 0.80 mm thick to close open ends at [exposed edges of floors,] [parapets,] [end walls,] [eaves,] [and] openings through deck.

2.2.3 Partition Closures

Provide closures for closing voids above interior walls and partitions that are perpendicular to the direction of the configurations and at open ends and sides of steel roof decking. [Provide sheet steel closures above typical partitions.] [Provide sheet steel closures above fire-resistant interior walls and partitions located on both sides of wall or partition.] [Provide glass fiber blanket insulation in the space between pairs of closures at acoustical partitions.]

2.2.4 Closure Plates for Composite Deck

Support and retain concrete at each floor level. Provide edge closures at all edges of the slab of sufficient strength and stiffness to support the wet concrete. Provide metal closures for all openings in composite steel deck 6 mm and over.

2.2.5 Sheet Metal Collar

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges

of deck. Do not cut deck until after installation of supplemental supports.

2.2.6 Cover Plates

Sheet metal to close panel edge and end conditions, and where panels change direction or butt. Polyethylene-coated, self-adhesive, 50 mm wide joint tape may be provided in lieu of cover plates on flat-surfaced decking butt joints.

Fabricate cover plates for abutting floor deck units from the specified structural-quality steel sheets not less than nominal 1.2 millimeter thick before galvanizing. Provide 150 millimeter wide cover plates and form to match the contour of the floor deck units.

2.2.7 Roof Sump Pans

Sump pans must be provided for roof drains and must be minimum 2 mm thick steel, [flat] [recessed] type. Shape sump pans to meet roof slope by the supplier or by a sheet metal specialist. Provide bearing flanges of sump pans to overlap steel deck a minimum of 75 mm. Shape, size, and reinforce the opening in bottom of the sump pan to receive roof drain.

2.2.8 Column Closures

Sheet metal, minimum 1.2 mm thick or metal rib lath.

2.2.9 Access Hole Covers

Sheet metal, minimum 1.2 mm thick.

2.2.10 Hanger

Provide clips or loops for [utility systems] [and] [suspended ceilings] of one or more of the following types:

a. Lip tabs or integral tabs where noncellular decking or flat plate of cellular section is 1.2 mm thick or more, and a structural concrete fill is used over deck.

b. Slots or holes punched in decking for installation of pigtails.

c. Tabs driven from top side of decking and arranged so as not to pierce electrical cells.

d. Decking manufacturer's standard as approved by the Contracting Officer.

2.2.11 Shear Connectors

Provide shear stud connectors JIS B 1198 [450MPa minimum ultimate tensile strength] [and 350MPa minimum yield strength]. Submit stud manufacture's certification that the studs delivered conform to the material requirements. Submit stud manufacture's test reports for the last completed in-plant quality control mechanical tests.

2.2.12 Cant Strips for Roof Decks

Fabricate cant strips from the specified commercial-quality steel sheets not less than nominal 1.0 millimeter thick before galvanizing. Bend strips

to form a 45-degree cant not less than 125 millimeter wide, with top and bottom flanges a minimum 75 millimeter wide. Length of strips 3000 millimeter.

2.2.13 Ridge and Valley Plates for Roof Decks

Fabricate plates from the specified structural-quality steel sheets, not less than nominal 1.0 millimeter thick before galvanizing. Provide plates of minimum 120 millimeter wide and bent to provide tight fitting closures at ridges and valleys. Provide a minimum length of ridge and valley plates of 3000 millimeter.

2.2.14 Metal Closure Strips for Roof Decks

Fabricate strips from the specified commercial-quality steel sheets not less than nominal 1.0 millimeter thick before galvanizing. Provide strips from the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking.

2.2.15 Galvanized Steel Angles for Roof Decks

Provide hot-rolled carbon steel angles conforming to JIS G 3106, SM400, 235 MPa, and hot-dip galvanized in accordance with JIS H 8641.

[2.2.16 Sound Absorbing Material

Provide [glass fiber in roll or premolded form for acoustical noncellular steel roof deck] [and] [glass fiber rigid strip for acoustical cellular steel deck] in accordance with the manufacturer's standards. Provide a sample of acoustical material to be used.

][2.2.17 Mechanical Fasteners

Provide mechanical fasteners, such as powder actuated fasteners, pneumatically driven fasteners or self-drilling screws, for anchoring the deck to structural supports and adjoining units[as indicated][that are designed to meet the loads indicated].

]2.2.18 Miscellaneous Accessories

Furnish the manufacturer's standard accessories to complete the deck installation. Furnish metal accessories of the same material as the deck and with the minimum design thickness as follows: saddles, 1.2 mm welding washers, 1.6 mm other metal accessories, 1.0 mm unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to installation of decking units and accessories, examine worksite to verify that as-built structure will permit installation of decking system without modification.

3.2 INSTALLATION

Install steel deck units in accordance with 29 CFR 1926, Subpart R – Steel Erection, ANSI/SDI QA/QC, [ANSI/SDI C][ANSI/SDI NC][ANSI/SDI RD][SDI DDM04] and approved shop drawings. Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports before

permanently securing in place. Damaged deck and accessories including material which is permanently stained or contaminated, deformed, or with burned holes shall not be installed. Extend deck units over three or more supports unless absolutely impractical. Report inaccuracies in alignment or leveling to the Contracting Officer and make necessary corrections before permanently anchoring deck units. Locate deck ends over supports only. [Lap 50 mm] [Butted] deck ends. Do not use unanchored deck units as a work or storage platform. [Do not fill unanchored deck with concrete.] Permanently anchor units placed by the end of each working day. Do not support suspended ceilings, light fixtures, ducts, utilities, or other loads by steel deck unless indicated. Distribute loads by appropriate means to prevent damage.[Prepare shoring in position before concrete placement begins in composite or form deck.][Size cellular decking provided as electrical raceways to accommodate indicated wiring systems. Chip off burrs and eliminate sharp edges which may damage wiring. Mesh decking panels accurately and place in accordance with UL 209.][Neatly fit acoustical material into the rib voids.]

3.2.1 Attachment

Immediately after placement and alignment, and after correcting inaccuracies, permanently fasten steel deck units to structural supports and to adjacent deck units by welding with normal 16 mm diameter arc spot welds,[fastened with screws, or pneumatically driven fasteners] as indicated on the design drawings and in accordance with manufacturer's recommended procedure[and ANSI/SDI C, ANSI/SDI NC or ANSI/SDI RD]. Clamp or weight deck units to provide firm contact between deck units and structural supports while performing welding [or fastening].[Anchoring the deck to structural supports with powder-actuated fasteners or pneumatically driven fasteners is prohibited.] Attachment of adjacent deck units by button-punching is prohibited.

3.2.1.1 Welding

Perform welding in accordance with JASS 6 using methods and electrodes recommended by the manufacturers of the base metal alloys being used. Ensure only operators previously qualified by tests prescribed in JASS 6 and JIS Z 3801 make welds. Immediately recertify, or replace qualified welders, that are producing unsatisfactory welding. [Indicate] [Conform to the recommendations of the Steel Deck Institute and the steel deck manufacturer]for location, size, and spacing of fastening. [Do][Do not] use welding washers at the connections of the deck to supports. Do not use welding washers at sidelaps. Holes and similar defects will not be acceptable. Attach all partial or segments of deck units to structural supports in accordance with Section 2.5 of SDI DDM04. [Attach shear connectors as shown and welded as per JASS 6 [through the steel deck to the steel member] [directly to the steel member]]. Immediately clean welds by chipping and wire brushing. Heavily coat welds, cut edges and damaged portions of [coated finish with zinc-dust paint conforming to JASS 6] [shop [primed] [painted] finish with the manufacturer's standard touch-up paint].

3.2.1.2 Sidelap Fastening

Lock sidelaps between adjacent floor deck units together by welding or screws as indicated.

3.2.2 Openings

Cut or drill all holes and openings required and be coordinated with the drawings, specifications, and other trades. Frame and reinforce openings through the deck in conformance with SDI DDP. Reinforce [holes and openings 150 to 300 mm across by 1.2 mm thick steel sheet at least 300 mm wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 150 mm on center. Reinforce holes and openings larger than 300 mm by steel channels or angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Install steel channels or angles perpendicular to the deck ribs and fasten to the channels or angles perpendicular to the steel joists.][Deck manufacturer shall approve holes or openings larger than 150 mm in diameter prior to drilling or cutting.] [Openings must not interfere with seismic members such as chords and drag struts.]

3.2.3 Deck Damage

SDI MOC3, for repair of deck damage.

3.2.4 Touch-Up Paint

3.2.4.1 Roof Deck

After roof decking installation, wire brush, clean, and touchup paint the scarred areas on top and bottom surfaces of metal roof decking. The scarred areas include welds, weld scars, bruises, and rust spots. Touchup galvanized surfaces with galvanizing repair paint. Touchup painted surfaces with repair paint of painted surfaces.

3.2.4.2 Floor Deck

For floor decking installation, wire brush, clean, and touchup paint the scarred areas on the top and bottom surfaces of the metal floor decking and on the surface of supporting steel members. Include welds, weld scars, bruises, and rust spots for scarred areas. Touched up the galvanized surfaces with galvanizing repair paint. Touch up the painted surfaces with paint for the repair of painted surfaces.

3.2.5 Accessory Installation

3.2.5.1 Adjusting Plates

Provide in locations too narrow to accommodate full-size deck units and install as shown on shop drawings.

3.2.5.2 End Closures

Provide end closure to close open ends of cells at columns, walls, and openings in deck.

3.2.5.3 Closures Above Partitions

Provide for closing voids between cells over partitions that are perpendicular to direction of cells. Provide a one-piece closure strip for partitions 100 mm nominal or less in thickness and two-piece closure strips for wider partitions. [Provide sheet metal closures above fire-rated partitions at both sides of partition with space between filled with fiberglass insulation.] [Provide flexible rubber closures above

acoustic-rated partitions at both sides of partition with space between filled with blanket insulation.]

3.2.5.4 Cover Plates

[Provide metal cover plates, or joint tape, at joints between cellular decking sheets to be used as electrical raceways.] [Where concrete leakage would be a problem, provide metal cover plates, or joint tape, at joints between decking sheets, cellular or noncellular, to be covered with concrete fill.]

[3.2.5.5 Column Closures

Provide for spaces between floor decking and columns which penetrate the deck. Field cut closure plate to fit column in the field and tack weld to decking and columns.

]3.2.5.6 Access Hole Covers

Provide access whole covers to seal holes cut in decking to facilitate welding of the deck to structural supports.

3.2.5.7 Hangers

Provide as indicated to support [utility system] [and] [suspended ceilings]. Space devices [as indicated] [so as to provide one device per 0.60 square meters].

[3.2.6 Sound Absorbing Material

Install sound absorbing [glass fiber roll or premolded form, neatly in voids between perforated webs of acoustical noncellular steel deck] [and] [glass fiber rigid strip, in cells of acoustical cellular steel deck]. Keep sound absorbing material dry before, during and after installation.

][3.2.7 Concrete Work

Prior to placement of concrete, inspect installed decking to ensure that there has been no permanent deflection or other damage to decking. Replace decking which has been damaged or permanently deflected as approved by the Contracting Officer. Place concrete on metal deck in accordance with Construction Practice of ANSI/SDI C or ANSI/SDI NC.

]3.2.8 Preparation of Fire-Proofed Surfaces

Provide deck surfaces, both composite and noncomposite, which are to receive sprayed-on fireproofing, galvanized and free of all grease, mill oil, paraffin, dirt, salt, and other contaminants which impair adhesion of the fireproofing. Complete any required cleaning prior to steel deck installation using a cleaning method that is compatible with the sprayed-on fireproofing.

3.3 ROOF SUMP PANS

Place sump pans over openings in roof decking and fusion welded to top surface of roof decking. Do not exceed spacing of welds of 300 millimeter with not less than one weld at each corner. Field cut opening in the bottom of each roof sump pan to receive the roof drain as part of the work of this section.

3.4 CANT STRIPS FOR ROOF DECKS

Provide strips to be fusion welded to surface of roof decking, secured to wood nailers by galvanized screws or to steel framing by galvanized self-tapping screws or welds. Do not exceed spacing of welds and fasteners of 300 millimeter. Lap end joints a minimum 75 millimeter and secure with galvanized sheet metal screws spaced a maximum 100 millimeter on center.

3.5 RIDGE AND VALLEY PLATES FOR ROOF DECKS

Provide plates to be fusion welded to top surface of roof decking. Lap end joints a minimum 75 millimeter. For valley plates, provide endlaps to be in the direction of water flow.

3.6 CLOSURE STRIPS FOR ROOF DECKS

Provide closure strips at open, uncovered ends and edges of the roof decking and in voids between roof decking and top of walls and partitions where indicated. Install closure strips in position in a manner to provide a weathertight installation.

3.7 ROOF INSULATION SUPPORT FOR ROOF DECKS

Provide metal closure strips for support of roof insulation where rib openings in top surface of metal roof decking occur adjacent to edges and openings. Weld metal closure strips in position.

3.8 CLEANING AND PROTECTION FOR ROOF DECKS

Upon completion of the deck, sweep surfaces clean and prepare for installation of the roofing.

3.9 FIELD QUALITY CONTROL

3.9.1 Headed Stud Inspection

In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in JASS 6 for stud welding and as follows:

a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.

b. Conduct tests according to requirements in JASS 6 on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.9.2 Deck Weld Inspection

Visual inspect welds in accordance with JASS 6.

[3.9.3 Decks Not Receiving Concrete

Inspect the decking top surface for distortion after installation. For roof decks not receiving concrete, verify distortion by placing a straight edge across three adjacent top flanges. The maximum allowable gap between the straight edge and the top flanges should not exceed manufacturing and

construction tolerances of supporting members. When gap is more than the allowable, provide corrective measures or replacement. Reinspect decking after performing corrective measures or replacement.

] -- End of Section --

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SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.1	(2012; Errata 2013) Square and Hex Bolts and Screws

JAPANESE ARCHITECTURAL STANDARD SPECIFICAITONS (JASS)

JASS 5	(2015) Reinforced Concrete Work
JASS 6	(2015) Structural Steelwork Specification for Building Construction

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 1111	(2017) Cross Recessed Machine Screws
JIS B 1112	(1995) Cross Recessed Head Wood Screws
JIS B 1180	(2014) Hexagon Head Bolts and Hexagon Head Screws
JIS B 1186	(2013) Sets of High Strength Hexagon Bolt, Hexagon Nut and Plain Washers for Friction Grip Joints
JIS B 1198	(2011) Headed Studs
JIS B 1220	(2015) Set of Anchor Bolt for Structures
JIS B 1250	(2008) Plain Washers for General Bolts, Machine Screws and Nuts - Overall System
JIS B 1251	(2018) Spring Lock Washers
JIS G 3101	(2017) Rolled Steels for General Structure (Amendment 1)
JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS G 3312	(2019) Prepainted Hot-Dip Zinc-Coated Steel Sheet and Strip
JIS G 3317	(2019) Hot-Dip Zinc-5 Percent Aluminum Allot-Coated Steel Sheet and Strip

JIS G 3323	(2019) Hot-dip Zinc-Aluminium-Magnesium Alloy-Coated Steel Sheet and Strip
JIS G 3444	(2016) Carbon Steel Tubes for General Structure
JIS G 3466	(2015) Carbon Steel Square and Rectangular Tubes for General Structure
JIS G 3475	(2014) Carbon Steel Tubes for Building Structure
JIS G 5501	(1995) Grey Iron Castings
JIS G 5702	(1998) Blackheart Malleable Iron Castings
JIS H 4001	(2006) Painted and Baked Aluminum and Aluminum Alloy Sheets and Strips
JIS H 4040	(2015) Aluminum and Aluminum Alloy Bars and Wires
JIS H 5202	(2010) Aluminum Alloy Castings
JIS H 8601	(1999) Anodic Oxide Coatings on Aluminum and Aluminum Alloys
JIS H 8602	(2010) Combined Coatings of Anodic Oxide and Organic Coatings on Aluminum and Aluminum Alloys
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS K 5553	(2006) Thick Film Zinc Rich Paint
JIS Z 0310	(2016) Abrasive Blast Cleaning Methods for Surface Preparation
JIS Z 3801	(2018) Standard Qualification Test and Acceptance Requirements for Manual Welding Technique
JIS Z 3821	(2018) Standard Qualification Test and Acceptance Requirements for Welding Technique of Stainless Steel
JIS Z 3841	(2018) Test Method and Criteria in Semi-Automatic Welding Technology Certification

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT-SS Chapter 7	(2019) Public Building Construction Standard Specifications - Ch.7 Steel Frame Work

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety and Health Requirements Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Structural Steel Door Frames, Fabrication Drawings; G[, [_____]]

Cover Plates and Frames, Installation Drawings; G[, [_____]]

Expansion Joint Covers, Installation Drawings; G[, [_____]]

Floor Gratings, Installation Drawings;

Roof Walkways, Installation Drawings;

Bollards/Pipe Guards; G[, [_____]]

Wheel Guards, Installation Drawings; G[, [_____]]

Window[and Door] Guards, Installation Drawings;

Embedded Angles and Plates, Installation Drawings; G[, [_____]]

Roof Hatches, Installation Drawings; G[, [_____]]

SD-03 Product Data

Corner Guards

Cover Plates and Frames;

Expansion Joint Covers

Floor Gratings;

Roof Walkways;

Structural Steel Door Frames;

Wheel Guards

Window[and Door] Guards;

Roof Hatches;

SD-04 Samples

Expansion Joint Covers

SD-07 Certificates

[Certified Mill Test Reports for Chemistry and Mechanical Properties; G[, [_____]]
]

1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with JIS Z 3801, JIS Z 3821, or JIS Z 3841. Use procedures, materials, and equipment of the type required for the work.

1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

1.5 MISCELLANEOUS REQUIREMENTS

1.5.1 Fabrication Drawings

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in MLIT-SS Chapter 7 and/or JASS 6.

1.5.2 Installation Drawings

Submit templates, erection, and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation in relation to the building construction.

PART 2 PRODUCTS

2.1 MATERIALS

Provide exposed fastenings of compatible materials (avoid contact of dissimilar metals). Coordinate color and finish with the material to which fastenings are applied.[Submit the manufacturer's certified mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied materials.]

2.1.1 Structural Carbon Steel

Provide in accordance with JIS G 3101, SS 400, 235 MPa.

2.1.2 Structural Tubing

Provide in accordance with JIS G 3466, SKTR 400, 245 MPa.

2.1.3 Steel Pipe

Provide in accordance with JIS G 3444 STK 400 and 235 MPa or JIS G 3475, STKN400B and 235 MPa.

2.1.4 Fittings for Steel Pipe

Provide standard malleable iron fittings in accordance with JIS G 5702.

2.1.5 Gratings

a. Provide gray cast iron in accordance with JIS G 5501, FC300.

b. Provide metal plank grating, non-slip requirement, [aluminum in accordance with KS651-T6 or KD610-T6[DM1]] [steel in accordance with JIS G 3302 Z27].

2.1.6 Floor Plates, Patterned

Provide steel plate not less than 1.9 mm.

2.1.7 Anchor Bolts

Provide in accordance with JIS B 1220. Where exposed, provide anchor bolts of the same material, color, and finish as the metal to which they are applied.

2.1.7.1 [Expansion Anchors] [Sleeve Anchors] [Adhesive Anchors]

Provide [_____]mm diameter [expansion anchors] [sleeve anchors] [adhesive anchors]. Minimum [concrete] [masonry] embedment of [_____]mm. Design values listed are as tested in accordance with JASS 5.

a. Provide minimum [ultimate] [allowable] pullout value of [_____]kN. Calculate pullout capacity according to JASS 5.

b. Provide minimum [ultimate] [allowable] shear value of [_____]kN. Calculate shear capacity according to JASS 5.

2.1.7.2 Lag Screws and Bolts

Provide in accordance with JIS lag screws, type and grade best suited for the purpose.

2.1.7.3 Toggle Bolts

Provide in accordance with ASME B18.2.1.

2.1.7.4 Bolts, Nuts, Studs and Rivets

Provide in accordance with JIS B 1180, JIS B 1186, or JIS B 1220.

2.1.7.5 Screws

Provide in accordance with JIS B 1111 and JIS B 1112.

2.1.7.6 Washers

Provide plain washers in accordance with JIS B 1250. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers in accordance with JIS B 1251.

2.1.7.7 Welded Headed Shear Studs

Provide in accordance with JIS B 1198.

2.1.8 Aluminum Alloy Products

Provide in accordance with JIS H 4040 for extrusions and JIS H 5202 or JIS H 5202 for castings. Provide aluminum extrusions at least 3 mm thick and aluminum plate or sheet at least 1.3 mm thick.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Provide galvanizing in accordance with JIS G 3302, JIS G 3312, JIS G 3317, JIS G 3323 and/or JIS H 8641 Z27.

2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

[2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint in accordance with JASS 6 12.4 and JIS K 5553 or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat, with a torch, surfaces to which stick or paste material will be applied. Heat to a temperature sufficient to melt the metals in the stick or paste. Spread molten material uniformly over surfaces to be coated and wipe off excess material.

]2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with JIS Z 0310. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned by means of power tools. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete must be free of dirt and grease prior to embed. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints. Shop coat these surfaces with rust prevention.

2.2.4.2 Pretreatment, Priming and Painting

Apply pre-treatment, primer, and paint in accordance with manufacturer's printed instructions. [On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 0.03 mm. Tint additional prime coat with a small amount of tinting pigment.]

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Aluminum Surfaces

2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.2.6.2 Aluminum Finishes

Unexposed sheet, plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, JIS H 8601, JIS H 8602 or JIS H 4001. Unless otherwise specified, provide all other aluminum items with a[standard mill finish][hand sanded or machine finish to a 240 grit][anodized finish]. Provide a coating thickness not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish, min. 0.7 mil for items used in exterior locations. Provide in accordance with JIS H 8601, JIS H 8602 or JIS H 4001. Provide a polished satin finish on items to be anodized.

2.3 CORNER GUARDS

For jambs and sills of openings and edges of platforms provide steel shapes and plates anchored in masonry or concrete with welded steel straps or end-weld stud anchors. Form corner guards for use with glazed or ceramic tile finish on walls with 1.6 mm thick corrosion-resisting steel with[polished][or][satin] finish, extend 1.5 m above the top of cove base or to the top of the wainscot, whichever is less, and securely anchor to the supporting wall. Provide [galvanized][_____] corner guards on exterior.[Provide interior corner guards as indicated in Section 10 26 00 WALL AND DOOR PROTECTION.]

2.4 COVER PLATES AND FRAMES

Fabricate cover plates of [6][_____] mm thick rolled steel weighing not more than 45 kg per plate with a [selected raised pattern nonslip top surface][slip-resistant, carbon steel in accordance with JIS G 3101. Provide aluminum oxide or silicon carbide on wearing surfaces]. Provide [galvanized][shop painted] plate. Reinforce to sustain a live load of [_____] MPa. Provide structural steel shapes and plates for frames, [with bent steel bars or headed anchors welded to frame for anchoring to concrete][securely fastened to the structure as indicated]. Miter and weld all corners. Butt joint straight runs. Allow for expansion on straight runs over 4500 mm.[Provide holes for lifting tools.][Provide flush drop handles for removal where indicated; form from 6 mm round stock.][Provide holes and openings with 13 mm clearance for pipes and equipment.] Remove sharp edges and burrs from cover plates and exposed edges of frames. Weld all connections and grind top surface smooth. Weld bar stops every 152 mm. Provide 3 mm clearance at edges and between cover plates.

2.5 EXPANSION JOINT COVERS

Provide expansion joint covers constructed of extruded aluminum with anodized satin aluminum finish for walls and ceilings and standard mill finish for floor covers and exterior covers. Furnish plates, backup angles, expansion filler strips and anchors as indicated.[Provide a

[_____]-hour fire-rating for expansion joints.]

2.6 FLOOR GRATINGS AND ROOF WALKWAYS

Design [steel] [aluminum] grating in accordance with manufacturer's charts for plank grating. [Galvanize steel floor gratings.]

a. Design floor gratings to support a stress live load of [_____] MPa for the spans indicated, with maximum deflection of L/240.

[b. In accordance with the manufacturer's standard for trim [unless otherwise indicated]. Design tops of bearing bars, cross or intermediate bars to be in the same plane and to match grating finish.

][b. Band ends of gratings with bars of the same or greater thickness than the metal used for grating. Weld banding bars to bearing bars or channels at least every fourth bar or channel and in every corner. Tack weld intervening bars or channels. Band diagonal or round cuts by welding bars of the same or greater thickness as the grating and in accordance with the manufacturer's standard for trim [unless otherwise indicated].

][c. [Attach gratings to structural members with welded-on anchors.][Anchor gratings to structural members with bolts, toggle bolts, or expansion shields and bolts.][Attach grating in accordance with manufacturer's roof attachment system.]
]
d. Provide slip resistant surface finishes.

[e. Rooftop walkway: Minimum 600 mm wide, 1.8 mm, JIS G 3302, Z27 steel with slip resistant surface. Furnish all brackets, connectors and other accessories. Support at minimum 1500 mm intervals on hard rubber pads in accordance with manufacturer's instructions.

]2.7 BOLLARDS/PIPE GUARDS

Provide [_____] mm [galvanized] [prime coated] [standard] [extra strong] weight steel pipe in accordance with JIS G 3444, STK 400 and 235 MPa or JIS G 3475, STKN400B and 235 MPa. Anchor posts in concrete [as indicated] and fill solidly with concrete with minimum compressive strength of 17 MPa.

2.8 DOWNSPOUT TERMINATIONS

Provide [102 x 102 mm], [102 x 152 mm] [and] [or] [152 x 152 mm] [_____] aluminum downspout tile adapter with [mill] [manufacturer's standard powder coated] finish. Units shall have all seams welded.

Provide [nickel bronze] [polished bronze] [chrome plated] cast downspout nozzle and flange.

Provide [100 x 76 mm], [125 x 100 mm] [and] [or] [100 mm diameter] [_____] [cast iron] [galvanized cast iron] downspout boot with cleanout access and manufacturer's standard cast iron strap.

2.9 MISCELLANEOUS PLATES AND SHAPES

Provide items that do not form a part of the structural steel framework, such as lintels, sill angles, [support framing for ceiling-mounted toilet partitions,] miscellaneous mountings and frames. Provide lintels

fabricated from structural steel shapes over openings in masonry walls and partitions [as indicated and] as required to support wall loads over openings. Provide with connections and [fasteners] [welds]. Construct to have at least [[_____] mm] [200 mm] bearing on masonry at each end.

Provide angles and plates in accordance with JIS G 3101 SS400, 235 MPa, for embedment as indicated. Galvanize embedded items exposed to the elements in accordance with JIS H 8641.

2.10 SAFETY CHAINS

Construct safety chains of galvanized steel, straight link type, minimum 5 mm diameter, with a minimum of twelve links per 300 mm, and snap hooks on each end. Provide boat type snap hooks. Provide galvanized 10 mm bolt with 20 mm eye diameter for attachment of chain, anchored as indicated. Supply two chains, 100 mm longer than the anchorage spacing, for each guarded area.

2.11 SECURITY GRILLES

Fabricate of channel frames with not less than two masonry anchors at each jamb and 12 mm hardened steel bars spaced not over 100 mm both ways and welded to frame. Provide 18 by 16 mesh screen and two layers of 6 mm hardware cloth clamped to frame.

2.12 STEEL PLATE WAINSCOTS FOR CONCRETE OR MASONRY COLUMNS

Shop bend to radius for round columns and at right angles for square and rectangular columns with slight 6 mm radius on corners, with no horizontal joints and not more than 2 vertical joints single strapped and butt welded with a thickness of [_____].

2.13 STRUCTURAL STEEL DOOR FRAMES

[a. Provide frames as indicated. Unless otherwise indicated, construct frames of structural shapes, or shape and plate composite, to form a full depth channel shape with at least 40 mm outstanding legs. For single swing doors, provide continuous 16 by 40 mm bar stock stops at head and jambs. For freight elevator hoistway entrance, include a non-skid metal sill. Provide extruded metal frames as required by the elevator manufacturer.

] b. Provide support where track, guides, hoods, hangers, operators, and other accessories are required.

c. Provide jamb anchors near top, bottom, and at not more than 600 mm intervals. Provide the bottom of each jamb member with a clip angle welded in place with two 12 mm diameter floor bolts for adjustment.

[d. Provide spreaders between bottoms of floor jamb members. When floor construction permits, spreaders may be left in place and concealed in the floor.

]

[Provide frames of rolled shapes as indicated. Miter and weld heads to jambs, or provide riveted clip angle connections concealed in the finished work. Provide frames for swinging doors with 16 by 40 mm solid bar stops secured to the frame by welding or by 6 mm diameter countersunk machine screws spaced not more than 300 mm on centers. Stiffen head openings greater than 900 mm as necessary to limit deflection to not more than 2 mm.

Secure frames to masonry with zinc-coated metal anchors spaced not more than 750 mm on centers. Where necessary to engage the threads of machine screws for fastening hardware, back frames on inside faces with steel plates of suitable thickness. Tap frames and reinforcing plates as necessary for the installation of hardware and other work. Countersink rivets and screw heads where they will be exposed in the finished work. Grind welds smooth.

]2.14 WHEEL GUARDS

Provide wheel guards of hollow, heavy-duty type cast iron with shaped, [rounded][half round][three quarters round]top, at least 450 mm high, and designed to provide a minimum of 150 mm of protection.

[2.15 ROOF HATCHES (SCUTTLES)

Provide [aluminum][zinc-coated steel] sheets not less than 1.9 mm with 75 mm beaded flange, welded and ground at corners. Provide a minimum clear opening of 760 by 900 mm. Insulate cover and curb with 25 mm thick rigid fiberboard insulation, covered and protected by [aluminum sheet][zinc-coated steel liner] of not less than 0.45 mm. Provide with 300 mm high curb, formed with 75 mm mounting flanges with holes for securing to the roof deck.

]2.16 WINDOW[AND DOOR] GUARDS, DIAMOND-MESH TYPE

Provide diamond-mesh window[and door] guards constructed of woven steel wire [or expanded metal]framed with hot-rolled or cold-formed structural steel shapes. Provide woven wire panels of 3.3 mm, 40 mm mesh secured through weaving bar to 25 by 12 by 3 mm thick channel frame.[Provide expanded metal panels in accordance with ASTM F1267.] Miter and weld corners of frames.[Mount window[and door] guards on interior of window[and door] frame with not less than two tamperproof hinged butts mounted on wood jambs with 6 mm lag bolts, to masonry jamb with toggle bolts, or welded to metal jambs.][Mount window[and door] guards on exterior of window frame with not less than two tamperproof hinged butts mounted on 25 by 12 by 3 mm jamb channel attached as indicated to 50 by 6 mm plate anchored to wood jamb with 6 mm lag bolts; to masonry jamb with toggle bolts, or to concrete jambs and solid masonry jambs with expansion shields and bolts.] Provide one additional butt for each 900 mm internal length of guard over 1500 mm. Provide one tamperproof hasp and padlock, with access from the interior, for each butt used and installed on the jamb opposite to that hinged.[Provide galvanized guards and accessories.]

2.17 WINDOW[AND DOOR] GUARDS

Provide woven wire window[and door] guards of size as necessary to completely fill opening. Construct guards with 10 mm round rod frame and 40 mm diamond-mesh of No. 10 U.S. Gage 3.4 mm wire. Provide all materials with zinc coating. Provide a minimum of three hinge side clips on one side and two lock ring hasps on the opposite side.

2.18 CLEANOUT DOORS

Provide [galvanized][cast iron]cleanout doors with frames, sized to match flues unless otherwise indicated. Provide continuous flange and anchors for securing frames to masonry. Provide smokeproof, hinged doors with[lockable] fastening devices to hold doors closed[and secured].

2.19 COAL HOPPER DOORS

Provide coal hopper doors of [galvanized][_____] steel plates and shapes. Provide complete assemblies including frames, stops, wall boxes, hinges, and hasp or lock-type latches. Weld joints and attachments.

2.20 GUY CABLES

Provide guy cables as pre-stretched, galvanized wire rope of sizes indicated. Provide wire rope high strength grade. Guys must have a factory attached clevis top-end fitting, a factory attached open-bridge strand socket bottom-end fitting, and must be complete with oval eye, threaded anchor rods. Provide hot-dip galvanized fittings and accessories.

2.21 WINDOW SUB-SILL

Provide window sub-sill of extruded aluminum alloy, standard mill finish, of size(s) and design(s) indicated. Provide a minimum of two anchors per window section for securing to mortar joints of masonry sill course. Provide sills with protective coating for shipment, of two coats of a clear, colorless, methacrylate lacquer applied to all surfaces of the sills.

2.22 WINDOW WELLS

Provide window wells in a minimum 1.5 mm, corrugated sheet steel, hot-dip galvanized after fabrication, with top edge of window well walls with a 19 mm bead or rolled top. Provide windows wells with radiused corners and of sizes that overlap each window by a minimum of 75 mm on each side. Provide removable covers, hot-dipped galvanized after fabrication, consisting of steel bar grate, with bars spaced at not more than 50 mm centers and welded to 25 by 6 mm frame. Frames must fit into, and rest on top edge of, window wells.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated in accordance with manufacturer's instructions. Verify all field dimensions prior to fabrication. Include materials and parts necessary to complete each assembly, whether indicated or not. Miss-alignment and miss-sizing of holes for fasteners is cause for rejection. Conceal fastenings where practicable. Joints exposed to weather must be watertight.

3.2 WORKMANSHIP

Provide miscellaneous metalwork that is true and accurate in shape, size, and profile. Make angles and lines continuous and straight. Make curves consistent, smooth and unfaceted. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections. Unless otherwise indicated and approved, provide a smooth finish on exposed surfaces. Provide countersuck rivets where exposed. Provide coped and mitered corner joints aligned flush and without gaps.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage as necessary, whether indicated or not, for fastening

miscellaneous metal items securely in place. Include slotted inserts, expansion shields, powder-driven fasteners, toggle bolts (when approved for concrete), through bolts for masonry, JIS B 1198 welded headed shear studs,machine and carriage bolts for steel, through bolts, lag bolts, and screws for wood. Do not use wood plugs. Provide non-ferrous attachments for non-ferrous metal. Provide exposed fastenings of compatible materials (avoid contact of dissimilar metals), that generally match in color and finish the surfaces to which they are applied. Conceal fastenings where practicable. Provide all fasteners flush with the surfaces they fasten, unless indicated otherwise.[Test a minimum of 2 bolt, nut, and washer assemblies from each certified mill batch in a tension measuring device at the job site prior to the beginning of bolting start-up.]

3.4 BUILT-IN WORK

Where necessary and not otherwise indicated, form built-in metal work for anchorage with concrete or masonry. Provide built-in metal work in ample time for securing in place as the work progresses.

3.5 WELDING

Perform welding, welding inspection, and corrective welding in accordance with JASS 6. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation. Provide welded headed shear studs in accordance with JASS 6, Clause 7, except as otherwise specified. Provide in accordance with the safety requirements of EM 385-1-1.

3.6 DISSIMILAR METALS

Where dissimilar metals are in contact, protect surfaces with a coating to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with asphalt-base emulsion. Clean surfaces with metal shavings from installation at the end of each work day.

3.7 PREPARATION

3.7.1 Material Coatings and Surfaces

Remove rust preventive coating just prior to field erection, using a remover approved by the metal manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

3.7.2 Environmental Conditions

Do not clean or paint surfaces when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than minus 15 degrees C above the dew point of the surrounding air, or when surface temperature is below 7 degrees C or over 35 degrees C, unless approved by the Contracting Officer. Metal surfaces to be painted must be dry for a minimum of 48 hours prior to the application of primer or paint.

3.8 EXPANSION JOINT COVERS

Provide in accordance with manufacturer's written instructions[and with seismic requirements indicated]. Verify installation allows specified movement prior to completion of work

3.9 COVER PLATES AND FRAMES

Provide tops of cover plates and frames flush with finished surface. Test for trip hazards and adjust for any encountered lippage.

3.10 WHEEL GUARDS

Anchor guards to concrete or masonry in accordance with manufacturer's instructions. Fill hollow cores solid with concrete with minimum compressive strength of 17 MPa.

[3.11 ROOF HATCH (SCUTTLES)

Construction and accessories as follows:

a. Provide insulated cover and curb with mounting flanges for securing to roof deck. Provide curbs with integral metal cap flashing of the same gage and metal as the curb, fully welded and ground at corners for weather tightness.

b. Provide hatches completely assembled, with pintle hinges, compression spring operators enclosed in telescopic tubes, positive snap latches with turn handles on inside and outside, and neoprene draft seals. Provide fasteners for padlocking from the inside. Provide covers with automatic hold-open arms complete with grip handle to permit one hand release. Cover action must be smooth through its entire range of motion with an operating pressure of approximately 130 N.

]3.12 DOOR GUARD FRAME

Mount door guard frames over glazed openings using 6 mm lag bolts on the interiors of wood doors or tamperproof through bolts on the interiors of metal doors.

3.13 INSTALLATION OF BOLLARDS/PIPE GUARDS

Set bollards/pipe guards vertically in concrete piers. Fill hollow cores with concrete having a minimum compressive strength of 21 MPa.

3.14 INSTALLATION OF DOWNSPOUT TERMINATIONS

Secure downspouts terminations to downspouts and substrate per manufacturer's instructions.

3.15 MOUNTING OF SAFETY CHAINS

Provide safety chains where indicated. Mount the top chain 1050 mm[_____] above the [floor][ground] and mount the lower chain 600 mm [_____] above the [floor][ground].

3.16 STRUCTURAL STEEL DOOR FRAMES

Secure door frames to the floor slab by means of angle clips and expansion bolts. Provide any necessary reinforcements and drill and tap frames as required for hardware. Clean metal shavings from finished surfaces at the end of each work day.

For freight elevator hoistway entrances, include a non-skid metal sill installed in accordance with the elevator manufacturer's written

installation instructions.

3.17 INSTALLATION OF WHEEL GUARDS

Fill wheel guards with concrete and anchor to slab in accordance with manufacturer's recommendations.

3.18 BAR-GRILLE WINDOW GUARDS

Securely anchor bar-grille window guards to masonry with 13 mm diameter prison-type screws or bolts and expansion shields, or other type of fastenings if the ends of such fastenings are welded to the adjoining metal grilles or otherwise made tamperproof in manner as approved by the Contracting Officer. Spanner-head screws or bolts are not considered prison-type fasteners.

3.19 DIAMOND MESH WINDOW [AND DOOR]GUARDS

Provide diamond mesh window guards on [interior window frames with not less than two tamperproof hinged butts mounted on wood jambs.][exterior of window frames with not less than two tamperproof hinged butts mounted on 25 by 300 by 3 mm jamb channel attached to 50 by 6 mm plate anchored][to wood jambs with 6 mm lag bolt,] to masonry jamb with toggle bolts[, or to concrete jambs and solid masonry jambs with expansion shields and bolts]. Provide one additional butt for each 900 mm internal length of guard over 1500 mm. Install hasp and padlock jamb opposite the hinged side.

3.20 INSTALLATION OF WINDOW WELLS

Provide window wells with walls securely anchored to foundation surface. Excavate the area within the well to the bottom of the well and cover with a 100 mm thick layer of coarse gravel or crushed rock.

3.21 INSTALLATION MISCELLANEOUS PLATES AND SHAPES

Provide lintels fabricated from structural steel shapes over openings in masonry walls and partitions[as indicated and] as required to support wall loads over openings. Provide with connections and [fasteners][welds]. Construct to have at least 200 mm bearing on masonry at each end.

-- End of Section --

SECTION 05 51 00

METAL STAIRS

PART 1 GENERAL

[Section 05 05 23.16 STRUCTURAL WELDING applies to work specified in this section.
]

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 314	(1990; R 2013) Standard Specification for Steel Anchor Bolts

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360	(2016) Specification for Structural Steel Buildings

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISC/AISI 121	(2007) Standard Definitions for Use in the Design of Steel Structures

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.6.5M	(2000; R 2010) Standard Specification for Metric Thread-Forming and Thread-Cutting Tapping Screws
ASME B18.6.7M	(1999; R 2010) Metric Machine Screws
ASME B18.22M	(1981; R 2017) Metric Plain Washers

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A6/A6M	(2021) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A27/A27M	(2020) Standard Specification for Steel Castings, Carbon, for General Application
ASTM A29/A29M	(2020) Standard Specification for General Requirements for Steel Bars, Carbon and

	Alloy, Hot-Wrought
ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A48/A48M	(2003; R 2021) Standard Specification for Gray Iron Castings
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A108	(2013) Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A283/A283M	(2013) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A325M	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)
ASTM A449	(2014; R 2020) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A500/A500M	(2021a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A512	(2006; R 2012) Standard Specification for Cold-Drawn Buttweld Carbon Steel Mechanical Tubing
ASTM A568/A568M	(2019a) Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
ASTM A575	(2020) Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or

	Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A924/A924M	(2020) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B209M	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C514	(2004; R 2020) Standard Specification for Nails for the Application of Gypsum Board
ASTM C636/C636M	(2013) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM E488/E488M	(2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
ASTM F568M	(2007) Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners
ASTM F1679	(2004e1) Standard Test Method for Using a Variable Incidence Tribometer

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 898-1	(2013) Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel — Part 1: Bolts, Screws and Studs with Specified Property Classes — Coarse Thread and Fine Pitch Thread

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 1180	(2014) Hexagon Head Bolts and Hexagon Screws
JIS B 1181	(2014) Hexagon Nuts and Hexagon Thin Nuts
JIS G 3101	(2020) Rolled Steels for General Structure
JIS G 3106	(2020) Rolled Steels for Welded Structure
JIS G 3114	(2016) Hot-Rolled Atmospheric Corrosion

	Resisting Steel for Welded Structure
JIS G 3136	(2022) Rolled Steels for Building Structure
JIS G 3138	(2021) Rolled Steel Bars for Building Structure
JIS G 3302	(2019) Hot-Dip Zinc-Coated Steel Sheet and Strip
JIS G 3444	(2021) Carbon Steel Tubes for General Structure
JIS G 3466	(2021) Carbon Steel Square and Rectangular Tubes for General Structure
JIS G 3475	(2021) Carbon Steel Tubes for Building Structure
JIS G 5101	(1991) Carbon Steel Castings
JIS G 5501	(2020) Grey Iron Castings
JIS G 5705	(2018) Malleable Iron Castings
JIS H 8641	(2021) Hot Dip Galvanized Coatings

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531	(2017) Metal Bar Grating Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2021) Life Safety Code

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Iron and Steel Hardware; G[, [____]]

Steel Shapes, Plates, Bars, and Strips; G[, [____]]

Metal Stair System; G[, [____]]

SD-03 Product Data

Structural Steel Plates, Shapes, and Bars; G[, [____]]

Structural Steel Tubing; G[, [____]]

Hot-Rolled Carbon Steel Sheets and Strips; G[, [____]]

Cold-Finished Steel Bars; G[, [_____]]

Hot-Rolled Carbon Steel Bars; G[, [_____]]

Cold-Rolled Carbon Steel Sheets; G[, [_____]]

Galvanized Carbon Steel Sheets; G[, [_____]]

Cold-Drawn Steel Tubing; G[, [_____]]

Gray Iron Castings; G[, [_____]]

Malleable Iron Castings; G[, [_____]]

Concrete Inserts; G[, [_____]]

Masonry Anchorage Devices; G[, [_____]]

Protective Coating; G[, [_____]]

Steel Pan Stairs; G[, [_____]]

Steel Stairs; G[, [_____]]

Steel Stairs, Circular; G[, [_____]]

SD-07 Certificates

[Welding Procedures; G[, [_____]]

][Welder Qualification; G[, [_____]]

] SD-08 Manufacturer's Instructions

Structural Steel Plates, Shapes, and Bars; G[, [_____]]

Structural Steel Tubing; G[, [_____]]

Hot-Rolled Carbon Steel Sheets and Strips; G[, [_____]]

Cold-Finished Steel Bars; G[, [_____]]

Hot-Rolled Carbon Steel Bars; G[, [_____]]

Cold-Rolled Carbon Steel Sheets; G[, [_____]]

Galvanized Carbon Steel Sheets; G[, [_____]]

Cold-Drawn Steel Tubing; G[, [_____]]

Gray Iron Castings; G[, [_____]]

Malleable Iron Castings; G[, [_____]]

Protective Coating; G[, [_____]]

Masonry Anchorage Devices; G[, [_____]]

1.3 QUALITY CONTROL

1.3.1 Qualifications for Welding Work

[Submit welding procedures in accordance with AWS D1.1/D1.1M. Make test specimens in the presence of the Contracting Officer, and have the specimens tested by an approved testing laboratory at the Contractor's expense.

][Certify welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition, perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, ensure that two test welds are retested immediately and that each test weld is made and passes. Failure in the immediate retest requires that the welder be retested after further practice or training and a complete set of test welds be made.

]PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Submit complete and detailed fabrication drawings for all iron and steel hardware, and for all steel shapes, plates, bars, and strips used in accordance with the design specifications referenced in this section.

2.2 FABRICATION

Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning and treating surfaces and applying surface finishes, including zinc coatings.

2.2.1 General Fabrication

Prepare and submit metal stair system shop drawings with detailed plans and elevations at scales not less than 1 to 12 scale and with details of sections and connections at scales not less than 1 to 4 scale. Also detail the placement drawings, diagrams, and templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchorage devices.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce a finished product that is strong enough and durable enough for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven methods of fabrication and support. Use the type of materials indicated or specified for the various components of work.

Form exposed work true to line and level, with accurate angles and surfaces and with straight sharp edges. Ease exposed edges to a radius of approximately 0.8 millimeter, and bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Continuously weld corners and seams in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flat-head (countersunk) screws or bolts.

Provide and coordinate anchorage of the type indicated for the supporting structure. Fabricate anchoring devices, and space them as indicated and as necessary to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified as fabricated from cold-finished or cold-rolled stock.

2.2.2 Steel Pan Stairs

2.2.2.1 General

Joining pieces by welding. Fabricate units so that bolts and other fastenings do not appear on finished surfaces. Make joints true and tight, and connections between parts lighttight. Grind continuous welds smooth where exposed.

Construct metal stair units to sizes and arrangements indicated to support a minimum live load of 500 kilogram per square meter. Provide framing, hangers, columns, struts, clips, brackets, bearing plates, and other components as required for the support of stairs and platforms.

2.2.2.2 Stair Framing

Fabricate stringers of structural steel channels, or plates, or a combination thereof as indicated. Provide closures for exposed ends of strings.

Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt headers to stringers and newels, and bolt framing members to stringers and headers.

2.2.2.3 Riser, Subtread, and Subplatform Metal Pans

[Form metal pans of 2.8 millimeter structural steel sheets, conforming to ASTM A1011/A1011M, or JIS G 3136, Grade 36. Shape the pans to the configuration indicated.

][Form metal pans of 2.8 millimeter galvanized structural steel sheets, conforming to ASTM A653/A653M, or JIS G 3302, Grade A, with zinc coating conforming to ASTM A653/A653M or JIS G 3302 and ASTM A924/A924M or JIS G 3302. Shape the pans to the configuration indicated.

] Construct risers and subtread metal pans with steel angle supporting brackets, of the size indicated, welded to stringers. Secure metal pans to brackets with rivets or welds. Secure subplatform metal pans to platform frames with welds.

2.2.2.4 Metal Safety Nosings

Between stringers, provide abrasive cast metal safety nosings, wide by the full length of the step. Fabricate nosings to the thickness, profile, and surface pattern indicated. Equip each nosing with integral anchors for embedding in the pan fill material, and space the anchors not more than 100 millimeter from each end and not more than 380 millimeter on center.

2.2.2.5 Steel Floor Plate Treads and Platforms

Provide raised-pattern steel floor plate fabricated from steel complying with ASTM A36/A36Mor JIS G 3101, JIS G 3106, JIS G 3114, JIS G 3136. Provide the pattern indicated or, if not indicated, as selected from the manufacturer's standard patterns.

Form treads of 6 millimeter thick steel floor plate with integral nosing and back-edge stiffener. Weld steel supporting brackets to strings, and weld treads to brackets.

[Fabricate platforms of steel floor plate to the thickness indicated. Provide nosing that match treads at landings. Secure floor plates to platform framing members with welds.

]2.2.2.6 Safety Nosings for Concrete Treads

[Provide safety nosings of [cast aluminum] [cast iron] with [cross-hatched] [plain] abrasive surfaces, or extruded aluminum with abrasive inserts, at least 100 mm wide and 6 mm thick [and terminating at not more than 150 mm from the ends of treads] [for metal-pan cement-filled treads extending the full length of the tread] for stairs and [as indicated] for platforms and landings. Provide safety nosings with anchors embedded a minimum of 20 mm in the concrete and with tops flush with the top of the traffic surface.

]2.2.2.7 Safety Treads

[NAAMM MBG 531 [aluminum] [steel], Type [_____]] [Plank grating ASTM A653/A653M or JIS G 3302, Z275] [aluminum ASTM B209M,] [ASTM A1011/A1011M or JIS G 3136, steel pan for concrete tread.

]2.2.2.8 Steel Framing for Concrete Stairs

When necessary, modify fabricated units to fit actual dimensions of the supporting structure. Join steel components by welding. Provide 2 millimeter steel risers unless otherwise indicated. Arrange components to receive finish materials as indicated.

2.2.3 Floor Grating Treads and Platforms

Provide floor grating treads and platforms conforming to ASTM A6/A6M or JIS G 3138, ASTM A29/A29M or JIS G 3138-2021 and NAAMM MBG 531, "Metal Bar Grating Manual." Provide the pattern, spacing, and bar sizes as indicated:

[a. Galvanized finish, conforming to ASTM A123/A123M or JIS H 8641.

][b. Manufacturer's baked-on primer for painted finishes.

] Fabricate grating treads with steel plate nosings on one edge and with steel angle or steel plate carriers at each end for string connections. Secure treads to strings with bolts.

Match the nosings of grating platforms with the nosing of grating treads at landings. Provide toeplates where the open-sided edges of floor grating meet platform framing members.

2.2.4 Protective Coating

[Shop-prime steelwork as indicated in accordance with [AISC/AISI 121] [Section 09 97 13.00 40 STEEL COATINGS], except surfaces of steel encased in concrete; welded surfaces; high-strength, bolt-connected surfaces; and surfaces of crane rails.

][Hot-dip galvanize steelwork as indicated in accordance with ASTM A123/A123M or JIS H 8641. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

]2.3 COMPONENTS

2.3.1 Steel Stairs

Provide steel stairs complete with stringers, [steel-plate treads and risers,] [metal-pan concrete-filled treads,] [grating treads,] [nonskid metallic treads,] [precast concrete treads,] landings, columns, handrails, and necessary bolts and other fastenings. [Hot-dip-galvanize] [Shop-paint] steel stairs and accessories.

2.3.1.1 Design Loads

Design stairs to sustain a live load of not less than [_____] kg per square meter, or a concentrated load of [_____] applied where it is most critical. Except for a commercial product, design and fabricate steel stairs to conform to AISC 360. [Design fire stairs to conform to NFPA 101.]

2.3.1.2 Materials

Provide steel stairs of welded construction except that bolts may be used where welding is not practicable. Do not use screw or screw-type connections.

a. Structural Steel: ASTM A36/A36M or JIS G 3101, JIS G 3106, JIS G 3114, JIS G 3136.

b. Gratings for Treads and Landings: [NAAMM MBG 531] [or] [Plank grating; ASTM A653/A653M or JIS G 3302, Z275 for steel; ASTM B209M for aluminum.] [Provide gratings with nonslip nosings.] [with slip resistance exceeding a static coefficient of friction, both wet and dry, of [0.5] [0.6] as tested in accordance with ASTM F1679.]

c. Support [steel floor plate] [metal pan for concrete fill] [steel grating] on angle cleats welded to stringers or treads with integral cleats, welded or bolted to the stringer. [Provide sheet-steel landings with angle stiffeners welded on.] Close exposed ends. [For exterior stairs, form all exposed joints to exclude water.]

[d. Ensure that precast concrete treads are factory-built as specified in Section 03 45 33 PRECAST[PRESTRESSED] STRUCTURAL CONCRETE.

] e. Before fabrication, obtain necessary field measurements and verify

drawing dimensions.

f. Clean metal surfaces free of mill scale, flake rust, and rust pitting before shop finishing. Weld permanent connections. Finish welds flush and smooth on surfaces that will be exposed after installation.

2.3.2 Steel Stairs, Circular

Provide standard open riser constructed of steel, with a minimum outside diameter of 1800 mm and with 12 treads to the circle. Construct the center pole from one continuous length of circular, cold-drawn, seamless tube with a minimum outside diameter of 90 mm and with caps at the top plate and base plate having countersunk machine screws and expansion shields for fastening to the concrete floor slab. Construct treads and platforms from steel grating conforming to NAAMM MBG 531. [Provide nonslip nosings for gratings.] [Design slip-resistant gratings to exceed a static coefficient of friction of 0.5 [0.6] as tested in accordance with ASTM F1679.]

2.3.3 Soffit Clips

Provide clips with holes for attaching metal furring for plastered soffits. Space the clips not more than 300 millimeter on center, and weld them to stair treads and platforms as required.

2.3.4 Concrete Inserts

[Threaded-type concrete inserts consisting of galvanized ferrous castings, internally threaded to receive M20 diameter machine bolts; either malleable iron conforming to ASTM A47/A47M or JIS G 5705 or cast steel conforming to ASTM A27/A27M or JIS G 5101, and hot-dip-galvanized in accordance with ASTM A153/A153M or JIS H 8641.

][Wedge-type concrete inserts consisting of galvanized box-type ferrous castings designed to accept M20 diameter bolts having special wedge-shaped heads; either malleable iron conforming to ASTM A47/A47M or JIS G 5705 or cast steel conforming to ASTM A27/A27M and hot-dip-galvanized in accordance with ASTM A153/A153M or JIS H 8641.

][Carbon steel bolts having special wedge-shaped heads, nuts, washers, and shims and galvanized in accordance with ASTM A153/A153M or JIS H 8641. Provide slotted-type concrete inserts consisting of galvanized 3 millimeter thick pressed steel plate conforming to ASTM A283/A283M or JIS G 3101; of box-type welded construction with slot designed to receive M20 diameter square-head bolt with knockout cover; and be hot-dip-galvanized in accordance with ASTM A123/A123M or JIS H 8641.

]2.3.5 Masonry Anchorage Devices

Provide masonry anchorage devices consisting of expansion shields complying with AASHTO M 314, ASTM E488/E488M and ASTM C514 as follows:

[a. Lead expansion shields for machine screws and bolts 6 millimeter and smaller; head-out embedded-nut type, single unit class, Group I, Type 1, Class 1.

][b. Lead expansion shields for machine screws and bolts larger than 6 millimeter in size; head-out embedded-nut type, multiple unit class, Group I, Type 1, Class 2.

][c. Bolt anchor expansion shields for lag bolts; zinc-alloy, long-shield anchors class, Group II, Type 1, Class 1.

][d. Bolt anchor expansion shields for bolts; closed-end bottom-bearing class, Group II, Type 2, Class 1.
]

Use toggle bolts of the tumble-wing type, conforming to ASTM A325M, ASTM A449, and ASTM C636/C636M, type, class, and style as required.

2.3.6 Fasteners

Select galvanized zinc-coated fasteners conforming to ASTM A153/A153M or JIS H 8641 for exterior applications or where the fasteners are built into exterior walls or floor systems. Select the fasteners for the type, grade, and class required for the installation of steel stair items:

a. Standard/regular hexagon-head bolts and nuts, conforming to ASTM F568M, or JIS B 1180 / JIS B 1181.

b. Square-head lag bolts conforming to ISO 898-1,.

c. Cadmium-plated steel machine screws, conforming to ASME B18.6.7M,.

d. Flat-head carbon steel wood screws, conforming to ASME B18.6.5M,.

e. Plain, round, general-assembly-grade, carbon steel washers, conforming to ASME B18.22M.

f. Helical-spring, carbon steel lockwashers, conforming to ISO 898-1.

2.4 MATERIALS

2.4.1 Structural Steel Plates, Shapes and Bars

Structural size shapes and plates, conforming to ASTM A36/A36M or JIS G 3101, JIS G 3106, JIS G 3114, JIS G 3136, unless otherwise noted, except bent or cold-formed plates.

Steel plates - bent or cold-formed, conforming to ASTM A283/A283M or JIS H 8641, Grade C.

Steel bars and bar-size shapes, conforming to ASTM A36/A36M or JIS G 3101, JIS G 3106, JIS G 3114, JIS G 3136, unless otherwise noted for steel bars and bar-size shapes.

2.4.2 Structural Steel Tubing

Provide the following:

[a. Structural steel tubing, hot-formed, welded or seamless, conforming to ASTM A500/A500M or JIS G 3444 / JIS G 3475, Grade B, unless otherwise noted.

][Structural steel tubing, hot-formed, welded or seamless, conforming to [_____] Grade [_____].

]2.4.3 Hot-Rolled Carbon Steel Bars

Provide the following:

[a. Hot-rolled carbon steel bars and bar-size shapes, conforming to ASTM A575 or JIS G 3138, grade as selected by the fabricator.

][b. Hot-rolled carbon steel bars and bar-size shapes, conforming to [_____], grade as selected by the fabricator.

]2.4.4 Cold-Finished Steel Bars

Provide the following:

[a. Cold-finished steel bars conforming to ASTM A108 or JIS G 3138, grade as selected by the fabricator.

][b. Cold-finished steel bars conforming to [_____], grade as selected by the fabricator.

]2.4.5 Hot-Rolled Carbon Steel Sheets and Strips

Provide the following:

[a. Hot-rolled carbon sheets and strips conforming to ASTM A568/A568M or JIS G 3136 and ASTM A1011/A1011M or JIS G 3136, pickled and oiled.

][b. Hot-rolled carbon sheets and strips conforming to [_____].

]2.4.6 Cold-Rolled Carbon Steel Sheets

Provide the following:

[a. Cold-rolled carbon steel sheets conforming to ASTM A1008/A1008M or JIS G 3136.

][b. Cold-rolled carbon steel sheets conforming to [_____].

]2.4.7 Galvanized Carbon Steel Sheets

Provide the following:

[a. Galvanized carbon steel sheets conforming to ASTM A653/A653M or JIS G 3302, with galvanizing conforming to ASTM A653/A653M or JIS G 3302 and ASTM A924/A924M or JIS G 3302.

][b. Galvanized carbon steel sheets conforming to [_____], with galvanizing conforming to [_____].

]2.4.8 Cold-Drawn Steel Tubing

Provide the following:

[a. Cold-drawn steel tubing conforming to ASTM A512 or JIS G 3466, sunk drawn, butt-welded, cold-finished, and stress-relieved.

][b. Cold-drawn steel tubing conforming to [_____], [_____].

]2.4.9 Gray Iron Castings

Provide the following:

[a. Gray iron castings conforming to ASTM A48/A48Mor JIS G 5501, Class 30.

][b. Gray iron castings conforming to [_____], Class [_____].

]2.4.10 Malleable Iron Castings

Provide the following:

[a. Malleable iron castings conforming to ASTM A47/A47Mor JIS G 5705, grade as selected.

][b. Malleable iron castings conforming to [_____], grade as selected.

]2.4.11 Steel Pipe

Provide the following:

[a. Steel pipe conforming to ASTM A53/A53M or JIS G 3466, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

][b. Steel pipe conforming to [_____], type as selected, Grade [_____]; primed finish, unless galvanizing is required; [standard weight (Schedule 40)] [_____].

]PART 3 EXECUTION

3.1 PREPARATION

Clean surfaces thoroughly before installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.

Protect installed products until completion of project. Touch up, repair or replace, damaged products before substantial completion

3.2 INSTALLATION

Install in accordance with the manufacturer's instructions and approved submittals. Install in proper relationship with adjacent construction.

Install items at locations indicated, according to the manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Ensure that exposed fastenings are compatible with generally match the color and finish of, and harmonize with the material to which they are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners is cause for rejection. Conceal fastenings where practicable. Select thickness of metal and details of assembly and supports that adequately strengthen and stiffen the construction. Form joints exposed to the weather to exclude water.

3.2.1 Field Preparation

Remove rust-preventive coating just before field erection, using a remover approved by the coating manufacturer. Provide surfaces, when assembled, free of rust, grease, dirt and other foreign matter.

3.2.2 Field Welding

Comply with AWS D1.1/D1.1M in executing manual shielded-metal arc welding, (for appearance and quality of new welds) and in correcting existing welding.

3.2.3 Safety Nosings

Completely embed nosing in concrete before the initial set of the concrete occurs and finish flush with the top of the concrete surface.

3.2.4 Touchup Painting

Immediately after installation, clean all field welds, bolted connections, and abraded areas of the shop-painted material, and repaint exposed areas with the same paint used for shop painting. Apply paint by brush or spray to provide a minimum dry-film thickness of 0.051 millimeter.

-- End of Section --

SECTION 05 51 33

METAL LADDERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 1048	(2007) Fasteners - Hot Dip Galvanized Coatings
JIS B 9713-4	(2004) Safety of machinery-Means of permanent access to machinery-Part 4: Fixed Ladders
JIS G 3101	(2017) Rolled Steels for General Structure (Amendment 1)
JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS G 3444	(2016) Carbon Steel Tubes for General Structure
JIS G 3466	(2015) Carbon Steel Square and Rectangular Tubes for General Structure
JIS G 5705	(2018) Malleable Iron Castings
JIS H 4000	(2017) Aluminium and Aluminium Alloy Sheets, Strips and Plates (Amendment 1)
JIS H 4100	(2015) Aluminum and Aluminum Alloy Extrusions
JIS H 5202	(2010) Aluminum Alloy Castings
JIS K 2208	(2009) Asphalt Emulsion
JIS K 5553	(2006) Thick Film Zinc Rich Paint
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS K 5674	(2019) Lead-Free, Chromium-Free Anticorrosive Paints
JIS Z 0310	(2016) Abrasive Blast Cleaning Methods for Surface Preparation
JIS Z 3410	(2013) Welding Coordination - Tasks and Responsibilities

JIS Z 3801	(2018) Standard Qualification Test and Acceptance Requirements for Manual Welding Technique
JIS Z 3841	(2018) Test Method and Criteria in Semi-Automatic Welding Technology Certification

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Ladders, Installation Drawings

Ship's Ladder (With or Without Guards), Installation Drawings

SD-03 Product Data

Ladders

Ship's Ladder (With or Without Guards)

Ladder Safety Devices (Climbing Ladder Fall Arrest Systems)

SD-07 Certificates

Fabricator Certification for Ladder Assembly

Fabricator Certification for Ships Ladder Assembly

1.3 CERTIFICATES

Provide fabricator certification for ladder assembly stating that the ladder and associated components have been fabricated according to the requirements of JIS B 9713-4.

Provide fabricator certification for ships ladder assembly stating that the ships ladder and associated components have been fabricated according to the requirements of JIS B 9713-4.

1.4 QUALIFICATION OF WELDERS

Qualify welders in accordance with JIS Z 3801, or JIS Z 3841. Use procedures, materials, and equipment of the type required for the work.

1.5 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove

and replace damaged items with new items.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Structural Carbon Steel

JIS G 3101.

2.1.2 Structural Tubing

JIS G 3466.

2.1.3 Steel Pipe

JIS G 3444, STK400.

2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings JIS G 5705.

2.1.5 Aluminum Alloy Products

Conform to JIS H 4000 for sheet plate, JIS H 4100 for extrusions and JIS H 5202 for castings, as applicable. Provide aluminum extrusions at least 3 mm thick and aluminum plate or sheet at least 1.3 mm thick.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: JIS B 1048, JIS H 8641, JIS G 3302, Z27, as applicable.

2.2.2 Galvanize

Anchor bolts, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to JIS K 5553 by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance withJIS Z 0310. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned with power tools. Wash cleaned surfaces

which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean.

2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions.[On surfaces concealed in the finished construction or not accessible for finish painting, apply an additional prime coat to a minimum dry film thickness of 0.03 mm. Tint additional prime coat with a small amount of tinting pigment.]

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Aluminum Surfaces

2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.2.6.2 Aluminum Finishes

Unexposed plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium. Unless otherwise specified, provide all other aluminum items with [standard mill finish.] [hand sanded or machine finish to a 240 grit.] Provide a coating thickness not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations.

2.3 LADDERS

Fabricate vertical ladders conforming to JIS B 9713-4. Ladders shall be capable of supporting their maximum intended load. Use 65 by 10 mm steel flats for stringers and 20 mm diameter steel rods for rungs. Ladder rungs, step and cleats must be spaced not less than 25 cm and not more than 400 mm wide (measured before installation of ladder safety system), spaced no more than 36 cm apart, plug welded or shouldered and headed into stringers. Install ladders so that the maximum perpendicular distance from the centerline of the steps or rungs, or grab bars, or both, to the nearest permanent object in the back of the ladder or to the finished wall surface will not be less than 175 mm, except for the elevator pit ladders, which have a minimum perpendicular distance of 11 cm. Provide heavy clip angles riveted or bolted to the stringer and drilled[for not less than two 12 mm diameter expansion bolts] as indicated. Provide intermediate clip angles not over 1200 mm on centers. The top rung of the ladder must be level with the top of the access level, parapet or landing served by the ladder except for hatches or wells. Extend the side rails of through or side step ladders 105 centimeters above the access level. Provide ladder access protective swing gates at the top of access/egress level. The drawings must indicate ladder locations and details of critical dimensions and materials.

2.3.1 Phasing out of Ladder Cages and Wells (29 CFR 1910.28, Nov 2016)

Conform to JIS B 9713-4.

[Each ladder installed before 19 November, 2018 shall be equipped with a personal fall arrest system, ladder safety device (climbing Ladder Fall Arrest System), cage, or well.

] Each newly installed ladder over 6,000 mm in length shall only be equipped with a personal fall arrest system or climbing ladder fall arrest system (ladder safety device), cages and wells are prohibited. When a fixed ladder, cage, or well, or any portion of a section thereof, is replaced, a personal fall arrest system or climbing ladder fall arrest system (ladder safety device) is installed in at least that section of the fixed ladder, cage, or well where the replacement is located. On and after November 18, 2036, all fixed ladders shall only be equipped with a personal fall arrest system or a ladder safety device (climbing ladder Fall Arrest System).

2.3.2 Ladder Safety Devices (Climbing Ladder Fall Arrest Systems)

Conform to JIS B 9713-4. Install ladder safety devices on ladders over 6000 mm long or more. The ladder safety systems must meet the design requirement of the ladders which they serve. The ladder safety system must be capable of sustaining a minimum static load of 4.44kN. The applied loads transferred to the climbing ladder mounting locations as a result of a fall shall be specified by the manufacturer of the climbing ladder fall arrest system. Each ladder safety system must allow the worker to climb up and down using both hands and does not require the employee continuously, hold, push, or pull any part of the system while climbing. The connection between the carrier or lifeline and the point of attachment to the body harness does not exceed 23 cm. The ladder safety system consists of a rigid or flexible carrier. Mountings for the rigid carries are attached at each end of the carrier, with intermediate mountings spaced as necessary, along the entire length of the carrier. Mountings for flexible carrier are attached at each end of the carrier and cable guides for flexible carriers are installed at least 7.6 cm apart but not more than 12.2 m apart along the entire length of the carrier. The design and installation of mountings and cable guides does not reduce the design strength of the ladder.

2.3.3 Ship's Ladder

Fabricate stringers and framing of steel plate or shapes. Bolt, rivet or weld connections and anchor to supporting construction. Provide treads with non-slip surface as specified for safety treads. [Aluminum ladders may be provided, subject to approval of treads, materials, and shop drawings. Requirements shown or specified for steel apply. Provide anchor items of zinc-coated steel.] Design assembly, including tread connections and methods of attachment, to support a live load of 1300 N per tread. Provide railings as specified for metal handrails.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Provide Exposed fastenings of compatible materials, generally matching in color and finish, and harmonize with the

material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners will be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports must provide strength and stiffness. Formed joints exposed to the weather to exclude water. Items listed below require additional procedures.

3.2 WORKMANSHIP

Metalwork must be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching must produce clean true lines and surfaces. Continuously weld along the entire area of contact. Do not tack weld exposed connections of work in place. Grid smooth exposed welds. Provide smooth finish on exposed surfaces of work in place, unless otherwise approved. Where tight fits are required, mill joints. Cope or miter corner joints, well formed, and in true alignment. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion anchors, and powder-actuated fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine bolts, carriage bolts and powder-actuated threaded studs for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.4 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with JIS Z 3410. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.5 FINISHES

3.5.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to JIS K 5674 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with JIS K 2208, asphalt-base emulsion.

3.5.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

3.5.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than minus 15 degrees C

above the dew point of the surrounding air, or when surface temperature is below 7 degrees C or over 35 degrees C, unless approved by the Contracting Officer.

3.6 LADDERS

Secure to the adjacent construction with the clip angles attached to the stringer.[Secure to masonry or concrete with not less than two 12 mm diameter expansion bolts.] Install intermediate clip angles not over 1200 mm on center. Install brackets as required for securing of ladders welded or bolted to structural steel or built into the masonry or concrete. Ends of ladders must not rest upon [finished roof][floor].

-- End of Section --

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SECTION 05 52 00

METAL RAILINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 898-1	(2013) Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel — Part 1: Bolts, Screws and Studs with Specified Property Classes — Coarse Thread and Fine Pitch Thread

JAPANESE STANDARDS ASSOCIATION (JSA)

JIS B 1048	(2007) Fasteners - Hot Dip Galvanized Coatings
JIS B 1111	(2017) Cross Recessed Machine Screws
JIS B 1112	(1995) Cross Recessed Head Wood Screws
JIS B 1189	(2014) Hexagon Bolt with Flange
JIS B 1251	(2018) Spring Lock Washers
JIS B 1256	(2008) Plain Washers
JIS F 2106	(2013) General Chain for Ships
JIS G 3101	(2017) Rolled Steels for General Structure (Amendment 1)
JIS G 3138	(2005) Rolled Steel Bars for Building Structure
JIS G 3444	(2016) Carbon Steel Tubes for General Structure
JIS G 3459	(2017) Stainless Steel Pipes (Amendment 1)
JIS G 3466	(2015) Carbon Steel Square and Rectangular Tubes for General Structure
JIS G 3475	(2014) Carbon Steel Tubes for Building Structure
JIS G 4051	(2018) Carbon Steels for Machine Structural Use (Amendment 1)

JIS G 4304	(2012) Hot-Rolled Stainless Steel Plate, Sheet and Strip
JIS G 4305	(2015) Cold-Rolled Stainless Steel Plate, Sheet and Strip (Amendment 1)
JIS G 5101	(1991) Carbon Steel Cast Steel Products
JIS G 5705	(2018) Malleable Iron Castings
JIS H 4040	(2015) Aluminum and Aluminum Alloy Bars and Wires
JIS H 4100	(2015) Aluminum and Aluminum Alloy Extrusions
JIS H 5202	(2010) Aluminum Alloy Castings
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS Z 3410	(2013) Welding Coordination - Tasks and Responsibilities
JIS Z 3420	(2003) Specification and Approval of Welding Procedures for Metallic Materials - General Rules
JIS Z 3604	(2016) Inert Gas Arc Welding Standard for Aluminum
JIS Z 3801	(2018) Standard Qualification Test and Acceptance Requirements for Manual Welding Technique
JIS Z 3841	(2018) Test Method and Criteria in Semi-Automatic Welding Technology Certification

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT Chapter 14	Metal Work

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Preinstallation Meetings

Within [30] [_____] days of contract award, submit fabrication drawings [to the Contracting Officer] for the following items:

[a. Iron and steel hardware

][b. Steel shapes, plates, bars and strips

][c. Steel railings and handrails

][d. Stainless Steel railings and handrails

][e. Aluminum railings and handrails

] f. Anchorage and fastening systems

Submit manufacturer's catalog data, including two copies of manufacturers specifications, load tables, dimension diagrams, and anchor details for the following items:

[a. Structural-steel plates, shapes, and bars

][b. Structural-steel tubing

][c. Cold-finished steel bars

][d. Hot-rolled carbon steel bars

][e. Cold-drawn steel tubing

][f. Concrete inserts

][g. Masonry anchorage devices

][h. Protective coating

][i. Steel railings and handrails

][j. Stainless Steel railings and handrails

][k. Aluminum railings and handrails

] l. Anchorage and fastening systems

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings; G[, [_____]]

Iron and Steel Hardware

Steel Shapes, Plates, Bars and Strips

SD-07 Certificates

Welding Procedures; G[, [_____]]

Welder Qualification; G[, [_____]]

SD-08 Manufacturer's Instructions

Installation Instructions

1.4 QUALITY CONTROL

1.4.1 Welding Procedures

[Section 05 05 23.16 STRUCTURAL WELDING applies to work specified in this section.

] Submit results of welding procedures testing in accordance with JIS Z 3801 or JIS Z 3841 made in the presence of the Contracting Officer and by an approved testing laboratory at the Contractor's expense.

1.4.2 Welder Qualification

Submit certified welder qualification by tests in accordance with JIS Z 3801 or JIS Z 3841, or under an equivalent approved qualification test. In addition, perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, conduct an immediate retest of two test welds and ensure that each test weld passes. Failure in the immediate retest will require that the welder be retested after further practice or training and make a complete set of test welds.

PART 2 PRODUCTS

2.1 DESIGN

Design all handrails and guards to resist a concentrated load of[890 N][ ] [_____] in any direction at any point of the top of the rail or[730 N/m][ ] [_____] applied horizontally to the top of the rail, whichever is more severe. Intermediate rails, balusters and panel fillers shall be design to resist a concentrated load of[220 N][ ]. MLIT Chapter 14, provide the same size rail and post. Provide pipe collars of the same material and finish as the handrail and posts. [Provide series 300 stainless-steel pipe collars.]

In addition to the above loads exterior railings shall be also designed to withstand a wind load of [ ]N/m.

2.2 FABRICATION

Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning, treating, and applying surface finishes, including zinc coatings.

Provide railing and handrail detail plans and elevations at not less than 1 to 10 scale. Provide details of sections and connections at not less than 1 to 5 scale. Also detail setting drawings, diagrams, templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchors.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce adequate strength and

durability in the finished product for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven details of fabrication and support. Use the type of materials indicated or specified for the various components of work.

Form exposed work true to line and level, with accurate angles and surfaces and straight sharp edges. Ensure that all exposed edges are eased to a radius of approximately 0.8 millimeter. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Weld corners and seams continuously and in accordance with the recommendations of JIS Z 3420 and JIS Z 3604. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form the exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use countersunk Phillips flathead screws or bolts.

Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified to be fabricated from cold-finished or cold-rolled stock.

2.2.1 Aluminum Railings and Handrails

Fabrication: Provide fabrication jointing by one of the following methods:

a. Use flush-type rail fittings, welded and ground smooth with splice locks secured with 10 mm recessed-head set screws.

b. Ensure that mitered and welded joints made by fitting; post to top rail; intermediate rail to post; and corners, are groove welded and ground smooth. Where allowed by the Contracting Officer, provide butt splices reinforced by a tight-fitting dowel or sleeve not less than 150 mm in length. Tack-weld or epoxy-cement the dowel or sleeve to one side of the splice.

c. Assemble railings using slip-on aluminum-magnesium alloy fittings for joints. Fasten fittings to pipe or tube with 6 or 10 mm stainless-steel recessed-head setscrews. Provide assembled railings with fittings only at vertical supports or at rail terminations attached to walls. Provide expansion joints at the midpoint of panels. Provide a setscrew in only one side of the slip-on sleeve. Provide alloy fittings to conform to JIS H 5202.

[Provide removable railing sections as indicated. [Provide toe-boards and brackets where indicated, using flange castings as appropriate.]

]2.2.2 Steel Railings and Handrails

Fabricate joint posts, rail, and corners by one of the following methods:

a. Flush-type rail fittings of commercial standard, welded and ground

smooth, with railing splice locks secured with 10 mm hexagonal-recessed-head setscrews.

b. Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove-welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight-fitting interior sleeve not less than 150 mm long.

c. Railings may be bent at corners in lieu of jointing, provided that bends are made in suitable jigs and the pipe is not crushed.

[Provide removable sections as indicated.

][2.2.3 Stainless Steel Railings and Handrails

Provide stainless steel tubing, welded or seamless, conforming to JIS G 4304, JIS G 4305 or JIS G 3459 unless otherwise noted.

][2.2.4 Protective Coating

[Shop-prime the steelwork as indicated in accordance with Section 09 90 00 PAINTS AND COATINGS except the following:

a. steel surfaces encased in concrete

b. steel surfaces for welding

c. high-strength bolt-connected contact surfaces

d. crane rail surfaces

][Provide hot-dipped galvanized steelwork as indicated in accordance with JIS H 8641. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

]]2.3 COMPONENTS

[2.3.1 Structural Steel Plates, Shapes And Bars

Provide structural-size shapes and plates, except plates to be bent or cold-formed, conforming to JIS G 3101, unless otherwise noted.

Provide steel plates, to be bent or cold-formed, conforming to JIS G 3101, SS 400.

Provide steel bars and bar-size shapes conforming to JIS G 3101, unless otherwise noted.

][2.3.2 Structural-Steel Tubing

Provide structural-steel tubing, hot-formed, welded or seamless, conforming to JIS G 3466 unless otherwise noted.

][2.3.3 Hot-Rolled Carbon Steel Bars

Provide bars and bar-size shapes conforming to JIS G 3138, grade as selected by the fabricator.

][2.3.4 Cold-Finished Steel Bars

Provide cold-finished steel bars conforming to JIS G 4051, grade as selected by the fabricator.

][2.3.5 Cold-Drawn Steel Tubing

Provide tubing conforming to JIS G 3444, sunk-drawn, butt-welded, cold-finished, and stress-relieved.

][2.3.6 Steel Pipe

Provide pipe conforming to JIS G 3466 STK 400 and 235 MPa or JIS G 3475, STKN400B and 235 MPa; primed finish, unless galvanizing is required; standard weight (Schedule 40).

][2.3.7 Concrete Inserts

[Provide threaded-type concrete inserts consisting of galvanized ferrous castings, internally threaded to receive M20 diameter machine bolts; either malleable iron conforming to JIS G 5705 or cast steel conforming to JIS G 5101, SC 42, SC 46 or SC 49, hot-dip galvanized in accordance with JIS B 1048.

][Provide wedge-type concrete inserts consisting of galvanized box-type ferrous castings designed to accept M20 diameter bolts having special wedge-shaped heads, made of either malleable iron conforming to JIS G 5705 or cast steel conforming to JIS G 5101 and hot-dip galvanized in accordance with JIS B 1048.

][Provide carbon steel bolts having special wedge-shaped heads, nuts, washers, and shims, galvanized in accordance with JIS B 1048. Provide slotted-type concrete inserts consisting of a galvanized 3 millimeter thick pressed-steel plate conforming to JIS G 3101 SS41 or SB35, made of box-type welded construction with a slot designed to receive M20 diameter square-head bolt with knockout cover; and hot-dip galvanized in accordance with JIS H 8641.

]][2.3.8 Fasteners

Provide galvanized zinc-coated fasteners in accordance with JIS B 1048 used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.

[Provide standard hexagon-head bolts, conforming to ISO 898-1.

][Provide square-head lag bolts conforming to JIS B 1189.

][Provide cadmium-plated steel machine screws conforming to JIS B 1111.

][Provide flat-head carbon steel wood screws conforming to JIS B 1112.

][Provide plain round, general-assembly-grade, carbon steel washers conforming toJIS B 1256.

][Provide helical spring, carbon steel lockwashers conforming to JIS B 1251.

]][2.3.9 Steel Railings and Handrails

2.3.9.1 Steel Handrails

Provide steel handrails, including inserts in concrete, [steel pipe conforming to JIS G 3466] [or] [structural tubing conforming to JIS G 3466]. Provide steel railings of [40] [50] mm nominal size,[hot-dip galvanized] [and] [shop-painted].

Provide kickplates between railing posts where indicated and consisting of 4 millimeter steel flat bars not less than 150 millimeter high. Secure kickplates as indicated.

[Galvanize exterior railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components. Provide black steel pipe for interior railings.

][Provide galvanized exterior and interior railings where indicated, including pipe, fittings, brackets, fasteners, and other ferrous metal components. Provide black steel pipe for interior railings not indicated as galvanized.

][Provide galvanized railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components.

]][2.3.10 Aluminum Railings and Handrails

Provide railings and handrails consisting of[[40] [50] mm nominal schedule 40 pipe JIS H 4100], 45 mm aluminum semi hollow tube with rounded corners JIS H 4040. Provide [mill-finish] [anodized] aluminum [_____] color railings. Ensure that all fasteners are Series 300 stainless steel.

]2.3.11 Safety Chains [and Guardrails]

Provide safety chains of galvanized steel, straight-link type, 5 mm diameter, with at least 12 links per 300 mm, and with snap hooks on each end. Test safety chain in accordance with JIS F 2106. Provide snap hooks of boat type. Provide galvanized 10 mm bolt with 20 mm eye diameter for attachment of chain, anchored as indicated. Supply two chains, 100 mm longer than the anchorage spacing, for each guarded area. Locate [guardrails] safety chain where indicated. Mount the top chain [rail] 1050 mm [_____] above the [floor] [ground] and mount the lower chain [rail] 600 mm [_____] above the [floor] [ground].

PART 3 EXECUTION

3.1 PREPARATION

Adjust stair railings and handrails before securing in place in order to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than [2440 millimeter] [_____] on center. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

[a. Anchor posts in concrete by means of pipe sleeves set and anchored into concrete. Provide sleeves of galvanized, standard-weight, steel pipe, not less than 150 millimeter long, and having an inside diameter not less than 13 millimeter greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to the bottom

of the sleeve, with closure width and length not less than 25 millimeter greater than the outside diameter of the sleeve. After posts have been inserted into sleeves, fill the annular space between the post and sleeve with non-shrink grout or a quick-setting hydraulic cement. Cover anchorage joint with a round steel flange welded to the post.

][b. Anchor posts to steel with oval steel flanges, angle type or floor type as required by conditions, welded to posts and bolted to the steel supporting members.

][c. Anchor rail ends into concrete and masonry with round steel flanges welded to rail ends and anchored into the wall construction with lead expansion shields and bolts.

][d. Anchor rail ends to steel with oval or round steel flanges welded to tail ends and bolted to the structural-steel members.

] Secure handrails to walls by means of wall brackets and wall return fitting at handrail ends. Provide brackets of malleable iron castings, with not less than 75 millimeter projection from the finished wall surface to the center of the pipe, drilled to receive one M10 bolt. Locate brackets not more than 1525 millimeter on center. Provide wall return fittings of cast iron castings, flush type, with the same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:

[a. For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.

][b. For hollow masonry and stud partition anchorage, use toggle bolts having square heads.

] Install toe boards and brackets where indicated. Make splices, where required, at expansion joints. Install removable sections as indicated.

3.2 INSTALLATION

Submit manufacturer's installation instructions for the following products to be used in the fabrication of [steel] [_____] [stair railing] [and] [hand rail work]:

[a. Structural-steel plates, shapes, and bars

][b. Structural-steel tubing

][c. Cold-finished steel bars

][d. Hot-rolled carbon steel bars

][e. Cold-drawn steel tubing

][f. Protective coating

][g. Masonry anchorage devices

][h. Steel railings and handrails

][i. Aluminum railings and handrails

][j. Anchorage and fastening systems

] Provide complete, detailed fabrication and installation drawings for all iron and steel hardware, and for all steel shapes, plates, bars, and strips used in accordance with the design specifications cited in this section.

[3.2.1 Steel Handrail

Install handrail [in pipe sleeves embedded in concrete and filled with non-shrink grout or quick-setting anchoring cement with anchorage covered with standard pipe collar pinned to post.][by means of pipe sleeves secured to wood with screws.][by means of masonry with expansion shields and bolts or toggle bolts.][by means of base plates bolted to stringers or structural-steel frame work.] Secure rail ends by steel pipe flanges [anchored by expansion shields and bolts.] [through-bolted to a back plate or by 6 mm lag bolts to studs or solid backing.]

][3.2.2 Aluminum Handrail

Affix to base structure by [flanges anchored to concrete or other existing masonry by expansion shields] [base plates or flanges bolted to stringers or structural-steel framework] [flanges through-bolted to a backing plate on the other side of a wall] [flanges lag-bolted to studs or other structural timbers]. Provide Series 300 stainless-steel bolts to anchor aluminum alloy flanges, of a size appropriate to the standard product of the manufacturer. Where aluminum or alloy fittings or extrusions are to be in contact with dissimilar metals or concrete, coat the contact surface with a heavy coating of bituminous paint.

][3.2.3 Touchup Painting

Immediately after installation, clean field welds, bolted connections, abraded areas of the shop paint, and exposed areas painted with the paint used for shop painting. Apply paint by brush or spray to provide a minimum dry-film thickness of 0.051 millimeter.

]3.3 FIELD QUALITY CONTROL

3.3.1 Field Welding

Ensure that procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welding work comply with JIS Z 3410, JIS Z 3420, or JIS Z 3604.

-- End of Section --

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN FOREST FOUNDATION (AFF)

ATFS STANDARDS	(2015) American Tree Farm System Standards of Sustainability 2015-2020

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1995; R 2004) Basic Hardboard

AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

AITC 111	(2005) Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection
AITC TCM	(2012) Timber Construction Manual, 5th Edition
ANSI/AITC A190.1	(2007) American National Standard, Structural Glued Laminated Timber

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20	(2015) American Softwood Lumber Standard

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA Eng Man	(2017) Manual for Railway Engineering

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.1	(2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B18.5.2.1M	(2006; R 2011) Metric Round Head Short Square Neck Bolts
ASME B18.5.2.2M	(1982; R 2010) Metric Round Head Square Neck Bolts

ASME B18.6.1	(2016) Wood Screws (Inch Series)

AMERICAN WOOD COUNCIL (AWC)

AWC NDS	(2015) National Design Specification (NDS) for Wood Construction
AWC WFCM	(2012) Wood Frame Construction Manual for One- and Two-Family Dwellings

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA BOOK	(2015) AWPA Book of Standards
AWPA M2	(2019) Standard for the Inspection of Preservative Treated Wood Products for Industrial Use
AWPA M6	(2013) Brands Used on Preservative Treated Materials
AWPA P5	(2015) Standard for Waterborne Preservatives
AWPA P18	(2014) Nonpressure Preservatives
AWPA P49	(2015; R 2021) Standard for Fire Retardant FR-1
AWPA T1	(2021) Use Category System: Processing and Treatment Standard
AWPA U1	(2021) Use Category System: User Specification for Treated Wood

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA E30	(2016) Engineered Wood Construction Guide
APA E445	(2002) Performance Standards and Qualification Policy for Structural-Use Panels (APA PRP-108)
APA EWS R540	(2013) Builder Tips: Proper Storage and Handling of Glulam Beams
APA EWS T300	(2007) Technical Note: Glulam Connection Details
APA F405	(19) Product Guide: Performance Rated Panels
APA L870	(2010) Voluntary Product Standard, PS 1-09, Structural Plywood
APA S350	(2014) PS 2-10, Performance Standard for Wood-Based Structural-Use Panels

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C208	(2012; R 2017; E 2017; E 2019) Standard Specification for Cellulosic Fiber Insulating Board
ASTM C1136	(2021) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C1396/C1396M	(2017) Standard Specification for Gypsum Board
ASTM D198	(2015) Standard Test Methods of Static Tests of Lumber in Structural Sizes
ASTM D696	(2016) Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer
ASTM D1435	(2013) Standard Practice for Outdoor Weathering of Plastics
ASTM D1972	(1997; R 2005) Standard Practice for Generic Marking of Plastic Products
ASTM D2344/D2344M	(2016) Standard Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates
ASTM D2898	(2010; R 2017) Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
ASTM D3498	(2019a) Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Stand Board) to Wood Based Floor System Framing
ASTM D6108	(2013) Standard Test Method for Compressive Properties of Plastic Lumber and Shapes

ASTM D6109	(2013) Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber and Related Products
ASTM D6111	(2013a) Standard Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement
ASTM D6112	(2013) Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes
ASTM D6117	(2016) Standard Test Methods for Mechanical Fasteners in Plastic Lumber and Shapes
ASTM E96/E96M	(2021) Standard Test Methods for Gravimetric Determination ofWater Vapor Transmission Rate of Materials
ASTM F547	(2017) Standard Terminology of Nails for Use with Wood and Wood-Base Materials
ASTM F1667/F1667M	(2021a) Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

COMPOSITE PANEL ASSOCIATION (CPA)

CPA A208.1	(2016) Particleboard

CSA GROUP (CSA)

CSA Z809-08	(R2013) Sustainable Forest Management

FM GLOBAL (FM)

FM 4435	(2013) Roof Perimeter Flashing

FOREST STEWARDSHIP COUNCIL (FSC)

FSC STD 01 001	(2015) Principles and Criteria for Forest Stewardship

GREEN SEAL (GS)

GS-36	(2013) Adhesives for Commercial Use

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS K 1570	(2018) Wood Preservatives

MINISTRY OF AGRICULTURE, FORESTRY AND FISHERIES (MAFF)

JAS no. 1920	Japanese Agricultural Standard for Lumber Notification
JAS no. 0360	Japanese Agricultural Standard for Structural Panel
JAS no. 1083	Japanese Agricultural Standard for Sawn Lumber

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules	(2015) Rules for the Measurement & Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules	(2013) Standard Grading Rules for Northeastern Lumber

PROGRAMME FOR ENDORSEMENT OF FOREST CERTIFICATION (PEFC)

PEFC ST 2002:2013	(2015) PEFC International Standard Chain of Custody of Forest Based Products Requirements

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)

RIS Grade Use	(1998) Redwood Lumber Grades and Uses

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Spec	(1986; Supple. No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003	(2014) Standard Grading Rules for Southern Pine Lumber

SUSTAINABLE FOREST INITIATIVE (SFI)

SFI 2015-2019	(2015) Standards, Rules for Label Use, Procedures and Guidance

SUSTAINABLE GREEN ECOSYSTEM COUNCIL (SGEC)

SGEC Document 1	Statues of SGEC

SGEC Document 2	Operationa Rules of SGEC
SGEC Document 3	FM principles indicators and guidelines
SGEC Document 4	CoC guidelines

TRUSS PLATE INSTITUTE (TPI)

TPI 1	(2014) National Design Standard for Metal Plate Connected Wood Truss Construction, Including Commentary and Appendices
TPI HIB	(1991) Commentary and Recommendations for Handling, Installing and Bracing Metal Plate Connected Wood Trusses

U.S. DEPARTMENT OF COMMERCE (DOC)

DOC/NIST PS56	(1973) Structural Glued Laminated Timber
DOC/NIST PS58	(1973) Basic Hardboard (ANSI A135.4)

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1923	(Rev A; Notice 3) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)
CID A-A-1924	(Rev A; Notice 3) Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors
CID A-A-1925	(Rev A; Notice 3) Shield Expansion (Nail Anchors)
FS UU-B-790	(Rev A; Notice 2) Building Paper Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 770	Formaldehyde Standards for Composite Wood Products

UNDERWRITERS LABORATORIES (UL)

UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17	(2015) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5	(2017) Western Lumber Grading Rules

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

[Structural Glued Laminated Members; G[, [_____]]

][Trussed Rafters; G[, [_____]]

][Trussed Joists; G[, [_____]]

][Fabricated Structural Members; G[, [_____]]

] Modifications of Structural Members; G[, [_____]]

Drawings of structural laminated members, fabricated wood trusses, engineered wood joists and rafters, and other fabricated structural members indicating materials, shop fabrication, and field erection details; including methods of fastening.

[Nailers and Nailing Strips; G[, [_____]]

Drawings of field erection details, including materials and methods of fastening nailers in conformance with Factory Mutual wind uplift rated systems specified in other Sections of these specifications.

] SD-03 Product Data

[Salvaged Lumber

][Recovered Lumber

][Underlayment

] Plastic Lumber

Fiberboard Wall Sheathing

Cellulose Honeycomb Panels

Fire-retardant Treatment

Structural-use and OSB Panels

Oriented Strand Board

Adhesives

[Biobased Content for Strawboard Panels; S

][Biobased Content for Cork Underlayment; S

][Recycled Content for Plastic Lumber; S

][Recycled Content for Fiberboard Underlayment; S

][Recycled Content for Cork Underlayment; S

][Recycled Content for Fiberboard Wall Sheathing; S

][Recycled Content for Cellulose Honeycomb Panels; S

] SD-05 Design Data

Modifications of Structural Members; G[, [_____]]

Design analysis and calculations showing design criteria used to accomplish the applicable analysis.

SD-06 Test Reports

Preservative-treated Lumber and Plywood

SD-07 Certificates

[Certificates of Grade

][Certified Sustainably Harvested Virgin Lumber; S

][Certified Sustainably Harvested Natural-decay and Insect-resistant Wood; S

][Certified Sustainably Harvested Framing Lumber; S

][Certified Sustainably Harvested Structural Glued Laminated Timber; S

][Certified Sustainably Harvested Plywood Subflooring; S

][Certified Sustainably Harvested Structural-use and OSB Panel Subfloor Sheathing; S

][Certified Sustainably Harvested Plywood Combination Subfloor Underlayment; S

][Certified Sustainably Harvested Plywood Wall Sheathing; S

][Certified Sustainably Harvested Structural-use and OSB Panel Wall Sheathing; S

][Certified Sustainably Harvested Plywood Roof Sheathing; S

][Certified Sustainably Harvested Plywood Diaphragm; S

][Certified Sustainably Harvested Structural-use and OSB Panel Diaphragm; S

][Certified Sustainably Harvested Plywood Shear Wall; S

][Certified Sustainably Harvested Structural-use and OSB Panel Shear Wall; S

][Certified Sustainably Harvested Plywood for Other Uses; S

][Certified Sustainably Harvested Structural-use and OSB Panels for Other Uses; S

][Certified Sustainably Harvested Plywood Underlayment; S

] Preservative Treatment

[Indoor Air Quality for Particleboard Underlayment; S

][Indoor Air Quality for Fiberboard Underlayment; S

][Indoor Air Quality for Strawboard Panels; S

][Indoor Air Quality for Fiberboard Wall Sheathing; S

][Indoor Air Quality for Aerosol Adhesives; S

][Indoor Air Quality for Non-aerosol Adhesives; S

] SD-10 Operation and Maintenance Data

Plastic

When not labeled, identify types in Operation and Maintenance Manual.

Take-back Program

Include contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling or reuse.

1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover forming a well ventilated enclosure. Store wood I-beams and glue-laminated beams and joists on edge. Adhere to requirements for stacking, lifting, bracing, cutting, notching, and special fastening requirements. [Handle and store laminated timber in accordance with AITC 111 or APA EWS R540.] Do not use materials that have visible moisture or biological growth. Remove defective and damaged materials and provide new materials. Store separated reusable wood waste convenient to cutting station and area of work.

1.4 GRADING AND MARKING

1.4.1 Lumber

Mark each piece of framing and board lumber or each bundle of small pieces of lumber with the grade mark of a recognized association or independent

inspection agency in accordance with JAS no. 1083. Such association or agency must be certified by the Board of Review, American Lumber Standards Committee or Japan Plywood Inspection Corporation (JPIC), to grade the species used. Surfaces that are to be exposed to view must not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

1.4.2 Structural Glued Laminated Timber

Mark each member with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of structural glued laminated timber products. The marking must indicate compliance with ANSI/AITC A190.1 and must include all identification information required by ANSI/AITC A190.1.[Structurally end-jointed lumber must also be certified and grade marked in accordance with ANSI/AITC A190.1.]

1.4.3 Plywood

Mark each sheet with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark must identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with APA L870. Surfaces that are to be exposed to view must not bear grademarks or other types of identifying marks.

1.4.4 Structural-Use and OSB Panels

Mark each panel with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the panel in accordance with JAS no. 0360. The mark must indicate end use, span rating, and exposure durability classification. Oriented Strand Board (OSB), APA F405.

1.4.5 Preservative-Treated Lumber and Plywood

The Contractor is responsible for the quality of treated wood products. Each treated piece must be inspected in accordance with AWPA M2 or JIS K 1570 and permanently marked or branded, by the producer, in accordance with AWPA M6or JIS K 1570. The Contractor must provide Contracting Officer's Representative (COR) with the inspection report of an approved independent inspection agency that offered products comply with applicable AWPA Standards. The appropriate Quality Mark on each piece will be accepted, in lieu of inspection reports, as evidence of compliance with applicable AWPA treatment standards.

1.4.6 Fire-Retardant Treated Lumber

Mark each piece in accordance with AWPA M6 or JIS K 1570 , except pieces that are to be natural or transparent finished. In addition, exterior fire-retardant lumber must be distinguished by a permanent penetrating blue stain. Labels of a nationally recognized independent testing agency will be accepted as evidence of conformance to the fire-retardant requirements of AWPA M6 or JIS K 1570.

1.4.7 Hardboard, Gypsum Board, and Fiberboard

Mark each sheet or bundle to identify the standard under which the material is produced and the producer.

1.4.8 Plastic Lumber

Label plastic products to be incorporated into the project in accordance with ASTM D1972, or provide product data indicating polymeric information in the Operation and Maintenance Manual.

a. Type 1: Polyethylene Terephthalate (PET, PETE).
b. Type 2: High Density Polyethylene (HDPE).
c. Type 3: Vinyl (Polyvinyl Chloride or PVC).
d. Type 4: Low Density Polyethylene (LDPE).
e. Type 5: Polypropylene (PP).
f. Type 6: Polystyrene (PS).
g. Type 7: Other. Use of this code indicates that the package in question. is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

1.5 SIZES AND SURFACING

ALSC PS 20 or JAS no. 1920 for dressed sizes of yard and structural lumber. Lumber must be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes must be within manufacturing tolerances allowed by the standard under which the product is produced. Other measurements are IP or SI standard.

1.6 MOISTURE CONTENT

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products must be as follows at the time of delivery to the job site:

a. Framing lumber and board, 19 percent maximum

b. Timbers 125 mm and thicker, 25 percent maximum

[c. Roof planking, 15 percent maximum

] d. Materials other than lumber; moisture content must be in accordance with standard under which the product is produced

1.7 PRESERVATIVE TREATMENT

Treat wood products with waterborne wood preservatives conforming to AWPA P5 or JIS K 1570 or JIS K 1570. Pressure treatment of wood products must conform to the requirements of AWPA BOOK or JPIC Use Category System Standards U1 and T1. Pressure-treated wood products must not contain arsenic, chromium, or other agents classified as carcinogenic, probably carcinogenic, or possibly carcinogenic to humans (compounds in Groups 1, 2A, or 2B) by the International Agency for Research on Cancer (IARC), Lyon, France. Pressure-treated wood products must not exceed the limits of the U.S. EPA's Toxic Characteristic Leaching Procedure (TCLP), and must not be classified as hazardous waste. Submit certification from treating plant stating chemicals and process used and net amount of preservatives retained are in conformance with specified standards. In accordance with AWPA U1 or JPIC provide non-copper preservative treatment such as EL2, PTI or SBX,DOT for products in direct contact with sheet metal.

a. 4 kg per cubic meter intended for above ground use.

b. 6.4 kg per cubic meter intended for ground contact and fresh water use. 9.6 kg per cubic meter intended for Ammoniacal Copper Quaternary Compound (ACQ)-treated foundations. 12.8 to 16.1 kg per cubic meter intended for ACQ-treated pilings. All wood must be air or kiln dried after treatment. Specific treatments must be verified by the report of an approved independent inspection agency, or the AWPA or JPIC Quality Mark on each piece.[Do not incise surfaces of lumber that will be exposed.] Minimize cutting and avoid breathing sawdust. Brush coat areas that are cut or drilled after treatment with either the same preservative used in the treatment or with a 2 percent copper naphthenate solution.[All lumber and woodwork must be preservative treated.] Plastic lumber must not be preservative treated. The following items must be preservative treated:

(1) Wood framing, woodwork, and plywood up to and including the subflooring at the first-floor level of structures having crawl spaces when the bottoms of such items are 600 mm or less from the earth underneath.

(2) Wood members that are in contact with water.

(3) Exterior wood steps, platforms, and railings; and all wood framing of open, roofed structures.

(4) Wood sills, soles, plates, furring, and sleepers that are less than 600 mm from the ground, furring and nailers that are set into or in contact with concrete or masonry.

(5) Nailers, edge strips, crickets, curbs, and cants for roof decks.

1.7.1 Existing Structures

Use borate, permathrin, or a sodium silicate wood mineralization process to treat wood. Use borate for interior applications only.

1.7.2 New Construction

Use a boron-based preservative conforming to AWPA P18or JIS K 1570, sodium silicate wood mineralization process, or Ammoniacal Copper Quaternary Compound to treat wood. Use boron-based preservatives for above-ground applications only.

1.8 FIRE-RETARDANT TREATMENT

Fire-retardant treated wood must be pressure treated with fire retardants conforming to AWPA P49 or JPIC. Fire retardant treatment of wood products must conform to the requirements of AWPA U1 or JPIC, Commodity Specification H and AWPA T1 or JPIC, Section H. Treatment and performance inspection must be by an independent and qualified testing agency that establishes performance ratings. Each piece or bundle of treated material must bear identification of the testing agency to indicate performance in accordance with such rating. Treated materials to be exposed to rain wetting must be subjected to an accelerated weathering technique in accordance with ASTM D2898 prior to being tested. Such items which will not be inside a building, and such items which will be exposed to heat or high humidity, must receive exterior fire-retardant treatment. [Fire-retardant-treated wood products must be free of halogens, sulfates, ammonium phosphate, and formaldehyde.]Items to be treated include the

following:

a. [_____].

1.9 QUALITY ASSURANCE

1.9.1 Drawing Requirements

For fabricated structural members, trusses, qlu-lam members, indicate materials, details of construction, methods of fastening, and erection details. Include reference to design criteria used and manufacturers design calculations. Submit drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

1.9.2 Data Required

Submit calculations and drawings for all proposed modifications of structural members. Do not proceed with modifications until the submittal has been approved.

1.9.3 Humidity Requirements

Sequence work to minimize use of temporary HVAC to dry out building and control humidity.

1.9.4 Plastic Lumber Performance

Plastic lumber intended for use in exterior applications must have no fading or discoloration and no change in dimensional stability as tested in accordance with ASTM D1435 for a period of [1][3][5][_____] year[s].

1.10 ENVIRONMENTAL REQUIREMENTS

During and immediately after installation of treated wood, engineered wood products, and laminated wood products at interior spaces, provide temporary ventilation.

1.11 CERTIFICATIONS

[1.11.1 Certified Wood Grades

Provide certificates of grade from the grading agency on graded but unmarked lumber or plywood attesting that materials meet the grade requirements specified herein.

][1.11.2 Certified Sustainably Harvested Wood

Provide wood certified as sustainably harvested by FSC STD 01 001[, ATFS STANDARDS, SGEC Document 1, SGEC Document 2, SGEC Document 3, and SGEC Document 4, CSA Z809-08, SFI 2015-2019, or other third party program certified by PEFC ST 2002:2013]. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable wood certification data; identify each certified product on a line item basis. Submit copies of invoices bearing certification numbers.

]1.11.3 Indoor Air Quality Certifications

Submit required indoor air quality certifications in one submittal package.
[1.11.3.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

]
[1.11.3.2 Composite Wood, Wood Structural Panel and Agrifiber Products

For purposes of this specification, composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), strawboard, panel substrates, and door cores. Provide products certified to meet requirements of 40 CFR 770. Provide current product certification documentation from certification body.

]PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Virgin Lumber

Lumber fabricated from old growth timber is not permitted. Avoid companies who buy, sell, or use old growth timber in their operations, when possible.[Provide certified sustainably harvested virgin lumber.]

[2.1.2 Salvaged Lumber

Provide salvaged lumber where specified. Unless otherwise noted, salvaged lumber must be delivered clean, denailed, and free of paint, finish materials, and other contamination. Lumber must meet the other criteria within this section. Provide documentation certifying products are from salvaged lumber sources.

][2.1.3 Recovered Lumber

Use recovered lumber where practical. Unless otherwise noted, recovered lumber must be delivered clean and free of contamination. Provide grading certificates for any recovered wood materials used in structural applications. Lumber must meet the other criteria within this section. Provide documentation certifying products are from recovered lumber sources.

]2.1.4 Natural Decay- and Insect-Resistant Wood

[Naturally durable wood must be certified sustainably harvested natural-decay and insect-resistant wood.]An occasional piece with corner sapwood is permitted if 90 percent or more of the width of each side on which the sapwood occurs is heartwood.[The primary species to use on this project is [redwood], [_____].]

[2.1.5 Plastic Lumber

HDPE lumber must contain a minimum of 90 percent total recycled content. Mixed plastics and cellulose lumber must contain a minimum of 100 percent total recovered materials content, with a minimum of 50 percent post-consumer recycled content. HDPE/fiberglass lumber must contain a minimum of 95 percent total recovered materials content with a minimum of 75 percent post-consumer recycled content. Other mixed resin lumber must contain a minimum of 95 percent total recovered materials content with a minimum of 50 percent post-consumer recycled content. Provide data identifying percentage of recycled content for plastic lumber.

2.1.5.1 Shear Parallel to Length

Maximum 1,550 K/m2 in accordance with ASTM D2344/D2344M.

2.1.5.2 Density

ASTM D6111.

2.1.5.3 Compressive Strength

a. Secant Modulus: Minimum 108,511 K/m2 in accordance with ASTM D6108.

b. Stress at 3 percent strain: Minimum 2,325 K/m2 in accordance with ASTM D6108.

c. Compression Parallel to Grain: Minimum 4,650 K/m2 in accordance with ASTM D6112.

d. Compression Perpendicular to Grain: Minimum 1,550 K/m2 in accordance with ASTM D6112.

2.1.5.4 Flexural Strength

Minimum 3,100 K/m2 in accordance with ASTM D6109.

2.1.5.5 Tensile Strength

Minimum 1,938 K/m2 in accordance with ASTM D198.

2.1.5.6 Coefficient of Thermal Expansion

Maximum 0.000044 mm/mm/degree C in accordance with ASTM D696.

2.1.5.7 Screw Withdrawal

0.35 K in accordance with ASTM D6117.

2.1.5.8 Nail Withdrawal

0.15 K in accordance with ASTM D6117.

]2.2 LUMBER

2.2.1 Structural Lumber

[Except where a specific grade is indicated or specified,] Any of the species and grades listed in AWC NDS that have allowable unit stresses in

kPa not less than [[_____] Fb, [_____] Ft, [_____] Fc, with [_____] E] [allowable unit stresses indicated]. Use for joists, rafters, headers, trusses, beams (except collar beams), columns, posts, stair stringers, girders, and all other members indicated to be stress rated.[Structural lumber exposed to view in [_____] must be appearance grade [of [_____] species][of any species] meeting the allowable unit stresses [specified][indicated].] Design of members and fastenings must conform to AITC TCM. Other stress graded or dimensioned items such as blocking, carriages, and studs must be standard or No. 2 grade except that studs may be Stud grade.

2.2.2 Framing Lumber

Framing lumber such as studs, plates, caps, collar beams, cant strips, bucks, sleepers, nailing strips, and nailers and board lumber such as subflooring and wall and roof sheathing must be one of the species listed in the table below. Minimum grade of species must be as listed. [Finger-jointed lumber may be used in the same applications as solid lumber of an equivalent species and grade, provided the finger-jointed lumber meets all the requirements of the certification and the quality control programs of the rules writing agency having jurisdiction and all applicable requirements of DOC/NIST PS56.][Provide certified sustainably harvested framing lumber.]

Table of Grades for Framing and Board Lumber			
Grading Rules	Species	Framing	Board Lumber
WWPA G-5 standard grading rules	Aspen, Douglas Fir-Larch, Douglas Fir South, Engelmann Spruce-Lodgepole Pine, Engelmann Spruce, Hem-Fir, Idaho White Pine, Lodgepole Pine, Mountain Hemlock, Mountain Hemlock-Hem-Fir, Ponderosa Pine-Sugar Pine, Ponderosa Pine-Lodgepole Pine, Subalpine Fir, White Woods, Western Woods, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	All Species: No. 3 Common
WCLIB 17 standard grading rules	Douglas Fir-Larch, Hem-Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	All Species: Standard

Table of Grades for Framing and Board Lumber

Grading Rules	Species	Framing	Board Lumber
SPIB 1003 standard grading rules	Southern Pine	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	No. 2 Boards
SCMA Spec standard specifications	Cypress	No. 2 Common	No. 2 Common
NELMA Grading Rules standard grading rules	Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine-Cedar	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	All Species: No. 3 Common except Standard for Eastern White and Northern Pine
RIS Grade Use standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 3 m and shorter)	Construction Heart

Table of Grades for Framing and Board Lumber			
Grading Rules	Species	Framing	Board Lumber
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

2.2.3 Structural Glued Laminated Timber

ANSI/AITC A190.1, allowable working stress values for loads of normal duration in kPa not less than the following:

Bending Members, [_____] Fb, [_____] Fv, [_____] E.
Compression Members, [_____] Fc, [_____] E.
Tension Members, [_____] Ft, [_____] E.

Fabricated with wet-use adhesives. Beams must use [glue-laminated][and] [laminated-strand][laminated-veneer] lumber. Posts and studs must use laminated-strand lumber. Joists must use laminated-veneer lumber. Members must be [Industrial] [Architectural] [Premium] Appearance Grade, sealed with a penetrating sealer, and [individually wrapped] [bundle wrapped] as standard with the manufacturer and approved. Members must be complete with hardware for joining laminated members and for their connection to other construction.[Provide certified sustainably harvested structural glued laminated timber.][When located on the interior of buildings, provide products with no added urea-formaldehyde resins.]

2.3 PLYWOOD, STRUCTURAL-USE, AND ORIENTED STRAND BOARD (OSB) PANELS

APA L870, APA S350, APA E445, and APA F405 respectively.

2.3.1 Subflooring

2.3.1.1 Plywood

C-D Grade, Exposure 1 durability classification, Span rating of [24/16] [48/24] or greater.[Provide certified sustainably harvested plywood subflooring.]

2.3.1.2 Structural-Use and OSB Panels

Sheathing grade with durability equivalent to Exposure 1, Span Rating of [32/16] [48/24] or greater. OSB, APA E445, Rated Sturd-I-Floor.[Provide certified sustainably harvested structural-use and OSB panel subfloor sheathing.]

2.3.2 Combination Subfloor-Underlayment

2.3.2.1 Plywood

[Underlayment Grade, Exposure 1][, or][Exterior Type, C-C (Plugged) Grade].[Provide certified sustainably harvested plywood combination subfloor underlayment.] Minimum thickness must be as listed below [except where indicated to have greater thickness].

Support Spacing	Underlayment Minimum Thickness
400 mm	12.7 mm for Group 1 species
	15 mm for Group 2 and 3 species
	18 mm for Group 4 species
600 mm	18 mm for Group 1 species
	22 mm for Group 2 and 3 species
	25 mm for Group 4 species

2.3.2.2 Structural-Use Panel

Combination subfloor-underlayment grade with durability equivalent to [Interior plywood with Exterior glue (Exposure 1)] [Exterior plywood], Span Rating of [16] [20] [24] [48] or greater.

2.3.3 Wall Sheathing

2.3.3.1 Plywood

C-D Grade, Exposure 1, and a minimum thickness of [9.5] [12.7] mm[, except where indicated to have greater thickness].[Provide certified sustainably harvested plywood wall sheathing.][Provide exterior grade material with phenol resin for interior and exterior applications.]

2.3.3.2 Structural-Use and OSB Panels

Sheathing grade with durability equivalent to Exposure 1, Span Rating of [16/0] [24/0] or greater. OSB, APA Rated Sheathing. OSB must be a phenolic-glued board.[Provide certified sustainably harvested structural-use and OSB panel wall sheathing.]

2.3.4 Roof Sheathing

2.3.4.1 Plywood

C-D Grade, Exposure 1, with an Identification Index of not less than [24/0] [_____].[Provide certified sustainably harvested plywood roof sheathing.] Provide exterior grade material with phenol resin for all applications.

2.3.4.2 Structural-Use Panel

Sheathing grade with durability equivalent to Exposure 1, Span Rating of [24/0] [_____] or greater.

2.3.5 Diaphragms

2.3.5.1 Plywood

[Structural I][Structural II], [C-C][C-D] grade, Exposure 1, and a minimum thickness of [_____] mm.[Provide certified sustainably harvested plywood diaphragm.]

2.3.5.2 Structural-Use and OSB Panels

Sheathing grade with durability equivalent to Exposure 1 and a minimum thickness of [_____] mm.[Provide certified sustainably harvested structural-use and OSB panel diaphragm.]

2.3.6 Shear Walls

2.3.6.1 Plywood

[Structural I] [Structural II], [C-C] [C-D] [_____] Grade and a minimum thickness of [_____] mm.[Provide certified sustainably harvested plywood shear wall.]

2.3.6.2 Structural-Use and OSB Panels

Sheathing grade with durability equivalent to Interior plywood with Exterior glue (Exposure 1) and a minimum thickness of [_____] mm.[Provide certified sustainably harvested structural-use and OSB panel shear wall.]

2.3.7 Other Uses

2.3.7.1 Plywood

Plywood for [_____]. C-D Grade, Exposure 1.[Provide certified sustainably harvested plywood for other uses.]

2.3.7.2 Structural-Use and OSB Panels

Structural-use and OSB panels for [_____]. Sheathing grade with durability equivalent to Exposure 1 and a minimum thickness of [_____] mm.[Provide certified sustainably harvested structural-use and OSB panels for other uses.]

2.4 UNDERLAYMENT

Underlayment must conform to one of the following:

2.4.1 Hardboard

AHA A135.4 service class, sanded one side, 6 mm thick, 1200 mm wide.

[2.4.2 Particleboard

CPA A208.1, Grade 1-M-1, 6 mm thick, 1200 by 1200 mm. Compressed [straw]

fibers with [phenol formaldehyde][polymeric methylene diisocyanate (PMDI)] resin binder.[Products must contain no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of indoor air quality for particleboard underlayment.]

]2.4.3 Plywood

Plywood must conform to APA L870, underlayment grade with exterior glue, or C-C (Plugged) exterior grade 9 mm thick, 1200 mm wide.[Provide certified sustainably harvested plywood underlayment.]

2.4.4 Oriented Strand Board

OSB underlayment grade 6 mm.

2.4.5 Fiberboard

Use [structural fiberboard, minimum 80 percent recycled newspaper.] [gypsum fiberboard, minimum 15 percent post-consumer newspaper.][Provide data identifying percentage of recycled content for fiberboard underlayment.][agrifibe particleboard.][particleboard or MDF.][Products must contain no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of indoor air quality for fiberboard underlayment.]

[2.4.6 Strawboard Panels

Minimum 70 percent agricultural waste straw with no added formaldehyde binders. Submit data identifying percentage of biobased content for strawboard panels.[Products must contain no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of indoor air quality for strawboard panels.]

][2.4.7 Cork

Minimum 85 percent total recycled content. Provide data identifying percentage of recycled content for cork underlayment.[Minimum 85 percent biobased content. Provide data identifying percentage of biobased content for cork underlayment.]

]2.5 OTHER MATERIALS

2.5.1 Hardboard Underlayment

DOC/NIST PS58, service class, sanded on one side, 6 mm thick 1200 mm wide.

[2.5.2 Fiberboard Wall Sheathing

ASTM C208, 600 mm wide by [13 mm thick for supports 400 mm (o.c.)] [20 mm thick for supports 600 mm o.c.] or 1200 mm wide by [13 mm thick for supports 400 mm o.c.] [20 mm thick for supports 600 mm o.c.], except only 1200 mm wide by 13 mm thick sheathing over supports at 400 mm o.c. may be applied without corner bracing of framing.. Sheathing must be asphalt impregnated or asphalt coated to render the sheathing water resistant but vapor permeable. Structural fiberboard must contain a minimum of 80 percent recycled content. Non-structural fiberboard must contain a minimum of [100][_____] percent post-consumer recycled content. Provide

data identifying percentage of recycled content for fiberboard wall sheathing.[Products must contain no added urea-formaldehyde resins. For products located on the interior of the building (inside of the weatherproofing system), provide certification of indoor air quality for fiberboard wall sheathing.]

]2.5.3 Gypsum Wall Sheathing

ASTM C1396/C1396M, 12.7 mm thick [fire retardant (Type X) 16 mm thick]; 1200 mm wide with square edge [for supports 400 mm o.c. with or without corner bracing of framing] [or] [for supports 600 mm o.c. with corner bracing of framing]; 600 mm wide with V-tongue and groove (T&G) edge for supports [400] [or] [600] mm o.c. with corner bracing of framing.

2.5.4 Foil-Faced Insulative Sheathing

Wood fiber core, chemically treated for water resistance, with aluminum foil laminated under pressure to both sides with water-resistant adhesive; 1200 mm wide; 2 mm thick when used with corner bracing, 2.9 mm thick with studs up to 400 mm o.c. without corner bracing, or 3.5 mm thick with studs up to 600 mm o.c. without corner bracing. The sheathing and installation must have been accepted by ICC as conforming to ICC IBC. The sheathing alone must have a thermal resistance value (R value) of not less than 0.20.

2.5.5 Cellulose Honeycomb Panels

ASTM C208. Panels must be made of [kraft paper] [fire retardant paper] [and must be impregnated with phenolic resins for moisture resistance].[Panels must contain a minimum of [100][_____] percent post-consumer recycled content. Provide data identifying percentage of recycled content for cellulose honeycomb panels.]

2.5.6 Building Paper

FS UU-B-790, Type I, Grade D, Style 1.

2.5.7 Trussed Rafters

Metal plate connected trusses designed in accordance with TPI 1 and TPI HIB and fabricated in accordance with TPI 1.

2.5.8 Trussed Joists

Metal plate connected parallel chord wood trusses designed and fabricated in accordance with TPI 1.

2.5.9 Roof Decking

[Roof decking must be [commercial][select] grade with minimum design value of [0.9] [7.6] MPa in bending. Decking must be [50 mm thick with single tongue and groove][100 mm thick with double tongue and groove]; V-jointed, matched and dressed. As an option, fabricated laminated lumber decking with interlocking tongue and groove joints may be provided.

]2.5.10 Miscellaneous Wood Members

2.5.10.1 Nonstress Graded Members

Members must include bridging, corner bracing, furring, grounds, and

nailing strips. Members must be in accordance with TABLE I for the species used. Sizes must be as follows unless otherwise shown:

Member	Size mm
Bridging	25 x 75 or 25 x 100 for use between members 50 x 300 and smaller; 50 x 100 for use between members larger than 50 x 300.
Corner bracing	25 x 100.
Furring	25 x [50] [75]
Grounds	Plaster thickness by 38.
Nailing strips	25 x 75 or 25 x 100 when used as shingle base or interior finish, otherwise 50 mm stock.

2.5.10.2 Wood Bumpers

AREMA Eng Man, Industrial grade cross ties

2.5.10.3 Sill Plates

Sill plates must be standard or number 2 grade.

2.5.10.4 Blocking

Blocking must be standard or number 2 grade.

2.5.10.5 Rough Bucks and Frames

Rough bucks and frames must be straight standard or number 2 grade.

2.5.11 Adhesives

Comply with applicable regulations regarding toxic and hazardous materials and as specified.[Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of GS-36. Provide certification or validation of indoor air quality for non-aerosol adhesives applied on the interior of the building (inside of the weatherproofing system). Provide certification or validation of indoor air quality for aerosol adhesives used on the interior of the building (inside of the weatherproofing system).]

2.6 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware must be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials must be as

recommended by the product manufacturer unless otherwise indicated or specified. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs must be hot-dip zinc-coated in accordance with ASTM A153/A153M.[Nails and fastenings for fire-retardant treated lumber and woodwork exposed to the weather must be copper alloy or hot-dipped galvanized fasteners as recommended by the treated wood manufacturer.]

2.6.1 Bolts, Nuts, Studs, and Rivets

ASME B18.2.1, ASME B18.5.2.1M, ASME B18.5.2.2M and ASME B18.2.2.

2.6.2 Anchor Bolts

ASTM A307, size as indicated, complete with nuts and washers.

2.6.3 Expansion Shields

CID A-A-1923, CID A-A-1924, and CID A-A-1925. Except as shown otherwise, maximum size of devices must be 10 mm.

2.6.4 Lag Screws and Lag Bolts

ASME B18.2.1.

2.6.5 Wood Screws

ASME B18.6.1.

2.6.6 Nails [and Staples]

ASTM F547, size and type best suited for purpose[; staples must be as recommended by the manufacturer of the materials to be joined]. For sheathing and subflooring, length of nails must be sufficient to extend 25 mm into supports. In general, 8-penny or larger nails must be used for nailing through 25 mm thick lumber and for toe nailing 50 mm thick lumber; 16-penny or larger nails must be used for nailing through 50 mm thick lumber. Nails used with treated lumber and sheathing must be hot-dipped galvanized in accordance with ASTM A153/A153M. Nailing must be in accordance with the recommended nailing schedule contained in AWC WFCM. Where detailed nailing requirements are not specified, nail size and spacing must be sufficient to develop an adequate strength for the connection. The connection's strength must be verified against the nail capacity tables in AWC NDS. Reasonable judgment backed by experience must ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector must be used.

2.6.7 Wire Nails

ASTM F1667/F1667M.

2.6.8 Timber Connectors

Unless otherwise specified, timber connectors must be in accordance with TPI 1, APA EWS T300 or AITC TCM.

2.6.9 Clip Angles

Steel, 5 mm thick, size [as indicated][best suited for intended use]; or zinc-coated steel or iron commercial clips designed for connecting wood members.

2.6.10 Joist Hangers

Steel or iron, zinc coated, sized to fit the supported member, of sufficient strength to develop the full strength of the supported member in accordance with ICC IBC, and furnished complete with any special nails required.

2.6.11 Tie Straps

For joists supported by the lower flange of steel beams, provide 3 by 40 mm steel strap, 600 mm long [, except as indicated otherwise].

2.6.12 Joist Anchors

For joists supported by masonry walls, provide anchors 5 by 40 mm steel tee or strap, bent and of length to provide 100 mm embedment into wall and 300 mm along joist [except as indicated otherwise]. For joists parallel to masonry or concrete walls, provide anchors 6 by 30 mm minimum cross-sectional area, steel strap, length as necessary to extend over top of first three joists and into wall [100] [200] mm, and with wall end of bend or pin type [, except as indicated otherwise].

2.6.13 Door Buck Anchors

Metal anchors, 3 by 30 mm steel, 300 mm long, with ends bent 50 mm [, except as indicated otherwise]. Anchors must be screwed to the backs of bucks and built into masonry or concrete. Locate 200 mm above sills and below heads and not more than 600 mm intermediately between.[Anchorage of bucks to steel framing must be [as indicated][as necessary to suit the conditions].]

2.6.14 Metal Bridging

[Where not indicated or specified otherwise,] No. 16 U.S. Standard gage, cadmium-plated or zinc-coated.

2.6.15 Toothed Rings and Shear Plates

AWC NDS.

2.6.16 Beam Anchors

Steel U-shaped strap anchors 6 mm thick by 40 mm wide [, except as indicated otherwise].

2.6.17 Metal Framing Anchors

Construct anchors to the configuration shown using hot dip zinc-coated steel conforming to ASTM A653/A653M, Z275.[Except where otherwise shown,] Steel must be not lighter than 18 gage. Special nails supplied by the manufacturer must be used for all nailing.

2.6.18 Panel Edge Clips

Extruded aluminum or galvanized steel, H-shaped clips to prevent differential deflection of roof sheathing.

2.7 AIR INFILTRATION BARRIER

Air infiltration barrier must be building paper meeting the requirements of ASTM C1136, Type IV, style optional or a tear and puncture resistant olefin building wrap (polyethylene or polypropylene) with a moisture vapor transmission rate of [125] [_____] g per square meter per 24 hours in accordance with ASTM E96/E96M, Desiccant Method at [23] [_____] degrees C or with a moisture vapor transmission rate of [670] [_____] g per square meter per 24 hours in accordance with ASTM E96/E96M, Water Method at [23] [_____] degrees C.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Conform to AWC WFCM and install in accordance with the National Association of Home Builders (NAHB) Advanced Framing Techniques: Optimum Value Engineering, unless otherwise indicated or specified. Select lumber sizes to minimize waste. Fit framing lumber and other rough carpentry, set accurately to the required lines and levels, and secure in place in a rigid manner. Space plastic lumber boards as necessary to allow for lengthwise expansion and contraction. Do not splice framing members between bearing points. Set joists, rafters, and purlins with their crown edge up. Frame members for the passage of pipes, conduits, and ducts. Provide adequate support as appropriate to the application, climate, and modulus of elasticity of the product. Do not cut or bore structural members for the passage of ducts or pipes without approval. Reinforce all members damaged by such cutting or boring by means of specially formed and approved sheet metal or bar steel shapes, or remove and provide new, as approved. Provide as necessary for the proper completion of the work all framing members not indicated or specified. Spiking and nailing not indicated or specified otherwise must be in accordance with the Nailing Schedule contained in ICC IBC; perform bolting in an approved manner. Spikes, nails, and bolts must be drawn up tight. Install plastic lumber with screws or bolts; if nails are used, use ring shank or spiral shank nails. [Timber connections and fastenings must conform to AWC NDS.][Provide 50 mm minimum clearance between chimneys and wood framing; provide 100 mm minimum clearance at fireplaces. Fill the spaces with strips of approved noncombustible material.] Use slate or steel shims when leveling joists, beams, and girders on masonry or concrete. Do not use shimming on wood or metal bearings. When joists, beams, and girders are placed on masonry or concrete, a wood base plate must be positioned and leveled with grout. The joist, beam, or girder must then be placed on the plate. When joists, beams, and girders are set into masonry or concrete, a pocket must be formed into the wall. The joist, beam, or girder must then be placed into the pocket and leveled with a steel shim.

3.1.1 Sills

Set sills level and square and wedge with steel or slate shims; point or grout with non-shrinking cement mortar to provide continuous and solid

bearing. Anchor sills to the foundations as indicated.[Where sizes and spacing of anchor bolts are not indicated, provide not less than 16 mm diameter bolts at all corners and splices and space at a maximum of 1800 mm o.c. between corner bolts. Provide at least two bolts for each sill member. Lap and splice sills at corners and bolt through the laps or butt the ends and through-bolt not more than 150 mm from the ends.] Provide bolts with plate washers and nuts. Bolts in exterior walls must be zinc-coated.

3.1.1.1 Anchors in Masonry

[Except where indicated otherwise,] Embed anchor bolts not less than 400 mm in masonry unit walls and provide each with a nut and a 50 mm diameter washer at bottom end. Fully grout bolts with mortar.

3.1.1.2 Anchors in Concrete

[Except where indicated otherwise,] Embed anchor bolts not less than 200 mm in poured concrete walls and provide each with a nut and a 50 mm diameter washer at bottom end. A bent end may be substituted for the nut and washer; bend must be not less than 90 degrees. Powder-actuated fasteners spaced 900 mm o.c. may be provided in lieu of bolts for single thickness plates on concrete.

3.1.2 Beams and Girders

Set beams and girders level and in alignment and anchor to bearing walls, piers, or supports with U-shaped steel strap anchors. Embed anchors in concrete or masonry at each bearing and through-bolt to the beams or girders with not less than two bolts. Provide bolts not less than 12 mm in diameter and with plate washers under heads and nuts. Install beams and girders [not indicated otherwise] with 200 mm minimum end bearing on walls or supports. Install beams and girders into walls with [12 mm clearance at the top, end, and sides] [or] [standard steel wall-bearing boxes]. Provide joints and splices over bearings only and bolt or spike together.

3.1.3 Roof Framing or Rafters

Tops of supports or rafters must form a true plane. Valley, ridge, and hip members must be of depth equal to cut on rafters where practicable, but in no case less than depth of rafters and nominally 50 mm thick. Rafters must [be notched and] have full and solid bearing on plates. Valleys, hips, and ridges must be straight and true intersections of roof planes. Necessary crickets and watersheds must be formed. Rafters, except hip and valley rafters, must be [spiked to wall plate and to ceiling joists with no less than three 8-penny nails] [bolted by angles]. Rafters must be toe-nailed to ridge, valley, or hip members with at least three 8-penny nails. Rafters must be braced to prevent movement until permanent bracing, decking or sheathing is installed. Hip and valley rafters must be secured to wall plates by clip angles. Openings in roof must be framed with headers and trimmers. Unless otherwise indicated, headers carrying more than two rafters and trimmers supporting headers carrying more than one rafter must be double. Hip rafters longer than the available lumber must be butt jointed and scabbed. Valley rafters longer than the available lumber must be double, with pieces lapped not less than 1200 mm and well spiked together. Install trussed rafters in accordance with TPI HIB. Install engineered wood joists in accordance with distributor's instructions.

3.1.4 Joists

Provide joists of the sizes and spacing indicated, accurately and in alignment, and of uniform width. Joists must have full bearing on sills, [plates,] [beams,] [girders,] [and] [trusses]; provide laps over bearing only and spike. Where joists are of insufficient length to produce a 300 mm lap, butt joists over bearing and provide wood scabs 2 nominal inches thick by depth of joists by 600 mm long or metal straps 6 by 40 mm by not less than 450 mm long nailed to each joist with not less than four 10-penny nails, or approved sheet metal connectors installed in accordance with the manufacturer's recommendations. Provide joists built into masonry with [a beveled fire cut so that the top of the joist does not enter the wall more than 25 mm] [or] [standard steel wall bearing boxes]. Provide metal hangers for joists framing into the side of headers, beams, or girders.[When a portion of the joist extends above the top flange of a steel beam or girder, provide a 10 mm space between the top flange and the extended portion of the joists to allow for shrinkage of joists.] The minimum joist end bearing must be 100 mm, and joists built into concrete or masonry must have a 12 mm minimum clearance at the top, end, and sides. For joists approved to be bored for the passage of pipes or conduits, bore through the neutral axis of the joist.[Provide steel joist hangers of proper size and type to receive the ends of all framed joists.]

[3.1.4.1 Floor (Ceiling) Framing

Except where otherwise indicated joists must have bearings not less than 100 mm on concrete or masonry and 40 mm on wood or metal. Joists, trimmers, headers, and beams framing into carrying members at the same relative levels must be carried on joist hangers. Joists must be lapped and spiked together at bearings or butted end-to-end with scab ties at joint and spiked to plates. Openings in floors must be framed with headers and trimmers. Headers carrying more than two tail joists and trimmers supporting headers carrying more than one tail joist must be doubled, unless otherwise indicated. Joists built into masonry must be provided with [a beveled fire cut so that the top of the joist does not enter the wall more than 25 mm] [or] [standard steel wall bearing boxes]. Install engineered wood joists in accordance with distributor's instructions.

]3.1.4.2 Doubled Joists

Provide under bearing walls and partitions running parallel with the floor joists[, around [stairways,] [chimneys,] [fireplaces,]] and at other openings where joists are cut and framed. Double, space for clearance, block apart 1200 mm on center, rigidly frame, and spike together joists under partitions that are to receive ducts, pipes, and conduits.

3.1.4.3 Tie Straps

For joists supported by the lower flange of steel beams, provide straps at every fourth joist and the corresponding fourth joist on the opposite side. Tie joists across the top of the steel beam with a steel strap. Form straps to lie flat across the top of the beam and twist at the ends to provide flat contact with the side of each joist. Nail each strap at each end with three 10-penny nails spaced 50 mm o.c.

3.1.4.4 Joist Anchors

Provide anchors for each fourth joist supported by a masonry wall. Build wall end of anchors into the wall. Nail anchor to the joist with three 10-penny nails spaced 50 mm o.c. Anchor the first three joists parallel to concrete or masonry walls at bridging points, but not less than 2400 mm o.c. from end walls. Let anchors into the tops of each joist and spike to the top of joist with one 10-penny nail. Extend anchors at least [100] [200] mm into the wall.

3.1.5 Bridging

Provide bridging for floor and ceiling joists and for roof rafters having slopes of less than 1/3. Locate bridging as indicated and as specified herein. Provide bridging for spans greater than 1800 mm, but do not exceed 2400 mm maximum spacing between rows of bridging. Install rows of bridging uniformly. Provide metal or wood cross-bridging, except where solid bridging is indicated. Do not nail the bottom end of cross-bridging until the subfloor has been laid.

3.1.5.1 Wood Cross-Bridging

Provide wood cross-bridging not less than [1 by 3] [2 by 3] [2 by 4] nominal size. Nail wood cross-bridging at each end with [two 8-penny nails for one by thick material] [and] [three 8-penny nails for 2 by thick material.]

3.1.5.2 Metal Cross-Bridging

Must be the manufacturer's standard product, not less than 16 gage before forming and coating. Metal bridging must be the compression type, lodged into or nailed to the wide faces of opposite joists at points diagonally across from each other near the bottoms and tops of joists.

3.1.6 Subflooring

3.1.6.1 Plywood, Structural-Use, and OSB Panels

Apply best side up with the grain of outer plies or the long dimension at right angles to joists. Stagger end joints and locate over the centerline of joists.[Support panel edges by nominal 2 by 4 members framed between joists so the edge joints of subfloor occur over the centerline of blocking.] Allow 3 mm spacing at panel ends and 6 mm at panel edges. Panels must be continuous over two or more spans. Nail panels 150 mm o.c. at supported edges and 250 mm o.c. over intermediate bearing. Nails must be 8-penny common or 6-penny threaded. Provide at least 12 mm clearance between subflooring and masonry or concrete walls. Subflooring may be installed with adhesive conforming to ASTM D3498 and nails spaced at 300 mm on center unless otherwise shown.

3.1.6.2 Combination Subfloor-Underlayment

Apply with the grain of the face plies or the long dimension at right angles to joists. Panels ust be continuous over two or more spans. Stagger end joints of adjacent panels. Panel edges must be T&G or supported by 2 by 4 members framed between joists so the edge joints of subfloor-underlayment occur over the centerline of blocking. Provide end joints of panels over the centerline of joists. Allow 3 mm spacing between panel edge and end joints. Nail panels 150 mm o.c. at ends and

edges and 250 mm o.c. along intermediate bearings unless they are glue-nailed in accordance with APA E30. Nails must be 8-penny coated common or 6-penny threaded. Provide at least 12 mm clearance between subfloor-underlayment and masonry or concrete walls.[Lightly sand all joints to receive [resilient flooring][_____].]

3.1.6.3 Wood

Subflooring must be applied diagonally with end joints made over supports. Each board must bear on at least three supports and must be nailed at each support using two nails for boards 150 mm and less in width and three nails for boards more than 150 mm in width.

3.1.6.4 Depressed Subfloors

Provide depressed subfloors to receive [ceramic] [and] [quarry] tile floors. Nail cleats or ledgers of one by four material to the sides of joists to support the flooring material. Place the cleats at a depth below the top of the joists sufficient to allow the installation of the subflooring below the tops of joists. Snugly fit subflooring as specified herein between joists.

3.1.7 Underlayment

Install underlayment over subfloor just prior to laying of [resilient flooring] [_____] and protect from water and physical damage. Stagger end joints of underlayment with respect to each other, and stagger all joints with respect to paralleling panel joints in subfloor. Space panels 2 mm apart at ends and 3 mm apart at edges and at least 12 mm from concrete or masonry walls. Nail panels 150 mm o.c. along edges and 150 mm o.c. each way throughout panel, but not closer than 10 mm to panel edges. Nails must be 4-penny annular ring or screw type and must be countersunk 2 mm.[Lightly sand all joints to receive [resilient flooring][_____].]

3.1.8 Columns and Posts

Set columns and posts, plumb, in alignment, and with full and uniform bearing. Do not embed the bottom and bearing surfaces of [posts] [columns] in concrete or set in direct contact with concrete slabs on grade. [Provide post and beam construction with [wood bolsters] [steel post caps] in such a manner that the post above will tier directly over the one below; fabricate the assembly in a rigid and substantial manner using bolts or lag screws.]

3.1.9 Wall Framing

3.1.9.1 Studs

Select studs for straightness and set plumb, true, and in alignment. In walls and partitions more than 2400 mm tall, provide horizontal bridging at not more than 2400 mm o.c. using nominal 50 mm material of the same width as the studs; install the bridging flat. Sizes and spacing of studs must be [_____] [as indicated]. Double studs at jambs and heads of openings and triple at corners to form corner posts. Frame corner posts to receive sheathing, lath, and interior finish. Truss over openings exceeding 1200 mm in width or use a header of sufficient depth. Toe-nail studs to sills or sole plates with four 8-penny nails or fasten with metal nailing clips or connectors. Anchor studs abutting concrete or masonry walls thereto near the top and bottom and at midheight of each story using

expansion bolts or powder-actuated drive studs.

3.1.9.2 Plates

Use plates for walls and partitions of the same width as the studs to form continuous horizontal ties. Splice single plates; stagger the ends of double plates. Double top plates in walls and bearing partitions, built up of two nominal 50 mm thick members. Top plates for nonbearing partitions must be single or double plates of the same size as the studs. Nail lower members of double top plates and single top plates to each stud and corner post with two 16-penny nails. Nail the upper members of double plates to the lower members with 10-penny nails, two near each end, and stagger 400 mm o.c. intermediately between. Nail sole plates on wood construction through the subfloor to each joist and header; stagger nails. Anchor sole plates on concrete with expansion bolts, one near each end and at not more than 1800 mm o.c., or with powder-actuated fasteners, one near each end and at not more than 900 mm o.c. Provide plates cut for the passage of pipes or ducts with a steel angle as a tie for the plate and bearing for joist.

3.1.9.3 Firestops

Provide firestops for wood framed walls and partitions and for furred spaces of concrete or masonry walls at each floor level and at the ceiling line in the top story. Where firestops are not automatically provided by the framing system used, they must be formed of closely fitted wood blocks of nominal 50 mm thick material of the same width as the [studs] [and] [joists].[Lightweight concrete units may be used at the first-floor level to serve jointly as firestopping and ratproofing.]

3.1.9.4 Diagonal Bracing

Provide diagonal bracing at all external corners and internal angles and at maximum 12000 mm centers in stud walls, except that bracing may be omitted where diagonally applied wood sheathing, plywood or structural-use panel sheathing, 1200 by 2400 mm fiberboard sheathing, or gypsum board sheathing is used. Bracing must be of 1 by 6 material, let into the exterior face of studs. Extend bracing from top plates to sill at an angle of approximately 45 degrees and double nail at each stud. When openings occur near corners, provide diagonal knee braces extending from the corner post above headers to top plates and from below window sills to the main sill. Nail bracing at each bearing with two 8-penny nails.

3.1.10 Wall Sheathing

3.1.10.1 Plywood, Structural-Use, and OSB Panel Wall Sheathing

Apply horizontally or vertically. Extend sheathing over and nail to sill and top plate. Abut sheathing edges over centerlines of supports. Allow 3 mm spacing between panels and 3 mm at windows and doors. If sheathing is applied horizontally, stagger vertical end joints. Nail panels with 6-penny nails spaced 150 mm o.c. along edges of the panel and 300 mm o.c. over intermediate supports. Keep nails 10 mm away from panel ledges. Provide 2 by 4 blocking for horizontal edges not otherwise supported.

3.1.10.2 Fiberboard Wall Sheathing

Apply fiberboard wall sheathing allowing a 3 mm joint at edges to permit expansion, except at frames and openings where sheathing must be fitted

snugly. Pre-expand sheathing before application, allowing sheathing to condition for humidity as recommended by the sheathing manufacturer. Provide 2 by 4 blocking for horizontal edges not otherwise supported.

a. Fiberboard wall sheathing used with diagonal-braced framing must be either 600 or 1200 mm wide. Sheathing 600 mm wide must have T&G or shiplapped edges and must be applied horizontally with vertical joints staggered. Apply sheathing with tongued edge up and nail at edges and intermediate bearings with 45 mm long, zinc-coated steel roofing nails spaced on maximum 115 mm centers. Apply sheathing 1200 mm wide either horizontally or vertically. Nail sheathing with 45 mm long, zinc-coated steel roofing nails spaced 100 mm maximum o.c. at edges and 200 mm maximum o.c. at intermediate bearings.

b. Fiberboard wall sheathing used with unbraced framing must be 1200 mm wide. Apply sheathing vertically. Extend sheathing over and nail to sill and top plates. Locate joints over centerlines of supports. Nail sheathing with 40 mm long, zinc-coated steel roofing nails with 9.5 mm diameter heads. Space nails 75 mm o.c. at edges and ends and 150 mm o.c. at intermediate bearings.

3.1.10.3 Gypsum Sheathing Board

Apply gypsum sheathing board either horizontally or vertically. Butt joints and locate over the centerlines of supports. Horizontally applied sheathing must be T&G, applied with tongued edge up. Stagger vertical joints and abut sheet closely to frames of openings. Nail sheathing with 11 gage, 9.5 mm head, zinc-coated nails 40 mm long for 12.7 mm sheathing and 45 mm long for 16 mm sheathing, spaced 10 mm minimum from edges. Provide 2 by 4 blocking for horizontal edges of 1200 mm wide panels not otherwise supported.

a. Gypsum Sheathing Board Used with Diagonal-Braced Framing: Sheathing must be either 600 or 1200 mm wide. Apply sheathing 600 mm wide horizontally. Nail 100 mm maximum o.c. at edges and over intermediate bearings. Apply sheathing 1200 mm wide either horizontally or vertically. Nail 150 mm maximum o.c. at edges and 200 mm maximum o.c. at intermediate bearings.

b. Gypsum Sheathing Board Used with Unbraced Frames: Sheathing must be 1200 mm wide and applied vertically. Extend sheathing over and nail to both sill and top plates. Nail 100 mm maximum o.c. at edges and 200 mm maximum o.c. at intermediate bearings.

3.1.10.4 Foil-Faced Insulative Sheathing

Apply sheathing vertically. Butt or overlap joints and locate over centerline of supports. Attach sheathing to framing with 30 mm, large, flat-head, 11 gage, galvanized roofing nails or 16 gage, 11 mm minimum crown, galvanized staples with 30 mm legs. For nonstructural application (with corner bracing), space fasteners 150 mm o.c. on all panel edges and 300 mm o.c. on intermediate supports, regardless of sheathing thickness, for studs not more than 600 mm o.c. For structural application (without corner bracing), for studs not more than 400 mm o.c., space fasteners 75 mm o.c. on all edges and 150 mm o.c. on intermediate members using minimum 2.9 mm thickness; for studs up to 600 mm o.c., space fasteners 75 mm o.c. on all edges and 75 mm o.c. on intermediate supports using minimum 3.5 mm thickness.

3.1.10.5 Particleboard

Install according to manufacturer's instructions and accepted industry standards.

3.1.10.6 Cellulose Honeycomb Panels

Install according to manufacturer's instructions and accepted industry standards.

3.1.11 Wood Sheathing

Sheathing end joints must be made over framing members and so alternated that there will be at least two boards between joints on the same support. Each board must bear on at least three supports. Boards must be nailed at each support using two nails for boards 150 mm and less in width and three nails for boards more than 150 mm in width. Roof sheathing must not be installed where roof decking is installed.

3.1.12 Building Paper

Provide building paper [where indicated] [on wood board sheathing for all types of exterior siding]. Apply paper shingle fashion, horizontally, beginning at the bottom of the wall. Lap edges 100 mm, and nail with 25 mm, zinc-coated roofing nails, spaced 300 mm o.c. and driven through tin discs.

3.1.13 Ceiling Joists

Size as indicated and set accurately and in alignment. Toe-nail joists to all plates with not less than three 10-penny nails. Frame openings in ceilings with headers and trimmers.

3.1.14 Metal Framing Anchors

Provide framing anchors at every [other] [rafter] [or] [trussed rafter] to fasten [rafter] [or] [trussed rafter] to plates and studs against uplift movement and forces as indicated. Anchors must be punched and formed for nailing so that nails will be stressed in shear only. Nails must be zinc-coated; drive a nail in each nail hole provided in the anchor.

3.1.15 Trusses

Metal plate connected wood trusses must be handled, erected, and braced in accordance with TPI HIB and as indicated.

3.1.16 Structural Glued Laminated Timber Members

Brace members before erection. Align members and complete all connections before removal of bracing. Unwrap individually wrapped members only after adequate protection by a roof or other cover has been provided. Treat scratches and abrasions of factory applied sealer with two brush coats of the same sealer used at the factory.

3.1.17 Plywood and Structural-Use Panel Roof Sheathing

Install with the grain of the outer plies or long dimension at right angles to supports. Stagger end joints and locate over the centerlines of supports. Allow 3 mm spacing at panel ends and 6 mm at panel edges. Nail panels with 8-penny common nails or 6-penny annular rings or screw-type

nails spaced 150 mm o.c. at supported edges and 300 mm o.c. at intermediate bearings. Do not use staples in roof sheathing. Where the support spacing exceeds the maximum span for an unsupported edge, provide adequate blocking, tongue-and-groove edges, or panel edge clips, in accordance with APA E30.

3.1.18 Stair Framing

Cut carriages to exact shape required to receive treads and risers, with risers of uniform height and treads of uniform width. Provide trimmers, nailers, and blocking as required to support finish materials.

3.1.19 Plastic Lumber

In conjunction with above requirements, follow manufacturer's recommendations for plastic lumber installation, including requirements for structural support, thermal movement, working, fastening, and finishing. Use standard woodworking tools, including carbide tips, coarse saw blades, and routers with aggressive cutters. Follow manufacturer's recommendations for repair by melting.

3.2 MISCELLANEOUS

3.2.1 Wood Roof Nailers, Edge Strips, Crickets, Curbs, and Cants

Provide sizes and configurations indicated or specified and anchored securely to continuous construction.

3.2.1.1 Roof Nailing Strips

Provide roof nailing strips for roof decks as [indicated] [and] [specified herein]. Apply nailing strips in straight parallel rows in the direction and spacing[indicated][specified in [_____]]. Strips must be[surface applied][embedded in concrete].

a. Surface-Applied Nailers: Must be 75 mm wide and of thickness to finish flush with the top of the insulation. Anchor strips securely to the roof deck with powder actuated fastening devices or expansion shields and bolts, spaced not more than 600 mm o.c.[On decks with slopes of 25 mm or more, provide surface applied wood nailers for securing insulation[and for nailing of roofing felts].]

b. Embedded Nailers: Must be nominal 50 by 75 with 20 mm sides beveled. Set and anchor nailers to finish flush with the roof deck surface.

3.2.1.2 Roof Edge Strips and Nailers

Provide at perimeter of roof, around openings through roof, and where roofs abut walls, curbs, and other vertical surfaces. Except where indicated otherwise, nailers must be 150 mm wide and the same thickness as the insulation. Anchor nailers securely to underlying construction. Anchor perimeter nailers in accordance with FM 4435.[Strips must be grooved [as indicated] for edge venting; install at walls, curbs, and other vertical surfaces with a 6 to 12 mm air space.]

3.2.1.3 Crickets, Cants, and Curbs

Provide wood saddles or crickets, cant strips, [curbs for scuttles and ventilators,] [and wood nailers bolted to tops of concrete or masonry

curbs] [and at expansion joints,] as indicated, specified, or necessary and of [lumber] [or [_____] mm thick exterior plywood].

3.2.2 Rough Wood Bucks

[Size as indicated] [50 mm nominal thickness]. Set wood bucks true and plumb. Anchor bucks to concrete or masonry with steel straps extending into the wall 200 mm minimum. Place anchors near the top and bottom of the buck and space uniformly at 600 mm maximum intervals.

3.2.3 Wood Blocking

Provide proper sizes and shapes at proper locations for the installation and attachment of wood and other finish materials, fixtures, equipment, and items indicated or specified.

3.2.4 Wood Grounds

Provide for fastening wood trim, finish materials, and other items to plastered walls and ceilings. Install grounds in proper alignment and true with an 2400 mm straightedge.

3.2.5 Wood Furring

Provide where shown and as necessary for facing materials specified. Except as shown otherwise, furring strips must be nominal one by 3, continuous, and spaced 400 mm o.c. Erect furring vertically or horizontally as necessary. Nail furring strips to masonry. Do not use wood plugs. Provide furring strips around openings, behind bases, and at angles and corners. Furring must be plumb, rigid, and level and must be shimmed as necessary to provide a true, even plane with surfaces suitable to receive the finish required. Form furring for [cornices,] offsets and breaks in walls or ceilings on 1 by 4 wood strips spaced 400 mm o.c.

3.2.6 Wood Bumpers

Dress to the sizes indicated, and bevel edges. Bore, countersink, and bolt bumpers in place.

3.2.7 Temporary Closures

Provide with hinged doors and padlocks and install during construction at exterior doorways and other ground level openings that are not otherwise closed. Cover windows and other unprotected openings with polyethylene or other approved material, stretched on wood frames. Provide dustproof barrier partitions to isolate areas as directed.

3.2.8 Temporary Centering, Bracing, and Shoring

Provide for the support and protection of masonry work during construction as specified in Section [_____]. Forms and centering for cast-in-place concrete work are specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.2.9 Wood Sleepers

Run wood sleepers in lengths as long as practicable and stagger end joints in adjacent rows.[Sleepers for gymnasium floors are specified in Section 09 64 66 WOOD ATHLETIC FLOORING.]

3.2.10 Diaphragms

Install plywood, structural-use, or OSB panels with the long dimension [parallel] [perpendicular] to supports. End joints must be [continuous] [staggered] and located over the centerline of supports. Longitudinal joints must be [continuous] [staggered] [and provided with blocking]. Nail panels with [6] [8] [10]-penny nails spaced not more than [_____] mm on centers around the diaphragm boundaries [and along continuous panel edges] and [_____] mm on centers at all other supported edges and 300 mm o.c. over intermediate bearings.

3.2.11 Shear Walls

Install plywood or structural-use panels with long dimension parallel or perpendicular to supports. Provide blocking behind edges not located over supports. Nail panels with [6] [8] [10]-penny nails spaced not more than [_____] mm on centers along panel edges and 150 mm o.c. over intermediate bearings.

3.2.12 Bridging

Wood bridging must have ends accurately bevel-cut to afford firm contact and must be nailed at each end with two nails. Indall metal bridging as recommended by the manufacturer. The lower ends of bridging must be driven up tight and secured after subflooring or roof sheathing has been laid and partition framing installed.

3.2.13 Corner Bracing

Indatall corner bracing when required by type of sheathing used or when siding, other than panel siding, is applied directly to studs. Corner bracing must be let into the exterior surfaces of the studs at an angle of approximately 45 degrees, must extend completely over wall plates, and must be secured at each bearing with two nails.

3.2.14 Sill Plates

Sill plates must be set level and square and anchor bolted at not more than 1800 mm on centers and not more than 300 mm from end of each piece. A minimum of two anchors must be used for each piece.

3.3 INSTALLATION OF TIMBER CONNECTORS

Install timber connectors in conformance with requirements of AWC NDS.

3.4 ERECTION TOLERANCES

a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, must be within the following limits:

(1) Layout of walls and partitions: 6 mm from intended position;

(2) Plates and runners: 6 mm in 2400 mm from a straight line;

(3) Studs: 6 mm in 2400 mm out of plumb, not cumulative; and

(4) Face of framing members: 6 mm in 2400 mm from a true plane.

b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive must be within the following limits:

(1) Layout of walls and partitions: 6 mm from intended position;

(2) Plates and runners: 3 mm in 2400 mm from a straight line;

(3) Studs: 3 mm in 2400 mm out of plumb, not cumulative; and

(4) Face of framing members: 3 mm in 2400 mm from a true plane.

[3.5 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components must be done in accordance with Section 01 45 35 SPECIAL INSPECTIONS.

]3.6 WASTE MANAGEMENT OF WOOD PRODUCTS

In accordance with the Waste Management Plan and as specified.[Separate and reuse scrap sheet materials larger than [0.2 square meters] [_____], framing members larger than [406 mm] [_____], and multiple offcuts of any size larger than [305 mm] [_____].] Clearly separate damaged wood and other scrap lumber for acceptable alternative uses on site, including bracing, blocking, cripples, ties, and shims.

[Separate composite wood from other wood types and recycle or reuse.] [Coordinate with manufacturer for take-back program and submit manufacturer's policy statement on program.] [Set aside scrap [plastic lumber] and return to manufacturer for recycling into new product. When such a service is not available, local recyclers must be sought after to reclaim the materials.][Fold up metal banding, flatten, and recycle.]

Separate treated, stained, painted, and contaminated wood and place in designated area for hazardous materials. Dispose of according to local regulations.[Do not leave any wood, shavings, sawdust, or other wood waste buried in fill or on the ground[, unless for planned future use].][Prevent sawdust and wood shavings from entering the storm drainage system.] [Compost sawdust.]Do not burn scrap lumber that has been pressure treated, or lumber that is less than one year old.

3.7 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements. Typical conversion is as shown:

PRODUCTS	INCH-POUND Nominal	METRIC Conversion
Sawn lumber	2 by 4	38 by 89 mm
	1 by	19 mm by

PRODUCTS	INCH-POUND Nominal	METRIC Conversion
Stud spacing	16 inches	400 mm
	If not 48 inches panel	406 mm
Plywood	48 by 96 inches	1200 mm by 2400 mm

-- End of Section --

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SECTION 06 41 16.00 10

PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 16893	(2016) Wood-based Panels - Particleboard

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5905	(2014) Fiberboards
JIS A 5908	(2015) Particleboards
JIS B 1099	(2019) Construction Standard Specification
JIS K 6903	(2008) Laminated Thermosetting High-Pressure Decorative Sheets

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT SS Chapter 12	(2019) Public Building Construction Standard Specification Chapter 12: Wood Work

1.2 SYSTEM DESCRIPTION

Work in this section includes laminate clad custom casework [cabinets] [vanities] [_____] as shown on the drawings and as described in this specification. This Section includes high-pressure laminate surfacing and cabinet hardware. Comply with EPA requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING. All exposed and semi-exposed surfaces, whose finish is not otherwise noted on the drawings or finish schedule, shall be sanded smooth and shall receive a clear finish of polyurethane. Wood finish may be shop finished or field applied in accordance with Section 09 90 00 PAINTS AND COATINGS.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality

Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings

Installation

SD-03 Product Data

Finish Schedule

SD-04 Samples

Plastic Laminates

Cabinet Hardware

SD-07 Certificates

1.4 QUALITY ASSURANCE

1.4.1 General Requirements

Unless otherwise noted on the drawings, all materials, construction methods, and fabrication shall conform to and comply with the [premium] [custom] grade quality standards as outlined in this specification. Contractors and their personnel engaged in the work shall be able to demonstrate successful experience with work of comparable extent, complexity and quality to that shown and specified. Submit a quality control statement which illustrates compliance with and understanding of project requirements. The quality control statement shall also certify a minimum of ten years Contractor's experience in laminate clad casework fabrication and construction. The quality control statement shall provide a list of a minimum of five successfully completed projects of a similar scope, size, and complexity.

1.5 DELIVERY, STORAGE, AND HANDLING

Casework may be delivered knockdown or fully assembled. Deliver all units to the site in undamaged condition, stored off the ground in fully enclosed areas, and protected from damage. The storage area shall be well ventilated and not subject to extreme changes in temperature or humidity.

1.6 SEQUENCING AND SCHEDULING

Coordinate work with other trades. Units shall not be installed in any room or space until painting, and ceiling installation are complete within the room where the units are located. Floor cabinets shall be installed before finished flooring materials are installed.

PART 2 PRODUCTS

2.1 WOOD MATERIALS

2.1.1 Lumber

a. All framing lumber shall be kiln-dried with moisture content 6 to 8 percent, to dimensions as shown on the drawings. Frame front, where indicated on the drawings, shall be nominal 15 mm to 19 mm hardwood.

b. Standing or running trim casework components, which are specified to receive a transparent finish, shall be [_____] hardwood species, plain sawn. Grade shall be [premium] [custom]. Location, shape, and dimensions shall be as indicated on the drawings.

2.1.2 Panel Products

2.1.2.1 Plywood

All plywood panels used for framing purposes shall be veneer core hardwood plywood. Nominal thickness of plywood panels shall be as indicated in this specification and on the drawings.

2.1.2.2 Particleboard

All particleboard shall be industrial grade, medium density (640 to 800 kg per cubic meter), 15 mm to 19 mm thick. A moisture-resistant particleboard shall be used as the substrate for plastic laminate covered [countertops] [backsplashes] [_____] [components as located on the drawings] and other areas subjected to moisture. Particleboard shall meet the minimum standards listed in JIS A 5908.

2.1.2.3 Medium Density Fiberboard

Medium density fiberboard (MDF) shall be an acceptable panel substrate where noted on the drawings. Medium density fiberboard shall meet the minimum standards listed in JIS A 5905.

2.2 SOLID POLYMER MATERIAL

Solid surfacing casework components shall conform to the requirements of Section 06 61 16 SOLID SURFACING FABRICATIONS.

2.3 HIGH PRESSURE DECORATIVE LAMINATE (HPDL)

All plastic laminates shall meet the requirements of JIS K 6903 for high-pressure decorative laminates. Design, colors, surface finish and texture, and locations shall be as indicated on [the drawings]. Submit two samples of each plastic laminate pattern and color. Samples shall be a minimum of 120 by 170 mm in size. Plastic laminate types and nominal minimum thicknesses for casework components shall be as indicated in the following paragraphs.

2.3.1 Horizontal General Purpose Standard (HGS) Grade

Horizontal general purpose standard grade plastic laminate shall be 0.95 mm to 1.2 mm in thickness. This laminate grade is intended for horizontal surfaces where postforming is not required.

2.3.2 Vertical General Purpose Standard (VGS) Grade

Vertical general purpose standard grade plastic laminate shall be 0.55 mm to 0.7 mm in thickness. This laminate grade is intended for exposed exterior vertical surfaces of casework components where postforming is not required.

2.3.3 Horizontal General Purpose Postformable (HGP) Grade

Horizontal general purpose postformable grade plastic laminate shall be 0.95 mm to 1.2 mm in thickness. This laminate grade is intended for horizontal surfaces where post forming is required.

2.3.4 Vertical General Purpose Postformable (VGP) Grade

Vertical general purpose postformable grade plastic laminate shall be 0.7 mmin thickness. This laminate grade is intended for exposed exterior vertical surfaces of components where postforming is required for curved surfaces.

2.3.5 Horizontal General Purpose Fire Rated (HGF) Grade (U.S. Product only)

Horizontal general purpose fire rated grade plastic laminate shall be 1.22 mm (plus or minus 0.127 mm) in thickness. Laminate grade shall have a class 1, class A fire rating in accordance with ASTM E84.

2.3.6 Vertical General Purpose Fire Rated (VGF) Grade

Vertical general purpose fire rated grade plastic laminate shall be 0.71 mm (plus or minus 0.012 mm) in thickness. This laminate grade shall have a class 1, class A fire rating in accordance with ASTM E84.

2.3.7 Cabinet Liner Standard (CLS) Grade

Cabinet liner standard grade plastic laminate shall be 0.55 mm in thickness. This laminate grade is intended for light duty semi-exposed interior surfaces of casework components.

2.3.8 Backing Sheet (BK) Grade

Undecorated backing sheet grade laminate is formulated specifically to be used on the backside of plastic laminated panel substrates to enhance dimensional stability of the substrate. Backing sheet thickness shall be 0.51 mm. Backing sheets shall be provided for all laminated casework components where plastic laminate finish is applied to only one surface of the component substrate.

2.4 THERMOSET DECORATIVE OVERLAYS (MELAMINE)

Thermoset decorative overlays (melamine panels) shall be used for [casework cabinet interior] [drawer interior] [all semi-exposed] [_____] surfaces.

2.5 EDGE BANDING

Edge banding for casework doors and drawer fronts shall be PVC vinyl and shall be [0.5 mm] [3 mm] [_____] thick. Material width shall be [as indicated on the drawings] [_____]. Color and pattern shall [match exposed door and drawer front laminate pattern and color] [be as indicated

on the drawings] [_____].

2.6 CABINET HARDWARE

Submit one sample of each cabinet hardware item specified to include [hinges], [pulls], [drawer glides], and [_____]. All hardware shall follow the requirements to MLIT SS Chapter 12, unless otherwise noted, and shall consist of the following components:

2.6.1 Door Hinges

[_____] type.

2.6.2 Cabinet Pulls

[_____] type.

2.6.3 Drawer Slide

Side mounted [_____] type, with [full] [_____] extension and a minimum [34 kg] [45 kg] [_____] load capacity. Slides shall include an [integral] [positive] stop to avoid accidental drawer removal.

2.6.4 Adjustable Shelf Support System

[Recessed (mortised) metal standards, finish: [_____]. Support clips for the standards shall be [open type,] [closed type,] finish: [_____]] [Multiple holes with [metal] [plastic] [wood] pin supports].

2.7 FASTENERS

Nails, screws, and other suitable fasteners shall be the size and type best suited for the purpose and shall conform to JIS B 1099 where applicable.

2.8 ADHESIVES, CAULKS, AND SEALANTS

2.8.1 Adhesives

Adhesives shall be of a formula and type recommended by manufacturer. Adhesives shall be selected for their ability to provide a durable, permanent bond and shall take into consideration such factors as materials to be bonded, expansion and contraction, bond strength, fire rating, and moisture resistance. Adhesives shall meet UL2818(Greenguard) Gold, SCS Global Services Indoor Advantage Gold, CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type), VOC content requirements of SCAQMD Rule 1168, or F 4-Star regarding VOC emissions and off-gassing.

2.8.1.1 Wood Joinery

Adhesives used to bond wood members shall be for interior use [urea-formaldehyde resin formula] [polyvinyl acetate resin emulsion] [_____]. Adhesives shall withstand a bond test as described in MLIT SS Chapter 12.

2.8.1.2 Laminate Adhesive

Adhesive used to join high-pressure decorative laminate to wood shall be

[a water-based contact adhesive] [_____] [adhesive consistent with AWI and laminate manufacturer's recommendations]. PVC edgebanding shall be adhered using a polymer-based hot melt glue.

2.8.2 Caulk

Caulk used to fill voids and joints between laminated components and between laminated components and adjacent surfaces shall be clear, 100 percent silicone.

2.8.3 Sealant

Sealant shall be of a type and composition recommended by the substrate manufacturer to provide a moisture barrier at sink cutouts and all other locations where unfinished substrate edges may be subjected to moisture.

2.9 WOOD FINISHES

Paint, stain, varnish and their applications required for laminate clad casework components shall be [_____] [as indicated in Section 09 90 00 PAINTS AND COATINGS] [as indicated in Section 09 06 00 SCHEDULES FOR FINISHES]. Color and location shall be as indicated on the drawings.

2.10 ACCESSORIES

2.10.1 Glass and Glazing

Glass required in laminated casework shall be referenced by type in accordance with Section 08 81 00 GLAZING. Glass shall be one of the following:

a. Type [A] [_____].

b. [Float] [Patterned] glass: [Clear] [pattern] quality.

c. Safety glass: [Clear] [_____]; [heat strengthened] [fully tempered] [laminated] [_____]; [_____] mm thick minimum.

d. Wire Glass: [Clear] [_____], polished [both sides] [one side]; [square] [diagonal] [_____] mesh woven stainless steel wire of grid [_____] mm size; [_____] mm thick.

2.10.2 Grommets

Grommets shall be [plastic] [metal] [rubber] [_____] material for cutouts with a diameter of [_____] mm. Locations shall be as indicated on the drawings.

2.11 FABRICATION

Verify field measurements as indicated in the shop drawings before fabrication. Fabrication and assembly of components shall be accomplished at the shop site to the maximum extent possible. Construction and fabrication of cabinets and their components shall meet or exceed the requirements for AWI [premium] [custom] grade unless otherwise indicated in this specification. Cabinet style, shall be [flush overlay] [reveal overlay] [flush inset without face frame] [flush inset with face frame] [as indicated on the drawings].

2.11.1 Base and Wall Cabinet Case Body

2.11.1.1 Cabinet Components

Frame members shall be glued-together, kiln-dried hardwood lumber. Top corners, bottom corners, and cabinet bottoms shall be braced with either hardwood blocks or water-resistant glue and nailed in place metal or plastic corner braces. Cabinet components shall be constructed from the following materials and thicknesses:

2.11.1.1.1 Body Members (Ends, Divisions, Bottoms, and Tops)

15 mm to 20 mm [veneered particleboard per JIS A 5908] [medium density fiberboard (MDF)] [veneer core plywood] panel product

2.11.1.1.2 Face Frames and Rails

15 mm to 20 mm [hardwood lumber] [panel product]

2.11.1.1.3 Shelving

15 mm to 20 mm [veneered particleboard per JIS A 5908 or ISO 16893] [medium density fiberboard (MDF)] [veneer core plywood] panel product

2.11.1.1.4 Cabinet Backs

5 mm [veneered particleboard per JIS A 5908 or ISO 16893] [medium density fiberboard (MDF)] [veneer core plywood] panel product

2.11.1.1.5 Drawer Sides, Backs, and Subfronts

13 mm [hardwood lumber] [panel product]

2.11.1.1.6 Drawer Bottoms

5 mm [veneered particleboard per JIS A 5908 or ISO 16893] [medium density fiberboard (MDF)] [veneer core plywood] panel product

2.11.1.1.7 Door and Drawer Fronts

15 mm to 20 mm [veneered particleboard] [medium density fiberboard (MDF)] panel product

2.11.1.2 Joinery Method for Case Body Members

2.11.1.2.1 Tops, Exposed Ends, and Bottoms

a. Steel "European" assembly screws (37 mm from end, 128 mm on center, fasteners will not be visible on exposed parts).

b. Doweled, glued under pressure (approx. 4 dowels per 300 mm of joint).

c. Stop dado, glued under pressure, and either nailed, stapled or screwed (fasteners will not be visible on exposed parts).

d. Spline or biscuit, glued under pressure.

2.11.1.2.2 Exposed End Corner and Face Frame Attachment

2.11.1.2.2.1 Mitered Joint

Lock miter or spline or biscuit, glued under pressure (no visible fasteners)

2.11.1.2.2.2 Non-Mitered Joint (90 degree)

Butt joint glued under pressure (no visible fasteners)

2.11.1.2.2.3 Butt Joint

Glued and nailed

2.11.1.2.3 Cabinet Backs (Wall Hung Cabinets)

Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated load for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanisms should transfer the load to case body members. Fabrication method shall be:

2.11.1.2.3.1 Full Bound

Full bound, captured in grooves on cabinet sides, top, and bottom. Cabinet backs for floor standing cabinets shall be side bound, captured in grooves; glued and fastened to top and bottom.

2.11.1.2.3.2 Full Overlay

Full overlay, plant-on backs with minimum back thickness of 13 mm and minimum No. 12 plated (no case hardened) screws spaced a minimum 80 mm on center. Edge of back shall not be exposed on finished sides. Anchor strips are not required when so attached.

2.11.1.2.3.3 Side Bound

Side bound, captured in groove or rabbetts; glued and fastened.

2.11.1.2.4 Cabinet Backs (Floor Standing Cabinets)

2.11.1.2.4.1 Side Bound

Side bound, captured in grooves; glued and fastened to top and bottom.

2.11.1.2.4.2 Full Overlay

Full overlay, plant-on backs with minimum back thickness of 13 mm and minimum No. 12 plated (no case hardened) screws spaced a minimum 80 mm on center. Edge of back shall not be exposed on finished sides. Anchor strips are not required when so attached.

2.11.1.2.4.3 Side Bound with Rabbetts

Side bound, placed in rabbetts; glued and fastened in rabbetts.

2.11.1.2.5 Wall Anchor Strips

Wall Anchor Strips shall be required for all cabinets with backs less than

13 mm thick. Strips shall consist of minimum 13 mm thick lumber, minimum 60 mm width; securely attached to wall side of cabinet back - top and bottom for wall hung cabinets, top only for floor standing cabinets.

2.11.2 Cabinet Floor Base

Floor cabinets shall be mounted on a base constructed of [nominal 50 mm thick lumber] [19 mm particleboard] [19 mm fiberboard] [19 mm veneer core exterior plywood]. Base assembly components shall be [treated lumber] [a moisture-resistant panel product]. Finished height for each cabinet base shall be [not less than the full height of the installed, specified wall base] [as indicated on the drawings]. Bottom edge of the cabinet door or drawer face shall [be flush with top of base] [extend below the top of the base as indicated on the drawings].

2.11.3 Cabinet Door and Drawer Fronts

Door and drawer fronts shall be fabricated from [15 mm medium density particleboard] [15 mm medium density fiberboard (MDF]. All door and drawer front edges shall be surfaced with [high pressure plastic laminate] [PVC edgebanding], color and pattern [to match exterior face laminate] [as indicated on the drawings] [as indicated in Section 09 06 00 SCHEDULES FOR FINISHES].

2.11.4 Drawer Assembly

2.11.4.1 Drawer Components

Drawer components shall consist of a removable drawer front, sides, backs, and bottom. Drawer components shall be constructed of the following materials and thicknesses:

2.11.4.1.1 Drawer Sides and Backs For Transparent Finish

13 mm thick [solid hardwood lumber] [7-ply hardwood veneer core plywood (no voids), any species]

2.11.4.1.2 Drawer Sides and Backs For Laminate Finish

13 mm thick 7-ply hardwood veneer core substrate

2.11.4.1.3 Drawer Sides and Back For Thermoset Decorative Overlay (Melamine) Finish

13 mm thick medium density particleboard or MDF fiberboard substrate

2.11.4.1.4 Drawer Bottom

6 mm thick [veneer core panel product for transparent or plastic laminate finish] [thermoset decorative overlay melamine panel product]

2.11.4.2 Drawer Assembly Joinery Method

a. Multiple dovetail (all corners) or French dovetail front/dadoed back, glued under pressure.

b. Doweled, glued under pressure.

c. Lock shoulder, glued and pin nailed.

d. Bottoms shall be set into sides, front, and back, 6 mm deep groove with a minimum 9 mm standing shoulder.

2.11.5 Shelving

2.11.5.1 General Requirements

Shelving shall be fabricated from [15 mm medium density particleboard] [15 mm medium density fiberboard (MDF] [15 mm veneer core plywood]. All shelving top and bottom surfaces shall be finished with [HPDL plastic laminate] [thermoset decorative overlay (melamine)]. Shelf edges shall be finished in a [HPDL plastic laminate] [thermoset decorative overlay (melamine)] [PVC edgebanding].

2.11.5.2 Shelf Support System

The shelf support system shall be:

2.11.5.2.1 Recessed (Mortised) Metal Shelf Standards

Mortise standards flush with the finishes surface of the cabinet interior side walls, two per side. Position and space standards on the side walls to provide a stable shelf surface that eliminates tipping when shelf front is weighted. Install and adjust standards vertically to provide a level, stable shelf surface when clips are in place.

2.11.5.2.2 Pin Hole Method

Drill holes on the interior surface of the cabinet side walls. Evenly space holes in two vertical columns Space the holes in each column at [25 mm] [_____] increments starting [150 mm] [_____] from the cabinet interior bottom and extending to within [150 mm] [_____] of the top interior surface of the cabinet. Drill holes to provide a level, stable surface when the shelf is resting on the shelf pins. Coordinate hole diameter with pin insert size to provide a firm, tight fit.

2.11.6 Edge Style

Front [and exposed side] countertop edges shall be in shapes and to dimensions as shown on the drawings. The countertop edge material shall be:

2.11.6.1 Post Formed Plastic Laminate

Laminate edge shall be integral with countertop surface. Shape and profile shall be [bullnose] [waterfall] [as indicated] [_____] and to dimensions as indicated.

2.11.6.2 Hardwood

Species, finish, profile, shape, and dimensions shall be as indicated on the drawings. Hardwood edge shall overlap the exposed countertop laminate edge and shall be installed flush with the countertop laminate surface.

2.11.6.3 Vinyl

Vinyl tee-mould edge shall be in shape, thickness, and color as indicated on the drawings. Tee mould edge shall overlap the exposed countertop

laminate edge and shall be installed flush with the countertop laminate surface.

2.11.6.4 Plastic Laminate Self Edge

Flat, 90 degree "self " edge. Edge must be applied before top. Laminate edge shall overlap countertop laminate and shall be eased to eliminate sharp corners.

2.11.7 Laminate Clad Splashes

Countertop splash substrate shall be 20 mm [particleboard] [MDF fiberboard] [veneer core plywood]. Laminate clad backsplash shall be [integral with countertop, coved to radius and to dimensions as indicated on the drawings] [loose, to be installed at the time of countertop installation]. Side splashes shall be straight profile and provided loose, to be installed at the time of countertop installation. Back and side splash laminate pattern and color shall match the adjacent countertop laminate.

2.11.8 Laminate Application

Laminate application to substrates shall follow the recommended procedures and instructions of the laminate manufacturer and JIS K 6903, using tools and devices specifically designed for laminate fabrication and application. Provide a balanced backer sheet (Grade BK) wherever only one surface of the component substrate requires a plastic laminate finish. Apply required grade of laminate in full uninterrupted sheets consistent with manufactured sizes using one piece for full length only, using adhesives specified herein or as recommended by the manufacturer. Fit corners and joints hairline. All laminate edges shall be machined flush, filed, sanded, or buffed to remove machine marks and eased (sharp corners removed). Clean up at easing shall be such that no overlap of the member eased is visible. Fabrication shall conform to laminate types and grades for component surfaces and shall be as follows unless otherwise indicated on the drawings:

2.11.8.1 Base/Wall Cabinet Case Body

a. Exterior (exposed) surfaces to include exposed and semi-exposed face frame surfaces: HPDL Grade [VGS] [VGP].

b. Interior (semi-exposed) surfaces to include interior back wall, bottom, and side walls: [HPDL Grade CLS] [Thermoset Decorative Overlay (melamine)].

2.11.8.2 Adjustable Shelving

2.11.8.2.1 Top and Bottom Surfaces

[HPDL Grade HGS] [Thermoset Decorative Overlay (melamine)]

2.11.8.2.2 All Edges

[HPDL Grade VGS] [Thermoset Decorative Overlay (melamine)][PVC edgebanding]

2.11.8.3 Fixed Shelving

2.11.8.3.1 Top and Bottom Surfaces

[HPDL Grade HGS] [Thermoset Decorative Overlay (melamine)]

2.11.8.3.2 Exposed Edges

[HPDL Grade VGS] [Thermoset Decorative Overlay (melamine)][PVC edgebanding]

2.11.8.4 Door, Drawer Fronts, Access Panels

2.11.8.4.1 Exterior (Exposed) and Interior (Semi-Exposed) Faces

HPDL Grade [VGS] [VGP]

2.11.8.4.2 Edges

[HPDL Grade VGS] [PVC edgebanding]

2.11.8.5 Drawer Assembly

All interior and exterior surfaces: [HPDL Grade CLS] [Thermoset Decorative Overlay (melamine)].

2.11.8.6 Countertops and Splashes

All exposed and semi-exposed surfaces: HPDL Grade HGS

2.11.8.7 Tolerances

Flushness, flatness, and joint tolerances of laminated surfaces shall meet the [premium] [custom] grade requirements.

2.11.9 Finishing

2.11.9.1 Filling

No fasteners shall be exposed on laminated surfaces. All nails, screws, and other fasteners in non-laminated cabinet components shall be countersunk and the holes filled with wood filler consistent in color with the wood species.

2.11.9.2 Sanding

All surfaces requiring coatings shall be prepared by sanding with a grit and in a manner that scratches will not show in the final system.

2.11.9.3 Coatings

Types, method of application and location of casework finishes shall be in accordance with the finish schedule, drawings and Section 09 90 00 PAINTS AND COATINGS. All cabinet reveals shall be painted. Submit descriptive data which provides narrative written verification of all types of construction materials and finishes, methods of construction, etc. not clearly illustrated on the submitted shop drawings. Data shall provide written verification of conformance for the quality indicated to include materials, tolerances, and types of construction. Both the manufacturer of materials and the fabricator shall submit available literature which

describes re-cycled product content, operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall comply with applicable requirements for [premium] [custom] quality standards. Countertops and fabricated assemblies shall be installed level, plumb, and true to line, in locations shown on the drawings. Cabinets and other laminate clad casework assemblies shall be attached and anchored securely to the floor and walls with mechanical fasteners that are appropriate for the wall and floor construction.

3.1.1 Anchoring Systems

3.1.1.1 Floor

[Base cabinets] [_____] shall utilize a floor anchoring system [as detailed on the drawings]. Anchoring and mechanical fasteners shall not be visible from the finished side of the casework assembly. [Cabinet] [_____] assemblies shall be attached to anchored bases without visible fasteners [as indicated in the drawings]. Where assembly abuts a wall surface, anchoring shall include a minimum 13 mm thick lumber or panel product hanging strip, minimum 60 mm width; securely attached to the top of the wall side of the cabinet back.

3.1.1.2 Wall

[Cabinet] [vanity] [_____] to be wall mounted shall utilize minimum 13 mm thick lumber or panel product hanging strips, minimum 60 mm width; securely attached to the wall side of the cabinet back, both top and bottom.

3.1.2 Countertops

Countertops shall be installed in locations as indicated on the drawings. Countertops shall be fastened to supporting casework structure with mechanical fasteners, hidden from view. All joints formed by the countertop or countertop splash and adjacent wall surfaces shall be filled with a clear silicone caulk. Loose [back] [side] splashes shall be adhered to both the countertop surface perimeter and the adjacent wall surface with adhesives appropriate for the type of materials to be adhered. Joints between the countertop surface and splash shall be filled with clear silicone caulk in a smooth consistent concave bead. Bead size shall be the minimum necessary to fill the joint and any surrounding voids or cracks.

3.1.3 Hardware

Casework hardware shall be installed in types and locations as indicated on the drawings. Where fully concealed European-style hinges are specified to be used with particleboard or fiberboard doors, the use of plastic or synthetic insertion dowels shall be used to receive 5 mm "Euroscrews". The use of wood screws without insertion dowels is prohibited.

3.1.4 Doors, Drawers and Removable Panels

The fitting of doors, drawers and removable panels shall be accomplished within target fitting tolerances for gaps and flushness in accordance with [premium] [custom] grade requirements.

3.1.5 Plumbing Fixtures

Install sinks, sink hardware, and other plumbing fixtures in locations as indicated on the drawings and in accordance with [Section 22 00 00 PLUMBING, GENERAL PURPOSE] [_____].

3.1.6 Glass

Install glass and glazing in the casework using methods and materials specified in Section 08 81 00 GLAZING in locations as indicated on the drawings.

-- End of Section --

SECTION 07 05 23

PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS

PART 1 GENERAL

1.1 SUMMARY

Employ an independent agency to conduct the pressure test on the building envelope in accordance with this specification section and ASTM E779 or JIS A 2201.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced within the text by the basic designation only.

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-105	(2020) ASNT Standard Topical Outlines for Qualification of Nondestructive Testing Personnel
ANSI/ASNT CP-189	(2020) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel
ASNT SNT-TC-1A	(2020) Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE RP-935	(1998) Protocol for Field Testing of Tall Buildings to Determine Envelope Air Leakage Rate

ASTM INTERNATIONAL (ASTM)

ASTM D3464	(1996; R 2014) Standard Test Method for Average Velocity in a Duct Using a Thermal Anemometer
ASTM E779	(2019) Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
ASTM E1186	(2017) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
ASTM E1258	(1988; R 2018) Standard Test Method for Airflow Calibration of Fan Pressurization Devices

ASTM E1827	(2011; R 2017) Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door
ASTM E2029	(2011) Standard Test Method for Volumetric and Mass Flow Rate Measurement in a Duct Using Tracer Gas Dilution

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 6781	(1983) Thermal Insulation - Qualitative Detection of Thermal Irregularities in Building Envelopes - Infrared Method
ISO 6781-2	(2010) Performance of Buildings - Detection of Heat, Air, and Moisture Irregularities in Buildings by Infrared Methods - Part2: Equipment Requirements
ISO 6781-3	(2015) Performance of Buildings - Detection of Heat, Air, and Moisture Irregularities in Buildings by Infrared Methods - Part 3: Qualifications of Equipment Operators, Data Analysts, and Report Writers

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 2201	(2017) Test Method for Performance of Building Air Tightness by Fan Pressurization

1.3 DEFINITIONS

The following terms as they apply to this section:

1.3.1 Air Barrier Envelope

The surface that separates the inside air from the outside air. The combination of air barrier assemblies and air barrier components, connected by air barrier accessories are designed to provide a continuous barrier to the movement of air through an environmental separator. A single building may have more than one air barrier envelope. The air barrier surface includes the top, bottom, and sides of the envelope. The term "air barrier envelope" is also known as "air barrier system" or simply "air barrier".

1.3.2 Air Leakage Rate

How leaky, or conversely how air tight a building envelope is. The air leakage is normally described in terms of air flow rate for the surface area of the envelope at a defined differential pressure.

1.3.3 Bias Pressure

Also known as zero flow pressure, baseline pressure, offset pressure or background pressure. With the envelope not artificially pressurized, bias is the differential pressure that always exists between the envelope that has been prepared (sealed) for the pressure test and the outdoors. Bias

pressure is made up of two components, fixed static offset (usually due to stack effect or the HVAC system) and fluctuating pressure (usually due to wind or a moving elevator). Because of pressure fluctuations many bias pressure readings are recorded and averaged for use in the calculations.

1.3.4 Blower Door

Commonly used term for an apparatus used to pressurize and depressurize the space within the building envelope and quantify air leakage through the envelope. The blower door typically includes a door fan and an air resistant fabric or a series of hard panels that extends to cover and seal the door opening between the fan shroud and door frame. The door fan is a calibrated fan capable of measuring air flow and is usually placed in the opening of an exterior door. With the air barrier otherwise sealed, air produced by the door fan pressurizes or de-pressurizes the envelope, depending on the fan's orientation.

1.3.5 Environmental Separator

The parts of a building that separate the controlled interior environment from the uncontrolled exterior environment, or that separate spaces within a building that have dissimilar environments. The term "environmental separator" is also known as the "control layer".

1.3.6 Pressure Test

A generic term for a test in which the envelope is either pressurized or de-pressurized with respect to the outdoors.

1.3.6.1 Negative Pressure Test (Depressurization Test)

A test wherein air inside the envelope is drawn to the outdoors. This places the envelope at a lower (negative) pressure with respect to the outdoors.

1.3.6.2 Positive Pressure Test (Pressurization Test)

A test wherein outdoor air is pushed into the envelope. This air movement places the envelope at a higher (positive) pressure with respect to the outdoors.

1.4 WORK PLAN

Submit the following not later than [120] [_____] calendar days [after contract award, but] before start of pressure testing work, steps to be taken by the lead pressure test technician to accomplish the required testing.

a. Memorandum of test procedure.

(1) Proposed dates for conducting the pressure, thermographic and fog tests.

(2) Submit detailed pressure test procedures prior to the test. Provide a plan view showing proposed locations (personnel doors or other similar openings) to install blower doors or flexible ducts (for trailer-mounted fans), if used.

b. Test equipment to be used.

c. Scaffolding, scissor lifts, power, electrical extension cords, duct tape, plastic sheeting and other Contractor's support equipment required to perform all tests.

d. Other Contractor's support personnel who will be on site for testing.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Work Plan; G[, [_____]]

SD-03 Product Data

Thermal Imaging Camera; G[, [_____]]

SD-05 Design Data

Envelope Surface Area Calculations; G[, [_____]]

SD-07 Certificates

Pressure Test Agency

Thermographer Qualifications

Test Instruments

Date Of Last Calibration

SD-06 Test Reports

Pressure Test Procedures; G[, [_____]]

Air Leakage Test Report; G[, [_____]]

Diagnostic Test Report; G[, [_____]]

1.6 QUALITY ASSURANCE

1.6.1 Modification of References

Perform all pressure and diagnostic tests according to the referenced publications listed in paragraph REFERENCES and as modified by this section. Consider the advisory or recommended provisions, of the referred references, as mandatory.

1.6.2 Qualifications

1.6.2.1 Pressure Test Agency

Submit, no later than [15] [_____] calendar days after contract award, information certifying that the pressure test agency is not affiliated with any other company participating in work on this contract. The work of the test agency is limited to pressure testing the building envelope, performing a thermography test and fog test, and investigating, through various methods, the location of air leaks through the air barrier. See paragraph PRESSURE TEST AGENCY for additional requirements. For thermographer qualifications, see paragraph THERMOGRAPHER QUALIFICATIONS.

Use the sample TEST AGENCY QUALIFICATIONS SHEET form (Appendix C), to submit the following information.

a. Verification of [2][_____] years of experience as an agency in pressure testing commercial and/or industrial buildings.

b. List of at least ten commercial/industrial facilities with building envelopes that the agency has tested within the past 2 years. Include building name, address, and name of prime construction contractor and contractor's point-of-contact information.

c. Confirmation of 2 years of commercial and or industrial building pressure test experience for the lead pressure test technician and the thermographer in using the specified ASTM E779 or JIS A 2201 testing standard. References from five Contracting Officers for facilities where the lead test technician has supervised commercial and or industrial building pressure tests in the last 2 years.

d. Verification that the lead pressure test technician has been employed by a building pressure testing agency in the capacity of a lead pressure test technician for not less than 1 year.

1.6.2.2 Thermographer Qualifications

To perform an infrared diagnostic evaluation, use a lead thermographer who has at least an active Level II Certification that is based on the requirements in ANSI/ASNT CP-105 or ANSI/ASNT CP-189 and is in accordance with ASNT SNT-TC-1A. The course of study is to be specifically focused on infrared thermography for building science. The thermographer must have at least two years of building science thermography experience in IR testing commercial or industrial buildings. The thermographer must also have experience in building envelopes and building science in order to make effective recommendations to the contractor should the envelope require additional sealing. Thermographic equipment operators, data analysists and report writers must comply with the requirements of ISO 6781-3. Submit the thermographer's certificate for approval. Submit a list of at least ten commercial/industrial buildings on which the thermographer has performed IR thermography in the past two years. The thermographer is to have a current active certification. Submit certification at least 60 days prior to thermography testing.

1.6.3 Test Instruments and Date of Last Calibration

Submit a signed and dated list of test instruments, their application, manufacturer, model, serial number, range of operation, accuracy and date of most recent calibration. Calibration data applicable to fan systems

must be in accordance with ASTM E1258.

1.6.4 Test Reports

No later than 14 days after completion of the pressure test, submit electronic copies of an organized report[and [_____] bound paper copies in a durable 3-ring binder]. The report is to contain a table of contents, an executive summary, an introduction, a results section and a discussion of the results. Submit the air leakage test report as described in paragraph AIR LEAKAGE TEST REPORT. Submit a diagnostic test report as described in paragraph LOCATING LEAKS BY DIAGNOSTIC TESTING. The diagnostic test report is to include the Thermographic Investigation Report and the Fog Test Report (if performed).

Submit field data and completed report forms found in the appendices. Use the sample forms, Test Agency Qualification Sheet, Air Leakage Test Form and Air Leakage Test Results Form to summarize the tests for the appropriate building envelope. Submit both electronically populated and field hand filled-in forms.

Report Data. Include in the report the following information for all tests:

a. Date of issue

b. Project title and number

c. Name, address, and telephone number of testing agency

d. Dates and locations of samples and tests or inspections

e. Names of individuals making the inspection or test

f. Designation of the work and test method

g. Identification of product and specification section

h. Complete inspection or test data

i. Test results and an interpretation of test results

j. Comments or professional opinion on whether inspected or tested work complies with contract document requirements

k. Recommendations on retesting

1.7 CLIMATE CONDITIONS SUITABLE FOR A PRESSURE TEST

As the test date approaches, monitor the weather forecast for the test site. Avoid testing on days forecast to experience high winds, rain, or snow. Monitor weather forecasts prior to shipping pressure test equipment to the site. Based on current and forecast weather conditions, the Contracting Officer's representative is to grant final approval for testing to occur.

1.7.1 Rain

For safety reasons, avoid testing during rain or if rain is anticipated during testing. If pneumatic hoses are installed and exposed to rain

inspect the hose to insure rainwater has not migrated into the hose ends. Orient all exposed hose ends to keep them out of water puddles. Success in temporarily sealing outdoor ventilation components such as louvers and exhaust fans may also be compromised by rain. Don't seal roof-mounted ventilation components during times of potential lightning.

1.7.2 Wind

Because wind can skew pressure test results, test only on days and at times when winds are anticipated to be the calmest. Avoid pressure testing during gusty or high wind conditions. Avoid installing test fans on the windward side of the building if wind gusts during the test are anticipated to be greater than 16.1 kilometers/hour.

PART 2 PRODUCTS

2.1 PRESSURE TEST EQUIPMENT

Depending on site conditions and size of the envelope, the test may be conducted using [blower door equipment] [and/or] [trailer-mounted fans] [or the building's own supply air system]. The testing agency is to supply sufficient quantity of blower equipment that will produce a minimum of 75 Pa differential pressure between the envelope and outdoors using the test methods described herein. Supplying additional blower test equipment to provide additional airflow capacity or to act as a backup is highly recommended.

2.1.1 Blower Door Fans and Trailer Mounted Fans

Each air flow measuring system including blower door fans and trailer mounted fans are to be calibrated within the last 5 years. Calibrated blower door fans and trailer mounted fans must measure accurately to within plus or minus 5 percent of the flow reading. Blower door equipment and trailer mounted fans are to be specifically designed to pressurize building envelopes. Each set of blower door equipment is to include fan(s), digital gage(s), door frame, door fabric or hard panels.

2.1.2 Digital Gages as Test Instruments

Use only digital gages as measuring instruments in the pressure test; analog gages are not acceptable. The gauges must be accurate to within 1.0 percent of the pressure reading or 0.15 Pa, whichever is greater. Each gage is to have been calibrated within two years of the test. The calibration is to be checked against a National Institute of Standards and Technology (NIST, formerly National Bureau of Standards) traceable standard.

2.2 THERMAL IMAGING CAMERA REQUIREMENTS

The thermal imaging camera used in the thermography test must have a thermal sensitivity (Noise Equivalent Temperature Difference.) of +/- 0.1 degree C at 30 degrees C or less. Ensure the camera's operating spectral range falls between 2 and 15 micrometers. Ensure the camera's IR image viewing screen resolution measures at least 320x240 pixels. Ensure the camera has a means of recording thermal images seen on the camera viewing screen. The camera is to display output as individual still frame images that also can be downloaded and inserted into an electronic Thermographic Investigation Report. All thermographic equipment must comply with the requirements of ISO 6781-2. Submit camera make and model, and catalog

information that defines the camera thermal sensitivity for approval.

PART 3 EXECUTION

3.1 PRESSURE TEST AGENCY

The test agency is to be an independent third party subcontractor, not an affiliated or subsidiary of the prime contractor, subcontractors or A/E firm. The agency is to be regularly engaged in pressure testing of commercial/industrial building envelopes. If using blower door or trailer-mounted fans, the lead test technician must have at least two years of experience in using such equipment in building envelope pressurization tests. Formal training using pressure test equipment is highly recommended. Technicians using the building's air handling system for pressure testing are to have tested at least five commercial/industrial buildings within the past two years with each building having over 4645 square meters of floor area. Submit the name, address and floor areas of each of these five buildings for approval.

3.1.1 Field Work

The lead pressure test technician and thermographer are to be present at the project site while testing is performed and is to be responsible for conducting, supervising, and managing of their respective test work. Management includes health and safety of test agency employees.

3.1.2 Reporting Work

The lead pressure test technician is to prepare, sign, and date the test agenda, equipment list, and submit a certified Air Leakage Test Report. The thermographer is to prepare, sign, and date the test agenda, equipment list, and submit a certified Thermographic Investigation Report. The contractor is to prepare a final report that identifies improvements that were made to the envelope to reduce air leaks [, mitigate thermal bridging][, eliminate moisture migration,][, repair insulation voids] discovered during diagnostic tests. Jointly submit all reports.

3.2 ENVELOPE SURFACE AREA CALCULATION

The architectural air barrier boundary includes the floor, walls, and ceiling. After construction of the air barrier envelope is complete, field measure the envelope to ensure the physical measurements match the design drawings and the air barrier envelope surface area calculations are generated. If the calculation result is not within 10 percent of the defined air barrier boundary calculation result as indicated, submit the envelope surface area calculation and results for review. [If the air barrier was defined during design but the air barrier envelope surface area was not calculated, calculate it during construction and submit the envelope surface area calculations and result for review.]

3.3 PREPARING THE BUILDING ENVELOPE FOR THE PRESSURE TEST

3.3.1 Testing During Construction

The pressure test cannot be conducted until all components of the air barrier system have been installed. After all sealing as described herein has been completed, inspect the envelope to ensure it has been adequately prepared. During the pressure test, stop all ongoing construction within and neighboring the envelope which may impact the test or the air barrier

integrity. The pressure test may be conducted before finishes that are not part of the air barrier envelope have been installed. For example, if suspended ceiling tile, interior gypsum board or cladding systems are not part of the air barrier the test can be conducted before they are installed. Recommend testing prior to installing the finished ceilings within the envelope and immediately surrounding it. The absence of finished ceilings allows for inspection and diagnostic testing of the roof/wall interface and for implementation of repairs to the air barrier, if necessary to comply with the maximum allowed leakage.

3.3.2 Sealing the Air Barrier Envelope

Seal all penetrations through the air barrier. Unavoidable penetrations due to electrical boxes or conduit, plumbing, and other assemblies that are not air tight are to be made so by sealing the assembly and the interface between the assembly and the air barrier or by extending the air barrier over the assembly. Support the air barrier so as to withstand the maximum positive and negative air pressure to be placed on the building without displacement or damage, and transfer the load to the structure. Durably construct the air barrier to last the anticipated service life of the assembly and to withstand the maximum positive and negative pressures placed on it during pressure testing. Do not install lighting fixtures that are equipped with ventilation holes through the air barrier.

3.3.3 Sealing Plumbing

Prime all plumbing traps located within the envelope full of water.

3.3.4 Close and Lock Doors

Close and lock all doors and windows in the envelope perimeter. For doors not equipped with latching hardware, temporarily secure them in the closed position. Secure the doors in such a way that they remain fully closed even when the maximum anticipated differential air pressure produced during the test acts on them.

3.3.5 Hold Excluded Building Areas at the Outdoor Pressure Level

Keep building areas immediately surrounding but excluded from the test envelope at the outdoor pressure level during the pressure test. Maintain these areas at the outdoor pressure level by propping exterior doors open, opening windows and de-energizing all air moving devices in or serving these areas.

3.3.6 Maintain an Even Pressure within the Envelope

Ensure the pressure differences within the envelope are minimized by opening all internal air pathways including propping open all interior doors. Distribute test fans throughout the envelope as necessary to ensure the internal pressures are uniform (within 10 percent of the average differential pressure). Ideally, do not install suspended ceilings until after all pressure tests have been completed. If, however the envelope includes finished suspended ceiling spaces, temporarily remove approximately 5 percent of all ceiling tiles or a minimum of 1 tile from each isolated suspended ceiling space, whichever comprises the greatest surface area. Temporarily remove additional ceiling tiles during testing to allow for inspection and diagnostic testing of the ceiling/wall interface. An alternative to removing ceiling tiles is to measure the differential pressure between each isolated suspended ceiling space and

the outdoors when the area below the suspended ceiling is maintained at a differential pressure of 75 Pa with respect to the outdoors. If the suspended ceiling differential pressure measurement is within ten percent of the 75 Pa pressure below the suspended ceiling no ceiling tiles need to be removed.

3.3.7 Maintain Access to Mechanical and Electrical Rooms

Maintain access to mechanical rooms and electrical rooms associated with the envelope to allow for de-energizing ventilation equipment and resetting circuit breakers tripped by blower door equipment, if used.

3.3.8 Minimize Potential for Blowing Dust and Debris

Because high velocity air will be blown into and out of the envelope during the test, debris, including dust and litter, may become airborne. Airborne debris may become trapped or entangled in test equipment, thereby skewing test results. Ensure areas within and surrounding the envelope are free of dust, litter and construction materials that are easily airborne. If pressurizing existing, occupied areas, provide adequate notice to building occupants of blowing dust and debris, and general disruption of normal activities during the test.

3.3.9 De-energize Air Moving Devices

De-energize all air moving devices serving the envelope to keep air within the envelope as still as reasonably achievable. De-energize all fans that deliver air to, exhaust air from, or recirculate air within the envelope. Also de-energize all fans serving areas adjacent to but excluded from the envelope.

[3.3.10 Installing Blower Door Equipment in a Door Opening

Where blower door fans are used, before installing blower door equipment, select a door opening that does not restrict air flow into and out of the envelope and has at least 1.5 m clear distance in front of and behind the door opening. Disconnect the door actuator and secure the door open to prevent it from being drawn into the fan by fan pressure. Avoid installing blower door equipment on the windward side of the building.

]3.4 BUILDING ENVELOPE AIR TIGHTNESS REQUIREMENT

For each building envelope, perform the Architectural Only test and if noted below, the Architectural Plus HVAC System test. The purpose of the pressure (air leakage) test is to determine final compliance with the airtightness requirement by demonstrating the performance of the continuous air barrier. An effective air barrier envelope minimizes infiltration and exfiltration through unintended air paths (leaks). The tests may be performed in any desired order.

3.4.1 Architectural Only Test

The test envelope is the architectural air barrier boundary as defined on the contract drawings. This boundary includes connecting walls, roof and floor which comprise a complete, whole, and continuous three dimensional envelope. Perform both a positive pressure test and a negative pressure test on this envelope, unless otherwise directed.

3.4.1.1 Test Goal

Input data from the test into the Air Leakage Rate by Fan Pressurization spreadsheet as described in paragraph CALCULATION PROGRAM via the Air Leakage Test Form. Compare output from the spreadsheet against the maximum allowable leakage defined in Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM. The envelope passes the test if the leakage rate, as calculated using the spreadsheet, is equal to or lower than the Architectural Only leakage rate goal.

3.4.1.2 Preparing the Envelope for the Pressure Test - Seal All Openings through the Air Barrier

Temporarily close all perimeter windows, roof hatches and doors in the envelope perimeter except for those doors that are to remain open to accommodate blower door or trailer mounted fan test equipment installation. Seal, or isolate all other intentional openings, pathways and fenestrations through the architectural envelope prior to pressure testing. Follow the Recommended Test Envelope Conditions identified in ASTM E1827, Table 1, for the Closed Envelope condition. These openings may include boiler flues, fuel-burning water heater flues, fuel-burning kitchen equipment, clothes dryer vents, fireplaces, wall or ceiling grilles, diffusers etc. Before sealing flues, close their associated fuel valves and verify the associated pilot lights are extinguished. Prime all plumbing traps located within the envelope full of water. In lieu of applying tape and/or plastic, typical temporary sealing materials include tape and sheet plastic or a self-adhesive grille wrap. Use and apply tape and plastic in a manner that does not deface or remove paint or mar the finish of permanent surfaces. Be especially aware of residue that remains from tape applied to stainless steel surfaces such as kitchen hoods or rollup doors. For painted surfaces, use tape types that do not remove finish paint when the tape is removed. If paint is removed from the finished surface, repaint to match existing surfaces. Secure dampers closed either manually or by using the building's HVAC system controls. Use the table below for further guidance in building preparation.

Building Component	Envelope Condition
Air handling units, duct fans	As found (open) or temporarily sealed as necessary
Clothes dryer	Off
Clothes dryer vents	Temporarily sealed
Dampers - intake, exhaust	Physically closed or closed using control power or temporarily sealed
Diffusers, registers, grilles within the envelope	Temporarily sealed
Doors, personnel type, at the envelope perimeter	Secured closed
Doors, personnel type, within the envelope	Secured (propped) open
Doors, roll-up type, at the envelope perimeter	Closed (no additional sealing)

Building Component	Envelope Condition
Exhaust hoods	Closed* and temporarily sealed
Fireplace hearth	Temporarily sealed *
Kitchen hoods	Temporarily sealed *
Pilot light and associated fuel valve	Extinguished and closed, respectively
Vented combustion appliance	Temporarily sealed *
Vented combustion appliance exhaust flue	Off
Windows	Secured closed
* If the building component has an associated manual or automatic damper, consider securing the damper closed in lieu of temporarily sealing.	

[3.4.2 Architectural Plus HVAC System Test

This test envelope includes the architectural air barrier boundary as defined on the contract drawings plus all HVAC supply, return and exhaust systems that penetrate and terminate within said architectural air barrier boundary and that extends outward from said boundary. All associated ductwork, intake and exhaust dampers, and air moving devices, including air handling units and fans, are included in this test envelope even if they are physically located outside of the architectural air barrier boundary. The boundary extends to and includes the low leakage intake and exhaust dampers. Perform both a positive pressure test and a negative pressure test on this envelope, unless otherwise indicated.

3.4.2.1 Test Goal

Data from the test is to be input into the Air Leakage Rate by Fan Pressurization spreadsheet as described in paragraph CALCULATION PROGRAM via the Air Leakage Test Form. If both a positive and negative pressure tests were performed, both data sets are together to be input in the spreadsheet. Compare output from the spreadsheet against the leakage rate goal. The envelope passes the test if the leakage rate, as calculated using the spreadsheet, is equal to or lower than the Architectural Plus HVAC System leakage rate goal.

3.4.2.2 Preparing the Building for the Pressure Test

In preparation of this test, de-energize all air moving devices within this envelope by putting their controls in the Unoccupied mode. This allows the building's HVAC controls to close all associated motorized intake, exhaust, and relief dampers. Make no other changes to the HVAC systems. Temporarily sealing diffusers, grilles, registers, kitchen hoods, exhaust hoods, fans, air handling units and all other HVAC system elements with tape and/or plastic sheeting or any other means is not allowed. If the envelope includes a fireplace hearth do not seal it with tape and plastic. Use the table below for further guidance in building preparation.

Building Component	Envelope Condition
Air handling units, duct fans	As found (open)
Clothes dryer	Off
Clothes dryer vents	As found (no preparation)
Dampers - intake, exhaust	As found (no preparation)
Diffusers, registers, grilles within the envelope	As found (open)
Doors, personnel type, at the envelope perimeter	Secured closed
Doors, personnel type, within the envelope	Secured (propped) open
Doors, roll-up type, at the envelope perimeter	Closed (no preparation)
Exhaust hoods	Closed
Fireplace hearth	As found (open)
Kitchen hoods	As found (open)
Pilot light and associated fuel valve	Extinguished and closed, respectively
Vented combustion appliance	Off
Vented combustion appliance exhaust flue	As found (open)
Windows	Secured closed

]3.5 CONDUCTING THE PRESSURE TEST

Notify the Contracting Officer at least 10 working days before conducting the pressure tests to provide the Government the opportunity to witness the tests and to monitor weather forecasts for conditions favorable for testing. Do not pressure test until verifying that the continuous air barrier is in place and installed without failures in accordance with installation instructions. During the pressure test periodically inspect temporarily sealed items to ensure they are still sealed. Seals on temporarily sealed items tend to release more readily at higher pressures. Test data obtained after temporarily sealed items become unsealed cannot be used as input into the calculation program. Follow the Envelope Pressure Test Procedures in the paragraphs below. Submit detailed pressure test procedures indicating the test apparatus, the test methods and procedures, and the analysis methods to be employed for the building envelope pressure (air tightness) test. Submit these procedures not later than 60 days after Notice to Proceed.

3.5.1 Extend Pneumatic Tubes and Establish a Reference Differential Pressure

Confirm the various zones within the envelope have a relatively uniform

interior pressure distribution by establishing a representative differential pressure between the envelope and the outdoors with blower door or trailer-mounted fans operating. The number of indoor pressure difference measurements (pneumatic hoses) required depends on the number of interior zones separated by bottle necks that could create significant pressure drops (e.g. doorways and stairwells). Extend at least four pneumatic hoses (differential pressure monitoring ports) to locations within the envelope that are physically opposite of each other. In multiple story buildings, especially those over three stories, extend hoses to multiple floors. Locate the hose ends away from the effects of air discharge from blower test equipment. Select one of the four (or more) interior hoses, one judged by the test agency to be the most unaffected by air velocity produced by blower test equipment, to serve as the interior reference pressure port. Extend at least one additional pneumatic hose to the outdoors (outdoor pressure port). To the end of this hose manifold at least four hoses together and terminate each hose on a different side of the building. With the envelope sealed and the blowers energized, measure the differential pressure using the interior reference pressure port and the four outdoor pressure ports. Then measure and record the differential pressure by individually using each of the remaining three interior hoses. Ensure each reading is within plus or minus 10 percent of the reference reading. Thus at an average 75 Pa maximum pressure difference across the envelope, the difference between the highest and lowest interior pressure difference measurements should be 15 Pa or less. If this condition cannot be met, attempt to create additional air pathways within the envelope to minimize pressure differences within the envelope. If necessary, move the interior hose ends. See step 2.13 of the Air Leakage Test Form in Appendix A.

3.5.2 Bias Pressure Readings

With the fan pressurization equipment de-energized and the envelope sealed, obtain the differential pressure between the outdoors and the envelope. Record 12 bias pressure readings before the pressure test and 12 bias pressure readings after the pressure test. Each reading is the average of ten or more 1-second measurements. Include positive and negative signs for each reading. To help dampen bias pressures that significantly contribute to test pressure, reduce temperature differences between indoor and outdoor air. Temperature differences can be reduced by operating test fan equipment for a few minutes to replace most of the indoor air with outdoor air.

3.5.3 Testing in Both Positive and Negative Directions

The preferred method for testing a building envelope is to test in both the pressurized and depressurized directions. Testing in one direction is only allowed if opposite direction testing cannot logistically be performed due to test equipment limitations or restrictions. After obtaining the pre-test bias differential pressure readings, conduct the pressure test. Record the envelope pressures (in units of Pascals) from one interior pneumatic hose (monitoring port) and the outdoor pneumatic hose(s), averaged or manifolded, with corresponding flows (in units of L/s) for each fan. Record the flow rates at at least 10 to 12 positive and 10 to 12 negative building pressure readings. If conducting both positive and negative pressure tests the lowest allowable test pressure is 40 Pa and the highest test pressure is 85 Pa. Keep at least 25 Pa difference between the lowest and highest test pressure readings. Include the 75 Pa pressure value between the lowest and highest readings. The 10 to 12 readings in each direction are to be roughly evenly spaced along the range

of pressures and flows. After testing is complete de-energize the equipment used to provide pressurization and obtain an additional 10 to 12 post-test bias pressure readings. None of the bias pressure readings are allowed to exceed 30 percent of the minimum test pressure. If these limits are exceeded the test fails and must be repeated.

[3.5.4 Single Direction Testing

After obtaining the 12 aforementioned bias pressure readings, conduct the [positive][negative] pressure test. Obtain flow rates at 10 to 12 roughly evenly spaced pressure readings over a pressure range of [50 to 85][25 to 50] Pa. After the data is recorded, de-energize the blower equipment and obtain an additional 10 to 12 bias pressure readings. None of the bias pressure readings may exceed 10 percent of the minimum test pressure. If these limits are exceeded the test fails.

]3.5.5 Using a Building's Own Air Handling System to Pressure Test an Envelope

3.5.5.1 Test Setup

Temporarily seal the envelope in a manner similar to that for testing with blower door or trailer-mounted fans. To positively pressurize the envelope, de-energize all ventilation equipment and close all associated dampers, except those outside air intake dampers associated with supply fans that will be used to pressurize the building envelope. Fully open these dampers. For the negative pressure test, de-energize all ventilation equipment except for those fans that will be used to de-pressurize the envelope. All dampers associated with de-energized fans are to be closed and all exhaust dampers associated with fans used to de-pressurize the envelope will be fully opened.

3.5.5.2 Measuring Airflows

When using the building's own air handling system to pressure test the envelope, air flows can generally be measured using one of the following methods:

a. [When testing using the building's own air handling system, ensure flow readings obtained by anemometer comply with ASTM D3464.]Pitot tube or hot wire anemometer traverse in accordance with ASTM D3464.

b. Pressure compensated shrouds (especially recommended for rooftop exhaust fans)

c. Tracer gas methods for measuring airflows in ducts in accordance with ASTM E2029. Do not use tracer gas decay, constant injection and constant concentration methods for estimating the total ventilation rate of the envelope.

3.5.5.3 Outdoor Air Flow Measuring Stations

Air flow stations may be used to measure outdoor airflows if one of the above methods is used to check accuracy of at least one air flow reading for each station or if the design of the HVAC system specifically placed outdoor air flow stations in locations that will yield accurate results. Field verify the accuracy of readings at the air flow measuring stations before obtaining pressure test readings.

3.5.6 Pressure Testing - Special Cases

[3.5.6.1 Pressure Testing a Tall or Large Building Envelope

Pressure testing the envelope of a tall or large building may be unworkable and unrealistic using blower door or trailer-mounted equipment. In this case, the test agency may define and pressure test separate zones or floors within the envelope and sum the leakage of all of the zones to create an overall envelope leakage rate. Using this method, the test agency is to comply with the requirements of ASHRAE RP-935.

]3.5.6.2 Pressure Testing a Multiple Isolated Zoned Building

Pressure test each exterior corner zone plus at least an additional 20 percent (as measured by floor area) of remaining zones. The Contracting Officer is responsible for selecting which of these additional zones to test. If all zones pass the pressure test it is assumed that all untested zones also pass and no further testing is required. If, however, any zone fails to pass the test's leakage requirements, re-seal and re-test until it passes in accordance with paragraph FAILED PRESSURE TEST. Test an additional 20 percent of previously untested zones. If all tested zones pass, no further testing is needed. If any zone in this group fails the test re-seal and re-test the zone until it passes. Continue this process until all the tested zones pass. When testing a zone, the doors to all adjacent zones that share a common surface with the tested zone are to have their doors opened to the outdoors. The resulting leakage from the test zoned is that through all 6 sufaces (4 walls, roof and floor, for a rectangular shaped zone).

3.5.6.3 Pressure Testing a Building Addition

If the existing building is occupied, coordinate the pressure test with building representatives. In preparation of the test, de-energize the air handling system serving that portion of the existing building that shares surfaces with the new building addition. Pressure testing a new building addition may also require pressurizing that part of the existing building that shares surfaces in common with the new building addition. If an air barrier is applied to the common surfaces separating the existing building from the new addition, prior to the test prop open a sufficient quantity of doors and/or windows to keep the existing building at the same pressure as the outdoors. If an air barrier is not applied to the common surfaces separating the existing building from the new addition, pressurize that part of the existing building that shares surfaces in common with the building addition to the same level as the as the addition using separate test pressurization equipment.

3.5.7 Failed Pressure Test

If the pressure test fails to meet the established criteria, use diagnostic test methods described in paragraph LOCATING LEAKS BY DIAGNOSTIC TESTING to discover the leak locations. Provide additional permanent sealing measures to reduce or eliminate leak sources discovered during diagnostic testing. Retest (perform another pressure test) after sealing has been completed. Repeat this sequence of documenting test results in the test report, performing diagnostic tests, documenting recommendations for additional sealing measures in the test report, sealing leak locations per recommendations, and re-testing as necessary until the building envelope passes the pressure test and is in compliance with the performance requirements.

3.5.8 Air Leakage Test Report

Report volumetric flow rates and corresponding differential pressures in liters per second (L/s) and Pascals (Pa), respectively, on the Air Leakage Test Form sample form found in Appendix A. Populate the accompanying spreadsheet file entitled Pressure Test Data Analysis with information obtained during the test. The spreadsheet uses equations found in ASTM E779 or JIS A 2201 as a basis for calculating the envelope leakage rate. Other similar leakage rate calculation programs cannot be used or submitted for review. Submit a printout of the data input and output in the report. Should any air tightness (pressure) test fail, the pressure test report is to include data and results from all previous failed tests along with the final successful test data and results. Indicate if the resulting leakage rate did or did not meet the goal leakage requirement. Identify and document deficiencies in the building construction upon failure of a test to meet the specified maximum leakage rate.

Include the Test Agency Qualification Sheet, Air Leakage Test Form and Air Leakage Test Results Form in the written report. Document every test set-up condition with diagrams and photos to ensure the tests can be made repeatable. Document all pneumatic hose termination locations. Record in detail how the building envelope was prepared for the tests. Also describe in detail which building items were temporarily sealed. Include photos of test equipment and sealing measures in the report. Include an electronic (pdf) version of all test reports on a CD. If the building envelope fails to meet the leakage rate goal, provide recommendations to further seal the envelope and document these recommendations in the test report.

3.6 LOCATING LEAKS BY DIAGNOSTIC TESTING

Use diagnostic test methods described herein to discover obvious leaks through the envelope. Perform diagnostic tests on the building envelope regardless of the envelope meeting or failing to meet the designated leakage rate goal. Use diagnostic test methods in accordance with ASTM E1186 and in conjunction with pressurization equipment as necessary. Use the thermography diagnostic test to establish a baseline for envelope leakage. Apply additional diagnostic tests (find, feel, fog or other tests) as necessary to further define leak locations and pathways discovered using thermography or to find additional leaks not readily detected by thermography. Using a variety of diagnostic tests may help locate leaks that would otherwise go undetected if only a single diagnostic test were used. Pay special attention to locating leaks at interfaces where there is a change in materials or a change in direction of like materials. These interfaces, at a minimum, include roof/wall, wall/wall, floor/wall, wall/window, wall/door, wall/louver, roof mounted equipment/roof curb interfaces and all utility penetrations (ducts,pipes, conduit, etc) through the envelope's architecture. Also use diagnostic tests to check for leakage between the air duct and duct damper, when the damper, under normal control power, is placed in the closed position. Should leaks be discovered during diagnostic tests, thoroughly document their exact locations on a floor plan so that sealing can be later applied, if required or as directed. If the envelope passes the leakage test, use the diagnostic test procedure described above to identify obvious leakage locations. Seal the leaks at the discretion of the COR based on the magnitude, location, potential for liquid moisture penetration or retention, potential for condensation, presence of daylight through an architectural surface or if the leakage location could

potentially cause rapid deterioration or mold growth of, or in the building envelope materials and assemblies. Apply sealing measures after diagnostic testing is complete and all pressurization blowers are off. To verify that the applied sealing measures that are effective, re-test for leaks using the same diagnostic methods that discovered the leak. Reseal and retest until the envelope meets the leakage rate goal and all obvious leaks through the envelope are sealed.

3.6.1 Find Test

Use visual observation to locate daylight and/or artificial light streaming from the opposite side of the envelope. Observe all interfaces identified above.

3.6.2 Feel Test

Use the building's air handling system or blower door equipment to negatively pressurize the building envelope, to at least 25 Pa but no greater than 85 Pa, with respect to the outdoors. The larger the pressure difference, the easier discovering leaks by feeling them becomes. While inside the envelope, hand feel roof/wall, wall/wall, and floor/wall interfaces and utility penetrations (ducts, pipes, conduit, etc) for leaks and note the leak locations on a floor plan. The "Feel" test may also be used to check for leaks between the ductwork and ductwork damper. To do this, positively pressurize the envelope and check for air movement from the envelope exterior.

3.6.3 Infrared Thermography Test

Avoid performing thermography tests just after pressure testing the building envelope (pressurizing and/or depressurizing the building envelope) as thermography readings may be inaccurate due to excessive air-wash. Perform thermography either before the pressure test or wait an appropriate amount of time after pressure test completion for the temperatures within the building envelope to stabilize before starting the thermography tests. Coordinate thermography examination with the pressure test agency and the test agency's pressurization equipment. The pressure test agency is to allow adequate time for the thermographer to perform a complete thermographic examination, as described hereinafter, of the envelope interior and exterior.

3.6.3.1 Thermography Test Methods

Before thermographic testing, remove furniture, construction equipment, and all other obstructions both inside and outside the building as necessary to gain a clear field of view. In the Thermographic Investigation Report, document all areas where obstructions remain. For exterior thermal examination of the envelope, verify that no direct solar radiation has heated the envelope surfaces to be examined for a period of approximately 3 hours for frame construction and for approximately 8 hours for masonry veneer construction. Conduct exterior investigations after sunset, before sunrise, or on an overcast day when the influence of solar radiation can be determined to be minimal. Limit exterior examinations to times when the influence of solar radiation is minimal, such as after sunset or before sunrise or during an overcast day. Conduct thermal imaging tests only when wind speeds are less than 8 mph at the time of analysis and at the end of analysis. Document any variations in wind during the test. Document all variations of test conditions in the Thermographic Investigation Report. Test only when exterior surfaces are

dry. Monitor and document ongoing test parameters, such as the temperatures inside and outside the air barrier envelope, wind speed, and differential pressure.

3.6.3.1.1 Thermography Testing of the Air Barrier

Test the building envelope in accordance with ISO 6781, and ASTM E1186. Perform a complete thermographic inspection consisting of the full inspection of the interior and exterior of the complete air barrier envelope. Document envelope areas that are inaccessible for testing. Use infrared thermography technology in concert with standard pressurization methods (blower doors, trailer mounted fans and/or the building's own air handling systems) to locate leaks through the air barrier. Because thermography works best with at least a 10 degree C temperature difference between the envelope interior and the exterior, adjust the HVAC system, if possible, to create or enhance this temperature difference. The minimum allowable temperature difference is 1.7 degree C. Maintain this temperature difference for at least 3 hours prior to the test. Use pressurization methods to establish a minimum of +20 Pa pressure difference with respect to the outdoors while using an infrared camera to view the envelope from outdoors. When viewing with the camera from inside the envelope, keep the envelope at a pressure differential of -20 Pa with respect to the outdoors using pressure testing equipment or the building's own air handling system.

3.6.3.2 Thermography Test Results

Document the location of all leaks, anomalies, and unusual thermal features on a floor plan and/or elevation view and catalog them with a visible light picture for locating the defect for correction. The thermographer is to recommend corrective actions to eliminate the leaks, anomalies and unusual thermal features. Where leaks are found perform corrective sealing as necessary to achieve the whole envelope air leakage rate specified. After sealing, again use thermography in concert with standard pressurization methods to verify that the air leakage has been reduced. After these leaks have been permanently sealed note all actions taken on the drawings or in the Thermographic Investigation Report. Submit the drawings for approval as part of the Thermographic Investigation Report. Also include thermographic photos that show where leaks were discovered. Include thermograms using an imaging palette that clearly shows the observed thermal patterns indicating air leakage. The Contracting Officer's Representative is to witness all testing.

3.6.4 Fog Test

Before using a theatrical fog generator, disable all building smoke detectors as they may alarm when fog is issued. Coordinate fog tests and the disabling of all smoke detectors with the Contracting Officer's representative and the local fire department as necessary. Use pressure test equipment or the buildings own air handling system to positively pressurize the building envelope to at least 25 Pa but not greater than 85 Pa over the outdoors. Using a theatrical fog generator within the envelope, direct fog at suspected leakage points such as at building interfaces. Test the following interfaces: roof/wall, wall/wall, floor/wall, wall/window, roof/mounted mechanical equipment. From the vantage point immediately outside the envelope and opposite that of the interface being tested, observe the effect as the fog is issued. Detection may also be further enhanced by using a scented fog liquid or a fog liquid that produces a colored fog. Look for fog and smell for

associated odor percolating through the interface. Also use smoke puffers and smoke sticks as necessary to locate leaks at these and other interface locations. If the Architectural Plus HVAC System pressure test will be/was performed introduce fog into ductwork to check for leakage between ductwork and associated dampers. After fog testing has ended, reactivate the building smoke detectors and notify the Contracting Officer and local fire department that the test has ended. After sealing has been completed retest these areas using fog. Seal additional leaks that are found.

3.6.5 Diagnostic Test Report

Once the diagnostic tests have been completed and the leakage locations identified and sealed, document these procedures, locations and recommendations in the diagnostic test report. Submit plan and/or profile drawings that thoroughly identify leak locations. Describe in detail all leak locations so that the seal-up crew knows where to apply sealing measures. After sealing measures have been applied, describe the methods used along with applicable photos of the final sealed condition.

3.6.5.1 Thermographic Investigation Report

Submit a report of each thermographic investigation identifying the thermal discontinuities in the thermal control layer. Indicate in the final report locations to which improvements for both the air control layer and the thermal control layer were made to reduce air leaks and correct discontinuities in the thermal control layer. Include in the report some selected radiometric images of suspected failure points in the air barrier envelope that indicate before and after conditions.[Devote a chapter(s) of the Thermographic Investigation Report to identifying suspected points of thermal bridging, moisture migration through roofs and walls, and insulation voids.] Indicate in the final report improvements that were made to the envelope to reduce air leaks. Include the following items in the report:

a. Brief description of the building construction

b. Types of interior and exterior surface materials used in the building.

c. Geographical orientation of the building with a description of the exterior surroundings including other buildings, vegetation, landscaping, and surface water drainage.

d. Camera brand, model and serial number, and date of most recent calibration date; optional lenses with serial numbers (if applicable)

e. Thermographer's and Government Inspector's names

f. Date and time of tests

g. Air temperature and humidity inside the air barrier envelope

h. Outdoor air temperature and humidity

i. General information for the last 12 hours on the solar radiation conditions in the geographic area where the test is being performed.

j. Ambient conditions such as precipitation and wind direction and speed occurring with the last 24 hours, as applicable. Refer to specific requirements in each section of each thermographic inspection type for

requirements in each specific area.

k. Documentation of those portions of the building envelop which were not within test conditions when the scan was performed and which portions were obstructed by adjacent structures, interior furnishings, intervening cavities or reflective surfaces.

l. Other relevant information, which may have influenced test results.

m. Drawings, sketches, floor plans and/or photographs detailing the locations in the buildings where thermograms were taken detailing possible irregularities in the components being tested.

n. Thermal images taken during the inspection with their relative locations and written or voiced recorded explanations of the anomaly listed along with visual and reference images.

o. An identification of the aspects or components of the building being examined.

p. Explanations for the type and the extent of each construction defect observed during the inspection.

q. Any results from additional measurements and investigations. Identify additional equipment used and support with type, model number, serial number and date of most recent calibrated.

3.6.5.2 Fog Test Report

Document all turbulent air flow and dead air spaces within the envelope. Report fog behavior as it exits from and/or is entrained within the building. Include a floor plan in the report that documents the locations where fog passed through the envelope.

3.7 CALCULATION PROGRAM

To calculate the envelope leakage rate and other required outputs, input the data obtained during the pressure tests as documented in the Air Leakage Test Form (Appendix A) into the Air Leakage Rate by Fan Pressurization Excel spreadsheet. This spreadsheet can be found at the following web site:
http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphic

3.8 AFTER COMPLETION OF THE PRESSURE AND/OR DIAGNOSTIC TEST

After all pressure and/or diagnostic testing has been completed unseal all temporarily sealed items. Unless otherwise directed by the Contracting Officer, return all dampers, doors, and windows to their pre-test condition. Remove tape and plastic from all temporarily sealed openings, being careful not to deface painted surfaces. If paint is removed from finished surfaces, repaint to match existing surfaces. Unless otherwise directed by the Contracting Officer's representative, return fuel (gas) valves to their pre-test position and relight pilot lights. Return all fans and air handling units to pre-test conditions.

3.9 REPAIR AND PROTECTION

Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for testing, inspection, and similar

services. Upon completion of inspection, testing, or sample taking and similar services, repair damaged construction and restore substrates and finishes, protect construction exposed by or for quality control service activities, and protect repaired construction.

3.10 APPENDICES

The following forms are available for download as a MS Word file at http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphic

Appendix A - Air Leakage Test Form
Appendix B - Air Leakage Test Results Form
Appendix C - Test Agency Qualifications Sheet

-- End of Section --

SECTION 07 14 00

FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE ARCHITECTURAL STANDARD SPECIFICAITONS (JASS)

JASS 8	Waterproofing Work Standard Specification

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5005	(2009) Crushed Stone and Manufactured Sand for Concrete
JIS A 6013	(2014) Polymer-Modified Bitumen Roofing Sheets
JIS A 6021	(2011) Liquid-applied Compounds for Waterproofing Membrane Coatings of Buildings
JIS A 9521	(2017) Thermal Insulation Materials for Buildings

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT SS Chapter 9	(2019) Building Construction Standard Specifications - Chapter 9 Waterproofing Construction

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fluid-Applied Membrane

Membrane Primer

Bond Breaker

Submit material description and physical properties, application details, and recommendations regarding shelf life, application procedures, and precautions on flammability and toxicity.

SD-11 Closeout Submittals

Warranty

Information Card

Instructions To Government Personnel

Include copies of Safety Data Sheets for maintenance/repair materials.

1.3 PREWATERPROOFING CONFERENCE

Prior to starting application of waterproofing system, arrange and attend a prewaterproofing conference to ensure a clear understanding of drawings and specifications. Give the Contracting Officer 7 days advance written notice of the time and place of meeting. Ensure that the mechanical and electrical subcontractor, flashing and sheetmetal subcontractor, and other trades that may perform other types of work on or over the membrane after installation, attend this conference.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver waterproofing materials in manufacturer's original, unopened containers, with labels intact and legible. Containers of materials covered by a referenced specification number shall bear the specification number, type, and class of the contents. Deliver materials in sufficient quantity to continue work without interruption. Store and protect materials in accordance with manufacturer's instructions, and use within their indicated shelf life. When hazardous materials are involved, adhere to special precautions of the manufacturer, unless precautions conflict with local, state, and federal regulations. Promptly remove from the site materials or incomplete work adversely affected by exposure to moisture or freezing. Store materials on pallets and cover from top to bottom with canvas tarpaulins.

1.5 ENVIRONMENTAL CONDITIONS

Apply materials when ambient temperature is 4 degrees C or above for a period of 24 hours prior to the application and when there is no ice, frost, surface moisture, or visible dampness on the substrate surface. Apply materials when air temperature is expected to remain above 4 degrees C during the cure period recommended by the manufacturer. Moisture test for substrate is specified under paragraph entitled "Moisture Test." Work may be performed within heated enclosures, provided the surface temperature of the substrate is maintained at a minimum of 4 degrees C for 24 hours prior to the application of the waterproofing, and remains above that temperature during the cure period recommended by the manufacturer.

1.6 WARRANTY

Provide roof system material and workmanship warranties meeting specified requirements. Provide revisions or amendment to standard membrane manufacturer warranty to comply with the specified requirements. Minimum manufacturer warranty shall have no dollar limit, cover full system

water-tightness, and shall have a minimum duration of 10 years.

1.6.1 Roof Membrane Manufacturer Warranty

Furnish the roof membrane manufacturer's 10-year no dollar limit roof system materials and installation workmanship warranty, including flashing, insulation, and accessories necessary for a watertight roof system construction. Write the warranty directly to the Government commencing at time of Government's acceptance of the roof work. Provide the the following statements for such warranty:

a. If within the warranty period the roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, blisters, splits, tears, cracks, delaminates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the roof system assembly and correction of defective workmanship are the responsibility of the roof membrane manufacturer. All cost associated with the repair or replacement work are the responsibility of the roof membrane manufacturer.

b. The warranty must remain in full force and effect, including emergency temporary repairs performed by others, when the manufacturer or his approved applicator fail to perform the repairs within 72 hours of notification.

1.6.2 Roofing System Installer Warranty

The roof system installer must warrant for a minimum period of two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof membrane, flashing, insulation, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Write the warranty directly to the Government. The roof system installer is responsible for correction of defective workmanship and replacement of damaged or affected materials. The roof system installer is responsible for all costs associated with the repair or replacement work.

1.6.3 Continuance of Warranty

Approve repair or replacement work that becomes necessary within the warranty period and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the roof membrane manufacturer warranty for the remainder of the manufacturer warranty period.

1.7 CONFORMANCE AND COMPATIBILITY

Work not specifically addressed and any deviation from specified requirements must be in general accordance with recommendations of the MLIT SS Chapter 9, membrane manufacturer published recommendations and details, and compatible with surrounding components and construction.

PART 2 PRODUCTS

2.1 FLUID-APPLIED MEMBRANE

JIS A 6021 and comply with JASS 8.

2.2 MEMBRANE PRIMER

As recommended by the fluid-applied membrane manufacturer unless specifically prohibited by the manufacturer of the fluid-applied membrane.

2.3 SEALANT

As specified in Section 07 92 00 JOINT SEALANTS.

2.4 SEALANT PRIMER

As specified in Section 07 92 00 JOINT SEALANTS.

2.5 BACKING MATERIAL

Premolded, closed-cell, polyethylene, or polyurethane foam rod having a diameter 25 percent larger than joint width before being compressed into joint. Provide bond breaker of polyethylene film or other suitable material between backing material and sealant.

2.6 [JOINT FILLER

As specified in [Section 03 30 00 CAST-IN-PLACE CONCRETE.]]

2.7 BOND BREAKER

As recommended by the fluid-applied membrane manufacturer. Bond breaker shall not interfere with the curing process or other performance properties of the fluid-applied membrane.

2.8 ELASTOMERIC SHEET

Preformed; as recommended by the fluid-applied membrane manufacturer. Bond strength between the fluid-applied membrane and the preformed elastomeric sheet shall be a minimum of 7 kPa when tested in accordance with JIS A 6013.

2.9 ELASTOMERIC SHEET ADHESIVE

As recommended by the elastomeric sheet manufacturer.

2.10 PROTECTION BOARD

Premolded bitumen composition board, 3 mm minimum thickness or other composition board compatible with the fluid-applied membrane.

2.11 DRAINAGE COURSE AGGREGATE

JIS A 5005, size 9.5 mm to 2.5 mm.

2.12 INSULATION

Polystyrene foam conforming to JIS A 9521, thickness as [indicated]

[required by indicated R-value].

PART 3 EXECUTION

3.1 PREPARATION

Coordinate work with that of other trades to ensure that components to be incorporated into the waterproofing system are available when needed. Inspect and approve surfaces immediately before application of waterproofing materials. Remove laitance, loose aggregate, sharp projections, grease, oil, dirt, curing compounds, and other contaminants which could adversely affect the complete bonding of the fluid-applied membrane to the concrete surface.

3.1.1 Flashings

Make penetrations through sleeves in concrete slab watertight before application of waterproofing. After flashing is completed, cover elastomeric sheet with fluid-applied waterproofing during waterproofing application.

3.1.1.1 Drains

Make drain flanges flush with surface of structural slab. Apply a full elastomeric sheet around the drain, with edges fully adhered to drain flange and to structural slab. Do not adhere elastomeric sheet over joint between drain and concrete slab. Do not plug drainage or weep holes. Cover elastomeric sheet with fluid-applied waterproofing during waterproofing application. Lap elastomeric sheet a minimum of 100 mm onto concrete slab.

3.1.1.2 Penetrations and Projections

Flash penetrations and projections through structural slab with an elastomeric sheet adhered to the concrete slab and the penetration. Leave elastomeric sheet unadhered for 25 mm over joint between penetration and concrete slab. Adhere elastomeric sheet a minimum of 100 mm onto horizontal deck.

3.1.1.3 Walls and Vertical Surfaces

Flash wall intersections which are not of monolithic pour or constructed with reinforced concrete joints with an elastomeric sheet adhered to both vertical wall surfaces and concrete slab. Flash intersections which are monolithically poured or constructed with reinforced concrete joints with either an elastomeric sheet or a vertical grade of fluid-applied waterproofing adhered to vertical wall surfaces and concrete slab. Leave sheet unadhered for a distance of 25 mm from the corner on both vertical and horizontal surfaces.

3.1.2 Cracks and Joints

Prepare visible cracks and joints in substrate to receive fluid-applied waterproofing membrane by placing a bond breaker and an elastomeric slip sheet between membrane and substrate. Cracks that show movement shall receive a 50 mm bond breaker followed by an elastomeric sheet adhered to the deck. Nonmoving cracks shall be double coated with fluid-applied waterproofing.

3.1.3 Priming

Prime surfaces to receive fluid-applied waterproofing membrane. Apply primer as required by membrane manufacturer's printed instructions.

3.2 SPECIAL PRECAUTIONS

Protect waterproofing materials during transport and application. Do not dilute primers and other materials, unless specifically recommended by materials manufacturer. Keep containers closed except when removing contents. Do not mix remains of unlike materials. Thoroughly remove residual materials before using application equipment for mixing and transporting materials. Do not permit equipment on the project site that has residue of materials used on previous projects. Use cleaners only for cleaning, not for thinning primers or membrane materials. Ensure that workers and others who walk on cured membrane wear clean, soft-soled shoes to avoid damaging the waterproofing materials.

3.3 APPLICATION

Over primed surfaces, provide a uniform, wet, monolithic coating of fluid-applied membrane, 1.5 mm thick, plus or minus 0.125 mm by following manufacturer's printed instructions. Apply material by trowel, squeegee, roller, brush, spray apparatus, or other method recommended by membrane manufacturer. Check wet film thickness as specified in paragraph entitled "Film Thickness" and adjust application rate as necessary to provide a uniform coating of the thickness specified. Where possible, mark off surface to be coated in equal units to facilitate proper coverage. At expansion joints, control joints, prepared cracks, flashing, and terminations, carry membrane over preformed elastomeric sheet in a uniform 1.5 mm thick, plus or minus 0.125 mm, wet thickness to provide a monolithic coating. If membrane cures before next application, wipe previously applied membrane with a solvent to remove dirt and dust that could inhibit adhesion of overlapping membrane coat. Use solvent recommended by the membrane manufacturer, as approved.

3.3.1 Work Sequence

Perform work so that protection board is installed prior to using the waterproofed surface. Do not permanently install protection board until the membrane has passed the flood test specified under paragraph entitled "Flood Test." Move material storage areas as work progresses to prevent abuse of membrane and overloading of structural deck.

3.3.2 Protection Board

Protect fluid-applied membrane by placing protection board over membrane at a time recommended by the membrane manufacturer. Protect membrane application when protection board is not placed immediately. Butt protection boards together and do not overlap.

3.3.3 Drainage Course

Place drainage course where shown after flood tests are completed and concrete protection slab or wearing course is ready to be installed.

3.3.4 Insulation

Place insulation of thickness indicated, on top of drainage course just

prior to placement of concrete protection slab.

3.4 FIELD QUALITY CONTROL

3.4.1 Moisture Test

Prior to application of fluid-applied waterproofing, measure moisture content of substrate with a moisture meter in the presence of the Contracting Officer. Do not begin application until meter reading indicates "dry" range.

3.4.2 Film Thickness

Measure wet film thickness every 10 square meters during application by placing flat metal plates on the substrate or using a mil-thickness gage especially manufactured for the purpose.

3.4.3 Flood Test

After application and curing is complete, plug drains and fill waterproofed area with water to a depth of 50 mm. A minimum 48 hour cure time, or longer cure time if recommended by the membrane manufacturer, shall be required prior to flood testing. Allow water to stand 24 hours. Test watertightness by measuring water level at beginning and end of the 24 hour period. If water level falls, drain water, allow installation to dry, and inspect. Make repairs or replace as required and repeat the test. Work shall not proceed before approval of repairs or replacement.

3.5 INSTRUCTIONS TO GOVERNMENT PERSONNEL

Furnish written and verbal instructions on proper maintenance procedures to designated Government personnel. Furnish instructions by a competent representative of the roof membrane manufacturer and include a minimum of 4 hours on maintenance and emergency repair of the membrane. Include a demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and emergency repair operations.

3.6 INFORMATION CARD

For each roof application, furnish a minimum 215 mm information card for facility records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 1 mm thick aluminum card for exterior display. Identify facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, membrane, number of plies, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, presence of vapor retarder; date of completion; installing contractor identification and contract information; membrane manufacturer warranty expiration, warranty reference number, and contact information. Install card at roof top or access location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

FORM 1
FLUID-APPLIED WATERPROOFING SYSTEM COMPONENTS
1. Contract Number
2. Date Work Completed
3. Project Specification Designation
4. Substrate Material
5. Slope of Substrate
6. Drains Type/Manufacturer
7. Waterproofing
a. Membrane
b. Sealant
c. Elastomeric Sheet
d. Materials Manufacturer(s)
8. Protection Board
a. Type
b. Thickness
c. Manufacturer's Name
9. Drainage Course Material Graduation
10. Insulation
a. Type
b. Thickness
c. Manufacturer's Name
11. Protection Slab
a. Material
b. Thickness
c. Support

FORM 1	
FLUID-APPLIED WATERPROOFING SYSTEM COMPONENTS	
d. Joint System	
12. Wearing Course	
a. Type	
b. Slope	
c. Joint System	
d. Sealant/Gasket Type	
13. Wearing Surface Type	
Manufacturer's Name	
14. Warranty	
a. Manufacturer warranty expiration	
b. Warranty reference number	
15. Statement of Compliance or Exception	
Contractor's Signature	Date Signed
Inspector's Signature	Date Signed

-- End of Section --

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SECTION 07 21 16

MINERAL FIBER BLANKET INSULATION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C665	(2017) Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C930	(2019) Standard Classification of Potential Health and Safety Concerns Associated with Thermal Insulation Materials and Accessories
ASTM D3575	(2020) Flexible Cellular Materials Made From Olefin Polymers
ASTM D3833/D3833M	(1996; R 2011) Water Vapor Transmission of Pressure-Sensitive Tapes
ASTM D4397	(2016) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D5359	(2015) Standard Specification for Glass Cullet Recovered from Waste for Use in Manufacture of Glass Fiber
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2021) Standard Test Methods for Gravimetric Determination ofWater Vapor Transmission Rate of Materials
ASTM E136	(2019a) Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers

GREEN SEAL (GS)

GS-36	(2013) Adhesives for Commercial Use

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	(2020) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2021) National Fuel Gas Code
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 211	(2019) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS	SCS Global Services (SCS) Indoor Advantage

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)

SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T803 OM	(2010) Puncture Test of Container Board

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.134	Respiratory Protection

UNDERWRITERS LABORATORIES (UL)

UL 2818	(2013) GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes And Furnishings

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 9504	(2021) Man-made Mineral Fibre Thermal Insulation Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Blanket Insulation

Recycled Content for Insulation Materials; S

[Sill Sealer Insulation

][Vapor Retarder

] Pressure Sensitive Tape

Accessories

SD-07 Certificates

Indoor Air Quality for Insulation Materials; S

Indoor Air Quality for Adhesives; S

SD-08 Manufacturer's Instructions

Insulation

1.3 CERTIFICATIONS

Submit required indoor air quality certifications and validations in one submittal package.

1.3.1 Insulation Products

Provide product certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification by other third-party programs. Provide current product certification from certification body.

1.3.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification or validation by other third-party programs that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver materials to site in original sealed wrapping bearing manufacturer's name and brand designation, specification number, type, grade, R-value, and class. Store and handle to protect from damage. Do not allow insulation materials to become wet, soiled, crushed, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storing, and protecting of materials before and during installation.

1.4.2 Storage

Inspect materials delivered to the site for damage; unload and store out of weather in manufacturer's original packaging. Store only in dry locations, not subject to open flames or sparks, and easily accessible for inspection and handling.

1.5 SAFETY PRECAUTIONS

1.5.1 Respirators

Provide installers with dust/mist respirators, training in their use, and protective clothing, all approved by National Institute for Occupational Safety and Health (NIOSH)/Mine Safety and Health Administration (MSHA) in accordance with 29 CFR 1910.134.

1.5.2 Other Safety Concerns

Consider other safety concerns and measures as outlined in ASTM C930.

PART 2 PRODUCTS

2.1 BLANKET INSULATION

ASTM C665 or JIS A 9504, Type [I, blankets without membrane coverings] [and] [II, blankets with non-reflecting coverings] [and] [III, blankets with reflective coverings]; Class [A, membrane-faced surface with a flame spread of 25 or less] [B, membrane-faced surface with a flame propagation resistance; critical radiant flux of 0.12 W/m2 or greater], except a flame spread rating of [25] [75] [100] or less [and a smoke developed rating of 150 or less] when tested in accordance with ASTM E84.

2.1.1 Thermal Resistance Value (R-VALUE)

The R-Value must be as indicated on drawings.

2.1.2 Recycled Materials

Provide insulation materials containing the following minimum percentage of recycled material content by weight:

Fiberglass: 20 percent glass cullet complying with ASTM D5359

Provide data identifying percentage of recycled content for insulation materials.

2.1.3 Prohibited Materials

Do not provide asbestos-containing materials.

[2.1.4 Reduced Volatile Organic Compounds (VOC) for Insulation Materials

Provide certification of indoor air quality for insulation materials.

][2.2 SILL SEALER INSULATION

Provide polyethylene foam sill sealer [89][139][190][241] millimeters in width with the following characteristics:.

Physical Properties	Test Method	Measurement
Nominal Thickness	ASTM D3575	4.76 mm

Physical Properties	Test Method	Measurement
Compressive Strength	ASTM D3575	8.27 kPa
- Vertical Direction	Suffix D	
Tensile Strength	ASTM D3575	220 kPa
	Suffix T	

]2.3 BLOCKING

Wood, metal, unfaced mineral fiber blankets in accordance with ASTM C665 or JIS A 9504, Type I, or other approved materials. Use only non-combustible materials meeting the requirements of ASTM E136 for blocking around chimneys and heat producing devices.

[2.4 VAPOR RETARDER

[a. 0.15 mm thick polyethylene sheeting conforming to ASTM D4397 and having a water vapor permeance of 57.2 ng/(Pa * s * m2) or less when tested in accordance with ASTM E96/E96M.

][b. Membrane with the following properties:

[Water Vapor Permeance: ASTM E96/E96M: 57.2 ng/(Pa * s * m2)
][Maximum Flame Spread: ASTM E84: [25] [50] [_____]
][Combustion Characteristics: Passing ASTM E136
][Puncture Resistance: TAPPI T803 OM: [15] [25] [50]

]]]2.5 PRESSURE SENSITIVE TAPE

As recommended by the vapor retarder manufacturer and having a water vapor permeance rating of 57.2 ng/(Pa * s * m2) or less when tested in accordance with ASTM D3833/D3833M.

2.6 ACCESSORIES

2.6.1 Adhesive

As recommended by the insulation manufacturer. Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of the building that meet either emissions requirements of CDPH SECTION 01350 (use the office or classroom requirements, regardless of space type) or VOC content requirements of GS-36. Provide certification or validation of indoor air quality for adhesives.

2.6.2 Mechanical Fasteners

Corrosion resistant fasteners as recommended by the insulation manufacturer.

2.6.3 Wire Mesh

Corrosion resistant and as recommended by the insulation manufacturer.

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

Before installing insulation, ensure that areas that will be in contact with the insulation are dry and free of projections which could cause voids, compressed insulation, or punctured vapor retarders. If moisture or other conditions are found that do not allow the workmanlike installation of the insulation, do not proceed but notify Contracting Officer of such conditions.

3.2 PREPARATION

3.2.1 Blocking at Attic Vents and Access Doors

Prior to installation of insulation, install permanent blocking to prevent insulation from slipping over, clogging, or restricting air flow through soffit vents at eaves.[Install permanent blocking around attic trap doors.][Install permanent blocking to maintain accessibility to equipment or controls that require maintenance or adjustment.]

3.2.2 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

a. Recessed lighting fixtures, including wiring compartments, ballasts, and other heat producing devices, unless these are certified by the manufacturer for installation surrounded by insulation: 75 mm from outside face of fixtures and devices or as required by NFPA 70 and, if insulation is to be placed above fixture or device, 600 mm above fixture.

b. Masonry chimneys or masonry enclosing a flue: 50 mm from outside face of masonry. Masonry chimneys for medium and high heat operating appliances: Minimum clearances required by NFPA 211.

c. Vents and vent connectors used for venting the products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances as required by NFPA 211.

d. Gas Fired Appliances: Clearances as required in NFPA 54.

e. Oil Fired Appliances: Clearances as required in NFPA 31.

Blocking around flues and chimneys is not required when insulation blanket, including any attached vapor retarder, passed ASTM E136, in addition to meeting all other requirements stipulated in Part 2. Blocking is also not required if the chimneys are certified by the manufacturer for use in contact with insulating materials.

3.3 INSTALLATION

3.3.1 Insulation

Install and handle insulation in accordance with manufacturer's instructions. Keep material dry and free of extraneous materials. Any materials that show visual evidence of biological growth due to presence of moisture must not be installed on the building project. Ensure personal protective clothing and respiratory equipment is used as required. Observe safe work practices.

3.3.1.1 Electrical wiring

Do not install insulation in a manner that would sandwich electrical wiring between two layers of insulation.

3.3.1.2 Continuity of Insulation

Install blanket insulation to butt tightly against adjoining blankets and to studs, rafters, joists, sill plates, headers and any obstructions. [Where insulation required is thicker than depth of joist, provide full width blankets to cover across top of joists.] Provide continuity and integrity of insulation at corners, wall to ceiling joints, roof, and floor. Avoid creating thermal bridges.

3.3.1.3 Installation at Bridging and Cross Bracing

Insulate at bridging and cross bracing by splitting blanket vertically at center and packing one half into each opening. Butt insulation at bridging and cross bracing; fill in bridged area with loose or scrap insulation.

[3.3.1.4 Cold Climate Requirement

Place insulation to the outside of pipes.

][3.3.1.5 Insulation Blanket with Affixed Vapor Retarder

Locate vapor retarder as indicated. Do not install blankets with affixed vapor retarders unless so specified. Unless the insulation manufacturer's instructions specifically recommend not to staple the flanges of the vapor retarder facing, staple flanges of vapor retarder at 150 mm intervals flush with face or set in the side of truss, joist, or stud. Avoid gaps and bulges in insulation and "fishmouth" in vapor retarders. Overlap both flanges when using face method. Seal joints and edges of vapor retarder with pressure sensitive tape. Stuff pieces of insulation into small cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers. Cover these insulated cracks with vapor retarder material and tape all joints with pressure sensitive tape to provide air and vapor tightness.

][3.3.1.6 Insulation without Affixed Vapor Retarder

Provide snug friction fit to hold insulation in place. Stuff pieces of insulation into cracks between trusses, joists, studs and other framing, such as at attic access doors, door and window heads, jambs, and sills, band joists, and headers.

]3.3.1.7 Sizing of Blankets

Provide only full width blankets when insulating between trusses, joists, or studs. Size width of blankets for a snug fit where trusses, joists or studs are irregularly spaced.

[3.3.1.8 Special Requirements for Ceilings

Place insulation under electrical wiring occurring across joists. Pack insulation into narrowly spaced framing. Do not block flow of air through soffit vents. [Attach insulation to attic door by adhesive or staples.]

][3.3.1.9 Installation of Sill Sealer

Size sill sealer insulation and place insulation over top of masonry or concrete perimeter walls or concrete perimeter floor slab on grade. Fasten sill plate over insulation.

][3.3.1.10 Special Requirements for Floors

Hold insulation in place with corrosion resistant wire mesh, wire fasteners, or wire lacing.

][3.3.1.11 Access Panels and Doors

Affix blanket insulation to access panels greater than one square foot and access doors in insulated floors and ceilings. Use insulation with same R-Value as that for floor or ceiling.

][3.3.2 Installation of Separate Vapor Retarder

Apply continuous vapor retarder as indicated. Overlap joints at least 150 mm and seal with pressure sensitive tape. Seal at sill, header, windows, doors and utility penetrations. Repair punctures or tears with pressure sensitive tape.

] -- End of Section --

SECTION 07 27 10.00 10

BUILDING AIR BARRIER SYSTEM

PART 1 GENERAL

1.1 SUMMARY

This Section specifies the construction and quality control of the installation of an air barrier system. Construct the air barrier system indicated, taking responsibity for the means, methods, and workmanship of the installation of the air barrier system. The air barrier must be contiguous and connected across all surfaces of the enclosed air barrier envelope indicated. The maximum leakage requirements of individual air barrier components and materials are specified in the other specification sections covering these items.[

This section also defines the maximum allowable leakage of the final air barrier system. The workmanship must be adequate to meet the maximum allowable leakage requirements of this specification. Test the assembled air barrier system to demonstrate that the building envelope is properly sealed and insulated. Passing the air barrier system leakage test and thermography test will result in system acceptance. Conform air barrier system leakage and thermography testing and reporting to the requirements of Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS.]

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4541	(2017) Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM E96/E96M	(2021) Standard Test Methods for Gravimetric Determination ofWater Vapor Transmission Rate of Materials
ASTM E2178	(2021a) Standard Test Method for Air Permeance of Building Materials
ASTM E2357	(2017) Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1324	(2017) Measuring Method of Water Vapor Permeance for Building Materials
JIS A 9511	(2021) Performed Cellular Plastics Thermal Insulation Materials

JIS A 9526	(2015) Spray Applied Rigid Polyurethane Foam for Thermal Insulation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 285	(2012) Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.3 DEFINITIONS

The following terms as they apply to this section:

1.3.1 Air Barrier Accessory

Products designated to maintain air tightness between air barrier materials, air barrier assemblies and air barrier components, to fasten them to the structure of the building, or both (e.g., sealants, tapes, backer rods, transition membranes, fasteners, strapping, primers).

1.3.2 Air Barrier Assembly

The combination of air barrier materials and air barrier accessories that are designated and designed within the environmental separator to act as a continuous barrier to the movement of air through the environmental separator.

1.3.3 Air Barrier Component

Pre-manufactured elements such as windows, doors, dampers and service elements that are installed in the environmental separator.

1.3.4 Air Barrier Envelope

The combination of air barrier assemblies and air barrier components, connected by air barrier accessories that are designed to provide a continuous barrier to the movement of air through an environmental separator. There may be more than one air barrier envelope in a single building. Also known as Air Barrier System.

1.3.5 Air Barrier Material

A building material that is designed, tested and/or produced to provide the primary resistance to airflow through an air barrier assembly of a wall system.

1.3.6 Air Barrier System

Same as AIR BARRIER ENVELOPE.

1.3.7 Air Leakage Rate

The rate of airflow (L/s) driven through a unit surface area (sq. m) of an assembly or system by a unit static pressure difference (Pa) across the assembly. (example: 1.27 L/s-m^2 @ 75 Pa)

1.3.8 Air Leakage

The total airflow (L/s) driven through the air barrier system by a unit static pressure difference (Pa) across the air barrier envelope. (example: 3070 L/s @ 75 Pa)

1.3.9 Air Permeance

The tested rate of airflow (L/s) through a unit area (sq. m) of a material driven by unit static pressure difference (Pa) across the material (example: 0.02 L/s-m^2 @ 75 Pa) as established by ASTM E2178 or JIS A 1324.

1.3.10 Environmental Separator

The parts of a building that separate the controlled interior environment from the uncontrolled exterior environment, or that separate spaces within a building that have dissimilar environments. Also known as the Control Layer.

1.3.11 Vapor Permeance

Vapor permeance is separated into three classes based on the water vapor permeance of a material as tested via ASTM E96/E96M or JIS A 9511

Class I Vapor Barrier/Retarder 0.1 perm or less

Class II Vapor Barrier/Retarder 0.1 perm to 1.0 perm

Class III Vapor Barrier/Retarder 1.0 perm to 10 perm

1.4 PREPARATORY PHASE OR PRECONSTRUCTION CONFERENCE

Organize pre-construction conferences between the air barrier inspector and the sub-contractors involved in the construction of or penetration of the air barrier system to discuss where the work of each sub-contractor begins and ends, the sequence of installation, and each sub-contractor's responsibility to ensure airtight joints, junctures, penetrations and transitions between materials. Discuss the products, and assemblies of products specified in the different sections to be installed by the different sub-contractors.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Air Barrier System Shop Drawings; G[, [_____]], Manufacturer produced warranted air barrier system

SD-03 Product Data

Air Barrier System Product Data; G[, [_____]]

SD-04 Samples

Mock-Up; G[, [_____]]

Material Samples For Air Barrier System; G[, [_____]]

SD-05 Design Data

Design Data And Calculations For The Air Barrier System; G[, [_____]], Manufacturer produced warranted air barrier system

SD-06 Test Reports

Design Review Report; G[, [_____]]

Testing and Inspection; G[, [_____]]

SD-07 Certificates

Air Barrier Inspector; G, RO

[1.6 AIR BARRIER ENVELOPE SURFACE AREA AND LEAKAGE REQUIREMENTS

The building air barrier systems must meet the following leakage requirements. The allowable leakage rate and the maximum leakage are at a differential test pressure of 75 Pa.

Air Barrier Envelope 1	
Surface Area	[_____] square meter
Architectural Only Test:	
Allowable leakage rate	[1.27][2.03][_____] L/s per square meter
Maximum leakage	[_____] total L/s
Architectural Plus HVAC System Test:	
Allowable leakage rate	[1.52][2.29][_____] L/s per square meter
Maximum leakage	[_____] total L/s

Air Barrier Envelope 2	
Surface Area	[_____] square meter
Architectural Only Test:	
Allowable leakage rate	[1.27][2.03][_____] L/s per square meter

Maximum leakage	[_____] total L/s
Architectural Plus HVAC System Test:	
Allowable leakage rate	[1.52][2.29][_____] L/s per square meter
Maximum leakage	[_____] total L/s

Air Barrier Envelope 3	
Surface Area	[_____] square meter
Architectural Only Test:	
Allowable leakage rate	[1.27][2.03][_____] L/s per square meter
Maximum leakage	[_____] total L/s
Architectural Plus HVAC System Test:	
Allowable leakage rate	[1.52][2.29][_____] L/s per square meter
Maximum leakage	[_____] total L/s

][1.7 AIR BARRIER INSPECTOR

Employ a designated Air Barrier Inspector on this project. The Air Barrier Inspector performs a Design Review, oversees quality control testing specified in these specifications, performs quality control air barrier inspection as specified, interfaces with the designer and product manufacturer's representatives to assure all installation requirements are met, and verifies that the constructed work is in accordance with both the manufacturer's recommendations for products used, the content of this specification and other contract drawings or docouments. Qualification for the Air Barrier Inspector are as follows:

a. Training and certification as an Air Barrier Auditor from the Air Barrier Association of America (ABAA) or other third party air barrier association.

b. Or, provide documentation in resume format that demonstrates that the individual proposed has the experience, knowledge, skills and abilities to fulfill the above stated duties as the air barrier inspector.

c. It is acceptable that this individual be employed by the firm who will be performing the building pressurization test or another independent third party entity, provided they meet the above requirements but shall not be a member of the installing contractor or firm.

Provide copies of Air Barrier Inspector qualifications 30 days after Notice to Proceed.

][1.8 DESIGN REVIEW

Review the Contract Plans and Specifications and advise the Contracting Officer of any deficiencies that would prevent the construction of an effective air barrier system. Provide a Design Review Report individually listing each deficiency and the corresponding proposed corrective action necessary for proper air barrier system. Provide copies of the Design Review Report not later than [14] [_____] days after approval of the Air Barrier Inspector Qualifications. Submit design data and calculations for the Air Barrier System for a manufacturer produced warranted air barrier system.

]PART 2 PRODUCTS

2.1 AIR BARRIER

Provide air barrier system of compatible parts from one or several manufacturers coordinated by the contractor or provide a single warranted system provided by a primary manufacturer. The air barrier system as part of a tested exterior wall assembly must meet the conditions of acceptance as tested in accordance with NFPA 285. Materials used for roof assembly air barrier must conform to the appropriate UL and FM wind and fire requirements for the specified roof assemblies.

If a complete air barrier system from a single manufacturer is utilized, whether warranted on not warranted, the air barrier system must conform to ASTM E2357.

Materials in the following categories as used in the air barrier system or assembly of the exterior wall system are tested and are required to conform to ASTM E2178 or JIS A 1324: Self-adhered sheet membranes, fluid applied membranes, spray polyurethane foam, mechanically fastened commercial building wrap, factory bonded membranes to sheathing, and adhesive backed commercial building wrap and accessory products.

Other materials used as an air barrier such as concrete, glass, wood, metal or gypsum board may or may not conform to ASTM E2178 or JIS A 1324 but are acceptable provided that when integrated into the air barrier system or assemblies that they are not subject to material or environmental induced degradation in their final produced state and once incorporated in the permanent construction.

All materials used must be identifiable through manufacturer testing data and/or literature to be compatible with all the attached or adjoining materials or substrates used in the system.

Provide Air Barrier System Shop Drawings, Material Samples for Air Barrier System and Air Barrier System Product Data.

PART 3 EXECUTION

3.1 QUALITY CONTROL

3.1.1 Documentation and Reporting

Document the entire installation process on daily job site reports. These reports include information on the Installer, substrates, substrate preparation, products used, ambient and substrate temperature, the location of the air barrier installation, the results of the quality

control procedures, and testing results.

[3.1.2 Construction Mock-Up

Build mock-up prior to building envelope construction.

a. Prepare a construction mock-up to demonstrate proper installation of the air barrier assemblies and components. Include air barrier system connections between floor and wall, wall and window, wall and roof. Also, include the sealing method between membrane joints at transitions from one material or component to another, at pipe or conduit penetrations of the wall and roof, and at duct penetration of the wall and roof. Work will not begin until the mock-up is satisfactory to the Contracting Officer.

b. Size the mock-up to approximately 2 m long by 2 m high. The mock-up must be representative of primary exterior wall assemblies and glazing components including backup wall and typical penetrations as acceptable to the Contracting Officer. A corner of the actual building may be used as the mock-up.

c. Mock-Up Tests for Adhesion: Test the mock-up of materials for adhesion in accordance with manufacturer's recommendations. Perform the test after the curing period recommended by the manufacturer. Record the mode of failure and the area which failed in accordance with ASTM D4541 or JIS A 9526. When the air barrier material manufacturer has established a minimum adhesion level for the product on the particular substrate, the inspection report must indicate whether this requirement has been met. Where the manufacturer has not declared a minimum adhesion value for their product/substrate combination, simply record the value.

]3.1.3 Quality Control Testing And Inspection

Conduct the following tests and inspections as applicable in the presence of the Contracting Officer during installation of the air barrier system, and submit quality control reports as indicated below.

a. Provide a Daily Report of Observations with a copy to the Contracting Officer.

b. Inspect to assure continuity of the air barrier system throughout the building enclosure and that all gaps are covered, the covering is structurally sound, and all penetrations are sealed allowing for no infiltration or exfiltration through the air barrier system.

c. Inspect to assure structural support of the air barrier system to withstand design air pressures.

d. Inspect to assure masonry surfaces receiving air barrier materials are smooth, clean, and free of cavities, protrusions and mortar droppings, with mortar joints struck flush or as required by the manufacturer of the air barrier material.

e. Inspect and test to assure site conditions for application temperature, and dryness of substrates are within guidelines.

f. Inspect to assure substrate surfaces are properly primed if applicable and in accordance with manufacturer's instructions. Priming must extend at least 50 mm beyond the air barrier material to make it

obvious that the primer was applied to the substrate before the air barrier material.

g. Inspect to assure laps in materials are at least a 50-mm minimum, shingled in the correct direction or mastic applied in accordance with manufacturer's recommendations, and with no fishmouths.

h. Inspect to assure that a roller has been used to enhance adhesion. Identify any defects such as fishmouths, wrinkles, areas of lost adhesion, and improper curing. Note the intended remedy for the deficiencies.

i. Measure application thickness of liquid applied materials to assure that manufacturer's specifications for the specific substrate are met.

j. Inspect to assure that the correct materials are installed for compatibility.

k. Inspect to assure proper transitions for change in direction and structural support at gaps.

l. Inspect to assure proper connection between assemblies (membrane and sealants) for cleaning, preparation and priming of surfaces, structural support, integrity and continuity of seal.

m. Perform adhesion tests for fluid-applied and self-adhered air barrier membranes to assure that the manufacturer's specified adhesion strength properties are met. Determine the bond strength of coatings to substrate in accordance with ASTM D4541 or JIS A 9526.

n. Provide cohesion tests for spray polyurethane foam (SPF). [Perform the tests in accordance with the specification sections which specify these materials.] [Perform adhesion tests as follows: Using a coring tool remove a sample and determine the relative adhesion quality of the foam. If the foam is hard to remove and leaves small bits of foam on the substrate it is called cohesive foam failure and is considered the best adhesion. If the foam comes away from the substrate with some force but is clean, it is called a mechanical bond. If it comes away easily from the substrate, the adhesion is poor. Cohesive foam failure and a good mechanical bond are acceptable.]

o. Provide written test reports of all tests performed.

3.2 REPAIR AND PROTECTION

Upon completion of inspection, testing, sample removal and similar services, repair damaged construction and restore substrates, coatings and finishes. Protect construction exposed by or for quality control service activities, and protect repaired construction.

-- End of Section --

SECTION 07 27 36

SPRAY FOAM AIR BARRIERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR BARRIER ASSOCIATION OF AMERICA (ABAA)

ABAA Accreditation	Accreditation
ABAA QAP	Quality Assurance Program

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP Z9.2	(2018) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems
ASSP Z88.2	(2015) American National Standard Practices for Respiratory Protection

ASTM INTERNATIONAL (ASTM)

ASTM C518	(2021) Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C1029	(2015) Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation
ASTM C1060	(2015) Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings
ASTM C1153	(2010) Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging
ASTM C1303/C1303M	(2015) Standard Test Method for Predicting Long-Term Thermal Resistance of Closed-Cell Foam Insulation
ASTM C1338	(2014) Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings
ASTM D1621	(2016) Standard Test Method for Compressive Properties of Rigid Cellular Plastics

ASTM D1622	(2014) Apparent Density of Rigid Cellular Plastics
ASTM D1623	(2017) Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
ASTM D2126	(2009) Response of Rigid Cellular Plastics to Thermal and Humid Aging
ASTM D2842	(2012) Water Absorption of Rigid Cellular Plastics
ASTM D4541	(2017) Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM D6226	(2015) Standard Test Method for Open Cell Content of Rigid Cellular Plastics
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2021) Standard Test Methods for Gravimetric Determination ofWater Vapor Transmission Rate of Materials
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E736	(2000; R 2011) Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
ASTM E2178	(2021a) Standard Test Method for Air Permeance of Building Materials
ASTM E2357	(2017) Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

ICC EVALUATION SERVICE, INC. (ICC-ES)

ICC-ES AC377	(2016) Acceptance Criteria for Spray-Applied Foam Plastic Insulation

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code

ICC IECC	(2021) International Energy Conservation Code

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1	(2020) Occupational and Educational Personal Eye and Face Protection Devices

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1412-2	(2016) Test Method for Thermal Resistance and Related Properties of Thermal Insulations - Part 2 Heat Flow Meter Apparatus
JIS A 9511	(2017) Preformed Cellular Plastics Thermal Insulation Materials
JIS A 9526	(2017) Spray-Applied Rigid Polyurethane Foam for Thermal Insulation
JIS K 7220	(2006) Rigid Cellular Plastics - Determination of Compression Properties

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2022; ERTA 1 2021) Standard for Portable Fire Extinguishers
NFPA 31	(2020) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2021) National Fuel Gas Code
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 211	(2019) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
NFPA 275	(2017) Standard Method of Fire Tests for the Evaluation of Thermal Barriers
NFPA 285	(2012) Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

SPRAY POLYURETHANE FOAM ALLIANCE (SPFA)

SPFA TechDocs	(2015) SPFA Technical Documents Library, four categories: General, Insulation, Roofing, Specialty

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-600-01	(2016; with Change 6, 2021) Fire

Protection Engineering for Facilities

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.132	Personal Protective Equipment
29 CFR 1910.133	Eye and Face Protection
29 CFR 1910.134	Respiratory Protection

UNDERWRITERS LABORATORIES OF CANADA (ULC)

ULC S705.2	(2005) Standard for Thermal Insulation - Spray Applied Rigid Polyurethane Foam, Medium Density - Application

1.2 RELATED REQUIREMENTS

Coordinate the requirements of Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM[, Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS][, Section 07 27 19.01 SELF-ADHERING AIR BARRIERS,][SECTION 07 27 26 FLUID-APPLIED MEMBRANE AIR BARRIERS,] and other building envelope sections to provide a complete air barrier system. Submit all materials, components, and assemblies of the air barrier system together as one complete submittal package.

1.3 DEFINITIONS

1.3.1 Long Term Thermal Resistance (LTTR)

The thermal resistance value of a closed cell foam insulation product measured using accelerated aging ASTM C1303/C1303M equivalent to the time-weighted average thermal resistance value over 15 years. Loss in thermal resistance is attributable to changes in cell gas composition caused by diffusion of air into and blowing agent out of the foam cells.

1.3.2 SPFA TechDocs

Reformatted documents, named SPFA TechDocs (http://www.sprayfoam.org/technical/spfa-technical-documents), places each document in one of four categories for easy reference and identification: Roofing, Insulation, Specialty and General.

Spray Polyurethane Foam: Thermal and air[/vapor] barrier system consisting of sprayed polyurethane foam (SPF).

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualification of Manufacturer; G[, [_____]]

Qualification of Installer; G[, [_____]]

Quality Control Plan; G[, [_____]]

Safety Plan; G[, [_____]]

Fire Prevention Plan; G[, [_____]]

Respirator Plan; G[, [_____]]

SD-02 Shop Drawings

Spray Foam Air Barrier System

Foam Air Barrier System; G[, [_____]]

Fire-Rated Assemblies; G[, [_____]]

SD-03 Product Data

[Closed Cell][Open Cell] SPF; G[, [_____]]

Transition Membrane; G[, [_____]]

Primers, Adhesives, and Mastics; G[, [_____]]

Sealants; G[, [_____]]

Safety Data Sheets; G[, [_____]]

Thermal Barrier Materials; G[, [_____]]

Ignition Barrier Coatings; G[, [_____]]

Accessories; G[, [_____]]

Recycled Content for Closed Cell Spray Foam Air Barrier; S

Recycled Content for Open Cell Spray Foam Air Barrier; S

SD-04 Samples

Spray Foam Air Barrier Mockup; G[, [_____]]

SD-06 Test Reports

Field Peel Adhesion Test; G[, [_____]]

Thermographic Test; G[, [_____]]

Air Barrier Test; G[, [_____]]

Primers; G[, [_____]]

[Fire-Ratings Of [Thermal][Ignition] Barrier Materials; G[, [_____]]

] Flame Spread And Smoke Developed Index Ratings Of SPF Products; G[, [_____]]

Flame Propagation Of Wall Assemblies; G[, [_____]]

Site Inspections Reports; G[, [_____]]

SD-07 Certificates

[Closed cell][Open cell] SPF; G[, [_____]]

Transition Membrane; G[, [_____]]

Indoor Air Quality for Spray Foam Air Barrier; S

SD-08 Manufacturer's Instructions

SPF Handling, Storage, and Spray Procedures; G[, [_____]]

Substrate Preparation; G[, [_____]]

Thermal Barrier; G[, [_____]]

Ignition Barrier; G[, [_____]]

Transition Membrane; G[, [_____]]

Primers, Adhesives, and Mastics; G[, [_____]]

SD-09 Manufacturer's Field Reports

Core Samples; G[, [_____]]

Daily Work Record; G[, [_____]]

Visual Inspection and Thermal Scanning; G[, [_____]]

1.5 MISCELLANEOUS REQUIREMENTS

For the spray foam air barrier system provide the following:

1.5.1 Shop Drawings

Submit spray foam air barrier shop drawings showing locations, detailing, and extent of spray foam air barrier assemblies. Provide details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings. Provide details for fire-rated assemblies and indicate materials for [thermal barriers][ignition barrier s]. Show details for bridging of gaps in construction, treatment of inside and outside corners, expansion joints, methods of attachment of materials covering the SPF without compromising the barrier. Indicate how miscellaneous penetrations such as conduit, pipes, electric boxes, brick ties, and similar items will be sealed.

1.5.2 Product Data

Submit manufacturer's technical data indicating compliance with performance and environmental requirements, manufacturer's printed instructions for evaluating, preparing, and treating substrates, temperature and other limitations of installation conditions, safety requirements for installation, and Safety Data Sheets. Indicate flame and smoke spread ratings for all products. Submit [thermal barrier][ignition

barrier] literature including material description, physical properties, and fire-ratings.

1.5.3 Mockup

Provide a mockup of each foam system specified. Apply foam in an area designated by the Contracting Officer. Apply an area of not less than 5 square meters. Include all components specified for the finished assembly including primers, support components, expansion and contraction joints,[ignition barriers,][thermal barriers,] and other accessories as representative of the complete system. Isolate the area and protect workers as required by 29 CFR 1910.132, 29 CFR 1910.133 and 29 CFR 1910.134. Notify the Contracting Officer a minimum of 48 hours prior to the test application. Select a test area representative of conditions to be sprayed including window or door openings, wall to ceiling transitions, flashings, and penetrations, as applicable.

1.5.4 Test Reports

Submit test reports indicating that field peel adhesion tests on all materials have been performed and the changes made, if required, in order to achieve successful and lasting adhesion. Submit test reports for flame spread and smoke developed index ratings of SPF products tested in accordance with ASTM E84. Submit test reports for flame propagation of wall assemblies tested in accordance with NFPA 285.[Submit test reports for fire-ratings of [thermal][ignition] barrier materials tested in accordance with ASTM E84.]

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Delivery

Deliver and store materials in sufficient quantity to allow for uninterrupted flow of work. Inspect materials delivered to the site for damage; unload and store out of weather. Deliver materials to the jobsite in their original unopened packages, clearly marked with the manufacturer's name, brand designation, description of contents, and shelf life of containerized materials. Store and handle to protect from damage. Submit SPF Handling, Storage, and Spray Procedures in accordance with submittal procedures.

1.6.2 Storage

Store materials in clean, dry areas, away from excessive heat, sparks, and open flame. Maintain temperatures in the storage area below the materials' flash point(s) and within limits recommended by the manufacturer's printed instructions. Provide ventilation in accordance with ASSP Z9.2 to prevent build-up of flammable gases. Store MDI (A-side) drums in locations that limit the risk of contact with water, acids, caustics (such as lye), alcohols, and strong oxidizing and reducing agents.

1.6.3 Handling

Handle materials and containers safely and in accordance with manufacturer's recommendations. Store liquids in airtight containers and keep containers closed except when removing materials. Do not use equipment or containers containing remains of dissimilar materials. Do not expose foam component containers to direct sunlight. Do not use materials from containers with content temperatures in excess of 26

degrees C.

Containers exposed to long periods of cold may also exhibit separation and poor performance. Do not use materials exposed to temperature ranges outside of manufacturer's instructions for exposure limits.

Mark and remove from job site materials which have been exposed to moisture, that exceed shelf life limits, or that have been exposed to temperature extremes.

1.6.3.1 Venting and Handling of Material Containers

Partially unscrew material container and drum caps to gradually vent the containers prior to opening. Do not inhale vapors. Decontaminate empty component containers by filling with water and allowing to stand for 48 hours with bung caps removed. Do not, under any circumstances seal, stop, or close containers which have been emptied of foam components.

1.7 FIELD PEEL ADHESION TEST

Perform a field peel adhesion test on the construction mockup. Test the SPF for adhesion in accordance with ASTM D4541 or JIS A 9526 using a Type II pull tester except use a disk that is 100 mm in diameter and cut through the membrane to separate the material attached to the dish from the surrounding material. Perform test after curing period in accordance with manufacturer's written recommendations. Record mode of failure and area which failed in accordance with ASTM D4541 or JIS A 9526. Compare adhesion values with the manufacturer's established minimum values for the particular combination of material and substrate. Indicate on the inspection report whether the manufacturer's requirement has been met. Where the manufacturer has not declared a minimum adhesion value for their product and substrate combination, the inspector must record actual values.

1.8 AIR BARRIER TESTING

Perform air barrier testing in accordance with[Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM][and Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS].

1.9 SAFETY PROVISIONS

1.9.1 Fire Prevention

Provide a written fire prevention plan for the SPF application. Address specific fire hazards such as spontaneous combustion from exothermic heat build-up of SPF components during curing. Provide a continuous fire watch during mixing and spraying of SPF and for a minimum of [two hours][30 minutes] after completion of work at the end of each day. Maintain fire watch for additional time as required to ensure no potential ignition conditions exist.

1.9.1.1 Fire Extinguishers

Furnish [two][_____] fire extinguishers of minimum 7 kg capacity each, in accordance with NFPA 10, in the immediate vicinity of the work. CAUTION: Do not discharge high pressure carbon dioxide extinguishers where explosive vapors exist since the discharge can cause a spark which will ignite the vapors.

1.9.2 Respirator Plan

Provide a written respirator plan in accordance with OSHA regulations that protects installers during application and addresses separation of the area to prevent other workers from entering the work area during spraying.

1.9.3 Isolation

Isolate the work area as recommended by spray foam manufacturer's written requirements. Prevent workers without respiratory, skin, and eye Personal Protective Equipment (PPE) or training from entering the work area or otherwise being exposed to off-gassing of the insulation in excess of permissible exposure limits.

1.9.4 Respirators and Eye Protection

Respiratory protective devices (respirators) must meet the requirements of ASSP Z88.2. Eye and face protective equipment must meet the requirements of ANSI/ISEA Z87.1. Additionally, sprayers and workers in the immediate vicinity of the spray must wear NIOSH-approved, full-face, supplied air respirators (SAR) operated in positive pressure or continuous flow mode. Workers not in the immediate vicinity of the sprayer must wear air purifying respirators (APR) with an organic gas / P100 particulate cartridge. Instruct personnel in the use of devices. Maintain such equipment and inspect regularly. All workers are required to have undergone pulmonary function testing and fit testing and must provide certification that they have done so. Change APR cartridges in accordance with manufacturer's written recommendations.

1.9.5 Clothing and Gloves

Sprayers and workers must wear protective clothing and gloves in accordance with OSHA requirements during materials application. Disposable coveralls must be worn and must cover all exposed skin. Sprayers and workers must wear fabric gloves coated with nitrile, neoprene, butyl or PVC.

1.9.6 Additional Requirements

Require personnel to review the Health, Safety and Environmental Aspects of Spray Polyurethane Foam and Coverings published by the Spray Polyurethane Foam Alliance (SPFA). Verify compliance prior to allowing personnel on site for installation work. http://www.sprayfoam.org.

1.10 QUALITY ASSURANCE

1.10.1 Qualification of Manufacturer

Submit documentation verifying that the manufacturer of the SPF is currently accredited by the Air Barrier Association of America (ABAA Accreditation https://www.airbarrier.org/) and by the Spray Polyurethane Foam Alliance (SPFA).

1.10.2 Qualification of Installer

Submit documentation verifying that installers of the spray foam air barrier are currently certified by ABAA/BPQI (Building Performance Quality Institute) [or][and] by the Spray Polyurethane Foam Alliance (SPFA) Professional Certification Program (PCP). Installers must provide photo

identification certification cards for inspection upon request.

1.10.3 General Quality Requirements

Provide all products and installation in accordance with SPFA TechDocs requirements (http://www.sprayfoam.org/technical/spfa-technical-documents) and documented best practices.

1.11 PRECONSTRUCTION MEETING

Conduct a preconstruction meeting after approval of submittals and a minimum of two weeks prior to commencing work specified in this Section. Attendance is required by the Contracting Officer's designated personnel, Contractor, and representatives of related trades including covering materials, substrate materials, adjacent materials, and materials and components of the air/vapor/thermal barrier system. Agenda must include, at a minimum, the following items:

a. Drawings, specifications and submittals related to the SPF work;

b. Sequence of construction;

c. Coordination with substrate preparation work and responsibility of repairing defects in substrates. Determine method of ensuring SPF work does not begin until substrates have been inspected and accepted;

d. Compatibility of materials;

e. Construction and testing of construction mockup;

f. Application of self-adhering air barrier transitions strips and primer as required for sealing the spray foam air barrier system at openings including but not limited to windows, doors and louvers;

g. Spray foam air barrier system installation; including methods to be used to provide a continuous barrier at thru-wall flashing, penetrations, and covering of embed items;

h. Quality control plan including methods of applying the product so that a consistent thickness across the face of the substrate is achieved.

i. Procedures for SPF manufacturer's technical representative's onsite inspection and acceptance of substrates, contact info for the representative, frequency of visits, and distribution of copies of inspection reports. Determine where core samples will be taken and review procedures for daily documentation of SPF application.

j. Property protection measures[, including isolation of the work,] and prevention of overspray and clean-up should overspray occur.

k. Safety requirements, including review of PPE, fire prevention, safety plan, respirator plan, ventilation and separation of the work area, fall protection, and posting of warning signs. Provide a complete schedule and a detailed, written fire protection plan[including temporary isolation of the product and the work area until permanent isolation or thermal barrier is in place].

1.12 ENVIRONMENTAL CONDITIONS

1.12.1 Temperature and Weather

Install SPF within the range of ambient and substrate surface temperatures in accordance with manufacturer's written instructions. Do not apply SPF to damp or wet substrates. Do not apply SPF during inclement weather or when ice, frost, surface moisture, or visible dampness is present on surfaces to be covered, or when precipitation is imminent. Do not apply SPF to exterior building surfaces when wind speeds exceed 40 kilometers per hour. Use moisture measuring methods and equipment to verify that the moisture conditions of substrate surfaces are in accordance with SPF manufacturer requirements prior to application. Substrate temperatures must be within limits recommended by the manufacturer's printed instructions.

1.12.2 Conditions for Primers

Follow manufacturer's printed application and curing instructions. Do not apply primer when ambient temperature is below 4 degrees C or when ambient temperature is expected to fall below 2 degrees C for the duration of the drying or curing period.

1.12.3 Conditions for Ignition Barriers

Ensure that sprayed surfaces comply with manufacturer's written requirements for application coverage, thickness, and curing prior to application of ignition barrier coatings.

1.12.4 Temporary Ventilation

Provide temporary ventilation for work of this section in accordance with manufacturer's written instructions and with OSHA requirements for this type of application.

1.13 FOAM SPRAY EQUIPMENT

1.13.1 Applicator

Use an air purge foam spray gun.

1.13.2 Equipment Calibration

Fully calibrate the foam metering equipment to monitor each liquid component to within 2 percent of the SPF manufacturer's required metering ratio. Calibrate spray equipment each day at the start of operations, after each restart if spraying operations have been terminated for more than one hour, whenever there is a change in fan pattern or pressure, whenever slow curing areas are noticed, whenever a change is made in hose length or working height, and after changeover between materials. Calibration consists of demonstrating that the equipment is adjusted to deliver components in proper mix and proportion. Conduct calibration tests on cardboard or plywood on a wall adjacent to the area to be sprayed.

1.13.3 Metering Equipment Requirements

Use foam metering equipment capable of developing and maintaining the SPF manufacturer's required liquid component pressures and temperatures. Foam metering equipment must have gages for visual monitoring. Equipment must

provide temperature control of foam components to within the temperature ranges recommended by the foam manufacturer's printed instructions.

1.13.4 Moisture Protection

Protect surfaces of supply containers and tanks used to feed foam metering equipment from moisture.

1.13.5 Compressed Air

Supply compressed air that is in contact with SPF during mixing or atomization through moisture traps that are continuously bled.

1.13.6 Dispense Excess Materials

Do not deposit materials used for cleaning of equipment or materials dispensed for calibration purposes and establishment of spray gun pattern onto the ground. Dispense such materials into scrap containers or onto plastic film, or cardboard, and dispose of in accordance with safety requirements and jobsite regulations.

PART 2 PRODUCTS

2.1 SPRAY FOAM AIR BARRIER

2.1.1 General

Provide [an open cell,][a closed cell,] sprayed in place, SPF that forms a continuous air[/vapor]/thermal barrier at the building enclosure. Provide in accordance with ASTM C1029 or JIS A 9526, with the requirements of UFC 3-600-01, ICC IBC Chapter 26, ICC-ES AC377, and NFPA 285. In the event of a conflict, the most stringent requirement applies. Provide all system components necessary for a complete, code compliant installation, whether indicated or not, including material support components, expansion and contraction joints,[ignition barrier coatings,][thermal barrier materials,] and accessories.

2.1.2 Physical Properties

[Provide a closed cell product with the following characteristics:

a. Density (ASTM D1622): 32 Kg per m3, nominal

b. Thermal Resistance (ASTM C518 or JIS A 1412-2)

(1) Initial R-value per inch thickness: 1.2 K·m2 per W

(2) Aged R-value per inch thickness (180 days at 23 degrees C): 1.17 square Km per W

c. Air Permeance (ASTM E2178): [In accordance with Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM][Less than 0.02 L per s-m2 at 75 Pa].

d. Air Leakage (ASTM E2357, ASTM E283): [In accordance with Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM[and Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS]][less than 0.02 L per s-m2 at 75 Pa at 25 mm].

e. Compressive Strength (ASTM D1621 or JIS K 7220): Minimum 195 kPa

f. Tensile Strength (ASTM D1623 or JIS A 9526)

(1) Medium density: 103 kPa

(2) Roofing: 276 kPa

g. Water Vapor Permeance (ASTM E96/E96M or JIS A 9511, water method): less than 69 ng per Pa sm2 at 25 mm thickness

h. Vapor Retarder (ICC IBC, ICC IECC) Class III

i. Surface Burning Characteristics (ASTM E84) 75 mm thickness:

(1) Flame Spread (FS) Index Rating less than [75 [_____],][_____].

(2) Smoke Developed (SD) Index Rating less than [150. SPF with an SD rating greater than 150 but less than 450 may be used when fully encapsulated. Approval of SPF product is contingent upon approval of encapsulation products and assemblies.][_____].

j. Closed Cell Content (ASTM D6226): 90 percent

k. Dimensional Stability (Humid Aging) (ASTM D2126): 15 percent at 28 days at 70 degrees C with 97 percent relative humidity.

l. Water Absorption (ASTM D2842): Maximum 1.0 per volume

m. Fungi Resistance (ASTM C1338): Pass, with no growth

n. Recycled Content: Minimum 9 percent (pre- and post-consumer). Provide data identifying percentage of recycled content for closed cell spray foam air barrier.

][Provide an open cell product with the following characteristics:

a. Density (ASTM D1622): 8 Kg per m3, nominal

b. Thermal Resistance (ASTM C518 or JIS A 1412-2)

(1) Initial R-value per inch thickness: .70 K·m2 per W)

(2) Aged R-value per inch thickness (180 days at 23 degrees C): .68 K·m2 per W

c. Air Permeance (ASTM E2178): [In accordance with Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM][less than 0.02 L per s-m2 at 75 Pa].

d. Air Leakage (ASTM E2357, ASTM E283): [In accordance with Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM[and Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS]][Less than 0.2 L per s-m2 at 75 Pa at 25 mm].

e. AC377 Compressive Strength (ASTM D1621 or JIS K 7220): 6.9-34 kPa

f. Tensile Strength (ASTM D1623 or JIS A 9526): 6.9-34 kPa

g. Water Vapor Permeance (ASTM E96/E96M or JIS A 9511, water method): Maximum 1300 ng per Pa sm2 at 50 mm thickness

h. Surface Burning Characteristics (ASTM E84) 75 mm thickness:

(1) Flame Spread (FS) Index Rating less than [75][_____].

(2) Smoke Developed (SD) Index Rating less than [150. SPF with an SD rating greater than 150 but less than 450 may be used when fully encapsulated. Approval of SPF product is contingent upon approval of encapsulation products and assemblies.][_____].

i. Open Cell Content (ASTM D6226): Greater than 92 percent

j. Fungi Resistance (ASTM C1338): Pass, with no growth

k. Recycled Content: minimum 9 percent (pre- and post-consumer). Provide data identifying percentage of recycled content for open cell spray foam air barrier.

]2.1.3 Expansion and Contraction

Provide an assembly that allows for relative movement due to temperature, moisture, and air pressure changes. Provide expansion and contraction measures as required by the manufacturer's written recommendations.

2.1.4 Fire-ratings, Flame Spread and Smoke Developed Index Ratings

Where fire-rated materials are indicated, provide products with the appropriate markings of a qualified testing agency. Submit fire-rating test reports. Submit flame spread (FS) and smoke developed (SD) index data. Where FS and SD values of foam products do not meet requirements, provide corresponding [ignition][thermal] barrier products or assemblies and verify complete encapsulation of the spray foam air barrier through product data or on shop drawings. Submit for approval in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

2.1.5 Prohibited Materials

Products that contain hexabromocyclododecane (HBCD) flame retardants are prohibited. Products that contain hydrochlorofluorocarbons (HCFCs), chlorofluorocarbons (CFCs), or other high ozone depleting blowing agents, are prohibited. For a list of acceptable substitute foam blowing agents see https://www.epa.gov/snap/foam-blowing-agents. Provide validation of indoor air quality for spray foam air barrier that no prohibited materials are used.

2.1.6 [Thermal][Ignition] Barrier

Provide a [thermal barrier][ignition barrier] in locations where SPF is exposed to the interior of the building, including attics and plenum spaces. Provide [thermal][ignition] barriers in accordance with ICC IBC Chapter 26 "Plastics," with ICC-ES AC377, ASTM E736, and NFPA 275. Choose one or more of the following methods of separation:

a. Building interior, other than fire-rated enclosures: [Separate the SPF from the occupied interior of a building by a continuous thermal barrier of 13 mm glass mat gypsum wallboard (GWB) in accordance with ICC IBC Chapter 26 requirements.][Separate the SPF from the occupied interior of a building by an intumescent thermal barrier coating or thermal barrier board identical to a third party tested thermal

barrier to limit the average temperature rise of the surface of the SPF to not more than 120 degrees C after 15 minutes of fire exposure (using the standard time-temperature curve of ASTM E119)]. Provide in accordance with NFPA 275.

b. Building interior, fire-rated enclosures: At walls, ceilings and floors that are required to be fire-rated, separate the SPF from the occupied interior of a building with an ignition barrier consisting of 16 mm, Type X, fire-rated GWB in the number of layers corresponding to required ratings. Include all accessories as necessary for complete fire-rated assemblies.

c. Unoccupied attics, crawl spaces: Where fire-rated enclosures are not required, and where entry is made only for service of utilities, separate the SPF from the attic or crawl space with a continuous ignition barrier in accordance with ICC IBC Chapter 26 requirements, and as approved by the Contracting Officer's Representative. Provide one of the following:

(1) 38 mm thick mineral fiber insulation

(2) 38 mm thick cellulose insulation

2.2 TRANSITION MEMBRANE

Provide as specified in Section 07 27 19.01 SELF-ADHERING AIR BARRIERS.

2.3 PRIMERS, ADHESIVES, AND MASTICS

Provide primers, adhesives, mastics and other accessory materials as recommended by spray foam manufacturer's printed literature.

2.4 FLASHING

As specified in Section 07 60 00 FLASHING AND SHEET METAL.

2.5 JOINT SEALANTS

As specified in Section 07 92 00 JOINT SEALANTS. Verify compatibility with other system products.

PART 3 EXECUTION

3.1 EXAMINATION

Before installing the spray foam air barrier and with the installer present, examine substrates, areas, and conditions under which SPF will be applied, for compliance with requirements. Ensure that surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants. Ensure that concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions. Correct defects that adversely affect the spray foam application or performance. Verify that work by other trades is in place and complete prior to application of spray foam.

3.2 PREPARATION

3.2.1 Substrate Preparation

Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for spray foam application.

a. Prepare surfaces by brushing, scrubbing, scraping, or grinding to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion of the SPF.

b. Wipe down metal surfaces to remove release agents or other non-compatible coatings, using clean sponges or rags soaked in a solvent compatible with the SPF.

3.2.2 Protection

Protect adjacent areas and surfaces from spray applied materials in accordance with the following:

a. Mask and cover adjacent areas to protect from over spray.

b. Ensure required foam stops and back up materials are in place to achieve a complete seal.

c. Seal off ventilation equipment. Install temporary ducting and fans to provide required exhaust of spray fumes. Provide make-up air as required.

d. Erect barriers, isolate area, and post warning signs to notify non-protected personnel of the requirement to avoid the spray area.

3.2.3 Blocking Around Heat Producing Devices

Install non-combustible blocking around heat producing devices to provide the following clearances:

a. Recessed light fixtures, including wiring compartments, ballasts, and other heat producing devices, unless certified for installation surrounded by insulation: Minimum of [75 mm][_____] from outside face of fixtures and devices and in accordance with NFPA 70 and, if insulation is to be placed above fixture or device, 610 mm above fixture.

b. Masonry chimneys or masonry enclosing a flue: a minimum of [51 mm][_____] from outside face of masonry. Masonry chimneys for medium and high heat operating appliances: Minimum clearances in accordance with NFPA 211.

c. Vents and vent connectors used for venting products of combustion, flues, and chimneys other than masonry chimneys: Minimum clearances in accordance with NFPA 211.

d. Gas Fired Appliances: Clearances in accordance with NFPA 54.

e. Oil Fired Appliances: Clearances in accordance with NFPA 31. Blocking is not required if chimneys or flues are certified by the manufacturer for use in contact with insulating materials.

3.2.4 Fire and Explosion Hazards

Prohibit open flames, sparks, welding, and smoking in the application area. Provide and maintain fire extinguishers of appropriate type, size and distance, as required by NFPA, in the application area. Mix batches in small enough quantities to avoid spontaneous combustion from exothermic heat build-up of SPF components during curing.

3.2.5 Warning Signs

Post warning signs at ground level adjacent to the work area and a minimum of 45.72 meters from the application area stating the area is off limits to unauthorized persons and warning of potential hazards. Place clearly visible and legible warning sign at entrance to primary road leading to the project facility warning of presence of flammable materials, irritating fumes, and potential of overspray damage.

3.2.6 Prime Substrate

Provide as recommended by the manufacturer for each substrate to be primed. Use primers at full strength. Do not dilute primers unless required and as recommended in writing by the manufacturer. Do not use cleaning solvents for thinning primers or other materials. Ensure that diluted primer(s) meet VOC requirements.

3.3 INSTALLATION

3.3.1 Sequencing and Coordination

Sequence the work so as to prevent access to the work area by other trades during foam application and curing. Limit access of non-essential workers during application. Notify the Contracting Officer 24 hours in advance of spraying operations.[Sequence spray foam work with other trades to permit continuous self-flashing of the spray foam air barrier.] Ensure expansion and control joints are provided as detailed on the manufacturer's shop drawings to accommodate the expansion of each layer of the air[/vapor]/thermal envelope.[Provide temporary fire protection of uncured foam, and isolate the work area, until foam application is isolated with a permanent thermal or ignition barrier.]

3.3.2 Installation of Transition Membrane

Install transition membrane materials in accordance with the details on the drawings, Section 07 27 19.01 SELF-ADHERING AIR BARRIERS, and the following:

a. Install transition membrane at all required locations prior to installation of the fluid-applied membrane air barrier.

b. Verify transition membrane is fully adhered to substrate and that its surface is clean, dry and wrinkle free prior to installation of the fluid-applied membrane air barrier.

c. Verify transition membrane completely covers all transition areas and will provide continuity of the finished SPF air barrier without gaps or cracks.

3.3.3 Installation of Spray Foam Air Barrier

Install materials in accordance with paragraph SAFETY PROVISIONS, in accordance with manufacturer's recommendations[, ULC S705.2 Installation Standard], and in accordance with the following:

a. Use spray equipment that complies with foam manufacturer's recommendations for the specific type of application, and as specified herein. Record equipment settings on the Daily Work Record. Each proportioned unit can supply only one spray gun.

b. Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer.

c. Continuously connect the spray foam air barrier between walls, roof, floor, and below grade assemblies to form a continuous integrated air barrier system around the entire building enclosure. Extend the spray foam air barrier into rough openings such as doors, windows, louvers, and other exterior penetrations. Use self-adhering air barrier transition strips if necessary to achieve full extension and continuity of the barrier at these locations. Seal edges of barrier at junctures with rough openings.

d. Install within manufacturer's tolerances, but not more than minus 6 mm or plus 13 mm.

e. Sequence work so as to completely seal all penetrations resulting from pipes, vents, wires, conduit, electrical fixtures, structural members, or other construction. If penetrations through the spray foam air barrier are made after the initial SPF application, reapply in accordance with manufacturer's written instructions for such remedial work.

f. Do not install SPF within 75 mm of heat emitting devices such as light fixtures and chimneys.

g. Finished surface of SPF must be free of voids and embedded foreign objects.

h. Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.

i. Trim, as required, any excess thickness that would interfere with the application of cladding and covering system by other trades.

j. Clean and restore surfaces soiled or damaged by work of other trades. Before cleaning and restoring damaged work, consult with other trades for appropriate and approved methods for cleaning and restoration to prevent further damage.

k. Complete connections to other components and repair any gaps, holes or other damage using material approved by the manufacturer.

l. Provide expansion joints in the SPF application aligned with expansion joints in the building enclosure, where substrate materials change, and in accordance with manufacturer's recommendations.

m. Provide a continuous fire watch in accordance with paragraph SAFETY

PROVISIONS.

3.4 FIELD QUALITY CONTROL

3.4.1 General Site Inspections and Testing

Provide site inspections and testing in accordance with ABAA protocol to verify conformance with the manufacturer's instructions, the ABAA QAP Quality Assurance Program (https://www.airbarrier.org/qap/), Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM,[Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS,] and this section.

a. Conduct inspections and testing at 5, 50, and 95 percent of completion of this scope of work. Forward written inspection reports to the Contracting Officer within 5 working days of the inspection and test being performed.

b. If inspections reveal any defects, promptly remove and replace defective work at no additional expense to the Government.

3.4.2 Manufacturer Site Inspections

Manufacturer's technical representative must visit the site during the installation process to ensure the SPF and accessories are being applied in compliance with requirements. At a minimum, manufacturer's technical representative must be present at work startup and perform field inspection of the first day's completed application and at substantial completion, prior to demobilization. After each inspection, submit an inspection report signed by the manufacturer's technical representative, to the Contracting Officer within five working days. The inspection report must note overall quality of work, deficiencies, and recommended corrective actions in detail. Notify the Contracting Officer a minimum of two working days prior to site visits by manufacturer's technical representative.

3.4.3 Contractor's Site Inspections

Establish and maintain an inspection procedure to ensure compliance of the foam installation with contract requirements. Conduct inspections and testing at 5, 50, and 95 percent completion of application. Forward written inspection reports to the Contracting Officer within five working days of the inspection and test being performed. Work not in compliance must be promptly removed and replaced or corrected, in an approved manner, at no additional cost to the Government. Quality control must include, but is not limited to, the following:

a. Observation of environmental conditions; number and skill level of insulation workers.

b. Verification of certification, listing, or label.

c. Verification of proper storage and handling of materials before, during, and after installation.

d. Inspection of SPF, support structure, primer, expansion joints,[ignition barrier,][thermal barrier,][vapor retarder,] and accessories.

3.4.4 Field Peel Adhesion Test

Conduct in accordance with test protocol indicated in Part 1 paragraph FIELD PEEL ADHENSION TEST.

[3.4.5 Visual Inspection and Thermal Scanning

Following completion of installation, inspect the SPF surface or cavity using infrared (IR) scanning as specified in[ASTM C1060,][ASTM C1153][and]. Where the IR inspection indicates construction inconsistencies including wet insulation, remove inconsistent portions of the assembly and replace insulation to correct thermal anomalies. Reinspect and document corrections to the satisfaction of the Contracting Officer.

3.4.5.1 Thermographic Test Report

Include thermographs in color and a color temperature scale to define the temperature indicated by the various colors. Identify the high temperature reading, the outdoor air temperature, the building indoor air temperature, and the wind speed and direction. Note areas of compromise in the building enclosure, and note actions required and taken to correct those areas. Final thermography test report must demonstrate that the problem areas have been corrected. Submit the complete test and analysis.

]3.5 CORRECTION OF DEFICIENCIES

Upon completion of inspection, testing, or sample taking, repair damaged construction, restore substrates and finishes, and protect repaired construction. Deficiencies found during inspection must be corrected within[5 working days][48 hours][_____] following notification.

3.6 CLEANUP OF SPILLS

Conduct cleanup of uncured product spillage in accordance with paragraph SAFETY PROVISIONS and the manufacturer's written safe handling instructions. In the event of a conflict, the most stringent requirement governs.

3.7 PROTECTION AND CLEANING

3.7.1 Protection of Installed Work

Protect SPF installation from damage during application and remainder of construction period in accordance with manufacturer's written instructions. Repair damaged areas to new condition.

3.7.2 Cleaning of Adjacent Surfaces

Clean overspray from adjacent construction using cleaning agents and procedures as recommended in writing by the manufacturer of each type of affected construction and as acceptable to same.

-- End of Section --

SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(2017) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM E108	(2011) Fire Tests of Roof Coverings

FM GLOBAL (FM)

FM 4470	(2010) Single-Ply, Polymer-Modified Bitumen Sheet, Built-up Roof (BUR), and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction
FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 6005	(2005) Asphalt Roofing Felts
JIS A 6012	(2005) Woven Fabrics Asphalt Roofings
JIS A 6013	(2014) Polymer-Modified Bitumen Roofing Sheets
JIS A 6022	(2010) Stretchy Asphalt Roofing Felts (Synthetic Fiber Base)
JIS A 9521	(2017) Thermal Insulation Materials for Buildings

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT SS Chapter 9	(2019) Building Construction Standard Specifications - Chapter 9 Waterproofing Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	(2013; Errata 2015) Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 58	(2017; ERTA 17-1) Liquefied Petroleum Gas Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.12	Construction Work
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.16	Rules of Construction

UNDERWRITERS LABORATORIES (UL)

UL 790	(2004; Reprint Jul 2014) Standard Test Methods for Fire Tests of Roof Coverings
UL RMSD	(2012) Roofing Materials and Systems Directory

1.2 DESCRIPTION OF ROOF MEMBRANE SYSTEM[S]

[[Minimum [two-ply][three-ply] SBS [or] [APP] [modified bitumen roof membrane consisting of [modified bitumen base sheet][fiberglass felt [venting]base sheet] [,interply sheet] and cap sheet. Modified bitumen roof membrane must be [set in hot asphalt][torch applied]][set in cold-applied adhesive].]

][[_____]: Minimum [two-ply][three-ply] SBS [or] [APP] modified bitumen roof membrane consisting of [modified bitumen base sheet][fiberglass felt [venting] base sheet] [,interply sheet] and cap sheet. Modified bitumen roof membrane must be [set in hot asphalt][torch applied][set in cold-applied adhesive].

] All work must follow the manufacturer guidelines and standards stated within this Section.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Roof plan; G[, [_____]] drawing depicting wind loads and boundaries of enhanced perimeter and corner attachments of roof system components, as applicable

SD-07 Certificates

Fire Resistance classification; G[, [_____]]

Submit the roof system assembly fire rating classification listings.

SD-11 Closeout Submittals

Warranty

Information Card

Instructions To [Government][Contractor] Personnel

Include copies of Safety Data Sheets for maintenance/repair materials.

Submit 20 year "No-Dollar-Limit" warranty for labor and materials.

1.4 QUALITY ASSURANCE

1.4.1 Qualification of Manufacturer

Modified bitumen sheet roofing system manufacturer must have a minimum of [5][_____] years experience in manufacturing modified bitumen roofing products.

1.4.2 Qualification of Applicator

Roofing system applicator must be approved, authorized, or licensed in writing by the modified bitumen sheet roofing system manufacturer and have a minimum of [five][_____] years experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. The applicator must supply the names, locations and client contact information of five projects of similar size and scope that the applicator has constructed using the manufacturer's roofing products submitted for this project within the previous three years. Applicator must be certified technician with Japan Roofing Contractors Association.

1.4.3 Qualifications of Photovoltaics (PV) Rooftop Applicator

The PV rooftop applicator must be approved, authorized, or certified by a Roof Integrated Solar Energy (RISE) Certified Solar Roofing Professional (CSRP), and comply with applicable codes, standards, and regulatory requirements to maintain the weatherproofing abilities of both the integrated roof system and photovoltaic system.

1.4.4 Qualification of Engineer of Record

[Engineer of Record must be currently licensed within the jurisdiction of the project.

][Engineer of Record must be approved, authorized, and currently licensed by

the state of [Florida][_____], and have a minimum of five years experience as an approved Engineer for manufacturers of similar roof systems. Engineer of Record must supply the names and locations of five projects of similar size and scope for which he has provided engineering calculations using the manufacturer's products submitted for this project within the previous three years. Engineer of Record must provide certified engineering calculations for:

] ASCE 7,in accordance with International Building Code.

[Seismic requirements per [local] [and state] building codes]

[Seismic requirements per ICC IBC Chapter 16, Section 1608.3

][Snow load requirements per ICC IBC Chapter 16 Section 1608.3 and Section 7 of ASCE 7

]]1.4.5 Fire Resistance

Complete roof covering assembly must:

a. Be Class A [or B] rated in accordance with ASTM E108, FM 4470, or UL 790; and

b. Be listed as part of Fire-Classified roof deck construction in UL RMSD, or Class I roof deck construction in FM APP GUIDE.

FM or UL approved components of the roof covering assembly must bear the appropriate FM or UL label.

1.4.6 Wind Uplift Resistance

Provide a complete roof system assembly that is rated and installed to resist wind loads [indicated] [calculated in accordance with ASCE 7] and validated by uplift resistance testing in accordance with Factory Mutual (FM) test procedures. Do not install non-rated systems, except as approved by the Contracting Officer. Submit licensed engineer's Wind uplift calculations and substantiating data to validate any non-rated roof system. Base wind uplift measurements on a design wind speed of [_____] km/h in accordance with ASCE 7 and other applicable building code requirements.

1.4.7 Preroofing Conference

After approval of submittals and before performing roofing [and insulation] system installation work, hold a preroofing conference to review the following:

a. Drawings, including Roof Plan, specifications and submittals related to the roof work

[Field inspection and verification of all existing conditions, including all fire safety issues, existing structure, and existing materials, including concealed combustibles, which may require additional protection during installation.

] b. Roof system components installation

c. Procedure for the roof manufacturer's technical representative's

onsite inspection and acceptance of the roof structure, and roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representatives to roof manufacturer

d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing

e. Quality control, (ARMA PMBRG98) plan for the roof system installation

f. Safety requirements

Coordinate preroofing conference scheduling with the Contracting Officer. The conference must be attended by the Contractor, the Contracting Officer's designated personnel, and personnel directly responsible for the installation of roofing [and insulation], flashing and sheet metal work, [[mechanical] [and] [electrical] work], other trades interfacing with the roof work, designated safety personnel trained to enforce and comply with [Fire Marshall,] and a representative of the roofing materials manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver materials in manufacturers' original unopened containers and rolls with labels intact and legible. Mark and remove wet or damaged materials from the site. Where materials are covered by a referenced specification, the container must bear the specification number, type, and class, as applicable. Deliver materials in sufficient quantity to allow work to proceed without interruption.

1.5.2 Storage

Protect materials against moisture absorption and contamination or other damage. Avoid crushing or crinkling of roll materials. Store roll materials on end on clean raised platforms or pallets one level high in dry locations with adequate ventilation, such as an enclosed building or closed trailer. Do not store roll materials in buildings under construction until concrete, mortar, and plaster work is finished and dry. Maintain roll materials at temperatures above 10 degrees C for 24 hours immediately before application. Do not store materials outdoors unless approved by the Contracting Officer. Completely cover felts stored outdoors, on and off roof, with waterproof canvas protective covering. Do not use polyethylene sheet as a covering. Tie covering securely to pallets to make completely weatherproof. Provide sufficient ventilation to prevent condensation. Do not store more materials on roof than can be installed the same day and remove unused materials at end of each days work. Distribute materials temporarily stored on roof to stay within live load limits of the roof construction.

Maintain a minimum distance of 10.67 meters for all stored flammable materials, including materials covered with shrink wraps, craft paper or tarps from all torch/welding applications.

Immediately remove wet, contaminated or otherwise damaged or unsuitable materials from the site. Damaged materials may be marked by the Contracting Officer.

1.5.3 Handling

Prevent damage to edges and ends of roll materials. Do not install damaged materials in the work. Select and operate material handling equipment to prevent damage to materials or applied roofing.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not install roofing system when air temperature is below 4.44 degrees C, during any form of precipitation, including fog, or when there is ice, frost, moisture, or any other visible dampness on the roof deck. Follow manufacturer's printed instructions for Cold Weather Installation.

[1.7 [TORCH][HOT-MOPPED ASPHALT] APPLIED [(HEAT WELD)] MODIFIED BITUMEN MEMBRANE SAFETY

1.7.1 Property Protection

Take all precautions necessary to prevent ignition of combustible materials during [hot-mopped asphalt application] of roofing. Immediately call the fire department if a fire commences. Review all fire safety procedures as outlined at the pre-roofing conference.

Install materials per MLIT SS Chapter 9. Application procedures must comply with NFPA 241, OSHA 29 CFR 1910 and 29 CFR 1910.12, 29 CFR 1926.16, 29 CFR 1926 Subpart F.[, UL Fire Resistance Directory Volume No. 1.]

Do not store flammable liquids on the roof.

No Asphalt Kettles are allowed on roofs. Locate kettles and supply LP-Gas Cylinders safely and secured per NFPA 241 outside of the building's perimeter a minimum of 6.096 m from the structure and any combustible materials.

Maintain a minimum separation of 6.096 m between LP-Gas Cylinders and kettle. Provide protective fire retardant blanket barrier or shield between any building structure to a minimum height of 8 foot and a clear surround distance of 2.44 m if operations force placement of kettle within a distance of 6.096 m. Do not obstruct or place kettles or Cylinder storage within 3.048 m of exits, means of egress, gates, roadways, entrances. Locate kettles downwind and away from any building air intakes.

Provide a minimum of two portable fully charged [9.072 kg CO2] [9.072 kg ABC (dry chemical)] fire extinguishers no closer than 1.524 m and no further than 7.62 m of horizontal travel distance from each kettle at all times while kettle is in operation, in easily accessible and identifiable locations. Also provide [a minimum of one][two] multipurpose 2-A:20-B:C portable fire extinguisher on the roof being covered or repaired.

Comply with the following safety procedures:

a. Fuel containers, burners, and related appurtenances of roofing equipment in which liquefied petroleum gas is used for heating must comply with the requirements of NFPA 58.

b. Fuel containers having capacities greater than one pound must be located a minimum of 3.048 m clear distance from the burner flame.

c. Clearly label all LP-Gas Cylinders as "Flammable Gas", and secure to prevent accidental tip-over.

d. Check all pressure regulators and hoses prior to use for proper functioning and integrity.

e. Turn off fuel supply at LP Gas Cylinder when kettle is not in use.

f. Equip all kettles with a functioning temperature measuring device to ensure no heating in excess of 10 degrees C below the flash point.

g. Provide covers, lid, or top which are close fitting, constructed of minimum No.14 manufacturer's gauge steel, and can be gravity closed on all kettles.

h. Clean all roofing mops and rags free of excess asphalt and store safely away from all combustible materials. Store discarded roofing mops and rags in a non-combustible container and remove from site each day.

i. Position all pump lines handling hot asphalt securely and equip all pump lines with a shut-off valve on each with a coupler which may be opened when lines are full. Do not subject pump lines to pressures in excess of safe and recommended NRCA and ARMA working pressures. Station an operator near the equipment to cut off flow and care for other emergencies while conducting heating, pumping and application operations.

j. Asphalt bucket used by roofers or workers in similar trades must be constructed of minimum No. 24 gauge or heavier sheet steel and have a metal bail of no less than 6.35 mm diameter material. The bail is to be fastened to offset ears or equivalent which have been riveted, welded, or otherwise safely and securely attached to the bucket. Soldered bail sockets are prohibited. Position workers and other employees to avoid being struck by bucket or other roofing materials, which may accidentally fall while being hoisted, lowered, or used in the roofing operation. Provide safety barriers and caution signs at all skylights or other roof holes.

k. Do not use flammable liquids with a flash point below 37.78 degrees C (gasoline and similar products) for cleaning purposes.

Do not use solid fuel or Class I liquids as fuel for roofing asphalt kettles. Provide a minimum of one employee fully knowledgeable of kettle operations and hazards to maintain constant surveillance during kettle operation within a minimum distance of 7.62 m of the kettle.

Check all fire extinguishers prior to commencement of work, and upon completion of the day's work, to ensure fullness and operability.

Project supervisor must make daily inspections with the facility manager of all conditions and operations which could present hazards during [hot-mopped] applications and issue directives to address all such concerns and items of the work and existing conditions.

Identify and protect all combustible roof components, possible fire traps, and hidden hazards. Seal off voids or openings in the substrate with non-combustible materials prior to installing [hot-mopped applied] materials in the area. Install protective fire retardant blankets and shields at building walls, eaves, parapets and equipments curbs constructed of combustible materials within 0.9144 meter radius of the area of [torch work][hot-mopped kettle] prior to commencement of the work.

When working around intakes and openings, temporarily disconnect and block to prevent [fumes from kettle] from being drawn into the opening.[Provide non-combustible shielding or flame guard protection where gaps or voids occur in the construction in area of torch work.]

1.7.2 Fire Watch

All personnel on the roof during [hot-mopped application] must be properly trained to use a fire extinguisher. Provide a fire watch for a minimum of [30 minutes after completion of hot-mopped kettle operations] at the end of each work shift. Maintain the fire watch for additional time required to ensure no potential ignition conditions exist. [Utilize heat sensing meters to scan for hot spots in the work.]

Do not leave the rooftop unattended during breaks in work during a work shift. Walk and scan all areas of application checking for hot spots, fumes, or smoldering, especially at wall and curb areas, prior to departure at the end of each work shift. Ensure any and all suspect conditions are eliminated prior to leaving the site each work shift.

1.7.3 Wind Conditions

Use side shields with all torching operations when winds are occurring to prevent flame distortion of end burners. Use torch machine equipment with bottom shield plate to prevent flame spread on to roof deck and substrate. When high wind gusts are present, notify the safety officer and cease all use of torching equipment until wind conditions lower and authorization from the safety officer to proceed is received.

]1.8 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that permanent flashing and counter flashing and are installed as the work progresses. Ensure temporary protection measures are in place to preclude moisture intrusion or damage to installed materials.[Apply roofing immediately following application of insulation as a continuous operation. Coordinate roofing operations with insulation work so that all roof insulation applied each day is covered with roof membrane installation the same day.]

1.9 WARRANTY

Provide roof system material and workmanship warranties meeting specified requirements. Provide revision or amendment to standard membrane manufacturer warranty as required to comply with the specified requirements. Provide a manufacturer's warranty that has no dollar limit, covers full system water-tightness, and has a minimum duration of 20 years.

1.9.1 Roof Membrane Manufacturer Warranty

Furnish the roof membrane manufacturer's 20-year no dollar limit roof system materials and installation workmanship warranty, including flashing, insulation, and accessories necessary for a watertight roof system construction. Provide warranty directly to the Government and commence warranty effective date at time of Government's acceptance of the roof work. The warranty must state that:

a. If within the warranty period the roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, blisters, splits, tears, delaminates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the roof system assembly and correction of defective workmanship are the responsibility of the roof membrane manufacturer. All costs associated with the repair or replacement work are the responsibility of the roof membrane manufacturer.

b. When the manufacturer or his approved applicator fail to perform the repairs within 72 hours of notification, emergency temporary repairs performed by others does not void the warranty.

c. Upon completion of installation, and acceptance by the [Contracting Officer] [, Architect][, Construction Manager] and Roofing System Engineer of Record, the manufacturer must supply the appropriate warranty to the Owner.

d. Installer must submit a minimum two year warranty to the membrane manufacturer from the date of acceptance, with a copy to the [Contracting Officer] [, Architect][, Construction Manager] and Roofing System Engineer of Record.

1.9.2 Roofing System Installer Warranty

The roof system installer must warrant for a period of two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof membrane, flashing, insulation, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Write the warranty directly to the Government. The roof system installer is responsible for correction of defective workmanship and replacement of damaged or affected materials. The roof system installer is responsible for all costs associated with the repair or replacement work.

1.9.3 Continuance of Warranty

Repair or replacement work that becomes necessary within the warranty period and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the roof membrane manufacturer warranty for the remainder of the manufacturer warranty period.

1.10 CONFORMANCE AND COMPATIBILITY

Provide the entire roofing and flashing system in accordance with specified and indicated requirements, including fire and wind resistance requirements. Work not specifically addressed and any deviation from

specified requirements must be in general accordance with MLIT SS Chapter 9, membrane manufacturer published recommendations and details, and compatible with surrounding components and construction. Submit any deviation from specified or indicated requirements to the Contracting Officer for approval prior to installation.

1.11 ELIMINATION, PREVENTION OF FALL HAZARDS

1.11.1 Fall Protection

[_____]

PART 2 PRODUCTS

2.1 MATERIALS

Coordinate with other specification sections related to the roof work. Furnish a combination of specified materials that comprise a roof system acceptable to the roof membrane manufacturer and meeting specified requirements. Protect materials provided from defects and make suitable for the service and climatic conditions of the installation.

2.1.1 Energy [and Cool Roof] Performance

Install a roof system that meets an overall performance as specified on the drawings or by insulation specified in other sections. [Provide emittance and reflectance percentages, solar reflectance index values, [and] slopes [_____], to meet sustainable third party certification requirements for Heat Island Reduction.]

2.2 MODIFIED BITUMEN SHEETS AND FIBERGLASS FELT MATERIALS

Furnish a combination of specified materials that comprise the modified bitumen manufacturer's standard system of the number and type of plies specified. Provide materials suitable for the service and climatic conditions of the installation. Modified bitumen sheets must be watertight and visually free of pinholes, particles of foreign matter, non-dispersed raw material, factory splices, or other conditions that might affect serviceability. Polymer modifier must comply with MLIT SS Chapter 9 and be uniformly dispersed throughout the sheet. Edges of sheet must be straight and flat.

[a. Venting Base Sheet: [Without][With] perforations and as approved by the modified bitumen roof membrane manufacturer.

][b. Fiberglass Felt Base Sheet: JIS A 6022 or JIS A 6012, and as approved by the modified bitumen roof membrane manufacturer.
]
[c. SBS Base Sheet: Minimum 2.0 mm thick, and as approved by the roof membrane manufacturer.

][d. SBS Interply Sheet: Minimum 2.0 mm thick, and as approved by the roof membrane manufacturer.
]
[e. SBS Cap Sheet: Minimum[3.7 mm] [_____] thick, and as required to provide specified fire safety rating.
]
[f. APP Base Sheet: Minimum 3.5 mm thick, and as approved by the roof membrane manufacturer.

]
[g. APP Cap Sheet: Minimum 4.0 mm thick, and as approved by the roof membrane manufacturer.

]2.3 BASE FLASHING MEMBRANE

Membrane manufacturer's standard, minimum two-ply modified bitumen membrane flashing system compatible with the roof membrane specified and as recommended in membrane manufacturer's published literature. Provide flashing membranes that meet or exceed the properties of the material standards specified for the modified bitumen [base][, interply] and cap sheet, except that flashing membrane thickness must be as recommended by the membrane manufacturer.[Provide metal clad flashing membrane that complies with MLIT SS Chapter 9].

[2.4 ASPHALT

JIS A 6005 / JIS A 6013, in accordance with modified bitumen membrane manufacturer requirements and compatible with the slope conditions of the installation.

][2.5 COLD-APPLIED MEMBRANE ADHESIVE

Membrane manufacturer's recommended [low volatile organic compound (VOC)] cold process adhesive for application of the membrane plies.

][2.6 MEMBRANE SURFACING

Provide modified bitumen roof membrane cap sheet with factory-applied granule surfacing of [light][_____] color [as selected from membrane manufacturer's standard colors].[Provide modified bitumen membrane manufacturer's recommended field-applied protective coating of [white][light gray][_____] color.][Light colored, opaque water-worn gravel aggregate surfacing material as recommended by the membrane manufacturer and approved by the Contracting Officer[, and applied in flood coat of hot asphalt].]

]2.7 PRIMER

Primer compatible with the application and as approved in writing by the modified bitumen membrane manufacturer.

2.8 MODIFIED BITUMEN ROOF CEMENT

Compatible with the modified bitumen roof membrane and as recommended by the modified bitumen membrane manufacturer.

2.9 CANT AND TAPERED EDGE STRIPS

Provide standard cants and tapered edge strips of [the same material as the roof insulation] treated with bituminous impregnation, sizing, or waxing and fabricated to provide maximum 45 degree change in direction of membrane. Cant strips must be minimum [38 mm thick and provide for minimum 125 mm face and 85 mm vertical height when installed at 45 degree face angle][100 mm vertical height with 45 degree cant angle], except where clearance restricts height to lesser dimension. Taper edge strips at a rate of 25 mm to 38 mm per 300 mm to a minimum of 3 mm of thickness. Provide kiln-dried preservative-treated wood cants, in compliance with requirements of Section 06 10 00 ROUGH CARPENTRY at base of wood nailers

set on edge and wood curbing and where otherwise indicated.

2.10 FASTENERS AND PLATES

Provide coated, corrosion-resistant fasteners as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM 4470 and FM APP GUIDE for Class I roof deck construction and the wind uplift resistance specified. For fastening of membrane or felts to wood materials, provide fasteners driven through 25 mm diameter metal discs, or one piece composite fasteners with heads not less than 25 mm in diameter or 25 mm square with rounded or 45 degree tapered corners.

2.10.1 Masonry or Concrete Walls and Vertical Surfaces

Use hardened steel nails or screws with flat heads, diamond shaped points, and mechanically deformed shanks not less than 25 mm long for securing felts, modified bitumen sheets, metal items, and accessories to masonry or concrete walls and vertical surfaces. Use power-driven fasteners only when approved in writing by the Contracting Officer.

2.10.2 Metal Plates

Provide flat corrosion-resistant round stress plates as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM 4470; not less than 50 mm in diameter. Form discs to prevent dishing or cupping.

[2.11 PRE-MANUFACTURED ACCESSORIES

Pre-manufactured accessories must be manufacturer's standard for intended purpose,[comply with applicable specification section,] compatible with the membrane roof system and approved for use by the modified bitumen membrane manufacturer.

[2.11.1 Pre-fabricated Curbs

Provide [_____] gauge [G90 galvanized][AZ55 galvalume][_____] curbs with minimum 100 mm flange for attachment to roof nailers. Curbs must be minimum height of 250 mm above the finished roof membrane surface.

][2.11.2 Elevated Metal [Walkways] [and] [Platforms]

As specified in Section[05 50 13 MISCELLANEOUS METAL FABRICATIONS][05 51 33 METAL LADDERS][05 52 00 METAL RAILINGS][05 51 00 METAL STAIRS].

]][2.12 WALKPADS

Provide roof walkpads that are polyester reinforced, granule-surfaced modified bitumen membrane material, minimum [_____] [5 mm] thick, compatible with the modified bitumen sheet roofing and as recommended by the modified bitumen sheet roofing manufacturer. Panels must not exceed 1.219 meters in length. Other walkpad materials require approval of the Contracting Officer prior to installation.

][2.13 PAVER BLOCKS

Precast concrete, minimum 38 mm thick, minimum 450 mm square for walkways and minimum 150 mm by 300 mm for use in supporting surface bearing

components but extending not less than 50 mm beyond all sides of surface bearing bases. Install walkpad material under all paver blocks.

][2.14 ROOF INSULATION BELOW MODIFIED BITUMEN MEMBRANE SYSTEM

Provide insulation compatible with the roof membrane, approved by the membrane manufacturer and meeting all the requirements of JIS A 9521 as specified in Section 07 22 00 ROOF AND DECK INSULATION.

]2.15 MEMBRANE LINER

Provide self-adhering modified bitumen underlayment or other waterproof membrane liner material as approved by the Contracting Officer.

[2.16 TOP COATING

Provide a top coating product that is complied with Energy Efficiency Standards/Labeling System based on Article 36 of the Act and is produced and compatible with the roof material of this specification. Provide data identifying Energy Efficiency Standard label for top coating product. Install to the manufacturer's written installation methods. Provide written confirmation that installation of a top coat will not modify or void the required roof warranty.

]PART 3 EXECUTION

3.1 EXAMINATION

Ensure that the following conditions exist prior to application of the roofing materials:

a. Do not install items that show visual evidence of biological growth.

b. [Drains,] [curbs,] [cants,] [control joints,] [expansion joints,] [perimeter walls,] [roof penetrating components,] [and] [equipment supports] are in place.

c. Surfaces are rigid, clean, dry, smooth, and free from cracks, holes, and sharp changes in elevation. Joints in the substrate are sealed to prevent dripping of bitumen into building or down exterior walls.

d. The plane of the substrate does not vary more than 6.35 mm within an area 3.048 by 3.048 meters when checked with a 3.048 meter straight edge placed anywhere on the substrate.

e. Substrate is sloped as indicated to provide positive drainage.

f. Walls and vertical surfaces are constructed to receive counter flashing, and will permit mechanical fastening of the base flashing materials.

g. Treated wood nailers are in place on non-nailable surfaces, to permit nailing of base flashing at minimum height of 200 mm above finished roofing surface.

h. Protect all combustible materials and surfaces which may contain concealed combustible or flammable materials. All fire extinguishing equipment has been placed as specified.

i. Verify all Fire Watch personnel assignments.

j. Treated wood nailers are fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of membrane, edging strips, attachment flanges of sheet metal, and roof fixtures.[Embedded nailers are flush with deck surfaces.][Surface-applied nailers are the same thickness as the roof insulation.]

k. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is 45 degrees and the height of the vertical leg is not less than 88.9 mm.

[l. Venting is provided in accordance with the following:

[(1) Edge Venting: Perimeter nailers are kerfed across the width of the nailers to permit escape of gaseous pressure at roof edges.

][(2) Underside Venting: Vent openings are provided in steel form decking for cast-in-place concrete substrate.

]]m. Exposed nail heads in wood substrates are properly set. Warped and split [boards] [sheets] have been replaced. There are no cracks or end joints 6.35 mm in width or greater. Knot holes are covered with sheet metal and nailed in place. [Wood][Plywood] decks are covered with rosin paper or unsaturated felt prior to base sheet or roof membrane application.[Joints in plywood substrates are taped or otherwise sealed to prevent air leakage from the underside.]

[n. Insulation boards are installed smoothly and evenly, and are not broken, cracked, or curled. There are no gaps in insulation board joints exceeding 6.35 mm in width. Insulation is being roofed over on the same day the insulation is installed.

][o. Cast-in-place substrates have been allowed to cure and the surface dryness requirements specified under paragraph FIELD QUALITY CONTROL have been met.

][p. Joints between precast concrete deck units are grouted, leveled, and stripped in with felt or bituminous stripping membrane set in bituminous cement prior to applying other roofing materials over the area.

] q. Roof deck and framing are sloped as indicated to provide positive drainage.

3.2 PREPARATION

3.2.1 Protection of Property

3.2.1.1 Protective Coverings

Install protective coverings at paving and building walls adjacent to hoists[, tankers][, and kettles] prior to starting the work. Lap protective coverings not less than 15.24 cm , secure against wind, and vent to prevent collection of moisture on covered surfaces. Keep protective coverings in place for the duration of the roofing work.

[3.2.1.2 Bitumen Stops

Provide felt bitumen stops or other means to prevent bitumen drippage at roof edges, openings, and vertical projections before hot mopped application of the roofing membrane.

][3.2.2 Equipment

[3.2.2.1 Mechanical Application Devices

Mount mechanical application devices on pneumatic-tired wheels. Use devices designed and maintained to operate without damaging the insulation, roofing membrane, or structural components.

]3.2.2.2 Electric-Heated Equipment

Provide adequate electrical service as required by manufacturer of electrical equipment to ensure against damage to equipment and property and to ensure proper application of roofing materials.

][3.2.3 Heating of Asphalt

Break up solid asphalt on a surface free of dirt and debris. Heat asphalt in kettle designed to prevent contact of flame with surfaces in contact with the asphalt. Utilize kettles with visible working thermometer and thermostatic controls set to the temperature limits specified herein. Keep controls in working order and calibrated. Use immersion thermometer, accurate within a tolerance of plus or minus one degree C, to check temperatures of the asphalt frequently. When temperatures exceed maximums specified, remove asphalt from the site. Do no permit cutting back, adulterating, or fluxing of asphalt.

[3.2.3.1 Temperature Limitations for Asphalt

Heat and apply asphalt at the temperatures specified below unless specified otherwise by manufacturer's printed application instructions. Use thermometer to check temperature during heating and application. Have kettle attended constantly during heating process to ensure specified temperatures are maintained. Do not heat asphalt above its finished blowing temperature (FBT). Do not heat asphalt between 260 and 274 degrees C for longer than four consecutive hours. Do not heat asphalt to the flash point (FP). Apply asphalt and embed membrane sheets when temperature of asphalt is within plus or minus 14 degrees C of the equiviscous temperature (EVT) but not less than 204 degrees C. Before heating and application of asphalt refer to the asphalt manufacturer's label or bill of lading for FP, FBT, and EVT of the asphalt used.

]]3.2.4 Priming of Surfaces

Prime all surfaces to be in contact with adhered membrane materials. Apply primer at the rate of 3 liters per 10 sq. meters or as recommended by modified bitumen sheet manufacturer's printed instructions to promote adhesion of membrane materials. Allow primer to dry prior to application of membrane materials to primed surface. Avoid flammable primer material conditions in torch applied membrane applications.

3.2.4.1 Priming of Concrete and Masonry Surfaces

After surface dryness requirements have been met, coat concrete and

masonry surfaces which are to receive membrane materials uniformly with primer.

3.2.4.2 Priming of Metal Surfaces

Prime flanges of metal components to be embedded into the roof system prior to setting in bituminous materials or stripping into roofing system.

3.2.5 Membrane Preparation

Unroll modified bitumen membrane materials and allow to relax a minimum of 30 minutes prior to installation. In cold weather, adhere to membrane manufacturer's additional recommendations for pre-installation membrane handling and preparation. Inspect for damage, pinholes, particles of foreign matter, non-dispersed raw material, factory splices, or other conditions that might affect serviceability. Edges of seams must be straight and flat so that they may be seamed to one another without forming fish mouths or wrinkles. Discard damaged or defective materials.

3.2.6 Substrate Preparation

Apply membrane to clean, dry surfaces only. Do not apply membrane to surfaces that have been wet by rain or frozen precipitation within the previous 12 hours. Provide cleaning and artificial drying with heated blowers or torches as necessary to ensure clean, dry surface prior to membrane application.

3.3 APPLICATION

Apply roofing materials as specified herein unless approved otherwise by the Contracting Officer. Keep roofing materials dry before and during application. Complete application of roofing in a continuous operation. Begin and apply only as much roofing in one day as can be completed that same day. Maintain specified temperatures for asphalt. [Provide temporary roofing and flashing as specified herein prior to application of permanent roofing system.]

3.3.1 Phased Membrane Construction

Phased application of membrane plies is prohibited unless otherwise approved by the Contracting Officer and supported by the membrane manufacturer's written application instructions. If cap sheet installation is delayed, thoroughly clean the applied membrane material surface and dry immediately prior to cap sheet installation. Priming of the applied membrane surface may be required at the discretion of the Contracting Officer prior to cap sheet installation.

3.3.2 Temporary Roofing and Flashing

Provide watertight temporary roofing and flashing where considerable work by other trades, such as installing [cooling towers,] [antennas,] [pipes,] [ducts,] [_____,] is to be performed on the roof or where construction scheduling or weather conditions require protection of the building's interior before permanent roofing system can be installed. Do not install temporary roofing over permanently installed insulation. Provide rigid pads for traffic over temporary roofing.

[3.3.2.1 Removal

Completely remove temporary roofing and flashing before continuing with application of the permanent roofing system.

]3.3.3 Application Method

[3.3.3.1 Hot Asphalt Application of Modified Bitumen Membrane

Apply membrane immediately following application of hot asphalt. Apply hot asphalt within 1.829 m of roll. Do not work ahead with asphalt. Asphalt must be completely fluid, with mop temperatures within the asphalt's EVT range, but not less than 204.4 degrees C, at the instant membrane comes into contact with asphalt. Apply bitumen between layers to provide full, continuous, uniform coverage and complete contact of hot asphalt with the sheet above and below. Embed sheets in asphalt. As sheets are being rolled into hot asphalt, immediately and thoroughly apply uniform positive pressure by squeegee, roll, or broom to ensure full adhesion and lap seal, eliminate trapped air and to provide tight, smooth laminations. Avoid excessive extrusion of asphalt at lap areas. Control asphalt bleed out to approximately 25.4 mm maximum.

]3.3.3.2 Torch Applied [Heat Welded] Modified Bitumen Membrane [Flashing]

[Base flashing membrane may be torch applied.] Ensure substrate membrane surfaces are warmed either naturally or by torch during the installation. Apply heat evenly to underside of roll membrane being installed and exposed side lap area of previously installed sheet. Provide for slight, uniform flow of bitumen in front of roll and full width of roll as the material is being rolled or set into place. Apply uniform positive pressure to ensure membrane is fully adhered and all laps are sealed. Prior to forming lap over granulated surfaces, embed granules of the receiving sheet by heating and troweling-in the granules to form a uniform black compound surface. [Roll all lap areas with a weighted roller immediately after forming lap. Provide for visual bleed out of compound in lap areas.][Avoid overheating the membrane or burning through to membrane reinforcement. Inspect and ensure all lap areas are fully sealed.

][3.3.3.3 Cold Adhesive Applied Modified Bitumen Membrane

Apply cold adhesive with airless sprayer or 6.35 mm saw-toothed rubber squeegee to prepared surfaces in accordance with membrane manufacturer's application instructions. Fully cover substrate with adhesive. Roll or lay membrane in adhesive in accordance with manufacturer's recommendations and within the time limitations of adhesive application. Broom the membrane to ensure full contact with adhesive. Seal laps with adhesive or by heat fusing with torch or hot air welder as required by membrane manufacturer. Minimize traffic on installed membrane during the adhesive cure and set time.

][3.3.4 Ventilating Base Sheets

Apply ventilating base sheets with 75 mm side laps and 150 mm end laps in accordance with manufacturer's printed application instructions for substrate [and wind uplift conditions]specified. [Provide mechanical attachments as required for wind resistance specified and to include increased frequency of attachment at corner and perimeter areas. Drive fasteners flush with no dishing or cupping of fastener plate.][Top mop perforated sheet with a full, continuous mopping of hot asphalt.]

]3.3.5 [Fiberglass Felt][Modified Bitumen] Base Sheet

[Fully adhere [spot adhere] base sheets in accordance with membrane manufacturer's printed instructions.] [Spot adhere base sheets with hot asphalt applied in 300 mm diameter spots installed in two staggered rows, centered 300 mm in from edge of the base sheet.][Apply cold adhesive with airless sprayer or a 6.35 mm saw-toothed rubber squeegee and at application rate recommended by the membrane manufacturer. Fully cover substrate with cold adhesive. Ensure laps areas of base sheet are fully sealed.] Roll and broom in the base sheet to ensure full contact with the [hot asphalt][adhesive] application.[On nailable substrates, mechanically fasten base sheet in conformance with specified wind resistance requirements and membrane manufacturer's printed instructions, and to include increased fastening frequency in corner and perimeter areas. Drive fasteners flush with no dishing or cupping of fastener plate. Where applicable, mechanically fasten base sheet in conjunction with insulation to the substrate, in accordance with membrane manufacturers printed instructions.] Apply sheets in a continuous operation. Apply sheets with side laps at a minimum of 50 mm unless greater side lap is recommended by the manufacturer's standard written application instructions. Provide end laps of not less than 150 mm and staggered a minimum of 900 mm. Apply sheets [at right angles to the roof slope so that the direction of water flow is over and not against the laps] [parallel to the roof slope] [so that plies of sheets extend from eave line on one side of the barrel-type roof and 450 mm over the center line of the crown of the roof. Apply sheets on the other side in the same manner, resulting in twice the normal amount of roofing sheets and asphalt at the crown]. Extend base sheets approximately 50 mm above the top of cant strips at vertical surfaces and to the top of cant strips elsewhere. Trim base sheet to a neat fit around vent pipes, roof drains, and other projections through the roof. Application must be free of ridges, wrinkles, and buckles.

3.3.6 Modified Bitumen Membrane Application

Ensure proper sheet alignment prior to installation. [Apply membrane layers perpendicular to slope of roof in shingle fashion to shed water, including application on areas of tapered insulation that change slope direction.][Apply membrane layers parallel to slope of roof.] Bucking or backwater laps are prohibited. Fully adhere membrane sheets to underlying substrate materials. Provide minimum 75 mm side laps and minimum 150 mm end laps and as otherwise required by membrane manufacturer. Stagger end laps minimum 900 mm . Offset side laps between membrane layers a minimum of 300 mm. Offset end laps between membrane layers a minimum of 900 mm. Install all membrane layers the same workday, unless supported otherwise by roof membrane manufacturer application instructions and approved by the Contracting Officer. Provide tight smooth laminations of each membrane layer without wrinkles, ridges, buckles, kinks, fishmouths, or voids. Ensure full membrane adhesion and full lap seals. Rework to seal any open laps prior to application of subsequent membrane layers. The completed membrane application must be free of surface abrasions, air pockets, blisters, ridges, wrinkles, buckles, kinks, fishmouths, voids, or open seams.

3.3.6.1 Cap Sheet Installation

Underlying applied membrane must be inspected and repaired free of damage, holes, puncture, gouges, abrasions, and any other defects, and free of

moisture, loose materials, debris, sediments, dust, and any other conditions required by the membrane manufacturer prior to cap sheet installation. Do not apply cap sheet if rain or frozen precipitation has occurred within the previous 24 hours. Align cap membrane and apply by the specified method with the proper side and end lap widths. [Set cap sheet in hot asphalt or torch apply as recommended by the modified bitumen membrane manufacturer.] Cut at a 45 degree angle across selvage edge of cap membrane to be overlapped in end lap areas prior to applying overlapping cap membrane. [Apply matching granules in any areas of [bitumen][adhesive] bleed out while the [asphalt is still hot][adhesive is still tacky].] Minimize traffic on newly installed cap sheet membrane.

[3.3.6.2 Backnailing of Cap Sheet

Unless otherwise recommended by the modified bitumen membrane manufacturer and approved by the Contracting Officer, provide minimum 85 mm wide nailing strips matching insulation thickness and applied perpendicular to roof slope for backnailing of roof membrane. Space nailing strips as recommended by the membrane manufacturer, but not exceeding 5 m on center unless approved otherwise by the Contracting Officer. Coordinate the nailer installation with insulation requirements. Install the modified bitumen cap sheet to provide for end laps at nailer locations. Nail the modified bitumen cap sheet at the end lap area across the width of the sheet. Nail within 25 mm of each edge of the sheet and at 200 mm to 215 mm on center across the width of the sheet in a staggered fashion. Nails must have 25 mm diameter metal cap or be nailed through 25 mm diameter caps. Cover nails by overlapping adjacent upslope sheet at the end lap area.

]3.3.7 Membrane Flashing

Apply two-ply modified bitumen strip flashing and sheet flashing in the angles formed where the roof deck abuts walls, curbs, ventilators, pipes, and other vertical surfaces, and where necessary to make the work watertight. Apply membrane flashing in accordance with the roof membrane manufacturers printed instructions and as specified. Cut at a 45 degree angle across terminating end lap area of cap membrane prior to applying adjacent overlapping cap membrane. Press flashing into place to ensure full adhesion and avoid bridging. Ensure full lap seal in all lap areas. Mechanically fasten top edge of modified bituminous base flashing 150 mm on center through minimum 25 mm diameter tin caps with fasteners of sufficient length to embed minimum 25 mm into attachment substrate.[Apply matching granules in any areas of [asphalt][adhesive] bleed out while the [asphalt is still hot][adhesive is still tacky].] Apply membrane liner over top of exposed nailers and blocking and to overlap top edge of base flashing installation at curbs, parapet walls, expansion joints and as otherwise indicated to serve as waterproof lining under sheet metal flashing components. Metal flashing is specified under Section 07 60 00 FLASHING AND SHEET METAL. Do not set metal flashing in hot asphalt.

3.3.7.1 Membrane Strip Flashing

Set primed flanges of metal flashing in full bed of modified bituminous cement material and securely fasten through to attachment substrate. Strip-in with membrane flashing so that strip extends not less than 101.6 mm beyond outer edge of flange. Where multiple membrane stripping plies are installed, extend each additional stripping ply minimum 101.6 mm beyond edge of previous ply.

[3.3.7.2 Membrane Flashing at Roof Drain

Roof drains are specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE. Flashing for roof drains, is specified in Section 07 60 00 FLASHING AND SHEET METAL. Extend membrane sheets to edge of drain bowl opening at the roof drain deck flange in accordance with membrane manufacturer's printed application instructions. Securely clamp membrane sheets and metal roof drain flashing and strip flashing in the flashing clamping ring. Secure clamps so that sheets and metal flashing are free from wrinkles and folds. Trim stripping must be flush with inside of clamping ring.

][3.3.7.3 Pre-fabricated Curbs

Securely anchor prefabricated curbs to nailer or other base substrate and flash with modified bitumen membrane.

]3.3.7.4 Set-On Accessories

Where pipe or conduit blocking, supports and similar roof accessories are set on the membrane, adhere walkpad material to bottom of accessories prior to setting on roofing membrane. Install set-on accessories to permit normal movement due to expansion, contraction, vibration, and similar occurrences without damaging roofing membrane. Do not mechanically secure set-on accessories through roofing membrane into roof deck substrate.

3.3.7.5 Lightning Protection

Flash and attach lightning protection system components to the roof membrane in a manner acceptable to the roof membrane manufacturer.

3.3.8 Roof Walkpads

Install walkpads at roof access points and where otherwise indicated for traffic areas and for access to mechanical equipment, in accordance with the modified bitumen sheet roofing manufacturer's printed instructions. Provide minimum 150 mm separation between adjacent walkpads to accommodate drainage. Provide walkpad [or an additional layer of cap sheet] under precast concrete paver blocks to protect the roofing.

[3.3.9 Elevated Metal [Walkways] [and] [Platforms]

Install over completed roof system in accordance with [Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS][Section 05 51 33 METAL LADDERS][Section 05 52 00 METAL RAILINGS][Section 05 51 00 METAL STAIRS]. Provide for protection of roof membrane by placing walkpad material, or other material approved by the Contracting Officer, at all surface bearing support locations.

]3.3.10 Paver Blocks

Install paver blocks where indicated and as necessary to support surface bearing items traversing the roof area. Set paver block on a layer of walkpad [or cap sheet] applied over the completed roof membrane.

[3.3.11 Field Applied Surfacing

After completion of roof membrane and flashing installation, and correction of tears, gouges, and other deficiencies in the installed work,

apply specified surfacing.

[3.3.11.1 Aggregate

Uniformly flood coat the surface with hot asphalt at a rate of approximate 27.2 kg per square. While asphalt is still hot, apply gravel aggregate surfacing material at a rate of 181.4 kg per square or 136.1 kg per square for slag or other approved aggregate surfacing. Provide for full and uniform coverage of the roof surface. Solidly adhere approximately 50 percent of the aggregate in the asphalt.

][3.3.11.2 Coating Application

Apply surface coating materials to membrane and flashing in accordance with coating material manufacturer's recommendations.

]]3.3.12 Correction of Deficiencies

Where any form of deficiency is found, take additional measures as deemed necessary by the Contracting Officer to determine the extent of the deficiency and perform corrective actions as directed by the Contracting Officer.

3.3.13 Clean Up

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

3.4 CORRECTION OF DEFICIENCIES

Where any form of deficiency is found, take additional measures as deemed necessary by the Contracting Officer to determine the extent of the deficiency and perform corrective actions as directed by the Contracting Officer.

3.5 PROTECTION OF APPLIED ROOFING

At the end of the day's work and when precipitation is imminent, protect applied modified bitumen roofing system from water intrusion.

[3.5.1 Water Cutoffs

Straighten insulation line using loose-laid cut insulation sheets and seal the terminated edge of modified bitumen roofing system in an effective manner. [Seal off flutes in metal decking along the cutoff edge.] Remove the water cut-offs to expose the insulation when resuming work, and remove the insulation sheets used for fill-in.

]3.5.2 Temporary Flashing for Permanent Roofing

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashing can be applied. Remove temporary flashing before applying permanent flashing.

3.5.3 Temporary Walkways, Runways, and Platforms

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards, mats or planks as necessary to avoid damage to

applied roofing materials, and to distribute weight to conform to live load limits of roof construction. Use rubber-tired equipment for roofing work.

3.6 FIELD QUALITY CONTROL

Perform field tests in the presence of the Contracting Officer. Notify the Contracting Officer one day before performing tests.

[3.6.1 Test for Surface Dryness

Before application of membrane sheets and starting work on the area to be roofed, perform test for surface dryness in accordance with the following:

a. Foaming: When poured on the surface to which membrane materials are to be applied, one pint of asphalt when heated in the range of 176 to 204 degrees C, must not foam upon contact.

b. Strippability: On cementitious substrate surfaces, after asphalt used in the foaming test application has cooled to ambient temperatures, test coating for adherence. Should a portion of the sample be readily stripped clean from the surface, do not consider the surface to be dry and do not start application. Should rain occur during application, stop work and do not resume until surface has been tested by the method above and found dry.

c. Prior to installing any roof system on a concrete deck, conduct a test using plastic sheet over concrete surface. The deck is acceptable for roof system application when there is no visible moisture on underside of plastic sheet after 24 hours.

]3.6.2 Construction Monitoring

During progress of the roof work, make visual inspections as necessary to ensure compliance with specified parameters. Additionally, verify the following:

a. Materials comply with the specified requirements.

b. Materials are not installed in adverse weather conditions.

All materials are properly stored, handled and protected from moisture or other damages.

c. Equipment is in working order. Metering devices are accurate.

d. Substrates are in acceptable condition, in compliance with specification, prior to application of subsequent materials.

(1) Nailers and blocking are provided where and as needed.

Insulation substrate is smooth, properly secured to its substrate, and without excessive gaps prior to membrane application.

(2) The proper number, type, and spacing of fasteners are installed.

Membrane heating, hot mopping, or adhesive application is provided uniformly and as necessary to ensure full adhesion of roll materials. Asphalt is heated and applied within the specified

temperature range.

The proper number and types of plies are installed, with the specified overlaps.

Applied membrane surface is inspected, cleaned, dry, and repaired as necessary prior to cap sheet installation.

(3) Lap areas of all plies are completely sealed.

Membrane is fully adhered without ridges, wrinkles, kinks, fishmouths, or other voids or delaminations.

Installer adheres to specified and detailed application parameters.

Associated flashing and sheet metal are installed in a timely manner in accord with the specified requirements.

Temporary protection measures are in place at the end of each work shift.

[3.6.2.1 Manufacturer's Inspection

Manufacturer's technical representative must visit the site a minimum of three [_____] times [once per week] during the installation for purposes of reviewing materials installation practices and adequacy of work in place.
[Inspections must occur during the first 20 squares of membrane installation, at mid-point of the installation, and at substantial completion, at a minimum. Additional inspections must not exceed one for each 100 squares of total roof area with the exception that follow-up inspections of previously noted deficiencies or application errors must be performed as requested by the Contracting Officer.] After each inspection, submit a report, signed by the manufacturer's technical representative to the Contracting Officer within 3 working days. Note in the report overall quality of work, deficiencies and any other concerns, and recommended corrective action.

]3.6.3 Samples of Roofing

Take samples sized 100 mm by 1015 mm cut across width of modified bitumen sheets as directed by the Contracting Officer. Cut samples will be examined by the Contracting Officer for specified number of plies, proper lap width, complete lap seal, full uniform adhesive compound application and adhesion, full bond between plies, harmful foreign materials, presence of moisture, and wet insulation. Where cuts are not retained by the Contracting Officer or disposed, set cut strip back in cut area in bed of modified bitumen cement. Repair area of cut with new minimum two-ply modified bitumen membrane patch.

3.6.4 Roof Drain Test

After completing roofing, but prior to Government acceptance, perform the following test for watertight integrity. Plug roof drains and fill with water to edge of drain sump for 8 hours. Do not plug secondary overflow drains at the same time as adjacent primary drain. To ensure some drainage from roof, do not test all drains at same time. Measure water at beginning and end of the test period. When precipitation occurs during test period, repeat test. When water level falls, remove water,

thoroughly dry, and inspect installation; repair or replace roofing at drain to provide for a properly installed watertight flashing seal. Repeat test until there is no water leakage.

3.7 INSTRUCTIONS TO [GOVERNMENT][CONTRACTOR] PERSONNEL

Furnish written and verbal instructions on proper maintenance procedures to designated Government personnel. Furnish instructions by a competent representative of the modified bitumen membrane manufacturer and include a minimum of 4 hours on maintenance and emergency repair of the membrane. Include a demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and emergency repair operations.

3.8 INFORMATION CARD

For each roof, furnish a typewritten information card for facility Records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 1 mm thick aluminum card for exterior display. Card must be 215 mm by 275 mm minimum, identifying facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, membrane, number of plies, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, presence of vapor retarder; date of completion; installing contractor identification and contact information; membrane manufacturer warranty expiration, warranty reference number, and contact information. Install card at roof top or access location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

-- End of Section --

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 6021	(2011) Liquid-applied Compounds for Waterproofing Membrane Coatings of Buildings
JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS H 3100	(2018) Copper and Copper Alloy Sheets, Plates and Strips
JIS G 4305	(2015) Cold-Rolled Stainless Steel Plate, Sheet and Strip (Amendment 1)
JIS H 4000	(2017) Aluminium and Aluminium Alloy Sheets, Strips and Plates (Amendment 1)
JIS H 4040	(2015) Aluminum and Aluminum Alloy Bars and Wires
JIS K 2208	(2009) Asphalt Emulsion
JIS K 5602	(2008) Determination of Reflectance of Solar Radiation by Paint Film
JIS K 5675	(2008) High Solar Reflectance Paint for Roof
JIS K 6720	(2008) Plastics-Vinyl Chloride Homopolymers and Copolymers (PVC)
JIS Z 3282	(2017) Solder-Chemical Composition and Shape
JIS Z 3604	(2016) Inert Gas Arc Welding Standard for Aluminum

1.2 GENERAL REQUIREMENTS

Finished sheet metal assemblies must form a weathertight enclosure without waves, warps, buckles, fastening stresses or distortion, while allowing for expansion and contraction without damage to the system. The sheet metal installer is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal modifications required to

accommodate the work of other trades. Coordinate installation of sheet metal items used in conjunction with roofing with roofing work to permit continuous, uninterrupted roofing operations.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Exposed Sheet Metal Coverings; G[, [_____]]

Gutters; G[, [_____]]

Downspouts; G[, [_____]]

Expansion Joints; G[, [_____]]

Gravel Stops and fascia; G[, [_____]]

Splash Pans; G[, [_____]]

Flashing for Roof Drains; G[, [_____]]

Base Flashing; G[, [_____]]

Counterflashing; G[, [_____]]

Flashing at Roof Penetrations and Equipment Supports; G[, [_____]]

Scuppers; G[, [_____]]

Copings; G[, [_____]]

Drip Edges; G[, [_____]]

Conductor Heads; G[, [_____]]

Open Valley Flashing; G[, [_____]]

Eave Flashing; G[, [_____]]

SD-08 Manufacturer's Instructions

Instructions for Installation; G[, [_____]]

Quality Control Plan; G[, [_____]]

SD-10 Operation and Maintenance Data

Cleaning and Maintenance; G[, [_____]]

1.4 MISCELLANEOUS REQUIREMENTS

1.4.1 Product Data

Indicate thicknesses, dimensions, fastenings, anchoring methods, expansion joints, and other provisions necessary for thermal expansion and contraction. Scaled manufacturer's catalog data may be submitted for factory fabricated items.

1.4.2 Finish Samples

Submit two color charts and two finish sample chips from manufacturer's standard color and finish options for each type of finish indicated.

1.4.3 Operation and Maintenance Data

Submit detailed instructions for installation and quality control during installation, cleaning and maintenance, for each type of assembly indicated.

1.5 DELIVERY, HANDLING, AND STORAGE

Package and protect materials during shipment. Uncrate and inspect materials for damage, dampness, and wet-storage stains upon delivery to the job site. Remove from the site and replace damaged materials that cannot be restored to like-new condition. Handle sheet metal items to avoid damage to surfaces, edges, and ends. Store materials in dry, weather-tight, ventilated areas until installation.

PART 2 PRODUCTS

2.1 RECYCLED CONTENT

Provide products with recycled content. Provide data for each product with recycled content, identifying percentage of recycled content.

2.2 MATERIALS

Do not use lead, lead-coated metal, or galvanized steel. Different items need not be of the same metal, except that[if copper is selected for any exposed item, all exposed items must be copper, and that] contact between dissimilar metals must be avoided.

Furnish sheet metal items in 2400 to 3000 mm lengths. Single pieces less than 2400 mm long may be used to connect to factory-fabricated inside and outside corners, and at ends of runs. Factory fabricate corner pieces with minimum 300 mm legs. Provide accessories and other items essential to complete the sheet metal installation. Provide accessories made of the same or compatible materials as the items to which they are applied. Fabricate sheet metal items of the materials specified below and to the gage, thickness, or weight shown in Table I at the end of this section. Provide sheet metal items with mill finish unless specified otherwise. Where more than one material is listed for a particular item in Table I, each is acceptable and may be used, except as follows:

2.2.1 Exposed Sheet Metal Items

Must be of the same material. Consider the following as exposed sheet metal: gutters, including hangers; downspouts; gravel stops and fascia;

cap, valley, steeped, base, and eave flashings and related accessories.

2.2.2 Drainage

Do not use copper for an exposed item if drainage from that item will pass over exposed masonry, stonework or other metal surfaces. In addition to the metals listed in Table I, lead-coated copper may be used for such items.

2.2.3 Copper, Sheet and Strip

Provide in accordance with JIS H 3100, cold-rolled temper (standard).

2.2.4 Lead Sheet

Provide in a minimum weight of 19.6 kilograms per square meter.

2.2.5 Steel Sheet, Zinc-Coated (Galvanized)

Provide in accordance with JIS G 3302.

2.2.6 Zinc Sheet and Strip

Provide a minimum of 0.61 mm thick.

2.2.7 Stainless Steel

Provide in accordance with JIS G 4305, SUS302, 304 or SUS304, 2D Finish, fully annealed, dead-soft temper.

2.2.8 Terne-Coated Steel

Provide a minimum of 350 by 500 mm with minimum of 18 kilogram coating per double base box.

2.2.9 Aluminum Alloy Sheet and Plate

Provide in accordance with JIS H 4000 [anodized [clear] [color [_____][_____]]] form alloy, and temper appropriate for use. Provide material not less than[0.813 mm][1.651 mm] in thickness.

[2.2.9.1 Alclad

When fabricated of aluminum, fabricate the following items with Alclad 3003, Alclad 3004, or Alclad 3005, clad on [one side][both sides] unless otherwise indicated.

a. Gutters, downspouts, and hangers

b. Gravel stops and fascia

c. Flashing

]2.2.10 Finishes

Provide exposed exterior sheet metal and aluminum with a baked on, factory applied color coating of polyvinylidene fluoride (PVF2) or approved equal fluorocarbon coating. Dry film thickness of coatings must be 0.020 to 0.033 mm. Color to be selected from [manufacturer's full range of "cool

roof" color choices][manufacturer's standard range of color choices][manufacturer's full range of color choices][as indicated on the Drawings]. Field applications of color coatings are prohibited and will be rejected.

2.2.11 Cool Roof Finishes

Provide cool roof finish coatings and colors in accordance with one of the following methods of analysis:

2.2.11.1 JIS K 5602 and JIS K 5675

Provide roof finishes having minimum initial solar reflectance of [40][50] when tested in accordance with JIS K 5602 and JIS K 5675.

2.2.12 Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes

JIS H 4040.

2.2.13 Solder

Provide in accordance with JIS Z 3282, 95-5 tin-antimony.

2.2.14 Reglets

2.2.14.1 Polyvinyl Chloride Reglets

Provide in accordance with JIS K 6720, 1.9 mm minimum thickness.

2.2.14.2 Metal Reglets

Provide factory fabricated caulked type or friction type reglets with a minimum opening of 6 mm and a depth of 30 mm, as approved.

2.2.14.2.1 Caulked Reglets

Provide with rounded edges, temporary reinforcing cores, and accessories as required for securing to adjacent construction. Provide built-up mitered corner pieces for inside and outside corners.

2.2.14.2.2 Friction Reglets

Provide with flashing receiving slots not less than 16 mm deep, 25 mm jointing tongues, and upper and lower anchoring flanges installed at 600 mm maximum snap-lock type receiver.

2.2.15 Scuppers

Line interiors of scupper openings with sheet metal. Provide a drip edge at bottom edges with returns of not less than 25 mm against the face of the outside wall at the top and sides. Provide the perimeter of the lining approximately 13 mm less than the perimeter of the scupper.

2.2.16 Conductor Heads

Provide conductor heads and screens in the same material as downspouts. Provide outlet tubes not less than 100 mm long.

2.2.17 Splash Pans

Provide splash pans where downspouts discharge onto roof surfaces and at locations indicated. Unless otherwise indicated, provide pans not less than 600 mm long by 450 mm wide with metal ribs across bottoms of pans. Provide sides of pans with vertical baffles not less than 25 mm high in the front, and 100 mm high in the back.

2.2.18 Copings

Unless otherwise indicated, provide copings in copper sheets, 2400 or 3000 mm long, joined by a 20 mm locked and soldered seam.

2.2.19 Bituminous Plastic Cement

Provide in accordance with JIS A 6021.

2.2.20 Roofing Felt

Provide in accordance with A6005 [Asphalt Felt] or [Asphalt Roofing].

2.2.21 Asphalt Primer

Provide in accordance with JIS K 2208.

2.2.22 Fasteners

Use the same metal as, or a metal compatible with the item fastened.[Use stainless steel fasteners to fasten.] Confirm compatibility of fasteners and items to be fastened to avoid galvanic corrosion due to dissimilar materials.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Metal Roofing

[3.1.1.1 [Flat Copper,] [Zinc,] [Terne-coated Steel] Roofing

Before applying roofing, cover deck with rosin-sized roofing felt. Lap 50 mm at joints and secure in place with roofing nails. Using solder of equal parts tin and lead, solder slowly with well-heated irons to thoroughly heat sheet and completely sweat solder through full width of seam.[Tin edges of copper to be soldered at least 20 mm before sheets are locked.][Use stainless nails in terne-coated steel]; [in copper, use solid copper or bronze roofing nails][in zinc, use zinc-coated roofing nails.] Where roof decks abut vertical surfaces, turn metal roofing up vertical surfaces about 200 mm where practicable; where vertical surfaces are covered with applied materials, turn up roofing behind applied materials. Use standing-seam method for roofs having rise of more than one in four, and use flat-seam method when rise is one in four or less. Walking not permitted directly on metal roofs; provide approved walkways.

][3.1.1.2 Standing-seam Method

Make standing seams parallel with slope of roof. Fabricate sheets into long lengths at shop by locking short dimensions together and thoroughly soldering joints thus formed. In applying metal, turn up one edge of

course at each side seam at right angles 40 mm. Then install 50 by 75 mm cleats spaced 300 mm apart by fastening one end of each cleat to roof with two 25 mm long nails and folding roof end back over nail heads. Turn end adjoining turned-up side seam up over upstanding edge of course. Turn up adjoining edge of next course 45 mm and abutting upstanding edges locked, turned over, and flattened against one side of standing seam. Make standing seams straight, rounded neatly at the top edges, and stand about 25 mm above roof deck. All sheets must be same length, except as required to complete run or maintain pattern. Locate transverse joints of each panel half way between joints in adjacent sheets. Align joints of alternate sheets horizontally to produce uniform pattern.

][3.1.1.3 Flat-seam Method

Lay metal so short dimension is parallel to gutter or eave lines and so water will flow over and not into seams. Make seams by turning edges of sheet 20 mm and lock and solder together. If sheets are laid one at a time, secure to roof deck with cleats, using three cleats to each sheet, two on long side and one on short side. Use cleats 50 mm wide, hooked over 20 mm upturned edges of sheets, and nail to roof deck with two 25 mm long nails. Turn back roof end of cleat over nail heads before next sheet is applied. If desired, sheets may be made into long lengths at shop by locking short dimensions together and soldering seams thus formed. Turn long lengths 20 mm, and secure each length to roof deck by cleats spaced 300 mm apart. Mallet and solder seams after pans are in place. All sheets to be same length, except as required to complete run or maintain pattern. Locate transverse joints of each panel half way between joints in adjacent sheets. Align joints of alternate sheets horizontally to produce uniform pattern.

]3.1.2 Workmanship

Make lines and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 13 mm hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight. Join sheet metal items together as shown in Table II.

3.1.3 Nailing

Confine nailing of sheet metal generally to sheet metal having a maximum width of 450 mm. Confine nailing of flashing to one edge only. Space nails evenly not over 75 mm on center and approximately 13 mm from edge unless otherwise specified or indicated. Face nailing will not be permitted. Where sheet metal is applied to other than wood surfaces, include in shop drawings, the locations for sleepers and nailing strips required to secure the work.[Secure flashing at one-half the normal interval to ensure a wind-resistant installation.]

3.1.4 Cleats

Provide cleats for sheet metal 450 mm and over in width. Space cleats evenly not over 300 mm on center unless otherwise specified or indicated. Unless otherwise specified, provide cleats of 50 mm wide by 75 mm long and

of the same material and thickness as the sheet metal being installed. Secure one end of the cleat with two nails and the cleat folded back over the nailheads. Lock the other end into the seam. [Where the fastening is to be made to concrete or masonry, use screws and drive in expansion shields set in concrete or masonry.]Pre-tin cleats for soldered seams.

3.1.5 Bolts, Rivets, and Screws

Install bolts, rivets, and screws where indicated or required. Provide compatible washers where required to protect surface of sheet metal and to provide a watertight connection. Provide mechanically formed joints in aluminum sheets 1.0 mm or less in thickness.

3.1.6 Seams

Straight and uniform in width and height with no solder showing on the face.

3.1.6.1 Flat-lock Seams

Finish not less than 20 mm wide.

3.1.6.2 Lap Seams

Finish soldered seams not less than 25 mm wide. Overlap seams not soldered, not less than 75 mm.

3.1.6.3 Loose-Lock Expansion Seams

Not less than 75 mm wide; provide minimum 25 mm movement within the joint. Completely fill the joints with the specified sealant, applied at not less than 3 mm thick bed.

3.1.6.4 Standing Seams

Not less than 25 mm high, double locked without solder.

3.1.6.5 Flat Seams

Make seams in the direction of the flow.

3.1.7 Soldering

Where soldering is specified, apply to copper, terne-coated stainless steel, zinc-coated steel, and stainless steel items. Pre-tin edges of sheet metal before soldering is begun. Seal the joints in aluminum sheets of 1.0 mm or less in thickness with specified sealants. Do not solder aluminum.

3.1.7.1 Edges

Scrape or wire-brush the edges of lead-coated material to be soldered to produce a bright surface. Flux brush the seams in before soldering. Treat with soldering acid flux the edges of stainless steel to be pre-tinned. Seal the joints in aluminum sheets of 1.0 mm or less in thickness with specified sealants. Do not solder aluminum.

3.1.8 Welding and Mechanical Fastening

Use welding for aluminum of thickness greater than 1.0 mm. Aluminum 1.0 mm or less in thickness must be butted and the space backed with formed flashing plate; or lock joined, mechanically fastened, and filled with sealant as recommended by the aluminum manufacturer.

3.1.8.1 Welding of Aluminum

Use welding of the inert gas, shield-arc type. For procedures, appearance and quality of welds, and the methods used in correcting welding work, conform to JIS Z 3604.

3.1.8.2 Mechanical Fastening of Aluminum

Use No. 12, aluminum alloy, sheet metal screws or other suitable aluminum alloy or stainless steel fasteners. Drive fasteners in holes made with a No. 26 drill in securing side laps, end laps, and flashings. Space fasteners 300 mm maximum on center. Where end lap fasteners are required to improve closure, locate the end lap fasteners not more than 50 mm from the end of the overlapping sheet.

3.1.9 Protection from Contact with Dissimilar Materials

3.1.9.1 Copper or Copper-bearing Alloys

Paint with heavy-bodied bituminous paint surfaces in contact with dissimilar metal, or separate the surfaces by means of moistureproof building felts.

3.1.9.2 Aluminum

Do not allow aluminum surfaces in direct contact with other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, paint the dissimilar metal with a primer followed by two coats of aluminum paint. Where drainage from a dissimilar metal passes over aluminum, paint the dissimilar metal with a non-lead pigmented paint.[Aluminum may be used over concrete construction, provided that required reglets are of stainless steel and aluminum surface in contact with concrete or masonry is coated with bituminous paint or zinc chromate primer.]

3.1.9.3 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.1.9.4 Wood or Other Absorptive Materials

Paint surfaces that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

3.1.10 Expansion and Contraction

Provide expansion and contraction joints at not more than 9750 mm intervals for aluminum and at not more than 12 meter intervals for other metals. Provide an additional joint where the distance between the last

expansion joint and the end of the continuous run is more than half the required interval. Space joints evenly. Join extruded aluminum gravel stops and fascia by expansion and contraction joints spaced not more than 3600 mm apart.

3.1.11 Base Flashing

[Lay the base flashings with each course of the roof covering, shingle fashion, where practicable, where sloped roofs abut chimneys, curbs, walls, or other vertical surfaces.]Extend up vertical surfaces of the flashing not less than 200 mm and not less than 100 mm under the roof covering. Where finish wall coverings form a counterflashing, extend the vertical leg of the flashing up behind the applied wall covering not less than 150 mm. Overlap the flashing strips [or shingles] with the previously laid flashing not less than 75 mm. Fasten the strips [or shingles] at their upper edge to the deck. Horizontal flashing at vertical surfaces must extend vertically above the roof surface and fastened at their upper edge to the deck a minimum of 150 mm on center with [large headed aluminum roofing nails] [hex headed, galvanized shielded screws] a minimum of 150 mm lap of any surface. Solder end laps and provide for expansion and contraction. Extend the metal flashing over crickets at the up-slope side of [chimneys,] [curbs,] [and similar] vertical surfaces extending through sloping roofs, the metal flashings. Extend the metal flashings onto the roof covering not less than 115 mm at the lower side of [dormer walls,] [chimneys,] [and similar] vertical surfaces extending through the roof decks. Install and fit the flashings so as to be completely weathertight. Provide factory-fabricated base flashing for interior and exterior corners. Do not use metal base flashing on built-up roofing.

3.1.12 Counterflashing

Except where indicated or specified otherwise, insert counterflashing in reglets located from 230 to 250 mm above roof decks, extend down vertical surfaces over upturned vertical leg of base flashings not less than 75 mm. Fold the exposed edges of counterflashings 13 mm. Where stepped counterflashings are required, they may be installed in short lengths a minimum [200 mm by 200 mm][200 mm by 250 mm] or may be of the preformed single piece type. Provide end laps in counterflashings not less than 75 mm and make it weathertight with plastic cement. Do not make lengths of metal counterflashings exceed 3000 mm. Form flashings to the required shapes before installation. Factory form corners not less than 300 mm from the angle. Secure the flashings in the reglets with lead wedges and space not more than 450 mm apart; on[chimneys and][stair/elevator towers] short runs, place wedges closer together. Fill caulked-type reglets or raked joints which receive counterflashing with caulking compound. Turn up the concealed edge of counterflashings built into masonry or concrete walls not less than 6 mm and extend not less than 50 mm into the walls. Install counterflashing to provide a spring action against base flashing.[Where bituminous base flashings are provided, extend down the counter flashing as close as practicable to the top of the cant strip. Factory form counter flashing to provide spring action against the base flashing.]

3.1.13 Metal Reglets

Keep temporary cores in place during installation. Ensure factory fabricated caulked type or friction type, reglets have a minimum opening of 6 mm and a minimum depth of 30 mm, when installed.

3.1.13.1 Caulked Reglets

Wedge flashing in reglets with lead wedges every 450 mm, caulked full and solid with an approved compound.

3.1.13.2 Friction Reglets

Install flashing snap lock receivers at 600 mm by 600 mm on center maximum. When flashing has been inserted the full depth of the slot, caulk the slot, lock [with wedges], and fill with sealant.

3.1.14 Polyvinyl Chloride Reglets for Temporary Construction

Rigid polyvinyl chloride reglets may be provided in lieu of metal reglets for temporary construction.

3.1.15 Gravel Stops and fascia

Prefabricate in the shapes and sizes indicated and in lengths not less than 2400 mm. Extend flange at least 100 mm onto roofing. Provide prefabricated, mitered corners internal and external corners. Install gravel stops and fascia after all plies of the roofing membrane have been applied, but before the flood coat of bitumen is applied. Prime roof flange of gravel stops and fascia on both sides with an asphalt primer. After primer has dried, set flange on roofing membrane and strip-in. Nail flange securely to wood nailer with large-head, barbed-shank roofing nails 38 mm long spaced not more than 75 mm on center, in two staggered rows.

3.1.15.1 Edge Strip

Hook the lower edge of fascia at least 20 mm over a continuous strip of the same material bent outward at an angle not more than 45 degrees to form a drip. Nail hook strip to a wood nailer at 150 mm maximum on center. Where fastening is made to concrete or masonry, use screws spaced 300 mm on center driven in expansion shields set in the concrete or masonry. Where horizontal wood nailers are slotted to provide for insulation venting, install strips to prevent obstruction of vent slots. Where necessary, install strips over 2 mm thick compatible spacer or washers.

3.1.15.2 Joints

Leave open the section ends of gravel stops and fascia 6 mm and backed with a formed flashing plate, mechanically fastened in place and lapping each section end a minimum of 100 mm set laps in plastic cement. Face nailing will not be permitted. Install prefabricated aluminum gravel stops and fascia in accordance with the manufacturer's printed instructions and details.

3.1.16 Metal Drip Edges

Provide a metal drip edge, designed to allow water run-off to drip free of underlying construction, at eaves and rakes prior to the application of roofing shingles. Apply directly on the wood deck at the eaves and over the underlay along the rakes. Extend back from the edge of the deck not more than 75 mm and secure with compatible nails spaced not more than 250 mm on center along upper edge.

3.1.17 Gutters

The hung type of shape indicated and supported on underside by brackets that permit free thermal movement of the gutter. Provide gutters in sizes indicated complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation. Bead with hemmed edge or reinforce the outer edge of gutter with a stiffening bar not less than 20 by 5 mm of material compatible with gutter. Fabricate gutters in sections not less than 2400 mm. Lap the sections a minimum of 25 mm in the direction of flow or provide with concealed splice plate 150 mm minimum. Join the gutters, other than aluminum, by riveted and soldered joints. Join aluminum gutters with riveted sealed joints. Provide expansion-type slip joints midway between outlets. Install gutters below slope line of the roof so that snow and ice can slide clear. Support gutters on[adjustable hangers spaced not more than 750 mm on center][as indicated][by continuous cleats][and][or][by cleats spaced not less than 900 mm apart]. Adjust gutters to slope uniformly to outlets, with high points occurring midway between outlets. Fabricate hangers and fastenings from compatible metals.

3.1.18 Downspouts

Space supports for downspouts according to the manufacturer's recommendation for the [wood][masonry] or [steel] substrate. Types, shapes and sizes are indicated. Provide complete including elbows and offsets. Provide downspouts in approximately 3000 mm lengths. Provide end joints to telescope not less than 13 mm and lock longitudinal joints. Provide gutter outlets with wire ball strainers for each outlet. Provide strainers to fit tightly into outlets and be of the same material used for gutters. Keep downspouts not less than 25 mm away from walls. Fasten to the walls at top, bottom, and at an intermediate point not to exceed 1500 mm on center with leader straps or concealed rack-and-pin type fasteners. Form straps and fasteners of metal compatible with the downspouts.

3.1.18.1 Terminations

Neatly fit into the drainage connection the downspouts terminating in drainage lines and fill the joints with a portland cement mortar cap sloped away from the downspout. Provide downspouts terminating in splash blocks with elbow-type fittings. Provide splash pans as specified.

3.1.19 Flashing for Roof Drains

Provide a 750 mm square sheet indicated. Taper insulation to drain from 600 mm out. Set flashing on finished felts in a full bed of asphalt roof cement. Heavily coat the drain flashing ring with asphalt roof cement. Clamp the roof membrane, flashing sheet, and stripping felt in the drain clamping ring. Secure clamps so that felts and drain flashing are free of wrinkles and folds.

3.1.20 Scuppers

Extend the scupper liner through and project outside of, the wall it penetrates to form a bottom drip edge against the face of the wall. Fold outside edges under 13 mm on all sides. Join the top and sides of the lining on the roof deck side to a closure flange by a locked and soldered joint. Join the bottom edge by a locked and soldered joint to the closure flange, where required, form with a ridge to act as a gravel stop around the scupper inlet. Provide surfaces to receive the scupper lining and

coat with bituminous plastic cement.

3.1.21 Conductor Heads

Set the depth of the top opening equal to two-thirds of the width or the conductor head. Flat-lock solder seams. Where conductor heads are used in conjunction with scuppers, set the conductor a minimum of 50 mm wider than the scupper. Attach conductor heads to the wall with masonry fasteners. Securely fasten screens to heads.

3.1.22 Splash Pans

Install splash pans lapped with horizontal roof flanges not less than 100 mm wide to form a continuous surface. Bend the rear flange of the pan to contour of can't strip and extend up 150 mm under the side wall covering or to height of base flashing under counterflashing. Bed the pans and roof flanges in plastic bituminous cement and strip-flash as specified.

3.1.23 Open Valley Flashing

Provide valley flashing free of longitudinal seams, of width sufficient to extend not less than 150 mm under the roof covering on each side. Provide a 13 mm fold on each side of the valley flashing. Lap the sheets not less than 150 mm in the direction of flow and secure to roofing construction with cleats attached to the fold on each side. Nail the tops of sheets to roof sheathing. Space the cleats not more than 300 mm on center. Provide exposed flashing not less than 100 mm in width at the top and increase 25 mm in width for each additional 2400 mm in length. Where the slope of the valley is one in 2.67 or less, or the intersecting roofs are on different slopes, provide an inverted V-joint, 25 mm high, along the centerline of the valley; and extend the edge of the valley sheets 200 mm under the roof covering on each side.

Valley flashing for asphalt shingle roofs is specified in Section 07 31 13 ASPHALT SHINGLES.

3.1.24 Eave Flashing

One piece in width, applied in 2400 to 3000 mm lengths with expansion joints spaced as specified in paragraph EXPANSION AND CONTRACTION. Provide a 20 mm continuous fold in the upper edge of the sheet to engage cleats spaced not more than 250 mm on center. Locate the upper edge of flashing not less than 450 mm from the outside face of the building, measured along the roof slope. Fold lower edge of the flashing over and loose-lock into a continuous edge strip on the fascia. Where eave flashing intersects metal valley flashing, secure with 25 mm flat locked joints with cleats that are 250 mm on center.

3.1.25 Sheet Metal Covering on Flat, Sloped, or Curved Surfaces

Except as specified or indicated otherwise, cover and flash all minor flat, sloped, or curved surfaces such as crickets, bulkheads, dormers and small decks with metal sheets of the material used for flashing; maximum size of sheets, 375 by 455 mm. Fasten sheets to sheathing with metal cleats. Lock seams and solder. Lock aluminum seams as recommended by aluminum manufacturer. Provide an underlayment of roofing felt for all sheet metal covering.

3.1.26 Expansion Joints

Provide expansion joints for roofs, walls, and floors as [specified] [indicated]. Provide [expansion joints in continuous sheet metal at [12 meter intervals for copper and stainless steel] [and at 9750 mm intervals for aluminum], [aluminum gravel stops and fascia which must have expansion joints at not more than 3600 mm spacing]. Provide evenly spaced joints. Provide an additional joint where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing]. Conform to the requirements of Table I.

3.1.26.1 Roof Expansion Joints

Consist of curb with wood nailing members on each side of joint, bituminous base flashing, metal counterflashing, and metal joint cover. Bituminous base flashing is specified in Roofing Section. Provide counterflashing as specified in paragraph COUNTERFLASHING, except as follows: Provide counterflashing with vertical leg of suitable depth to enable forming into a horizontal continuous cleat. Secure the inner edge to the nailing member. Make the outer edge projection not less than 25 mm for flashing on one side of the expansion joint and be less than the width of the expansion joint plus 25 mm for flashing on the other side of the joint. Hook the expansion joint cover over the projecting outer edges of counterflashing. Provide roof joint with a joint cover of the width indicated. Hook and lock one edge of the joint cover over the shorter projecting flange of the continuous cleat, and the other edge hooked over and loose locked with the longer projecting flange. Joints are specified in Table II.

3.1.26.2 Floor and Wall Expansion Joints

Provide U-shape with extended flanges for expansion joints in concrete and masonry walls and in floor slabs.

3.1.27 Flashing at Roof Penetrations and Equipment Supports

Provide metal flashing for all pipes, ducts, and conduits projecting through the roof surface and for equipment supports, guy wire anchors, and similar items supported by or attached to the roof deck. Goose-necks, rain hoods, power roof ventilators, and [_____] are specified in [_____].

3.1.28 Single Pipe Vents

See Table I, footnote (d). Set flange of sleeve in bituminous plastic cement and nail 75 mm on center. Bend the top of sleeve over and extend down into the vent pipe a minimum of 50 mm. For long runs or long rises above the deck, where it is impractical to cover the vent pipe with lead, use a two-piece formed metal housing. Set metal housing with a metal sleeve having a 100 mm roof flange in bituminous plastic cement and nailed 75 mm on center. Extend sleeve a minimum of 200 mm above the roof deck and lapped a minimum of 75 mm by a metal hood secured to the vent pipe by a draw band. Seal the area of hood in contact with vent pipe with an approved sealant.

3.1.29 Stepped Flashing

Provide stepped flashing where sloping roofs surfaced with shingles abut vertical surfaces. Place separate pieces of base flashing in alternate shingle courses.

3.1.30 Copings

Provide coping with locked and soldered seam. Terminate outer edges in edge strips. Install with sealed [lap joints][cover plate joints][standing seam joints] as indicated.

3.2 PAINTING

Touch ups in the field may be applied only after metal substrates have been cleaned and pretreated in accordance with manufacturer's written instructions and products.

Field-paint sheet metal for separation of dissimilar materials.

[3.2.1 Aluminum Surfaces

Clean with solvent and apply one coat of zinc-molybdate primer and one coat of aluminum paint.

]3.3 CLEANING

Clean exposed sheet metal work at completion of installation. Remove grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris, and scrub-clean. Free the exposed metal surfaces of dents, creases, waves, scratch marks, and solder or weld marks.

3.4 REPAIRS TO FINISH

Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Repair damaged surfaces caused by scratches, blemishes, and variations of color and surface texture. Replace items which cannot be repaired.

[3.5 FIELD QUALITY CONTROL

Establish and maintain a Quality Control Plan for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Remove work that is not in compliance with the contract and replace or correct. Include quality control, but not be limited to, the following:

a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.

b. Verification that specified material is provided and installed.

c. Inspection of sheet metalwork, for proper size(s) and thickness(es), fastening and joining, and proper installation.

3.5.1 Procedure

Submit for approval prior to start of roofing work. Include a checklist of points to be observed. Document the actual quality control observations and inspections. Furnish a copy of the documentation to the Contracting Officer at the end of each day.

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES					
Sheet Metal Items	[Copper kilograms per square meter]	[Aluminum, mm]	[Stainless Steel, mm]	[Terne-Coated Stainless Steel, mm]	[Zinc-Coated Steel, mm]
[Building Expansion Joints]					
[Cover]	4.9	0.81	0.38	0.38	0.6
[Waterstop-bellows or flanged, U-type.]	4.9	-	0.38	0.38	-
[Covering on minor flat, pitched or curved surfaces]	6.125	1.02	0.46	0.46	-
[Downspouts and leaders]	4.9	0.81	0.38	0.38	0.6
[Downspout clips and anchors]	-	1.02 clip 3.175 anchor	-	-	-
[Downspout straps, 50 mm]	14.7 (a)	1.52	1.27	-	-
[Conductor heads]	4.9	0.81	0.38	0.38	-
[Scupper lining]	6.125	0.81	0.38	0.38	-
[Strainers, wire diameter or gage]	4.0 gage	3.66 diameter	2.77 diameter	-	
[Flashings:]					
[Base]	6.125	1.02	0.46	0.46	0.6
[Cap (Counter-flashing)]	4.9	0.81	0.38	0.38	0.5
[Eave]	4.9	-	0.38	0.38	0.6
[Spandrel beam]	3.1	-	0.25	0.25	-
[Bond barrier]	4.9	-	0.38	0.38	-
[Stepped]	4.9	0.81	0.38	0.38	-
[Valley]	4.9	0.81	0.38	0.38	-
[Roof drain]	4.9 (b)				

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES

Sheet Metal Items	[Copper kilograms per square meter]	[Aluminum, mm]	[Stainless Steel, mm]	[Terne-Coated Stainless Steel, mm]	[Zinc-Coated Steel, mm]
[Pipe vent sleave (d)]					
[Coping]	4.9	-	-	-	-
[Gravel stops and fascia:]					
[Extrusions]	-	1.91	-	-	-
[Sheets, corrugated]	4.9	0.81	0.38	0.38	-
[Sheets, smooth]	6.125	1.27	0.46	0.46	0.6
[Edge strip]	7.35	1.27	0.635	-	-
[Gutters:]					
[Gutter section]	4.9	0.81	0.38	0.38	0.6
[Continuous cleat]	4.9	0.81	0.38	0.38	0.6
[Hangers, dimensions]	25 mm by 3 mm (a)	25 mm by 2 mm (c)	25 mm by 1 mm	-	-
[Joint Cover plates (See Table II)]	4.9	0.81	0.38	0.38	0.6
[Reglets (c)]	3.1	-	0.25	0.25	-
[Splash pans]	4.9	1.02	0.46	0.46	-

(a) Brass.

(b) May be lead weighing 19.6 kilograms per square meter.

(c) May be polyvinyl chloride.

(d) 12.25 kilogram minimum lead sleeve with 100 mm flange. Where lead sleeve is impractical, refer to paragraph SINGLE PIPE VENTS for optional material.

TABLE II. SHEET METAL JOINTS			
	TYPE OF JOINT		
Item Designation	Copper, Terne-Coated Stainless Steel, Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks
Joint cap for building expansion seam, cleated joint at roof	30 mm single lock, standing seam, cleated	30 mm single lock, standing	--
Flashings			
Base	25 mm 75 mm lap for expansion joint	25 mm flat locked, soldered; sealed; 75 mm lap for expansion joint	Aluminum manufacturer's recommended hard setting sealant for locked aluminum joints. Fill each metal expansion joint with a joint sealing compound.
Cap-in reglet	75 mm lap	75 mm lap	Seal groove with joint sealing compound.
Reglets	Butt joint	--	Seal reglet groove with joint sealing compound.
Eave	25 mm flat locked, cleated. 25 mm loose locked, sealed expansion joint, cleated.	25 mm flat locked, locked, cleated 25 mm loose locked, sealed expansion joints, cleated	Same as base flashing.
Stepped	75 mm lap	75 mm lap	--
Valley	150 mm lap cleated	150 mm lap cleated	--
Edge strip	Butt	Butt	--
Gravel stops:			

TABLE II. SHEET METAL JOINTS			
TYPE OF JOINT			
Item Designation	Copper, Terne-Coated Stainless Steel, Zinc-Coated Steel and Stainless Steel	Aluminum	Remarks
Extrusions	--	Butt with 13 mm space	Use sheet flashing beneath and a cover plate
Sheet, smooth	Butt with 6 mm space	Butt with 6 mm space	Use sheet flashing backup plate.
Sheet, corrugated	Butt with 6 mm space	Butt with 6 mm space	Use sheet flashing beneath and a cover plate or a combination unit
Gutters	40 mm lap, riveted and soldered	25 mm flat locked riveted and sealed	Aluminum producers recommended hard setting sealant for locked aluminum joints.
(a) Provide a 75 mm lap elastomeric flashing with manufacturer's recommended sealant.			
(b) Seal Polyvinyl chloride reglet with manufacturer's recommended sealant.			

] -- End of Section --

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SECTION 07 92 00

JOINT SEALANTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM C919	(2012; R 2017) Standard Practice for Use of Sealants in Acoustical Applications

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5758	(2016) Sealants for Sealing and Glazing in Buildings

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT SS Chapter 9	(2019) Building Construction Standard Specifications - Chapter 9 Waterproofing Construction

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.3 PRODUCT DATA

Include storage requirements, shelf life, curing time, instructions for mixing and application, and accessories. Provide manufacturer's Safety Data Sheets (SDS) for each solvent, primer and sealant material proposed.

1.4 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between 4 and 32 degrees C.

1.5 DELIVERY AND STORAGE

Deliver materials to the jobsite in unopened manufacturers' sealed

shipping containers, with brand name, date of manufacture, [color,] and material designation clearly marked thereon. Label elastomeric sealant containers to identify type, class, grade, and use. Handle and store materials in accordance with manufacturer's printed instructions. Prevent exposure to foreign materials or subjection to sustained temperatures exceeding 32 degrees C or lower than 4 degrees C. Keep materials and containers closed and separated from absorptive materials such as wood and insulation.

1.6 QUALITY ASSURANCE

1.6.1 Compatibility with Substrate

Verify that each sealant is compatible for use with each joint substrate in accordance with sealant manufacturer's printed recommendations for each application.

1.6.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

1.6.3 Mock-Up

Provide a mock-up of each type of sealant using materials, colors, and techniques approved for use on the project. Approved mock-ups may be incorporated into the Work.

1.6.4 Adhesion

Provide in accordance with JIS A 5758.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant products that have been tested, found suitable, and documented as such by the manufacturer for the particular substrates to which they will be applied, and comply with MLIT SS Chapter 9.

[In areas with ambient temperatures that exceed 43.33 degrees C, do not use polybutene, bituminous, acrylic-latex, polyvinyl acetate latex sealants, polychloroprene (neoprene), and polyurethane foams, and neoprene, and styrene butadiene rubber extruded seals and closure strips due to these materials having maximum recommended surface temperature ranges from 54.44 degrees C to 82.22 degrees C.

]2.1.1 Interior Sealants

Provide sealant products per JIS A 5758, used on the interior of the building (defined as inside of the weatherproofing system) meeting VOC content requirements to attain F4-Star, and meet Japan Sealants Industry Association requirement. Provide certification or validation of indoor air quality for interior sealants. Location(s) and color(s) of sealant for the following. Note, color "as selected" refers to manufacturer's full range of color options

LOCATION	COLOR
a. Small voids between walls or partitions and adjacent lockers, casework, shelving, door frames, built-in or surface mounted equipment and fixtures, and similar items.	[As selected] [Gray] [White] [_____]
b. Perimeter of frames at doors, windows, and access panels which adjoin exposed interior concrete and masonry surfaces.	[_____]
c. Joints of interior masonry walls and partitions which adjoin columns, pilasters, concrete walls, and exterior walls unless otherwise detailed.	[_____]
d. Joints between edge members for acoustical tile and adjoining vertical surfaces.	[_____]
e. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	[_____]
f. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where non-planar tile surfaces meet.	[_____]
g. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.	[_____]
h. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.	[_____]
i. [_____]	[_____]

2.1.2 Exterior Sealants

For joints in vertical surfaces and horizontal surfaces, provide JIS A 5758. Provide location(s) and color(s) of sealant as follows. Note, color "as selected" refers to manufacturer's full range of color options:

LOCATION	COLOR
a. Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	[Match adjacent surface color] [As selected] [Gray] [White] [_____]
b. Joints between new and existing exterior masonry walls.	[_____]
c. Masonry joints where shelf angles occur.	[_____]

LOCATION	COLOR
d. Joints in wash surfaces of stonework.	[_____]
e. Expansion and control joints.	[_____]
f. Interior face of expansion joints in exterior concrete or masonry walls where metal expansion joint covers are not required.	[_____]
g. Voids where items pass through exterior walls.	[_____]
h. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.	[_____]
i. Metal-to-metal joints where sealant is indicated or specified.	[_____]
j. Joints between ends of gravel stops, fascia, copings, and adjacent walls.	[_____]
k. [_____]	[_____]

2.1.3 Floor Joint Sealants

Provide sealant products per JIS A 5758 used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of UL 2818(Greenguard) Gold, SCS Global Services Indoor Advantage Gold, CDPH Section 01350 (limit requirements of either office or classroom spaces regardless of space type), VOC content requirements of SCAQMD Rule 1168, or F4-star, and meet Japan Sealant Industry Association requirement. Provide location(s) and color(s) of sealant as follows. Note, color "as selected" refers to manufacturer's full range of color options:

LOCATION	COLOR
a. Seats of metal thresholds for exterior doors.	[As selected] [Gray] [White] [_____]
b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.	[_____]

2.1.4 Acoustical Sealants

[_____] Rubber or polymer based acoustical sealant in accordance to ASTM C919, to have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Provide non-staining acoustical sealant with a consistency of 250 to 310. Acoustical sealant must remain flexible and adhesive after 500 hours of accelerated weathering. Provide sealant products used on the interior of the building (defined as inside of the weatherproofing system) to have low or no pollutant emissions.

2.1.5 Preformed Sealants

Provide preformed sealants of polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealants capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus 34 to plus 71 degrees C, sealants must be non-bleeding and have no loss of adhesion.

2.1.5.1 Tape

[_____] Tape sealant: Provide cross section dimensions of [_____].

2.1.5.2 Bead

[_____] Bead sealant: Provide cross section dimensions of [_____].

2.1.5.3 Foam Strip

Provide [_____] foam strip of polyurethane foam with cross section dimensions of [_____]. Provide foam strip capable of sealing out moisture, air, and dust when installed and compressed in accordance with manufacturer's printed instructions. Service temperature must be minus 40 to plus 135 degrees C. Furnish untreated strips with adhesive to hold them in place. Do not allow adhesive to stain or bleed onto adjacent finishes. Saturate treated strips with butylene waterproofing or impregnate with asphalt.

2.2 PRIMERS

Non-staining, quick drying type and consistency as recommended by the sealant manufacturer for the particular application. Provide primers for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

2.3 BOND BREAKERS

Type and consistency as recommended by the sealant manufacturer to prevent adhesion of the sealant to the backing or to the bottom of the joint. Provide bond breakers for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

2.4 BACKSTOPS

Provide glass fiber roving, neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Provide 25 to 33 percent oversized backing for closed cell and 40 to 50 percent oversized backing for open cell material, unless otherwise indicated. Provide backstop material that is compatible with sealant. Do not use oakum[, [_____]] or other types of absorptive materials as backstops.

2.4.1 Rubber

Provide in accordance per manufacturer requirement [round] [_____] cross section for [_____] cellular rubber sponge backing.

2.4.2 Silicone Rubber Base

Provide in accordance with JIS A 5758. Color [as selected from

manufacturer's full range of color choices] [_____].

2.5 CAULKING

For interior use and only where there is little or no anticipated joint movement. Provide products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350(limit requirements of either office or classroom spaces regardless of space type), VOC content requirements of SCAQMD Rule 1168, or F-4 Star. Provide certification or validation of indoor air quality for interior caulking.

2.6 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer and in accordance with environmental requirements herein. [Protect adjacent aluminum and bronze surfaces from solvents]. Provide solvents for interior applications that meet the indoor air quality requirements of the paragraph SEALANTS above.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

Perform a field adhesion test in accordance with manufacturer's instructions. Remove sealants that fail adhesion testing; clean substrates, reapply sealants, and re-test. Test sealants adjacent to failed sealants. Submit field adhesion test report indicating tests, locations, dates, results, and remedial actions taken.

3.2 SURFACE PREPARATION

Prepare surfaces according to manufacturer's printed installation instructions. Clean surfaces from dirt, frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would destroy or impair adhesion. Remove oil and grease with solvent; thoroughly remove solvents prior to sealant installation. Wipe surfaces dry with clean cloths. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant. For surface types not listed below, provide in accordance with sealant manufacturer's printed instructions for each specific surface.

3.2.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finished work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue free solvent. Remove resulting debris and solvent residue prior to sealant installation.

3.2.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive prior to sealant application. For removing protective coatings and final cleaning, use non-staining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

3.2.3 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing. Remove laitance, efflorescence and loose mortar from the joint cavity. Remove resulting debris prior to sealant installation.

3.2.4 Wood Surfaces

Ensure wood surfaces that will be in contact with sealants are free of splinters, sawdust and other loose particles.

[3.2.5 Removing Existing Hazardous Sealants

For sealants applied prior to 1979, or that have been tested and found to contain polychlorinated biphenyls (PCBs), remove and dispose of these sealants in accordance with Section 02 84 33 REMOVAL AND DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCBs).

]3.3 SEALANT PREPARATION

Do not add liquids, solvents, or powders to sealants. Mix multicomponent elastomeric sealants in accordance with manufacturer's printed instructions.

3.4 APPLICATION

3.4.1 Joint Width-To-Depth Ratios

Acceptable Ratios:

JOINT WIDTH	JOINT DEPTH	
	Minimum	Maximum
For metal, glass, or other nonporous surfaces:		
6 mm (minimum)	6 mm	6 mm
over 6 mm	1/2 of width	Equal to width
For wood, concrete, masonry, stone, or [_____]:		
6 mm (minimum)	6 mm	6 mm
over 6 mm to 13 mm	6 mm	Equal to width
over 13 mm to 25 mm	50 mm	16 mm
Over 25 mm	prohibited	

Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding is prohibited at metal surfaces.

3.4.2 Unacceptable Sealant Use

Do not install sealants in lieu of other required building enclosure weatherproofing components such as flashing, drainage components, and joint closure accessories, or to close gaps between walls, floors, roofs, windows, and doors, that exceed acceptable installation tolerances. Remove sealants that have been used in an unacceptable manner and correct building enclosure deficiencies to comply with contract documents requirements.

3.4.3 Masking Tape

Place masking tape on the finished surface on one or both sides of joint cavities to protect adjacent finished surfaces from primer or sealant smears. Remove masking tape within 10 minutes of joint filling and tooling.

3.4.4 Backstops

Provide backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide joints in specified depths. Provide backstops where indicated and where backstops are not indicated but joint cavities exceed the acceptable maximum depths specified in JOINT WIDTH-TO-DEPTH RATIOS Table.

3.4.5 Primer

Clean out loose particles from joints immediately prior to application of. Apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's printed instructions. Do not apply primer to exposed finished surfaces.

3.4.6 Bond Breaker

Provide bond breakers to surfaces not intended to bond in accordance with, sealant manufacturer's printed instructions for each type of surface and sealant combination specified.

3.4.7 Sealants

Provide sealants compatible with the material(s) to which they are applied. Do not use a sealant that has exceeded its shelf life or has jelled and cannot be discharged in a continuous flow from the sealant gun. Apply sealants in accordance with the manufacturer's printed instructions with a gun having a nozzle that fits the joint width. Work sealant into joints so as to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Apply sealant uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply additional sealant, and tool smooth as specified. Apply sealer over sealants in accordance with the sealant manufacturer's printed instructions.

3.5 PROTECTION AND CLEANING

3.5.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled and no residual tape marks remain.

3.5.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

a. Masonry and Other Porous Surfaces: Immediately remove fresh sealant that has been smeared on adjacent masonry, rub clean with a solvent, and remove solvent residue, in accordance with sealant manufacturer's printed instructions. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding. Remove resulting debris.

b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent moistened cloth. Remove solvent residue in accordance with solvent manufacturer's printed instructions.

-- End of Section --

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SECTION 08 11 13

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/SDI A250.8	(2017) Specifications for Standard Steel Doors and Frames

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1516	(1998) Windows and Doorsets - Air Permeability Test
JIS A 4702	(2015) Doorsets
JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS G 3313	Electrolytic Zinc-Coated Steel Sheet and Strip
JIS G 3317	(2019) Hot-Dip Zinc-5 Percent Aluminum Allot-Coated Steel Sheet and Strip
JIS Z 3420	(2003) Specification and Approval of Welding Procedures for Metallic Materials - General Rules

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT SS Chapter 16	(2019) Building Construction Standard Specifications - Chapter 16 Opening Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 105	(2016; TIA 16-1) Standard for Smoke Door Assemblies and Other Opening Protectives
NFPA 252	(2017) Standard Methods of Fire Tests of Door Assemblies
NFPA 80	(2016; TIA 16-1) Standard for Fire Doors and Other Opening Protectives

UNDERWRITERS LABORATORIES (UL)

UL 10C (2016) UL Standard for Safety Positive Pressure Fire Tests of Door Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors; G[, [_____]]

Frames; G[, [_____]]

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

Schedule of Doors; G[, [_____]]

Schedule of Frames; G[, [_____]]

Submit door and frame locations.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging.[Strap knock-down frames in bundles.][Provide temporary steel spreaders securely fastened to the bottom of each welded frame.] Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 6 mm airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

JIS A 4702, except as specified otherwise. Prepare doors to receive door hardware as specified in Section 08 71 00 DOOR HARDWARE. Undercut where indicated. Provide exterior doors with top edge closed flush and sealed to prevent water intrusion. Provide doors at 44.5 mm thick, unless otherwise indicated. Provide door material that uses a minimum of 25 percent recycled content. [Provide exterior glazing in accordance with project load resistance requirement.]

2.1.1 Classification - Level, Performance, Model

2.1.1.1 Standard Duty Doors (Level 1)

35 mm to 45 mm door thickness, 0.8 mm door faces steel thickness, 1.0 mm frames steel thickness [full flush] of size(s) and design(s) indicated and

core construction as required by the manufacturer. Provide door classification label per JIS A 4702.

2.1.1.2 Heavy Duty Doors (Level 2)

45 mm door thickness, 1.0 mm door faces steel thickness, 1.3 mm frames steel thickness [full flush] [seamless], with core construction as required by the manufacturer [for interior doors][and][for exterior doors], of size(s) and design(s) indicated. [Where vertical stiffener cores are required, the space between the stiffeners must be filled with board insulation.][Provide door classification label per JIS A 4702.]

2.1.1.3 Extra Heavy Duty Doors (Level 3)

45 mm door thickness, 1.3mm door faces and frames steel thickness, [full flush] [seamless] [stile and rail] with core construction as required by the manufacturer [for interior doors][and][for indicated exterior doors], of size(s) and design(s) indicated.[Where vertical stiffener cores are required, the space between the stiffeners must be filled with mineral board insulation.][Provide door classification label per JIS A 4702.]

2.1.1.4 Maximum Duty Doors (Level 4)

45 mm door thickness, 1.7mm door faces and frames steel thickness, [full flush] [seamless] with core construction as required by the manufacturer [for interior doors][and][for indicated exterior doors], of size(s) and design(s) indicated.[Where vertical stiffener cores are required, the space between the stiffeners must be filled with mineral board insulation.][Provide door classification label per JIS A 4702.]

2.2 CUSTOM HOLLOW METAL DOORS

Provide custom hollow metal doors where nonstandard steel doors are indicated. Provide custom steel doors in the door size(s), design(s), materials, construction, gages, and finish as specified for custom steel doors and complying with the requirements. Fill all spaces in doors with insulation. Close top and bottom edges with steel channels not lighter than 1.5 mm thick.[Close tops of exterior doors flush with an additional channel and seal to prevent water intrusion.] Prepare doors to receive hardware specified in Section 08 71 00 DOOR HARDWARE.[Undercut doors where indicated.] Provide doors at 45 mm thick, unless otherwise indicated.

2.3 INSULATED STEEL DOOR SYSTEMS

[At the option of the Contractor, insulated steel doors and frames may be provided in lieu of Level 1 standard steel doors and frames. Provide insulated steel doors in the door size(s), design, and material as specified for standard steel doors.]Provide insulated steel doors with a core of polyurethane foam; face sheets, edges, and frames of galvanized steel not lighter than 0.7 mm thick, 1.5 mm thick, and 1.5 mm respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Provide to doors and frames a phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Door shall meet JIS A 4702 and tested for 500,000 cycles. Prepare doors to receive specified hardware. Provide doors 44.5 mm thick.[Provide insulated steel doors and frames [at entrances to dwelling units][where shown][_____].]

[2.4 SOUND RATED STEEL DOORS

Provide sound rated doors with a Transmission Loss (TL) [of [_____]][as indicated on the drawings].

]2.5 ACCESSORIES

2.5.1 Shelves for Dutch Doors

Fabricate shelves of steel not lighter than 1.5 mm thick, [[_____] mm wide][of the size indicated]. Provide brackets of stock type fabricated of the same metal used to fabricate shelves.

2.5.2 Louvers

2.5.2.1 Interior Louvers

Where indicated, provide louvers of stationary [sightproof][and][lightproof] type[where scheduled].[Louvers for lightproof must not transmit light.] Detachable moldings on room or non security side of door; on security side of door, moldings to be integral part of louver. Form louver frames of 1 mm thick steel and louver blades of a minimum 0.6 mm.[Louvers for lightproof doors must have minimum of 20 percent net-free opening.][Sightproof louvers to be inverted ["V" blade design with minimum 55][and][inverted ["Y"] blade design with minimum 40] percent net-free opening.]

2.5.2.2 Exterior Louvers

Provide louvers of the inverted ["Y"]["V"]["Z"] type with minimum of [30][55][35] percent net-free opening. Weld or tenon louver blades to continuous channel frame and weld assembly to door to form watertight assembly. Form louvers of hot-dip galvanized steel of same gage as door facings. At louvers provide steel-framed [insect][bird] screens secured to room side and readily removable. Provide [aluminum wire cloth, 7 by 7 per 10 mm or 7 by 6 per 10 mm mesh, for insect screens][galvanized steel, 13 by 13 mm mesh hardware cloth, for bird screens]. Net-free louver area to be before screening.

2.5.3 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08 71 00 DOOR HARDWARE provide overlapping steel astragals with the doors.

2.5.4 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide nonremovable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide snap-on moldings.

2.6 INSULATION CORES

Provide insulating cores of the type specified, and provide an apparent U-factor per insulation requirements in accordance with JIS A4702, [H-_____]

2.7 STANDARD STEEL FRAMES

Provide hardware reinforcing thickness per ANSI/SDI A250.8 requirement. Form frames to sizes and shapes indicated, with [welded corners][or][knock-down field-assembled corners]. Provide steel frames for doors, [transoms,] [sidelights,] [mullions,] [cased openings,][and][interior glazed panels,] unless otherwise indicated. Provide frame product that uses a minimum of 25 percent recycled content. Provide data indicating percentage of recycled content for steel frame product.

2.7.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

Weld frames in accordance with the recommended practice of Welding Code per JIS Z 3420 and in accordance with the practice specified by the producer of the metal being welded.

2.7.2 Knock-Down Frames

Design corners for simple field assembly by concealed tenons, splice plates, or interlocking joints that produce square, rigid corners and a tight fit and maintain the alignment of adjoining members. Provide locknuts for bolted connections.

2.7.3 Mullions and Transom Bars

Provide mullions and transom bars of closed or tubular construction with heads and jambs butt-welded together[or knock-down for field assembly]. Bottom of door mullions must have adjustable floor anchors and spreader connections.

2.7.4 Stops and Beads

Provide form and loose stops and beads from 0.9 mm thick steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 300 to 400 mm on center. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

2.7.5 Terminated Stops

Where indicated, terminate interior door frame stops 150 mm above floor.[Do not terminate stops of frames for [lightproof,] [soundproof,] [or lead-lined] doors.]

2.7.6 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

2.7.7 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated not lighter than 1.2 mm thick.

2.7.7.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 2285 mm in height, provide one additional anchor for each jamb for each additional 760 mm or fraction thereof.

a. Masonry: Provide anchors of corrugated or perforated steel straps or 5 mm diameter steel wire, adjustable or T-shaped;

b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened [to wood studs with nails,] [to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding];

c. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with JIS A 4702; and

d. Solid plaster partitions: Secure anchors solidly to back of frames and tie into the lath. Provide adjustable top strut anchors on each side of frame for fastening to structural members or ceiling construction above. Provide size and type of strut anchors as recommended by the frame manufacturer.

2.7.7.2 Floor Anchors

Provide floor anchors drilled for 10 mm anchor bolts at bottom of each jamb member. [Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.]

2.8 FIRE [AND] [SMOKE] DOORS AND FRAMES

Provide fire[and smoke] doors and frames in accordance with NFPA 80[and][NFPA 105] and this specification.[Include insulated core materials in fire doors where indicated in the door schedule.]

2.8.1 Labels

Provide fire doors and frames bearing the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing must be in accordance with NFPA 252 or UL 10C. Provide labels that are metal with raised letters, bearing the name or file number of the door and frame manufacturer. Labels must be permanently affixed at the factory to frames and to the hinge edge of the door. Do not paint door and labels. Use of Japanese tested and labeled fire doors, up to 20 minutes, is permitted. NFPA 252 paragraph 6.2.2 requires hose stream test for fire rated doors greater than 20 minutes. Japanese manufactured fire rated doors are not subjected to hose stream tests and are not deemed equivalent to US products or requirements.

2.8.2 Oversized Doors

For fire doors and frames which exceed the size for which testing and labeling are available, furnish certificates stating that the doors and frames are identical in design, materials, and construction to a door which has been tested and meets the requirements for the class indicated.

2.8.3 Astragal on Fire [and Smoke] Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements.[On smoke control doors, conform to NFPA 105.]

2.9 EXTERIOR FRAMES

Provide thermal insulation in all exterior frames. Provide frames of a minimum Level 4, with frames of a minimum thickness of 1.7 mm, 14 gage.

2.10 WEATHERSTRIPPING

As specified in Section 08 71 00 DOOR HARDWARE.

[2.10.1 Integral Gasket

Black synthetic rubber gasket with tabs for factory fitting into factory slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals specified in Section 08 71 00 DOOR HARDWARE. Insert gasket in groove after frame is finish painted. Provide doors where air leakage of weatherstripped doors does not exceed [2.19 by 10-5] [5.48 by 10-5] cubic meters per second of air per square meter of door area when tested in accordance with JIS A 1516.

]2.11 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in JIS A 4702. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of JIS A 4702. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of JIS A 4702, as applicable. Punch door frames [, with the exception of frames that will have weatherstripping [or] [lightproof] [or] [soundproof] gasketing,] to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.12 FINISHES

[2.12.1 Factory-Primed Finish

Thoroughly clean all surfaces of doors and frames then chemically treat and factory prime with a rust inhibiting coating as specified in JIS A 4702.[, or paintable A25 galvannealed steel without primer. Where coating is removed by welding, apply touchup of factory primer.]

][2.12.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate [exterior][interior][scheduled] doors and frames from hot dipped zinc coated steel, alloyed type, that complies with JIS G 3302 and JIS G 3317. The coating weight must meet or exceed the minimum requirements for coatings having zinc-5 percent. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in JIS A 4702.[Provide for [exterior doors][and][interior doors][door openings No. [_____]]].

]2.12.3 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with JIS G 3313, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in JIS A 4702.

[2.12.4 Factory-Applied Enamel Finish

Provide coatings that meet test procedures and acceptance criteria in accordance with JIS A 4702. After factory priming, apply [one coat][two coats] of [low-gloss][medium-gloss] enamel to exposed surfaces. Separately bake or oven dry each coat. Drying time and temperature requirements must be in accordance with the coating manufacturer's recommendations. Provide finish coat color(s) [as indicated][_____] to match approved color sample(s).

]2.13 FABRICATION AND WORKMANSHIP

Provide finished doors and frames that are strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Provide molded members that are clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints must be well formed and in true alignment. Conceal fastenings where practicable.[Frames for use in solid plaster partitions must be welded construction.][On wraparound frames for masonry partitions, provide a throat opening 3 mm larger than the actual masonry thickness.][Design[other] frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive caulking compound.]

2.13.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

2.14 PROVISIONS FOR GLAZING

Materials are specified in Section 08 81 00, GLAZING.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with JIS A 4702 and MLIT SS Chapter 16. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. [Where frames require ceiling struts or overhead bracing, anchor frames to the struts or bracing.]

3.1.2 Doors

Hang doors in accordance with clearances specified in JIS A 4702 and

MLIT SS Chapter 16. After erection and glazing, clean and adjust hardware.

3.1.3 Fire [and Smoke] Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80.[Install[fire rated] smoke doors and frames in accordance with [NFPA 80][and][NFPA 105].]

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

-- End of Section --

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SECTION 08 11 16

ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(2017) Minimum Design Loads for Buildings and Other Structures

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 16932	(2007) Glass in Buildings - Destructive Windstorm-Resistant Security Glazing - Test and Clarification

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1516	(1998) Windows and Doorsets - Air Permeability Test
JIS A 1517	(1996) Windows and Doorsets-Watertightness Test Under Dynamic Pressure
JIS A 4702	(2015) Doorsets
JIS H 4000	(2017) Aluminium and Aluminium Alloy Sheets, Strips and Plates (Amendment 1)
JIS H 4100	(2015) Aluminum and Aluminum Alloy Extrusions
JIS H 4040	(2015) Aluminum and Aluminum Alloy Bars and Wires
JIS H 8602	(2010) Combined Coatings of Anodic Oxide and Organic Coatings on Aluminum and Aluminum Alloys
JIS K 5906	(1998) Aluminum Pigments For Paints
JIS R 3109	(2018) Glass in Building - Destructive-Windstorm-Resistant Security Glazing - Test Method

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT SS Chapter 16	(2019) Building Construction Standard Specifications - Chapter 16 Opening

Construction

1.2 PERFORMANCE REQUIREMENTS

1.2.1 Structural Calculations

Commentary: Add wind pressure requirements in accordance with ASCE 7.

1.2.1.1 Minimum Antiterrorism Performance

Provide doors meeting the minimum antiterrorism performance as specified in the paragraphs below.

Aluminum door, window frame and window wall shall be designed to support the wind pressures specified, but not less than the minimum section properties indicated. The anchorages shall be designed to support the wind load reactions calculated, but not less than the support loads indicated on the contract documents.

If the minimum section properties and anchorages were not indicated, one of the following methods can be used as noted in the following:

[a. Static Equivalent Load Design

][1.2.2 Wind Borne Debris

Provide impact resistant door [_____] assemblies meeting the Windborne-Debris-Impact Resistant Performance requirements of JIS R 3109 as follows:

(1) Pass missile-impact tests when tested according to JIS R 3109 for missiles A and D in Table 2 or ISO 16932 (Missile C).

]1.2.3 Air Infiltration

When tested in accordance with JIS A 1516, air infiltration per door leaf cannot exceed 2.83 by 10-4 cms per square meter of fixed area at a test pressure of 0.30 kPa.

1.2.4 Water Penetration

When tested in accordance with JIS A 1517, there can be no water penetration at a pressure of 0.14 kPa of fixed area.

1.2.5 Thermal Transmittance, Solar Heat Gain, Visible Light Transmittance

1.2.5.1 U-Factor

Provide exterior glazed assemblies, including aluminum entrances doors with greater than 50 percent glazed area with U-Factor [_____].

1.2.5.2 Solar Heat Gain Coefficient (SHGC)

Provide exterior glazed assemblies, including aluminum entrances doors with greater than 50 percent glazed area, certified by the National Fenestration Rating Council with a whole window SHGC of [_____].

1.2.5.3 Visible Light Transmittance (VLT)

Provide exterior glazed assemblies, including aluminum entrances doors with greater than 50 percent glazed area with VLT [_____].

[1.2.5.4 Doors with Less than 50 Percent Glazed Area

For exterior aluminum entrances doors with less than 50 percent glazed area, the glazed area is considered the fenestration area with a whole window U-Factor, SHGC and VLT as required above.

]1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

For Each Type of Door and Frame Assembly; G[, [_____]]

SD-04 Samples

Finish Samples; G[, [_____]]

SD-05 Design Data

Structural Calculations for Deflection; G[, [_____]]

SD-06 Test Reports

Air Infiltration; G[, [_____]]

Water Penetration; G[, [_____]]

SD-10 Operation and Maintenance Data

Adjustments, Cleaning, and Maintenance; G[, [_____]]

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for damage. Unload and store with minimum handling. Provide storage space in dry location with adequate ventilation, free from dust or water, and easily accessible for inspection and handling. Stack materials on non-absorptive strips or wood platforms. Do not cover doors and frames with tarps, polyethylene film, or similar coverings. Protect finished surfaces during shipping and handling using manufacturer's standard method. Do not apply coatings or lacquers to surfaces to which caulking and glazing compounds must adhere.

1.5 QUALITY CONTROL

1.5.1 Shop Drawing

Indicate elevations and sections for each type of door and frame assembly. Show sizes and details of each assembly, frame construction,[subframe attachment,] thickness and gages of metal, details of door and frame construction, proposed method(s) of anchorage, glazing details, provisions for an location of hardware, [mullion details,] method and materials for flashing and weatherstripping, miscellaneous trim, installation details, and other related items necessary for a complete representation of all components. A qualified blast engineer must perform testing or calculations for door system design resistance to specified blast loads.

1.5.2 Finish Samples

Submit two color charts and two finish sample chips from manufacturer's standard color and finish options for each type of finish indicated.

1.5.3 Operation and Maintenance Data

Submit detailed instructions for installation, adjustments, cleaning, and maintenance of each type of assembly indicated.

PART 2 PRODUCTS

2.1 DOORS AND FRAMES

Provide swing-type aluminum doors and frames of size, design, and location indicated. Provide doors complete with frames, framing members[, subframes][, transoms][, adjoining side lites] , trim, and accessories.[Coordinate side lites, window walls, adjacent curtainwall with Section 08 41 13 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS][and Section 08 44 00 CURTAIN WALL AND GLAZED ASSEMBLIES.]

2.2 MATERIALS

2.2.1 Anchors

Stainless steel [or steel with hot-dipped galvanized finish].

2.2.2 Weatherstripping

Continuous wool pile, silicone treated, or type recommended by door manufacturer, and per JIS A 4702.

2.2.3 Aluminum Alloy for Doors and Frames

JIS H 4040, Alloy 6063-T5 for extrusions. JIS H 4000, alloy and temper best suited for aluminum sheets and strips.

2.2.4 Fasteners

Hard aluminum or stainless steel.

2.2.5 Structural Steel

JIS H 4100.

2.2.6 Aluminum Paint

Aluminum door manufacturer's standard aluminum paint.

2.3 FABRICATION

2.3.1 Aluminum Frames

Extruded aluminum shapes with contours approximately as indicated. Provide removable glass stops and glazing beads for frames accommodating fixed glass. Use countersunk stainless steel Phillips screws for exposed fastenings, and space not more than 300 mm on center. Mill joints in frame members to a hairline fit, reinforce, and secure mechanically.

2.3.2 Aluminum Doors

Of type, size, and design indicated and minimum 45 mm thick. minimum wall thickness, 3 mm, except beads and trim, 1.25 mm. Door sizes shown are nominal; include standard clearances as follows: 2.5 mm at hinge and lock stiles, 3 mm between meeting stiles, 3 mm at top rails, 5 mm between bottom and threshold, and 17 mm between bottom and floor.[Provide bevel single-acting doors 2 or 3 mm at lock, hinge, and meeting stile edges.][Provide double-acting doors rounded edges at hinge stile, lock stile, and meeting stile edges.]

2.3.2.1 Full Glazed Stile and Rail Doors

Provide doors with [narrow][medium][wide] stiles and rails as indicated. Fabricate from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Fasten top and bottom rail together by means of welding or by 10 or 13 mm diameter cadmium-plated tensioned steel tie rods. Provide an adjustable mechanism of jack screws or other methods in the top rail to allow for minor clearance adjustments after installation.

2.3.2.2 Flush Doors

Use facing sheets with[a vertical ribbed][an embossed][or][a plain smooth] surface. Use one of the following constructions:

a. A phenolic resin-impregnated kraft paper honeycomb core, surrounded at edges and around glass and louvered areas with extruded aluminum shapes. Provide cores with a minimum impregnation of 18 percent resin content. Provide sheet aluminum door facings minimum 0.8 mm thick laminated to a 2.5 mm thick tempered hardboard backing, with the backing bonded to the honeycomb core. Bond facing sheets to cores under heat and pressure with thermosetting adhesive and mechanically lock to extruded edge members.

b. A phenolic resin-impregnated kraft paper honeycomb core. Use aluminum facing sheets minimum 1.25 mm thick and form into two pans to eliminate seams on faces. Bond honeycomb core to face sheets using epoxy resin or contact cement-type adhesive.

c. A solid fibrous core, surrounded at edges and around glass and louvered areas and cross braced at intermediate points with extruded aluminum shapes. Use aluminum facing sheets of minimum 1.25 mm thickness. Bond facing sheets to core under heat and pressure with a thermosetting adhesive, and mechanically lock to the extruded edge

members.

d. Form from extruded tubular stiles and rails mitered at corners, reinforce, and continuously weld at miters. Provide facing sheets of minimum 0.8 mm thick sheet aluminum internally reinforced with aluminum channels or Z-bars placed horizontally not more than 400 mm apart and extending the full width of panels. Fit spaces between reinforcing with sound-deadening insulation. Weld facing sheets to reinforcing bars or channels and to stiles and rails. Finish facing sheets flush with faces of stiles and rails.

e. Form from an internal grid composed of extruded aluminum tubular sections. Provide tubular sections at all sides and perimeter of louver and glass openings. Provide three extruded aluminum tubular sections at top and bottom of each door. Provide wall thickness of tubular sections minimum 2.25 mm except at lock rails which must be minimum 3 mm thick, hinge lock rails which must be minimum 3 mm thick, and hinge rail edges which must be minimum 5 mm thick. Fill spaces in door with mineral insulation. Provide facing sheets of aluminum minimum 2.25 mm thick.

f. Form from extruded aluminum members at top and bottom, both sides, and at perimeters of louver and glass openings. Provide wall sections of extruded aluminum members minimum 2.25 mm thick and reinforce for application of hardware. Cover framing members on both sides with aluminum facing sheets minimum 2 mm thick. Fill door panels with [172 kPa density polystyrene] [40 kg per cubic meter density, chlorofluorocarbon (CFC) free, foamed urethane] with a flame spread rating of no more than 25.

2.3.3 Welding and Fastening

Where possible, locate welds on unexposed surfaces. Dress welds on exposed surfaces smoothly. Select welding rods, filler wire, and flux to produce a uniform texture and color in finished work. Remove flux and spatter from surfaces immediately after welding. Exposed screws or bolts will be permitted only in inconspicuous locations, and must have countersunk heads. Weld concealed reinforcements for hardware in place.

2.3.4 Weatherstripping

Provide on stiles and rails of exterior doors. Fit into slots which are integral with doors or frames. Weatherstripping must be replaceable without special tools, and adjustable at meeting rails of pairs of doors. During installation, verify doors swing freely and close positively. Refer to paragraph AIR INFILTRATION for air leakage requirements and testing.

2.3.5 Anchors

On the backs of subframes, provide anchors of the sizes and shapes indicated for securing subframes to adjacent construction. Anchor transom bars at ends and mullions at head and sill.[Where indicated, reinforce vertical mullions with structural steel members of sufficient length to extend up to the overhead structural slab or framing and secure thereto.][Reinforce and anchor freestanding door frames to floor construction as indicated on approved shop drawings and in accordance with manufacturer's recommendation.] Place anchors [as indicated][near top and bottom of each jamb and at intermediate points not more than 635 mm apart].

2.3.6 Provisions for Hardware

Coordinate with Section 08 71 00 DOOR HARDWARE. Deliver hardware templates and hardware (except field-applied hardware) to the door manufacturer for use in fabrication of aluminum doors and frames. Cut, reinforce, drill, and tap doors and frames at the factory to receive template hardware. Provide doors to receive surface-applied hardware, except push plates, kick plates, and mop plates, with reinforcing only; drill and tap in the field. Provide hardware reinforcements of stainless steel or steel with hot-dipped galvanized finish, and secure with stainless steel screws.[Provide reinforcement in core of flush doors as required to receive locks, door closers, and other hardware.]

2.3.7 Provisions for Glazing

[Provide extruded aluminum snap-in glazing beads on interior side of doors.][Provide extruded aluminum, theft-proof, snap-in glazing beads or fixed glazing beads on exterior or security side of doors.][Provide glazing beads with vinyl insert glazing gaskets.][Design glazing beads to receive thickness indicated for each glazed assembly.] Coordinate requirements with Section 08 81 00 GLAZING.

2.3.8 Finishes

Provide exposed aluminum surfaces with [mill finish] [factory finish of anodic coating or organic coating].

2.3.8.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to JIS H 8602. Provide [as selected from manufacturer's [standard][complete] range of color options].

2.3.8.2 Organic Coating

Clean and prime exposed aluminum surfaces. Provide [a baked enamel finish in accordance with JIS K 5906 with total dry film thickness minimum 0.02 mm]. Finish color to be [_____] [as indicated] [as selected from manufacturer's [standard][complete] range of color options].

PART 3 EXECUTION

3.1 INSTALLATION

Plumb, square, level, and align frames and framing members to receive doors[, transoms][, adjoining side lites][, and][, adjoining window walls] per MLIT SS Chapter 16. Anchor frames to adjacent construction as indicated and in accordance with manufacturer's printed instructions and the approved shop drawings. Install anchorage that complies with applicable structural requirements. Anchor bottom of each frame to rough floor construction with 2.4 mm thick minimum stainless steel angle clips secured to back of each jamb and to floor construction; use stainless steel bolts and expansion rivets for fastening clip anchors. Hang doors to produce clearances specified in paragraph ALUMINUM DOORS. After erection and glazing, adjust doors and hardware to operate properly.

3.2 PROTECTION FROM DISSIMILAR MATERIALS

3.2.1 Dissimilar Metals

Where aluminum surfaces come in contact with metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact to dissimilar metals.

3.2.1.1 Protection

Provide one of the following systems to protect surfaces in contact with dissimilar metals:

a. Paint the dissimilar metal with one coat of heavy-bodied bituminous paint.

b. Apply elastomeric sealant between aluminum and dissimilar metals in accordance with Section 07 92 00 JOINT SEALANTS.

c. Paint dissimilar metals with one coat of primer and one coat of aluminum paint.

d. Use a non-absorptive tape or gasket in permanently dry locations.

3.2.2 Drainage from Dissimilar Metals

In locations where drainage from dissimilar metals has direct contact with aluminum, provide protective paint to prevent aluminum discoloration.

3.2.3 Masonry and Concrete

Provide aluminum surfaces in contact with mortar, concrete, or other masonry materials with one coat of heavy-bodied bituminous paint.

3.2.4 Wood or Other Absorptive Materials

Provide aluminum surfaces in contact with absorptive materials subject to frequent moisture, and aluminum surfaces in contact with treated wood, with two coats of aluminum paint or one coat of heavy-bodied bituminous paint. In lieu of painting aluminum, paint the wood or other absorptive surface with two coats of aluminum paint and seal joints with elastomeric sealant.

3.3 SEALING AROUND ASSEMBLIES

Seal all penetrations of the air barrier by sealing around door openings as necessary to achieve compliance with air leakage requirements indicated in [the air barrier sections of the specifications][, the requirements of Section 07 27 10.00 10 BUILDING AIR BARRIER SYSTEM][, and Section 07 05 23 PRESSURE TESTING AN AIR BARRIER SYSTEM FOR AIR TIGHTNESS]. Flash all doors with corrosion resistant flashing to prevent water intrusion.

3.4 CLEANING

Upon completion of installation, clean door and frame surfaces in accordance with door manufacturer's written recommended procedure. Do not use abrasive, caustic, or acid cleaning agents.

3.5 PROTECTION

Protect doors and frames from damage and from contamination by other materials such as cement mortar. Prior to completion and acceptance of the work, restore damaged doors and frames to original condition, or replace with new ones.

-- End of Section --

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SECTION 08 14 00

WOOD DOORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E2226	(2015a; R 2019b) Standard Practice for Application of Hose Stream

FOREST STEWARDSHIP COUNCIL JAPAN (FSC)

FSC STD 01 001	(2015) Principles and Criteria for Forest Stewardship

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8272	(1985) Doorsets - Air Permeability Test
ISO 10140	(2016) Acoustics - Laboratory Measurement of Sound Insulation of Building Elements

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1460	(2015) Determination of the Emission of Formaldehyde from Building Boards - Desiccator Method
JIS A 1416	(2000) Acoustics - Measuring Method of Air Sound Insulation Performance of Building Materials in Laboratory
JIS A 1516	(1998) Windows and Doorsets - Air Permeability Test
JIS A 1530	(2014) Windows and Doors - Resistance to Repeated Opening and Closing - Test Method
JIS K 6903	(2008) Laminated Thermosetting High-Pressure Decorative Sheets

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT-SS Ch 16, Sec 7	(2019) Public Building Construction Standard Specification: Chapter 16, Section 7 Wood Door

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 105	(2016; TIA 16-1) Standard for Smoke Door Assemblies and Other Opening Protectives
NFPA 252	(2017) Standard Methods of Fire Tests of Door Assemblies
NFPA 80	(2016; TIA 16-1) Standard for Fire Doors and Other Opening Protectives

PROGRAMME FOR ENDORSEMENT OF FOREST CERTIFICATION (PEFC)

PEFC ST 2002:2013	(2015) PEFC International Standard Chain of Custody of Forest Based Products Requirements

SUSTAINABLE GREEN ECOSYSTEM COUNCIL (SGEC)

SGEC Certification Japan	Sustainable Green Ecosystem Council - Documents 1 - 4

UNDERWRITERS LABORATORIES (UL)

UL 10B	(2008; Reprint Feb 2015) Fire Tests of Door Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors; G[, [_____]]

Submit drawings or catalog data showing each type of door unit [; include descriptive data of head and jamb weatherstripping with installation instructions]. Indicate within drawings and data the door types and construction, sizes, thickness, [methods of assembly,] [door louvers,] and [glazing,].

SD-04 Samples

Doors

Prior to the delivery of wood doors, submit a sample section of each type of door which shows the stile, rail, veneer, finish, and core construction.

Door Finish Colors

Submit a minimum of three color selection samples [, minimum 76 by

127 mm in size representing wood stain] [for selection by the Contracting Officer].

SD-11 Closeout Submittals

Warranty

1.3 CERTIFICATIONS

1.3.1 Certified Wood Grades

Provide certificates of grade from the grading agency on [acoustical doors], and [fire doors].

[1.3.2 Certified Sustainably Harvested Wood

Provide wood certified as sustainably harvested by FSC STD 01 001, SGEC Certification Japan[, or other third party program certified by PEFC ST 2002:2013]. Provide a letter of Certification of Sustainably Harvested Wood signed by the wood supplier. Identify certifying organization and their third-party program name and indicate compliance with chain-of-custody program requirements. Submit sustainable wood certification data; identify each certified product on a line item basis. Submit copies of invoices bearing certification numbers.

][1.3.3 Indoor Air Quality Certification

[1.3.3.1 Composite Wood, Wood Structural Panel and Agrifiber Products

For purposes of this specification, composite wood and agrifiber products include particleboard, medium density fiberboard (MDF), wheatboard, strawboard, panel substrates, and door cores. Provide products certified to meet F 4-star and contents of ethylbenzene <1% 20 ppm, and xylene <5% ppm, and methanol <1% 200 ppm.

]]1.4 DELIVERY, STORAGE, AND HANDLING

Deliver doors to the site in an undamaged condition and protect against damage and dampness. Stack doors flat under cover. Support on blocking, a minimum of 100 mm thick, located at each end and at the midpoint of the door. Store doors in a well-ventilated building so that they will not be exposed to excessive moisture, heat, dryness, direct sunlight, or extreme changes of temperature and humidity.[Do not store in a building under construction until concrete, masonry work, and plaster are dry.] Replace defective or damaged doors with new ones.

1.5 WARRANTY

Warrant doors free of defects as set forth in the door manufacturer's standard door warranty.

PART 2 PRODUCTS

2.1 DOORS

Provide doors of the types, sizes, and designs [indicated] [specified] free of urea-formaldehyde resins. Provide products certified to meet F 4-star requirements of JIS A 1460.

2.1.1 Stile and Rail Doors

Stile and rail doors conforming to MLIT-SS Ch 16, Sec 7. Furnish laminate panels in not less than three ply thickness. Provide flat panels with a minimum finished panel thickness of [_____] mm and [_____] thickness for raised panels.[Provide certified sustainably harvested stile and rail wood doors.]

2.1.2 Flush Doors

Conform to MLIT-SS Ch 16, Sec 7 for flush doors. Provide hollow core doors with lock blocks and 25 mm minimum thickness hinge stile. Hardwood stile edge bands of doors receives a natural finish, compatible with face veneer. Provide mill option for stile edge of doors scheduled to be painted. No visible finger joints will be accepted in stile edge bands. When used, locate finger-joints under hardware.[Provide certified sustainably harvested flush wood doors.]

2.1.2.1 Interior Flush Doors

Provide [staved lumber] [particleboard] [agrifiber] [hollow] core, Type II flush doors conforming to MLIT-SS Ch 16, Sec 7 with faces of [sound grade hardwood or hardboard for painted finish] [premium] [good] grade [natural birch] [select [premium white] [red] birch] [[premium] [good] grade [red] [white] oak] [[premium] [good] grade walnut] [plastic laminate]. [Hardwood veneers must be [[rotary cut] [plain sliced] [quarter sliced]] [[random] [slip] [book] matched]]. [Finish plastic laminate faced doors on both vertical edges with [wood] [laminated plastic] of color matching faces.] [Products must contain no added urea-formaldehyde resins.]

2.1.3 Bi-Fold Closet Doors

Provide [hardboard grade flush doors conforming to MLIT-SS Ch 16, Sec 7.] [paneled] [louvered] doors [premium or select] [standard] grade, conforming to MLIT-SS Ch 16, Sec 7 with [_____] [_____] mm thickness. Equip doors with the manufacturer's standard hardware, including tracks, hinges, guides, and pulls.

2.1.4 Sliding Closet Doors

Provide flush wood doors to conform to MLIT-SS Ch 16, Sec 7. Provide [paneled] [and] [louvered] doors to conform to MLIT-SS Ch 16, Sec 7 [premium or select] [standard] grade with [_____] mm thickness. Equip doors with the manufacturer's standard hardware.

2.1.5 Acoustical Doors

MLIT-SS Ch 16, Sec 7, solid core, constructed to provide Weighted Sound Reduction Index (Rw) rating of [35] [_____] when tested in accordance with JIS A 1416 or ISO 10140.

2.1.6 [Composite-Type] Fire Doors

Provide doors specified or indicated to have a fire resistance rating conforming to the requirements of UL 10B, ASTM E2226, or NFPA 252 for the class of door indicated. Affix a permanent metal label with raised or incised markings indicating testing agency's name and approved hourly fire rating to hinge edge of each door.

2.1.7 Prehung Doors

Frames for prehung interior doors to be for [painted] [clear] finish, with [3 piece adjustable jamb units] [3 piece adjustable jamb units with pins]. Provide doors complete with frame, hinges, and prepared to receive finish hardware.

2.2 ACCESSORIES

2.2.1 Door Louvers

Fabricate from wood and of sizes indicated. Provide louvers with a minimum of 35 percent free air. Equip louvers with [slat] [sightproof inverted vee slat] type. [Block hollow core doors to provide solid anchorage for the louvers.] Mount louvers in the door with [flush wood moldings.] [wood lip moldings.]

2.2.2 Door Light Openings

Provide glazed openings with the manufacturer's standard wood moldings. [Provide moldings for doors to receive natural finish of the same wood species and color as the wood face veneers.] Provide moldings on the exterior doors with sloped surfaces. [Lip type moldings for flush doors.]

2.2.3 Weatherstripping

Provide weatherstripping that is a standard cataloged product of a manufacturer regularly engaged in the manufacture of this specialized item. Provide weatherstripping [tempered spring bronze] [or] [looped neoprene or vinyl held in an extruded non-ferrous metal housing]. Install [bronze weatherstripping with a minimum thickness of 0.23 mm for sills, and a minimum thickness of 0.16 mm elsewhere.] Air leakage of weatherstripped doors not to exceed [0.0025] [0.0031] cubic meter per second of air per square meter of door area when tested in accordance with JIS A 1516 or ISO 8272.

2.2.4 Additional Hardware Reinforcement

Provide the minimum lock blocks to secure the specified hardware. The measurement of top, bottom, and intermediate rail blocks is a minimum 125 mm by full core width. Comply with the manufacturer's labeling requirements for reinforcement blocking, but not mineral material similar to the core.

2.3 FABRICATION

2.3.1 Marking

Stamp each door with a brand, stamp, or other identifying mark indicating quality and construction of the door.

2.3.2 Quality and Construction

Identify the standard on which the construction of the door was based [, identify the standard under which preservative treatment was made,] and identify doors having a glue bond.

2.3.3 Preservative Treatment

Treat doors scheduled for restrooms, janitor closets and other possible wet locations including exterior doors with a water-repellent preservative treatment and so marketed at the manufacturer's plant.

2.3.4 Adhesives and Bonds

MLIT-SS Ch 16, Sec 7. Use bond as recommended by manufacturer for interior and exterior doors. Provide a nonstaining adhesive on doors with a natural finish.

2.3.5 Prefitting

Provide factory [prefinished] [finished] [and] factory prefitted doors for the specified hardware, door frame and door-swing indicated. Machine and size doors at the factory by the door manufacturer in accordance with the standards under which the doors are produced and manufactured. The work includes sizing, beveling edges, mortising, and drilling for hardware and providing necessary beaded openings for glass and louvers. Provide the door manufacturer with the necessary hardware samples, and frame and hardware schedules to coordinate the work.

2.3.6 Finishes

2.3.6.1 Field Painting

Factory prime or seal doors, and field paint.

2.3.6.2 Factory Finish

Provide doors finished at the factory by the door manufacturer. Use stain when required to produce the finish specified for color. Seal edges, cutouts, trim, and wood accessories, and apply two coats of finish compatible with the door face finish. Touch-up finishes that are scratched or marred, or where exposed fastener holes are filled, in accordance with the door manufacturer's instructions. Match color and sheen of factory finish using materials compatible for field application.

2.3.6.3 Plastic Laminate Finish

Factory applied, JIS K 6903, General or Specific purpose type, 1.25 mm minimum thickness. Glue laminated plastic for hollow core doors to wood veneer, plywood, or hardboard backing to form door panel. Provide a combined thickness of laminate sheet and backing of 2.5 mm minimum.

2.3.6.4 Color

Provide door finish colors in accordance with Section 09 06 00 SCHEDULES FOR FINISHES.

2.3.7 Water-Resistant Sealer

Provide manufacturer's standard water-resistant sealer compatible with the specified finish[es].

2.4 SOURCE QUALITY CONTROL

Meet or exceed the following minimum performance criteria of stiles fire

doors utilizing standard mortise leaf hinges:

a. Cycle-slam: [Standard Duty Doors: no loose hinge screws or other visible signs of failure when tested in accordance with the requirements of JIS A 1530] [Heavy Duty Doors: no loose hinge screws or other visible signs of failure when tested in accordance with the requirements of JIS A 1530] [Extra Heavy Duty Doors: no loose hinge screws or other visible signs of failure when tested in accordance with the requirements of JIS A 1530].

b. Hinge loading resistance: Averages of ten test samples not less than [Standard Duty doors: 1780 Newton force] [Heavy Duty doors: 2110 Newton force] [Extra Heavy Duty doors: 2440 Newton force] when tested for direct screw withdrawal in accordance with JIS A 1530. Do not use a steel plate to reinforce screw area.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Before installation, seal top and bottom edges of doors with the approved water-resistant sealer. Seal cuts made on the job immediately after cutting using approved water-resistant sealer. Fit, trim, and hang doors with manufacturer required maximum clearance at sides and top, and a clearance over thresholds per manufacturer recommendation. Provide 10 mm minimum, 11 mm maximum clearance at bottom where no threshold occurs. Bevel edges of doors at the rate of 3 mm in 50 mm. Door warp must not exceed 6 mm when measured in accordance with MLIT-SS Ch 16, Sec 7.

3.1.1 Fire[and Smoke] Doors

Install fire doors in accordance with NFPA 80. [Install smoke doors in accordance with NFPA 105.]Do not paint over labels.

3.1.2 Prehung Doors

Install doors in accordance with the manufacturer's instructions and details. Provide fasteners for [stops] [and] [casing trim] within 75 mm of each end and spaced 279 mm on center maximum. Provide side and head jambs joined together with a dado or notch of 5 mm minimum depth.

[3.1.3 Weatherstripping

Install doors in strict accordance with the door manufacturer's printed installation instructions and details. Weatherstrip exterior swing-type doors at sills, heads and jambs to provide weathertight installation. Apply weatherstripping at sills to bottom rails of doors and hold in place with a brass or bronze plate. Apply weatherstripping to door frames at jambs and head. Shape weatherstripping at sills to suit the threshold. [Meeting stiles of exterior double-doors must be made weathertight by means of [a looped vinyl or neoprene strip in an extruded nonferrous metal housing applied to the edge of one door leaf] [a neoprene, vinyl or spring-bronze weatherstripped astragal secured to the inactive door leaf].]

] -- End of Section --

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SECTION 08 31 00

ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A666	(2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E119	(2020) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E413	(2016) Classification for Rating Sound Insulation
ASTM E1332	(2016) Standard Classification for Rating Outdoor-Indoor Sound Attenuation

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 4702	(2021) Doorsets
JIS G 3136	(2008) Rolled Steels for Building Structure

JIS G 4305	(2008) Cold-rolled Stainless Steel Plate, Sheet and Strip

MASTER PAINTERS INSTITUTE (MPI)

MPI 79	(2016) Primer, Alkyd, Anti-Corrosive for Metal

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
NFPA 252	(2022) Standard Methods of Fire Tests of Door Assemblies
NFPA 288	(2017) Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal Fire Resistance-Rated Assemblies

UNDERWRITERS LABORATORIES (UL)

UL 10B	(2008; Reprint May 2020) Fire Tests of Door Assemblies
UL 263	(2011; Reprint Aug 2021) UL Standard for Safety Fire Tests of Building Construction and Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Access Doors And Panels; G[, [_____]]

SD-03 Product Data

Access Doors And Panels; G[, [_____]]

Hardware Including Locks and Keys; G[, [_____]]

Accessories; G[, [_____]]

[Power Transfer Components; G[, [_____]]

] Recycled Content; S

SD-04 Samples

Finishes; G[, [_____]]

[SD-06 Test Reports

Fire-rating(s) of Assemblies; G[, [_____]]

Acoustical Ratings of Assemblies; G[, [_____]]

]1.3 MISCELLANEOUS REQUIREMENTS

For access doors and panels provide the following:

1.3.1 Shop Drawings

For field assembled access doors and panels, provide plans, elevations, sections, and details for each type of access door and panel assembly. Indicate frame, surface and edge construction, materials, and accessories. Indicate types of finished surfaces and details for panel edge conditions. Provide a door schedule with a unique number for each access door and panel, specific location in the project, location of hinges and hardware for each door.[Indicate [acoustical ratings of assemblies as sound transmission class (STC) ratings][,][and][fire-rating(s) of assemblies][and][locations and power transfer components for electrified locks and alarms].]

1.3.2 Product Data

For shop assembled access doors and panels, provide literature indicating sizes, types, frame and edge construction, finishes, hardware, accessories such as gaskets, seals and weatherstripping, and location of each door and panel in the project. Indicate[acoustical ratings of assemblies,][fire-ratings of assemblies,][and][locations and power transfer components for electrified locks and alarms.]. Provide details of adjoining work for each condition indicated.

1.3.3 Finish Samples

Submit two color charts from manufacturer's standard color and finish options for each type of frame and panel assembly finish indicated.

[1.3.4 Test Reports

[Provide test reports for acoustical assemblies when tested in accordance with ASTM E90 and classified in accordance with ASTM E413 and ASTM E1332.][Provide test reports for fire-rated assemblies when tested in accordance with NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically and NFPA 288 for fire-rated access door assemblies installed horizontally.]

]1.4 PERFORMANCE REQUIREMENTS

1.4.1 Structural Requirements

Provide floor access assemblies to support live loads indicated for floors. Deflection must not exceed 1/180 of span.

[1.4.2 Acoustical Requirements

Provide access panels with a minimum sound transmission class (STC) of [_____][as indicated on the Drawings]. Provide gasketing in accordance

with manufacturer's written recommendations.

][1.4.3 Fire-Rating Requirements

Provide access panels with a minimum fire-rating of [[_____]-Hour][as indicated on the Drawings].

][1.4.4 Insulated Access Panels

Provide panels in a thickness as necessary to achieve a minimum R-value of [_____][as indicated on the Drawings]. Provide gasketing as necessary for an airtight installation.

][1.4.5 Access Panels for Wet Areas

Provide panel assemblies that will be located in wet areas with corrosion resistant finishes and hardware and water resistant gasketing.

]1.5 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 RECYCLED CONTENT

Provide products with recycled content. Provide data for each product with recycled content, identifying percentage of recycled content.

2.2 MATERIALS

2.2.1 Steel Plates, Shapes, and Bars

Provide in accordance with ASTM A36/A36M or JIS A 4702.

2.2.2 Sheet Steel

Provide cold rolled steel sheet substrate in accordance with ASTM A1008/A1008M or JIS G 3136, Commercial Steel (CS), exposed.

2.2.3 Stainless Steel

Provide in accordance with ASTM A666 or JIS G 4305, type 302 or 304.

2.2.4 Metallic Coated Steel Sheet

Provide in accordance with ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.2.5 Hardware

Provide automatic closing devices. Provide latch releases operable from insides of doors.[Provide anchors in accordance with applicable fire test parameters.]

2.2.6 Hinges

Provide concealed spring hinges, 175 degrees of opening, with [non-]removable hinge pins[to allow removal of door panel from frame]. Provide hinges of same steel as door and frame or in accordance with manufacturer's written recommendations. If providing non-continuous hinges, provide in numbers required to maintain alignment of door panel with frame. Provide coatings as necessary to permanently protect dissimilar metals from contact with one another; see Part 3 herein for more information.

2.2.7 Locks

Unless otherwise indicated, provide flush [screwdriver operated cam lock. Provide plastic sleeve or stainless steel bushings to protect holes in surface finishes for screwdriver to access lock.][keyed lock][tamper proof screws (spanner head locks) for access panels in locations requiring such security.][Lock cylinders are specified in Section 08 71 00 DOOR HARDWARE.]

2.2.8 Accessories

Provide anchors in size, number and location on four sides to secure access door to substrate. Provide anchors in types as recommended by manufacturer's written installation instructions for each substrate indicated. Provide shims, bushings, clips, gaskets, and other devices as necessary for a complete installation.

2.3 FABRICATION

2.3.1 Thickness, Size, Edges

Fabricate frames for access doors of steel not lighter than 16 gage with welded joints and anchorage for securing to adjacent construction. Provide doors a minimum of 600 by 600 mm and of not lighter than 16 gage steel, with stiffened edges and welded attachments. Provide with eased (lightly rounded) edges, without burrs, snags or sharpness and exposed welds ground smooth.

2.3.2 Welding

Provide in accordance with AWS D1.1/D1.1M.

2.4 ACCESS ASSEMBLY TYPES

Unless indicated otherwise, provide flush-face steel access doors and panels with steel frames and flanges.

[2.4.1 Recessed Doors

Provide recessed access doors[with gypsum wallboard bead flanges]. Depth of door panel recess must accommodate the installed thickness of the finish material of the wall assembly for a flush finished condition of the wall and the access panel face. Reinforce panel and frame to prevent sagging.

][2.4.2 Fire-rated Doors

2.4.2.1 Door Construction

Provide ceiling access door construction in accordance with ASTM E119 or UL 263. Provide wall access doors in accordance with NFPA 252 or UL 10B.

2.4.2.2 Labels

Provide class B opening according to UL 10B or test by another nationally recognized laboratory, approved by the Contracting Officer. Provide fire-rating as indicated herein, with a maximum temperature rise of 120 degrees C.

2.4.2.3 Door Panel and Frame

[Steel][Stainless steel] sheet, with mineral fiber insulation core, insulated sandwich type construction.

][2.4.3 Acoustical Doors

Manufacturer's standard assembly rated in accordance with STC requirements indicated herein. Acoustical insulating materials must have a flame spread rating of no more than 25.

][2.4.4 Insulated Doors

Provide access door panels with [172 kPa density polystyrene][80 kg per cubic meter density, chlorofluorocarbon (CFC) free, foamed urethane] with a flame spread rating of no more than 25.

[Provide ceiling access panels for terminal air blenders as indicated. Provide pin-tumbler cylinder locks with appropriate cams in lieu of screwdriver-operated latches.]

]2.5 FINISHES

[Provide steel frames and panel surfaces with a [baked enamel][powder coated finish.]Provide manufacturer's standard two coat finish system consisting of one coat primer and one thermoset topcoat. Provide dry film thickness in 0.05 mm minimum.][Provide steel frame and panel surfaces with a shop applied prime coat. [Field paint frames and panels to match wall and ceiling surfaces in which they occur.]][Provide stainless steel frames and panels.][Provide brushed aluminum frames and panels.] Provide exposed fastenings that approximately match the color and finish of the each material to which fastenings are applied.

PART 3 EXECUTION

3.1 PREPARATION

Field verify all measurements prior to fabrication. Verify access door locations and sizes provide required maintenance access to installed building services components. Protect existing construction and completed work from damage during installation.

3.2 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, in accordance with manufacturer's

written instructions. Include materials and parts as necessary for a complete installation of each item. Conceal fastenings where practicable. Poor matching of holes to fasteners is cause for rejection of the work.

3.3 ACCESS LOCATIONS

Install removable access panels directly below each valve, flow indicator, damper, air splitter or other utility requiring access that is located above ceilings, other than at acoustical panel ceilings, and that would otherwise not be accessible. Install access doors and panels permitting access to service valves, traps, dampers, cleanouts, and other mechanical, electrical and conveyor control items concealed in walls and partitions.

3.4 ACCESS LOCATIONS IN WET AREAS

When possible, avoid locating access panels in wet areas. When such locations cannot be avoided, provide moisture resistant assemblies as indicated in Part I herein.

[3.5 RECESSED ACCESS DOORS

Install fire-rated access doors in fire-rated partitions and ceilings in accordance with NFPA 80.

]3.6 FIELD PAINTING

Field painting primed access doors in accordance with the requirements of Section 09 90 00 PAINTS AND COATINGS.

3.7 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, protect surfaces with a coating in accordance with MPI 79 to prevent galvanic or corrosive action.

3.8 ADJUSTMENT

Adjust hardware so that door panel opens freely. Adjust door when closed center door panel in frame.

3.9 ENVIRONMENTAL CONDITIONS

Do not paint surfaces when damp or exposed to weather, when surface temperature is below 7 degrees C or over 35 degrees C, unless approved by the Contracting Officer.

-- End of Section --

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SECTION 08 32 13

ALUMINUM SLIDING GLASS DOORS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA/WDMA/CSA 101/I.S.2/A440	(2011; Update 1 2014) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

ASTM INTERNATIONAL (ASTM)

ASTM F842	(2017) Standard Test Methods for Measuring the Forced Entry Resistance of Sliding Door Assemblies, Excluding Glazing Impact

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1514	(2015) Test Method of Dew Condensation for Windows and Doorsets
JIS H 4040	(2015) Aluminum and Aluminum Alloy Bars and Wires
JIS A 4702	(2015) Doorsets
JIS H 8601	(1999) Anodic Oxide Coatings on Aluminum and Aluminum Alloys
JIS R 3222	(2003) Heat-Strengthened Glass

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT SS Chapter 16	(2019) Building Construction Standard Specifications - Chapter 16 Opening Construction

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Aluminum sliding glass doors

SD-10 Operation and Maintenance Data

Aluminum sliding glass doors, Data Package 1; ; G[, [_____]]

1.2.1 Shop Drawing Information

Submit drawings for aluminum sliding glass doors[, screens,] and accessories that indicate elevations of each door type, full size sections, thickness, nominal gages of metal, fastenings, proposed method of installation and anchoring, the size and spacing and method of glazing, details of operating hardware, method and material for weatherstripping, type of finish, and screen details.

1.2.2 Samples Information

Submit color chart of factory color coatings when factory-finished color coating is to be provided.

1.3 TEMPORARY PROTECTIVE COVERING

Prior to shipment from the factory, finished surfaces of aluminum sliding glass doors shall receive a protective covering of waterproof tape, strippable plastic, or cardboard to protect against discoloration and surface damage that may occur during transportation, storage, and construction activities. Also, no coatings or lacquers shall be applied to surfaces to which caulking and glazing compounds must adhere. Covering shall be readily removable after installation.

1.4 DELIVERY AND STORAGE

Inspect aluminum sliding glass doors, [including screens,] hardware and accessories, for damage and unload and store doors upright on platforms in accessible spaces with a minimum of handling. The storage spaces must be dry, adequately ventilated, free from heavy dust and not subject to combustion products, sources of water or other conditions that could damage the door. Storage spaces must have easy access for inspection and handling of doors.

1.5 EXTRA STOCK

[Deliver an extra stock of markings for glass panels to the Government for use in future replacement of original markings. The extra stock shall be of the same designs, colors, and materials as the markings installed on this project. Furnish markings in original containers or packages in a quantity not less than [_____] percent of the amount of markings to be installed.]

PART 2 PRODUCTS

2.1 ALUMINUM SLIDING GLASS DOORS

Provide aluminum sliding glass doors with sliding panels and fixed panels in the sizes and arrangements indicated and conforming [except frame must be equipped with thermal barrier]. [Mark panels identically and permanently to visibly interrupt the span of glass. Use markings [of the

design and color indicated] [approximately 2500 square millimeters] of opaque, pressure-sensitive vinyl film with precoated adhesive.] Sliding door glazing must be set in aluminum frames and roller assemblies of sufficient strength to withstand lateral live stresses and static load or weight requirements.

2.1.1 Hardware

Sliding door panel must have a manually operated adjustable latch [operable by latch handle or slide bar from inside only] [operable by a five-pin tumbler cylinder lock on outside and thumb-turn on the inside] [operable by a five-pin tumbler cylinder lock from either side]. Fit sliding screen door panel with a self-latching hook or rotary-type latch operable from [inside only] [both sides]. [Provide pulls for both inside and outside of sliding panel and the sliding screen panel]. [Provide a pull on the inside of the sliding door panel and the sliding screen panel only]. [Provide auxiliary pin lock [bottom] [top and bottom] on inner side of sliding glass door panel opposite manually operated adjustable latch.] Exposed hardware is to be aluminum or stainless steel, color finished to match door color finish.

2.1.2 Glazing

Factory glazed sliding glass doors, including fixed panel, with [double-glazed] glass conforming to JIS R 3222 not less than [6] [_____] mm thick. [Double glazing must have a minimum condensation resistance factor of [_____] in accordance with JIS A 1514.] Glazing material must be certified by independent testing agency. Set glazing unit in polyvinyl-chloride or synthetic rubber glazing channels. Channels must be reusable when replacing glass and have mitered or continuous corners. Channels exposed to view must blend in color with the aluminum frame finish.

2.1.3 Weatherstripping

Provide four sides of each sliding panel and interlocking stiles and jambs with weatherstripping. Weatherstripping must conform to JIS A 4702 and must provide maximum protection against the elements and be designed for ease of replacement.

2.1.4 Screens

Provide horizontal sliding aluminum screens in combination with aluminum sliding glass doors. Provide screen frames shall consist of aluminum shapes of size and design standard with the door manufacturer. Frames must have removable splines of aluminum or vinyl and must permit screening fabric replacement. Screening shall be [18 by 16 mesh aluminum conforming to JIS H 4040,] [_____ color] [selected color to match doors]. Install screening with weave parallel with frames and sufficiently tight to present a smooth appearance. Conceal edges of screening in the spline channel. Screens must be complete with rollers, hardware, and accessories and must slide on or within tracks provided in the door frame members. Design and assemble doors so that aluminum-to-aluminum contact of moving members will not occur. Provide insect-proofing, formed of wool pile or other suitable material, at interlocking stiles and jambs. Finish on screen frames must be as specified for doors.

2.1.5 Finish

Before fabrication, clean sliding glass door units and give a [clear (natural) anodized finish] [_____] (color) anodized finish in accordance with the requirements of the JIS H 8601. The finish thickness must be [0.01 mm or greater.] [0.0175 mm or greater.]

2.2 CAULKING AND SEALING

As specified under Section 07 92 00 JOINT SEALANTS.

2.3 FORCED ENTRY RESISTANT DOORS (U.S. PRODUCT ONLY)

In addition to meeting AAMA/WDMA/CSA 101/I.S.2/A440, doors designated forced entry resistant must conform to ASTM F842.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Doors, Frames, and Accessories

Install doors, frames, framing members, hardware, and accessories in accordance with approved shop drawings and the requirements specified herein. Set frames securely anchored in place to straight, plumb, square, level condition without distortion and in alignment. Install door panels to retain proper weathering contact with frames. Caulk metal-to-metal joints between frame members and remove excess material. Caulking around perimeter of door frame and wall openings to provide weathertight installation must be accomplished in accordance with MLIT SS Chapter 16 and manufacturer's recommendations. Finished work shall be rigid, neat in appearance, and free from defects. Upon completion, adjust sliding doors to operate properly. Thoroughly clean aluminum frames and glass in accordance with manufacturer's recommendation. Doors damaged prior to completion and acceptance must be restored to original manufactured condition or replaced with new doors as directed.

3.1.2 Protection of Aluminum from Dissimilar Materials

3.1.2.1 Aluminum to Dissimilar Metals

Prevent aluminum surfaces from contacting dissimilar metals other than stainless steel, zinc, or white bronze by one or a combination of the following:

a. Paint dissimilar metal with one coat of heavy-bodied bituminous paint.

b. Apply caulking between aluminum and dissimilar metal.

c. Paint dissimilar metal with primer, followed by one coat of aluminum paint or other suitable lead-free coating.

d. Use nonabsorptive tape or gasket in permanently dry locations.

3.1.2.2 Drainage from Dissimilar Metals

Paint dissimilar metals located in areas where their drainage washes over aluminum to prevent the staining of aluminum.

3.1.2.3 Aluminum to Masonry and Concrete

Prevent aluminum surfaces from coming into contact with mortar, concrete, or other masonry materials by applying one coat of heavy-bodied bituminous paint to the aluminum surfaces.

3.1.2.4 Aluminum to Wood

Prevent aluminum surfaces from coming into contact with wood, treated wood, or similarly absorptive materials by one or a combination of the following methods:

a. Paint aluminum surfaces with two coats of aluminum paint or one coat of heavy-bodied bituminous paint.

b. Paint the wood, treated wood, or other absorptive surfaces with two coats of aluminum paint and seal contiguous joints with caulking compound.

-- End of Section --

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SECTION 08 51 13

ALUMINUM WINDOWS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E1886	(2013a) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996	(2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1514	(2015) Test Method of Dew Condensation for Windows and Doorsets
JIS A 1516	(1998) Windows and Doorsets - Air Permeability Test
JIS A 1517	(1996) Windows and Doorsets-Watertightness Test Under Dynamic
JIS A 4706	(2015) Windows
JIS A 4709	(2018) Screens for windows
JIS B 1220	(2015) Set of Anchor Bolt for Structures
JIS B 1051	(2014) Coarse And Fine Screws Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel Bolts, Screws and Studs with Specified Property Classes-Coarse Thread and Fine Pitch Thread
JIS H 8601	(1999) Anodic Oxide Coatings on Aluminum and Aluminum Alloys
JIS K 5906	(1998) Aluminum Pigments For Paints

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT SS Chapter 16 (2019) Building Construction Standard Specifications - Chapter 16 Opening Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2018; TIA 18-1; TIA 18-2; TIA 18-3) Life Safety Code

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 4-020-01 (2008) DoD Security Engineering Facilities Planning Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Windows; G[, [_____]]

Fabrication Drawings

SD-06 Test Reports

[Windborne-Debris-Impact Performance

] SD-10 Operation and Maintenance Data

Windows, Data Package 1; G[, [_____]]

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.3 QUALITY ASSURANCE

1.3.1 Qualification of Manufacturer

Window manufacturer must specialize in designing and manufacturing the type of aluminum windows specified in this section, and have a minimum of 5 years of documented successful experience. Manufacturer must have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.3.2 Shop Drawing Requirements

Take field measurements prior to preparation of drawings and fabrications. Provide drawings that indicate elevations of windows,

full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, [mullion details,] [method and materials for weatherstripping,] [method of attaching screens,] [material and method of attaching subframes,] [stools,] [casings,] [sills,] [trim,] [window cleaner anchors,] installation details, and other related items.

[1.3.3 Engineer's Qualifications for Blast Design

All blast design calculations must be performed by or under the direct supervision of a registered engineer with a minimum of 5 years experience performing blast design. The engineer performing the blast design must be able to demonstrate experience on similar size projects using similar design methods to meet the requirements outlined in this specification.

]1.3.4 Sample Requirements

1.3.4.1 Finish Sample Requirements

Submit color chart of standard factory color coatings when factory-finish color coating is to be provided.

1.3.4.2 Window Sample Requirements

[Submit one full-size corner of each window type proposed for use. Where screens or weatherstripping is required, fit sample with such items that are to be used, only required for large scale projects with numerous windows.

]1.3.5 Design Data Requirements

Submit calculations to substantiate compliance with deflection requirements[and Antiterrorism Performance Requirements]. A registered Professional Engineer must provide calculations.

Calculations verifying the structural performance of each window proposed for use, under the given loads, must be prepared and signed by a registered professional engineer. Reflect the window components and anchorage devices to the structure, as determined by the design analysis, in the shop drawings.

1.3.6 Test Report Requirements

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein by independent testing agency including test size, [and] minimum condensation resistance factor (CRF)[, and resistance to forced entry].

1.3.7 Certification

Ensure that construction is performed with products that meet or exceed JIS A 4706 requirement.

Each prime window unit must demonstrate that the product complies with JIS A 4706. Certified test reports attesting that the prime window units meet the requirements of JIS A 4706, including test size, will be acceptable in lieu of product labeling.

1.4 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Repair damaged windows to an "as new" condition as approved. If windows can not be repaired, provide a new unit.

1.5 PERFORMANCE REQUIREMENTS

1.5.1 Wind Loading Design Pressure

Design window components, including mullions, hardware, and anchors, to withstand a wind-loading design pressure of at least [_____] pascal.

[1.5.2 Tests

Perform tests by a nationally recognized independent testing laboratory equipped and capable of performing the required tests. Submit the results of the tests as certified laboratory reports required herein. For Japanese manufactured windows, provide structural calculations to prove compliance.

Minimum design load for a uniform-load structural test must be 2400 pascal.

[Test projected windows in accordance with the applicable portions of the JIS A 1516 for air infiltration, water resistance, uniform-load deflection, and uniform-load structural test.

][Test double-hung windows in accordance with the applicable portions of the JIS A 1516 for air infiltration, water resistance, uniform-load deflection, and uniform-load structural test.

]]## 1.6 DRAWINGS

Submit the Fabrication Drawings for aluminum window units showing complete window assembly including hardware, weatherstripping, and subframe assembly details.

1.7 WINDOW PERFORMANCE

Aluminum windows must meet the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

1.7.1 Structural Performance

Structural test pressures on window units must be for positive load (inward) and negative load (outward). After testing, there will be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There must be no permanent deformation of any main frame, sash or ventilator member for the window types and classification specified in this section.

1.7.2 Air Infiltration

Air infiltration must not exceed the amount established by JIS A 1516 for each window type.

1.7.3 Water Penetration

Water penetration must not exceed the amount established by JIS A 1517 for each window type.

1.7.4 Thermal Performance

Windows shall meet specified Solar Heat Gain Coefficient (SHGC) and Visual Transmittance (VT) or greater.

[1.7.4.1 Southern Climate

Windows installed in Climate Zone [1] [2] will have a U-Factor of [1.3] [1.25] [_____] $W/m^{2\cdot}°C$ or less and a SHGC of [0.25] [_____] or less.

][1.7.4.2 South-Central Climate

Windows installed within Climate Zone 3 will have a U-Factor of [0.85] [1.25] [_____] $W/m^{2\cdot}°C$ or less and a SHGC of [0.25] [_____] or less.

][1.7.4.3 North-Central Climate

Windows installed within Climate Zone 4 will have a U-Factor of [0.85] [1.25] [_____] $W/m^{2\cdot}°C$ or less and a SHGC of [0.36] [_____] or less.

][1.7.4.4 Northern Climate

Windows installed within Climate Zone [5] [6] [7] will have a U-Factor of [0.65] [1.25][_____] $W/m^{2\cdot}°C$ or less and a SHGC of [0.36] [0.41] [_____] or less.

][1.7.4.5 Subarctic Climate

Windows installed within Climate Zone 8 will have a U-Factor of [0.45] [1.25] [_____] $W/m^{2\cdot}°C$ or less. There is no SHGC limit for this climate zone.

][1.7.5 Life Safety Criteria

Provide windows that conform to NFPA 101 Life Safety Code when rescue and/or second means of escape are indicated.

][1.7.6 Sound Attenuation

Provide window with sound attenuation with the window glazed with 13 mm air space between two pieces of 6 mm. Provide documentation to support transmission loss properties.

][1.7.7 Windborne-Debris-Impact Performance

Exterior window system including glazing must comply with indicated basis or enhanced protection testing requirements in ASTM E1996 for [Wind Zone 1] [Wind Zone 2] [Wind Zone 3] [Wind Zone 4] when tested according to ASTM E1886. Test specimens must be no smaller in width and length than glazing indicated for use on Project and must be installed in same manner as glazing indicated for use on Project.

a. Refer to drawings for classification of window requiring basic or enhanced protection.

[b. Large-Missile Test: For glazing located within 9.1 m of grade.

][c. Small-Missile Test: For glazing located more than 9.1 m above grade.

]]1.8 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 WINDOWS

Provide prime windows that comply with MLIT SS Chapter 16, JIS A 4706 and the requirements specified herein. In addition to compliance with JIS A 4706, window framing members for each individual light of glass must not deflect to the extent that deflection perpendicular to the glass light exceeds L/175 of the glass edge length when subjected to uniform loads at specified design pressures. Provide Structural calculations for deflection to substantiate compliance with deflection requirements. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. Design windows to accommodate hardware, glass, weatherstripping, screens, and accessories to be furnished. Each window must be a complete factory assembled unit with or without glass installed. Dimensions shown are minimum. Provide windows with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of [_____] when tested in accordance with JIS A 1514. Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with JIS B 1051, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

2.1.1 Awning Windows (AP)

Type AP-[R15] [LC25] [CW30] [AW40] [[R] [LC] [CW] [AW]- [_____] (Optional Performance Grade)]. Conceal operating mechanism within the frame members or enclose within a metal casing not less than 1.59 mm thick sheet aluminum.

2.1.2 Horizontal Sliding Windows (HS)

Type HS-[R15] [LC25] [CW30] [AW40] [[R] [LC] [CW] [AW]- [_____] (Optional Performance Grade)].

2.1.3 Fixed Windows (F)

Type F-[R15] [LC25] [CW30] [AW40] [[R] [LC] [CW] [AW]- [_____] (Optional Performance Grade)].

2.1.4 Forced Entry Resistant Windows

In addition to meeting the requirements of JIS A 4706, windows designated for resistance to forced entry must conform to the requirements per UFC 4-020-01 as applicable.

2.1.5 Glass and Glazing

Materials are specified in Section 08 81 00 GLAZING.

2.1.6 Caulking and Sealing

Are specified in Section 07 92 00 JOINT SEALANTS.

2.1.7 Weatherstripping

JIS A 4706. Provide for all ventilating (operable) sash for all windows. Provide woven wool pile weatherstripping 5.3 millimeter thick, or polypropylene multifilament fiber weatherstripping installed in an integral weatherstripping groove in the sash or frame, and flexible polyvinylchloride weatherstripping installed in the sill member.

2.1.8 Sash Poles

Seamless aluminum tube, 1.59 mm minimum wall thickness, 25 mm diameter, [_____] m long, with cast aluminum hook and protective cover or tip on the lower end. Finish must match windows.

2.2 FABRICATION

Fabrication of window units must comply with JIS A 4706.

2.2.1 Fasteners

Use window manufacturer's standard for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 2 mm thick.

2.2.2 Adhesives

Provide joint sealants as specified in Section 07 92 00 JOINT SEALANTS. For interior application of joint sealants, comply with applicable regulations regarding reduced VOC's, and as specified in Section 07 92 00 JOINT SEALANTS.

2.2.3 Drips and Weep Holes

Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, drips must be continuous across tops of fixed windows. Provide drips and weep holes as required to return water to the outside.

2.2.4 Combination Windows

Windows used in combination must be factory assembled of the same class and grade. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

2.2.5 Mullions and Transom Bars

[Provide mullions between multiple window units to resist two times (2X) glazing resistance in accordance with impact force: [_____ kpa].]Provide mullions with a thermal break. Secure mullions and transom bars to

adjoining construction and window units in such a manner as to permit expansion and contraction and to form a weathertight joint.[Where window cleaner anchors are required, reinforce mullions and anchor to adjoining construction so as to provide safe and adequate support.] Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance.[Provide special covers over structural support at mullions as indicated.]

2.2.6 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation.[Furnish extruded aluminum subframe receptors[and subsill] with each window unit.]

2.2.6.1 Hardware

The item, type, and functional characteristics must be the manufacturer's standard for the particular window type. Provide [stainless steel]hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

2.2.6.2 Fasteners

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners must be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 150 mm from each end and at midpoint.

2.2.6.3 Window-Cleaner Anchors

Provide double head anchors for windows[indicated][specified]. Anchors must be stainless steel of size and design required for the window type and application, conforming to JIS B 1220. Provide two anchors for each single window[and each adjacent fixed glass window unit]. Fasten anchors 1120 mm above the window sill utilizing appropriate methods for the window type and application in accordance with industry safety standards.

2.2.6.4 Window Anchors

Anchoring devices for installing windows must be made of aluminum or stainless steel, or zinc-plated steel conforming to JIS B 1220.

2.2.7 Finishes

Comply with JIS H 8601 for applying and designating finishes. Exposed aluminum surfaces must be factory finished with an[anodic coating][or][organic coating].[Color must be [_____][as indicated].] All windows[for each building] must have the same finish.

2.2.7.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to JIS H 8601. Finish shall be selected from JIS standard.

2.2.7.2 Organic Coating

Clean and prime exposed aluminum surfaces. Provide a[baked enamel finish in accordance with JIS K 5906 with total dry film thickness not less than 0.02 mm]

2.2.8 Screens

Provide one insect screen for each operable exterior sash or ventilator. Design screens to be rewirable, easily removable from inside the building, and to permit easy access to operating hardware. Manufacturers standard aluminum frame complying with JIS A 4709. Fabricate frames with mitered or coped joints or corner extrusion, concealed fasteners and removable PVC spline/anchors concealing edge of frame.

2.2.8.1 Insect Screen

Insect screen mesh to be[glass-fiber mesh, 18x16 of PVC-coated glass-fiber threads; woven and fused to form a fabric mesh in accordance with] [aluminum wire fabric, 18x16 mesh of 0.2794 mm diameter coated aluminum wire].

2.3 SPECIAL OPERATORS

For windows having operating hardware or locking or latching devices located more than 1800 mm above the floor, provide suitably designed operators or locking or latching devices necessary for convenient and proper window operation.

2.3.1 Pole Operators

Poles must be of proper length to permit window operation from 1500 mm above the floor. Provide one pole operator for each room, and one pole hanger for each pole. Locate hangers where directed.

2.3.2 Extension Crank Operators

Provide removable handles for crank-operated rotary-type operators located more than 1800 mm above the floor. Provide one removable handle for each room.

2.3.3 Mechanical Operators

Provide [manual] [electric motor driven] operators for group operation of continuous rows of windows [located [_____] mm above the floor]. Operators must be capable of opening and closing windows without appreciable deflection, vibration or rattle. Provide means of adjustment for transmission lines. Provide operators to control window units in groups [as recommended by the window manufacturer] [or] [as indicated].

2.4 THERMAL-BARRIER WINDOWS

Provide thermal-barrier windows, complete with accessories and fittings, where indicated.

Specify material and construction except as follows:

a. Aluminum alloy must be 6063-T6.

b. Frame construction, including operable sash, must be factory-assembled and factory-sealed inner and outer aluminum completely separated from metal-to-metal contact. Join assembly by a continuous, concealed, low conductance divider housed in an interlocking extrusion of the inner frame. Metal fasteners, straps, or anchors must not bridge the connection between the inner and outer frame.

c. Operating hardware for each sash must consist of spring-loaded nylon cushion blocks and pin locks designed to lock in predetermined locations.

d. Sash must be completely separated from metal-to-metal contact by means of woven-pile weatherstripping, plastic, or elastomeric separation members.

e. Operating and storm sash must be factory-glazed with the type of glass indicated and of the quality specified in Section 08 81 00 GLAZING.

2.5 MULLIONS

Provide mullions between multiple-window units where indicated.

Provide profiles for mullions and mullion covers, reinforced as required for the specified wind loading, and securely anchored to the adjoining construction. Mullion extrusion will include serrations or pockets to receive weatherstripping, sealant, or tape at the point of contact with each window flange.

Mullion assembly must include aluminum window clamps or brackets screwed or bolted to the mullion and the mullion cover.

Mullion cover must be screw-fastened to the mullion unless otherwise indicated.

Mullion reinforcing members must be fabricated of the materials specified and meet the specified design loading.

2.6 WINDOW CLEANERS' BOLTS

Provide window cleaners' bolts for all windows 2100 millimeter or higher above finished grade, except for windows that can be removed and cleaned from the ground or from a lower roof level without the use of an extension ladder. Provide two bolts for each single window unit and each fixed glass unit. Locate bolts 1120 millimeter above the window sill.

Window cleaners' bolts must be double-head type, corrosion-resistant steel, size and design per manufacturer. Contact side of the bolts must be ground to fit flat against window jambs. Bolts must be factory- or field-attached before windows are set. Reinforce backs of frames to receive bolts with 6 by 150 millimeter corrosion-resistant steel or aluminum plates bolted or welded to the frames at the factory. Special wall anchors must be provided on frames at the point of bolt attachment.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install and caulk windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in place.

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, protect the aluminum surface from dissimilar materials. Do not coat surfaces in contact with sealants after installation with any type of protective material. Do not apply coatings or lacquers to surfaces to which caulking and glazing components must adhere.

3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls must have head and jamb members designed to recess into masonry wall not less than 11 mm.

3.1.4 Adjustments After Installation

After installation of windows and completion of glazing and field painting, adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary. Verify that products are properly installed, connected, and adjusted.

3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

-- End of Section --

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SECTION 08 51 23

STEEL WINDOWS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA/WDMA/CSA 101/I.S.2/A440	(2017) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.6.3	(2013; R 2017) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM D3656/D3656M	(2013) Standard Specification for Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E330/E330M	(2014; R 2021) Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

ASTM E331	(2000; R 2016) Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E1300	(2016) Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM E1886	(2019) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E1996	(2017) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes
ASTM F1642/F1642M	(2017) Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings
ASTM F2248	(2012) Standard Practice for Specifying an Equivalent 3-Second Duration Design Loading for Blast Resistant Glazing Fabricated with Laminated Glass
ASTM F2912	(2017) Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS H 8641	(2021) Hot Dip Galvanized Coatings

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2020) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2020) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
NFPA 101	(2021) Life Safety Code

STEEL WINDOW INSTITUTE (SWI)

SWI SWS (2017; R 2018) Steel Window Specifications

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 4-010-01 (2018; with Change 1, 2020) DoD Minimum Antiterrorism Standards for Buildings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Windows

SD-03 Product Data

Steel Framing Materials

Recycled Content for Steel Framing Materials; S

Mullions

Hardware

Hardware Materials

Fasteners

Accessories

Operators

Screens

SD-04 Samples

Color Coating; G[, [_____]]

Windows

SD-05 Design Data

Structural Calculations for Deflection; G[, [_____]]

Design Analysis; G[, [_____]]

SD-06 Test Reports

Air Infiltration

Water Infiltration

Mullion and Transom Bar Wind Load

Minimum Condensation Resistance Factor

[Resistance to Forced Entry

][Standard Airblast Test; G[, [_____]]

][Windborne-Debris-Impact Performance

] SD-07 Certificates

[Engineer's Qualifications

] SD-10 Operation and Maintenance Data

Windows, Data Package 1; G[, [_____]]

1.3 QUALITY ASSURANCE

1.3.1 Shop Drawing Information

Indicate elevations of windows, full-size sections, thicknesses and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, [mullion details,] [method and materials for weatherstripping,] [method of attachment of screens,] [metal subframes,] [stools,] [casings,] [sills,] [trim,] other related items, and installation details.

1.3.2 Color Coating Samples Information

Submit chart of manufacturer's color coatings if factory finish is to be provided in lieu of field painting.

1.3.3 Windows Samples Information

Submit one complete, full size glazed window of each type proposed for use, complete with hardware, anchors, and other accessories.[Where screens or weatherstripping are required, fit sample windows with such items that are to be used.] After approval, install each sample in the work, clearly identified, with location recorded.

[1.3.4 Engineer's Qualifications for Blast Design

All blast design calculations must be performed by or under the direct supervision of a registered engineer with a minimum of 5 years experience performing blast design. The engineer performing the blast design must be able to demonstrate experience on similar size projects using similar design methods to meet the requirements outlined in this specification.

][1.3.5 Design Data Requirements

Submit structural calculations for deflection to substantiate compliance requirements[and Antiterrorism Performance Requirements]. A registered Professional Engineer must provide calculations. Submit design analysis with calculations showing that the design of each different size and type of steel window unit and its anchorage to the structure[.][meets the requirements of paragraph ANTITERRORISM PERFORMANCE REQUIREMENTS.]

Calculations verifying the structural performance of each window proposed for use, under the given loads, must be prepared and signed by a registered professional engineer. Reflect the window components and anchorage devices to the structure, as determined by the design analysis, in the shop drawings.

]1.4 TEST REPORT REQUIREMENTS

1.4.1 Air and Water Infiltration

ASTM E283 and ASTM E331. Do not exceed maximum air infiltration of 0.05 cubic meter per minute per meter of crack length when subjected to a static pressure of 75 Pa (equivalent to a wind velocity of 40 kilometers per hour (kph)). Water infiltration must be "zero."

1.4.2 Mullion and Transom Bar Wind Load Tests

ASTM E330/E330M. Members must withstand a uniform wind load of 958 Pa of window area without deflecting more than 1/175 of the span.

1.4.3 Blast Testing

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to AAMA/WDMA/CSA 101/I.S.2/A440 including test size, [and] minimum condensation resistance factor (CRF)[, and resistance to forced entry][, and, for Antiterrorism windows, in lieu of a Design Analysis, results of a Standard Airblast Test].[For Antiterrorism windows, in lieu of a Design Analysis, results of airblast testing, whether by arena test or shock tube, must be included in a test report, providing information in accordance with ASTM F1642/F1642M, as prepared by the independent testing agency performing the test. The test results must demonstrate the ability of each window proposed for use to withstand the airblast loading parameters and achieve the hazard level rating specified in paragraph STANDARD AIRBLAST TEST METHOD.]

1.5 WINDOW PERFORMANCE

Steel windows must meet the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

1.5.1 Structural Performance

Structural test pressures on window units must be for positive load (inward) and negative load (outward). After testing, there will be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There must be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA/WDMA/CSA 101/I.S.2/A440 for the window types and classification specified in this section.

1.5.2 Thermal Performance

Non-residential glazed systems (including frames and glass) must be certified by the National Fenestration Rating Council with a whole-window Solar Heat Gain Coefficient (SHGC) maximum of [_____] determined according to NFRC 200 procedures and a U-factor maximum of [_____] W per square m by K in accordance with NFRC 100.

[1.5.3 Windborne-Debris-Impact Performance

Exterior window system including glazing must comply with indicated basis or enhanced protection testing requirements in ASTM E1996 for [Wind Zone 1] [Wind Zone 2] [Wind Zone 3] [Wind Zone 4] when tested according to ASTM E1886. Test specimens must be no smaller in width and length than glazing indicated for use on Project and must be installed in same manner as glazing indicated for use on Project.

a. Refer to drawings for classification of window requiring basic or enhanced protection.

[b. Large-Missile Test: For glazing located within 9.1 m of grade.

][c. Small-Missile Test: For glazing located more than 9.1 m above grade.

]][1.5.4 Antiterrorism Performance Requirements

Windows must meet the antiterrorism performance criteria as specified in the paragraphs below in accordance with UFC 4-010-01. Conformance to the performance requirements must be validated by one of the following methods.

1.5.4.1 Computational Design Analysis Method

Design window assembly to the criteria listed herein. Include computational design analysis calculations verifying the structural performance of each window assembly proposed for use, under the given static equivalent loads.

Design window frames, mullions, sashes, and glazing to the criteria listed herein. Include computational design analysis calculations verifying the structural performance of each window system proposed for use, under the given static equivalent loads.

Glazing resistance must be greater than equivalent 3-second duration loading of [_____] Pascal pounds per square foot (psf) for type [_____] window[and [_____] Pascal psf for the remaining window types]. The glazing frame bite for the window frames must be in accordance with ASTM F2248.

Design Steel window framing members to restrict deflections of the edges of glazing they support to L/60 under two times (2X) the glazing resistance per the requirements of ASTM F2248 and ASTM E1300.

[Anchor window frames to the supporting structure with anchors designed to resist [two times (2X)][one time (1X)] the glazing resistance in accordance with ASTM F2248 and ASTM E1300.

]1.5.4.2 Dynamic Design Analysis Method

Design window assembly using a dynamic analysis to prove the system will provide performance equivalent to or better than a [low;] [very low;] [_____] hazard rating in accordance with ASTM F2912 for the peak positive pressure of [_____] kilopascals (kPa) and peak positive phase impulse of [_____] kilopascal-millisecond (kPa-msec). Use a triangular blast load using the applicable pressure and impulse indicated above. The allowable response limits of [aluminum] [steel] frame elements are as follows: Maximum ductility ratio of [_____] and maximum support rotation of [_____]

degrees.

1.5.4.3 Standard Airblast Test Method

As an alternative to the 'Computational Design Analysis Method' and 'Dynamic Design Analysis Method' indicated above, window [_____] assembly may be tested for evaluation of hazards generated from airblast loading in accordance with ASTM F1642/F1642M by an independent testing agency regularly engaged in blast testing. For proposed window systems that are of the same type as the tested system but of different size, the test results may be accepted provided the proposed window size is within the range from 25 percent smaller to 10 percent larger in area and aspect ratio of the original qualified tested glazing systems in accordance with ASTM F2912. Proposed window system/assembly of a size outside this range will require testing to evaluate their hazard rating or are certified by the 'Dynamic Design Analysis Method' indicated above. Testing may be by shock tube or arena test. Perform the test on the entire proposed window system/assembly, including, the glazing, its framing/support system, operating devices, and all anchorage devices. Window support system replicate anchorage of the window support system with the method of installation to be used for the project. The minimum airblast loading parameters for the test will be as follows: peak positive pressure of [_____] kilopascals (kPa) and peak positive phase impulse of [_____] kilopascal-millisecond (kPa-msec). The hazard rating for the proposed window systems, as determined by the rating criteria of ASTM F2912, to provide performance equivalent to or better than a [low;] [very low;] [_____] hazard rating (i.e. the "No Break", "No Hazard", "Minimal Hazard", "Very Low Hazard" and "Low Hazard" ratings are acceptable. "High Hazard" ratings are unacceptable. Results of window systems previously tested by test protocols other than ASTM F1642/F1642M may be accepted provided the required loading, hazard level rating, and size limitations stated herein are met.

]1.6 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

1.7 DELIVERY AND STORAGE

Deliver to project site in undamaged condition. Store windows and components on edge, out of contact with the ground, under weathertight covering, and arranged to avoid bending, warping, or other damage.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 General System Requirements

Steel framing materials must contain a minimum of 40 percent total recycled content. Provide data identifying percentage of recycled content for steel framing materials.

2.1.2 Steel Bars

SWI SWS.

2.1.3 Sheet Steel

ASTM A1011/A1011M.

2.1.4 Zinc-Coated Sheet Steel

ASTM A653/A653M or JIS G 3302.

2.1.5 Zinc Coating

ASTM A123/A123M or JIS H 8641.

2.1.6 Screws and Bolts

ASME B18.6.3 as applicable.

2.2 FABRICATION OF WINDOWS

Form permanent joints by welding or mechanically fastening as specified for each type window. Use joints of strength to maintain structural value of members connected. Weld joints solid, remove excess metal, and dress smooth on exposed and contact surfaces. Closely fit joints formed with mechanical fastenings and make permanently watertight. Assemble frames and sash, including ventilators and thermal breaks, at the plant and ship as a unit with hardware unattached. Provide the following construction:

a. Where fixed window sections adjoin ventilator sections, provide fixed sash, fabricated from similar frame members, and of manufacturer's standard type suitable for the purpose.

b. Roll weathering surfaces integrally to provide two-point parallel-surface contact with overlap at both inside and outside points of closure.

c. Provide drips and weep holes as required to return water to outside.

d. Design glazed windows and rabbets suitable for glass thickness shown on drawings [or specified].

e. Use flathead, cross recessed type, exposed head screws and bolts with standard threads on windows, trim and accessories. Screw heads must finish flush with adjoining surfaces. Self tapping sheet-metal screws are not acceptable.

f. For hot-dipped galvanized windows, use stainless steel or hot-spun galvanized steel fasteners. For windows with painted finish use electro-galvanized fasteners. Finish exposed heads to match finish of windows.

2.3 FIRE RATED WINDOWS

Provide sash and frame with necessary hardware to conform to the requirements of Underwriters Laboratories Inc. (UL), for class of window indicated. Submit proof of conformance. UL label will be accepted as proof. Labeled window details take precedence over details indicated or specified for nonlabeled windows, except when sections required for nonlabeled windows are heavier than those required by UL. In lieu of UL label, written certification by approved nationally recognized testing agency may be submitted. Certification must state that complete window

unit of type provided has been tested and conforms to published standards, including methods of tests, of UL.

2.4 PROVISIONS FOR GLAZING

Design sash for [inside] [outside] glazing and for securing glass with [metal beads] [glazing clips] and glazing compound.[Where insulating glass is indicated, use rabbets of adequate weight and depth to receive and properly support glass and glazing accessories.][For windows required to comply with antiterrorism provisions, design in accordance with Standard 10 of UFC 4-010-01.]

2.5 MULLIONS AND TRANSOM BARS

Provide mullions between multiple window units designed to withstand specified wind load requirements.[Provide mullions with a thermal break.] Secure mullions and transom bars to adjoining construction and window units in such a manner as to permit expansion and contraction and to form weathertight joint. Provide mullion covers of manufacturer's stock design on the interior and exterior to completely cover exposed joints and recesses between window units and for neat appearance.[Provide special covers over structural supports at mullions as indicated.]

2.6 METAL-TO-METAL JOINTS

Set in mastic, using type recommended by window manufacturer to provide weathertight joints. Remove excess mastic before it hardens.

2.7 ACCESSORIES

Provide windows with hardware, clips, fins, anchors, glazing beads, and fastenings, necessary for complete installation and operation of ventilators.

2.7.1 Anchors

Use hot-dip galvanized steel anchors. Secure anchors and fastenings to heads, jambs, and sills of openings, and fasten securely to windows or frames. Use anchors recommended by window manufacturer for specific type of construction and conceal. Anchor each frame at jambs with minimum of three adjustable steel anchors.[Provide perforated anchor stems for mortar keying with anchor flanges of sufficient width to provide sliding friction fit inside frames. Extend perforated stems not less than 100 mm into masonry.][For anchorage at concrete walls and prepared openings, equip frames with manufacturer's standard bent-clips located approximately 150 mm from each end and at midpoint.]

2.7.2 Weatherstripping

Provide on all operable windows so that, when tested before leaving factory, in accordance with ASTM E283, do not exceed a maximum air infiltration of 0.05 cubic meter per minute per meter of crack length when subjected to static pressure of 75 Pa equivalent to wind velocity of 40 kmh.

2.7.3 Hardware

Equip all operable sash with latching device which can be secured from inside. The item, type, and function of hardware required are specified under individual window type. Attach hardware securely to windows with

corrosion resisting bolts or machine screws; do not use sheet metal screws. At fixed screens, adapt hardware to permit operation of ventilators. Fit and test hardware for each window at factory to ensure satisfactory operation and security.

2.7.3.1 Hardware Materials and Finish

Provide[non-magnetic type stainless steel exposed hardware with satin finish][white bronze with satin finish hardware][yellow bronze with dull (oxidized) finish hardware]. Use galvanizedsteel or malleable iron hinges, with nonferrous pins, or with steel pins and non-ferrous bushings or washers.

2.7.4 Fasteners

Stainless steel or aluminum materials[; zinc-coated steel elsewhere as shown on Drawing Sheet No. [_____.]] Prime exposed heads of coated or plated fasteners and finish to match adjacent material.

2.7.5 Metal Sub-frames and Stools

Manufacturer's standard type designed to suit the particular window. Match exposed surfaces to windows.

2.8 GLASS AND GLAZING

Provide materials in accordance with Section 08 81 00 GLAZING.

2.9 WINDOW FINISH

2.9.1 Shop Primed Finish

After fabrication, clean all surfaces of windows, fins, mullions, cover plates, and screen frames and provide a hot-dip galvanized, phosphate-treated and shop primed finish. Conform to SWI SWS for the methods of cleaning, chemical treatment, galvanizing, and painting.

2.9.2 Factory Finish

In lieu of shop primed finish, factory finish may be provided using the following method, in which case finish field painting will not be required:

a. Chemically clean and bonderize windows. Apply dip coat of epoxy primer baked on for not less than 15 minutes at not less than 149 degrees C, followed by finish coat of alkyd-amine enamel of not less than 0.025 mm thickness, baked on for 15 minutes at not less than 149 degrees C.

b. Finish color coating to be selected from manufacturer's standard color chart.

c. Touch up abraded surfaces with enamel as specified for factory finish.

2.10 WINDOW TYPES

Conform to SWI SWS. Provide combinations, types and sizes indicated. Each window must consist of a unit including [subframe,] [frame,] sash, hardware, [mullions,] trim, [casing,] [insect screen,] [storm units,] and anchors. Design windows indicated to have screen [or storm units] to

accommodate items to be furnished.

2.10.1 Awning Windows

Provide compression-type weatherstripping. Heavy Intermediate materials in group of top-hinged or projected out-swinging ventilators:

2.10.1.1 Operators

[Control must be simultaneous by means of cam-type lever handle fastener for hand push-pull operation. For windows with screens, provide with underscreen push bar operators. For operators more than 2 meters above floor, provide with hardware designed for pole operation.

][Provide simultaneous control by means of a rotary mechanical power unit manually operated by bronze [removable] crankhandle, providing positive adjustment and holding of vents in any position from fully open to fully closed. Operator must securely close ventilators on both sides of window without additional locking devices. Heavy-duty worm-gear rotary operator with machine-cut case-hardened steel gears in steel housing with smooth lacquer finish.

]2.10.1.2 Ventilators

Support on two hinges and two arms, or on two steel slide arms pivoted to vent and to principal frame member. Provide bronze-brushed pivots and hinges with bronze pins. Design ventilators to close and weather on each other, or on independent meeting rails assembled as part of window frame. Provide for positive adjustment of individual vents to ensure positive contact between sash and frame when closed.

2.10.2 Casement Windows

[Standard Intermediate] [Heavy Intermediate] [Heavy Custom]. Provide continuous drip molds immediately above ventilators. Where fixed sections adjoin ventilators, provide drips continuous across top of fixed sections. Provide each side hinged ventilator with one pair of non-friction extension hinges, one sash operator, and one locking handle. Provide sash over 1680 mm high with three hinges. Provide hinges with strength necessary to permanently support glazed ventilator without twist or sag. Provide compression-type weatherstripping.

2.10.2.1 Sash Operators

Use [sliding underscreen] [crank-operated rotary] sash operators. Design operators to hold ventilators firmly in position at any angle up to 90 degrees.[Use friction or thumb-screw sliding operators.] Use heavy-duty worm-gear rotary operators, with machine-cut, case hardened steel gears. Provide pivoted lever type locking handles, engaging beveled strike plate or keeper. For ventilators exceeding 1680 mm in height, provide two-point locking device, operated by rods from single lever handle. Conceal rods where design of sash section will permit.

2.10.2.2 Hopper or Sill Type Ventilators

For hopper or sill type ventilators occurring under casement or fixed sash, provide cam-acting locking handle. For hinged type, provide one pair of hinges and two concealed friction stay arms; for projected type, use two friction shoes with nonfriction stay arms to hold ventilator in

any position, up to 45 degrees. For hopper vents over 1220 mm wide, use two locking handles.

2.10.2.3 Transom Ventilators

When transom ventilators occur above casement or fixed sash, hang on two stay arms sliding in friction shoes. Provide ventilators with hardware designed for pole operation.

2.10.3 Continuous Windows

Continuous type with [manual] [motorized] mechanical operation.

2.10.4 Fixed Windows

[Standard Intermediate] [Heavy Intermediate] [Heavy Custom] windows.

2.10.5 Horizontally Pivoted Windows

[Standard Intermediate] [Heavy Intermediate] [Heavy Custom]. Make pivots integral with jamb weathering bars to ensure permanent alignment. Hold ventilator in place at pivots with solid bronze, replaceable shouldered pivots, washer and nuts.

2.10.5.1 Operators

Equip ventilators with chain roller guide, chain and chain stay located at convenient distance from floor. Attach chain to spring-latch at ventilator head, looping down and back up through roller-guide in spring-catch. Secure end to keeper on frame. Unscreened ventilators readily accessible from floor may have steel stay adjusters.

2.10.6 Projected Windows

[Standard Intermediate] [Heavy Intermediate] [Heavy Custom].

2.10.6.1 Operators

Equip ventilators under 1220 mm wide with one cam-type lever handle fastener; equip ventilators 1220 mm wide and over, and not pole operated, with two fasteners. Where fixed screens occur at projected-out ventilators, provide underscreen push bar operators. Provide ventilators with locking rails more than 2 meters above the floor with hardware designed for pole operation.

2.10.7 Security Windows

SWI SWS. Provide ventilators with manufacturer's standard hardware of iron, steel or zinc. Equip ventilators having locking rails more than 2 meters above floor with hardware designed for pole operation.

2.11 SCREENS

Provide one insect screen for each operable exterior sash or ventilator. Locate screen units either inside or outside, depending upon window type and method of operation. Provide [full-length top-hung] [double vertical sliding] [half-length sliding] [half-length fixed] type screens. Design screens to fit closely around entire perimeter of ventilator or opening, to be rewirable, easily removable from inside building, and

interchangeable for same size ventilators of similar type windows, with minimum of exposed fasteners and latches. Provide all guides, stops, clips, bolts, and screws, as necessary, for a secure and insect-tight attachment to window. Where wickets are necessary, use sliding or hinged type, with friction catches, framed and trimmed for durability and tight fit. Provide wicket opening frames of similar material and cross-section as screen frames. Provide continuous framing bar between the two sides of screen frames.

2.11.1 Construction

Provide screen frames of steel with finish matching that of windows. Equip frames with removable splines of steel or vinyl. Form groove in frame for holding screen cloth in place with noncylindrical splines. Make spline and groove assembly so that cloth cannot be removed from groove by pressure on cloth. Make splines of such size and shape that rotation of spline in groove will be prevented and spline will tightly hold cloth in place.

2.11.2 Insect Screening

ASTM D3656/D3656M, Class 2, 18 by 14 mesh, color [charcoal] [gray] [_____]. Install with weave parallel to frames. Stretch tight for smooth appearance. Conceal edges in spline channels.

2.12 SPECIAL OPERATORS

2.12.1 Pole Operators

Provide for windows having operating hardware or locking rails more than 2 meters above floor. Provide window manufacturer's standard pole design of length to provide operation from 1.67 meters above floor, and with push-pull hooks of proper shape and length. Provide one pole operator for each room, and one pole hanger for each pole in location as directed.

[2.12.2 Extension Crank Operators

Provide removable handles for crank operated rotary operators located more than 2 meters above floor. Provide one removable handle for each room.

]2.12.3 Mechanical Operators

Provide [manual] [motorized] operators for group operation of continuous rows of windows, and for windows located at unusual heights, where other types of remote operation are not feasible. Provide operators that open and close windows without appreciable deflection, vibration or rattle. Provide transmission lines equipped with means of adjustment. Control window units in groups with operators as recommended by window manufacturer for the particular window arrangement shown, unless specifically indicated otherwise. Use mechanical operators of one of the following types:

a. On-Sill Operators: Centrally located, manually controlled mechanisms for adjusting ventilators, assembled of bronze telescoping shafts with machine cut threads. Conceal, except for linkage members, by appropriate covers. Provide one operator, secured to sill, for each window. Finish operators exposed to view to match hardware finish. Finish covers to match window casings.

b. Geared Lever-Arm Operator: Provide power unit with machine-cut gears and machined thrust bearings housed in dustproof oil-tight case, with provision for lubrication. Provide torsion shaft of standard black iron pipe not less than 25 mminside diameter. Rigidly clamp steel or malleable iron operating arms to shaft and connect to ventilator by push bar and hinge bracket. Support operating mechanism on brackets securely attached to building structure or mullions. No single line is allowed to extend more than 9 meters from either or both sides of power unit.

c. Geared Rack-and-Pinion Operator: Provide power unit with machine-cut gears and machined thrust bearings housed in dustproof oil-tight case, with provision for lubrication. Provide torsion shaft of standard black iron pipe not less than 25 mminside diameter. Cut steel rack to a pitch that will mesh accurately with the cut teeth on a steel or cast iron pinion. Fasten pinion securely to torsion shaft. Provide steel rack with a hinged bracket for attaching to ventilator. Hold rack in mesh with pinion by steel yoke with bearing rollers of solid brass. Support operating mechanism on steel brackets securely attached to building structure or mullions. No single line is allowed to extend more than 15 meters from either or both sides of power unit.

[2.12.3.1 Operating Arms and Racks

Provide each ventilator not more than 900 mm wide with single operating arm or rack attached at center of rail. Provide each ventilator more than 900 mm wide with two operating arms or racks attached to side rails or near ends of horizontal rail of ventilator.

][2.12.3.2 Chain Control

Provide power unit with hand chain, operating over chain wheel with chain guard. Drill and secure wheel to worm shaft by key. Terminate chain approximately 600 mm above floor. Where building construction makes it impracticable to hang chain vertically from power unit, furnish single or double chain idlers to convey chain to point shown or directed.

][2.12.3.3 Steel Shaft Control

Provide power unit with vertical standard black iron pipe of not less than 19 mm inside diameter or solid steel shaft with malleable iron or steel coupling. Support vertical shaft with brackets spaced not over 2 meters apart. Where hand operating wheel is indicated 1.5 meters above floor, place wheel in vertical position. Where hand operating wheel is indicated 2 meters above floor, place wheel in horizontal position. Secure wheel in place permanently. Furnish universal joints or beveled gears to locate control at point shown or as directed on nearest wall or column. Where practicable, mount vertical shafts on walls instead of pilasters.

]PART 3 EXECUTION

3.1 INSTALLATION

Install in accordance with window manufacturer's printed instructions and details. Coordinate installation with commissioning as specified in Section [_____].[Install fire rated windows in accordance with NFPA 80 and NFPA 101.] Build in windows as work progresses or install without forcing into prepared window openings. Set at proper elevation, location, and reveal; plumb, square, level, and in alignment. Brace and stay to

prevent distortion and misalignment. Protect ventilators and operating parts against dirt and building materials by keeping closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant recommended by window manufacturer. Install and seal windows in a manner that will prevent entrance of water and wind.[Fasten insect screens securely in place.]

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

3.2 ANCHORS AND FASTENINGS

Make provision for securing units to each other and to adjoining construction. Design head and jamb members to enter into masonry not less than 11 mm where windows are installed in direct contact with masonry. Where windows are set in prepared masonry openings, build in anchors and fastenings to jambs of openings and fasten securely to windows or frames and to adjoining construction. Space anchors not more than 450 mm apart on jambs and sills, and install a minimum of three anchors on each side of each opening. Anchors and fastenings must have sufficient strength to hold member firmly in position. Where type, size, or spacing of anchors is not shown or specified, use expansion or toggle bolts or screws as best suited to construction material. Provide expansion shield and bolt assemblies of type designed to give holding power beyond tensile and shearing strength of bolt. Minimum fastener penetration must be not less than that recommended by manufacturer for type fastener and wall material involved.

3.3 OPERATORS

Install operators before glazing. Plumb and level shaft risers and runs. Adjust ventilators for free opening and tight closing. Secure housings and adjustable supports to wall. Anchor operator parts to steel window mullions with 13 mm bolts. Couple individual lengths of shafting with steel rivets or bolts. Leave mechanical equipment and ventilators in proper operating condition.

3.4 WEATHERSTRIPPING

Use bronze, spring-brass, or stainless steel and secure with non-ferrous screws. Secure weatherstripping or rubbing-blocks to parting-strip and each end of meeting-rails. For solid bar stock windows, use manufacturer's standard weatherstripping inserted into groove.

3.5 ADJUSTMENTS AFTER INSTALLATION

After installation of windows and completion of glazing and field painting, adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts. Adjust weatherstripping to assure weathertight contact with frames when ventilators are closed and locked. Weatherstripping must not cause binding of sash, or prevent closing and locking of ventilator. Verify products are properly installed, connected, and adjusted.

3.6 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster,

paint spattering spots, and other foreign matter to present a neat appearance and to prevent fouling of weathering surfaces and weatherstripping, or interference with operation of hardware. Clean and touch up abraded surfaces. Replace with new windows any stained, discolored, or abraded windows that cannot be restored to original condition.

-- End of Section --

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1510-2	(2019) Test Method for Door Fittings - Part 2: Fittings for Doors
JIS A 1510-3	(2001) Test Methods for Door Fittings - Part 3: Floor Concealed Door Closers, Door Closers and Hinge Closers
JIS A 1516	(1998) Windows and Doorsets - Air Permeability Test
JIS A 1541-1	(2016) Building Hardware - Locks and Latches - Part 1: Test Methods for Locks and Latches
JIS A 1541-2	(2016) Building Hardware - Locks and Latches - Part 2: Methods of the Presentation and Grade of Criteria for Practical Performance Item
JIS A 1525	(1996) Doorsets - Repeated and Opening and Closing Test
JIS A 1551	(2014) Test Method for Automatic Door Opener
JIS A 4702	(2015) Doorsets
JIS A 4721	(2005) Automatic Revolving Door - Safety
JIS A 4722	(2017) Power Operated Pedestrian Door Sets - Safety
JIS A 5756	(2013) Preformed Gaskets Used in Buildings - Classification, Specifications and Test Methods

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2018; TIA 18-1; TIA 18-2; TIA 18-3) Life Safety Code
NFPA 252	(2017) Standard Methods of Fire Tests of

	Door Assemblies
NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code
NFPA 72	(2019; TIA 19-1; ERTA 2019) National Fire Alarm and Signaling Code
NFPA 80	(2016; TIA 16-1) Standard for Fire Doors and Other Opening Protectives

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

UNDERWRITERS LABORATORIES (UL)

UL 14C	(2006; Reprint Jul 2017) UL Standard for Safety Swinging Hardware for Standard Tin-Clad Fire Doors Mounted Singly and in Pairs
UL 437	(2013) Standard for Key Locks
UL Bld Mat Dir	(updated continuously online) Building Materials Directory

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Manufacturer's Detail Drawings; G[, [_____]]

Verification of Existing Conditions; G[, [_____]]

Hardware Schedule; G[, [_____]]

Keying System; G[, [_____]]

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule Items, Data Package 1; G[, [_____]]

SD-11 Closeout Submittals

Key Bitting

1.3 SHOP DRAWINGS

Submit manufacturer's detail drawings indicating all hardware assembly components and interface with adjacent construction.[Indicate power components and wiring coordination for electrified hardware.] Base shop drawings on verified field measurements and include verification of existing conditions.

1.4 PRODUCT DATA

Indicate fire-ratings at applicable components. Provide documentation of ABA/ADA accessibility compliance of applicable components, as required by 36 CFR 1191 Appendix D - Technical.

1.5 HARDWARE SCHEDULE

Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publi-cation Type No.	Finish	Mfr Name and Catalog No.	Key Control Symbols	UL Mark (If fire-rated and listed)	BHMA Finish Desig-nation

In addition, submit hardware schedule data package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.6 KEY BITTING CHART REQUIREMENTS

1.6.1 Requirements

Submit key bitting charts to the Contracting Officer prior to completion of the work. Include:

a. Complete listing of all keys.

b. Complete listing of all key cuts.

c. Tabulation showing which key fits which door.

d. Copy of floor plan showing doors and door numbers.

e. Listing of 20 percent more key cuts than are presently required in each master system.

1.7 QUALITY ASSURANCE

1.7.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges,[pivots,] and closers of one lock, hinge,[pivot,] or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

1.7.2 Key Shop Drawings Coordination Meeting

Prior to the submission of the key shop drawing, the Contracting Officer, Contractor, Door Hardware Subcontractor, using Activity and Base Locksmith must meet to discuss and coordinate key requirements for the facility.

1.8 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown on hardware schedule.[Deliver permanent keys[and removable cores] to the Contracting Officer, either directly or by certified mail. Deliver construction master keys with the locks.]

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

Hardware applied to metal [or to prefinished]doors must be manufactured using a template. Provide templates to door and frame manufacturers in accordance with JIS A 1510-2 for template hinges. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 72 for door alarms, NFPA 80 for fire doors, NFPA 101 for exit doors, NFPA 252 for fire tests of door assemblies, ABA/ADA accessibility requirements, and all other requirements indicated, even if such hardware is not specifically mentioned in paragraph HARDWARE SCHEDULE.[Provide swinging hardware for tin-clad fire doors in accordance with UL 14C.] Provide Underwriters Laboratories, Inc. labels for such hardware in accordance with UL Bld Mat Dir or equivalent labels in accordance with another testing laboratory approved in writing by the Contracting Officer.

2.3 HARDWARE ITEMS

Clearly and permanently mark with the manufacturer's name or trademark, hinges, pivots, locks, latches, exit devices, bolts and closers where the identifying mark is visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover. Coordinate electrified door hardware components with corresponding components specified in Division 28 ELECTRONIC SECURITY SYSTEMS (ESS).

2.3.1 Hinges

Provide in accordance with JIS A 1510-3. Provide hinges that are 114 by 114 mm unless otherwise indicated. Construct loose pin hinges for interior doors and reverse-bevel exterior doors so that pins are non-removable when door is closed. Other anti-friction bearing hinges may

be provided in lieu of ball bearing hinges.

[2.3.1.1 Protection Devices

Provide full height hand and finger protection device at the hinge-side area opening of doors and gates. Provide hinge-side protection devices on both sides of doors and gates, covering hinges and space between door and frame when doors are in the open position. The installed device must push hand and fingers out of the opening and away from a crushing hazard.

]2.3.2 Continuous Hinges

Where continuous hinges are required, provide in accordance with JIS A 1510-2.

2.3.3 Pivots

Provide in accordance with JIS A 1510-3.

2.3.4 Spring Hinges

Provide in accordance with JIS A 1510-3.

2.3.5 Locks and Latches

[a. At exterior locations provide locksets of full stainless steel type 302 or 304 construction including fronts, strike, escutcheons, knobs, bolts and all interior working parts. Marine Grade I, fully non-ferrous.

b. In non-air-conditioned interior environments or humid interior environments, provide interior locksets on the same Marine Grade I, fully non-ferrous as exterior locksets.

]2.3.5.1 Mortise Locks and Latches

Provide in accordance with JIS A 1541-1.[Provide factory installed lead lining in locks for lead shielded doors.][Provide mortise locks with escutcheons not less than 178 by 57 mm with a bushing at least 6 mm long. Cut escutcheons to fit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges.] Provide knobs and roses of mortise locks with screwless shanks and no exposed screws.

2.3.5.2 Bored Locks and Latches

Provide in accordance with JIS A 4702.[Provide factory installed lead lining in locks for lead -shielded doors.]

2.3.5.3 Residential Bored Locks and Latches

Provide in accordance with JIS A 4702. Install locks for exterior doors with threaded roses or concealed machine screws.

[2.3.5.4 Interconnected Locks and Latches

Provide in accordance with JIS A 1541-2.

]2.3.5.5 Hospital Latches

Push-pull latch set as required to meet operational requirements, 13 mm throw, [70 mm] [127 mm] backset, to fit 161 cutout. Cover approximately 64 by 140 mm, handle approximately 38 by 114 mm, projection approximately 64 mm, covers and handles of stainless steel finish, engraved "PUSH" and "PULL" on handles, push handle pointing up, pull handle pointing down.

2.3.5.6 Auxiliary Locks

Provide lock having a [latch bolt] or [dead bolt] operated by a [key], [paddle [and] [and/or] turn], which is used in addition to a primary lock or latching device to meet operational requirements.

2.3.5.7 Combination Locks

[Key pharmacy door locks separately from building master key system.]Heavy-duty, mechanical combination lockset with five push buttons, standard sized knobs, 20 mm deadlocking latch, 70 mm backset. Locks to operate by pressing two or more of the buttons in unison or individually in the proper sequence. Inside knob operates the latch. Provide a keyed cylinder on the interior to permit setting the combination.[Provide a keyed [removable core]cylinder on the exterior to permit bypassing the combination.][Provide a thumb turn on the interior to activate passage set function so that outside knob operates latch without using the combination.]

2.3.6 Exit Devices

Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices. Provide [touch bars in lieu of conventional crossbars and arms.][Provide escutcheons not less than 178 by 57 mm.]

[Use stainless steel or bronze base metal with plated finishes. Also include stainless steel fasteners and screws.

]2.3.7 Exit Locks With Alarm

Provide [with full width horizontal actuating bar] for single doors; Type E0431 [with actuating bar] or E0471 [with actuating bar and top and bottom bolts, both leaves active] for pairs of doors, unless otherwise specified.[Provide terminals for connection to remote indicating panel.][Provide outside control key.] Provide door alarms integrated with the fire alarm system in accordance with NFPA 72.

2.3.8 Cylinders and Cores

[Provide cylinders and cores for new locks, including locks provided under other sections of this specification.]Provide cylinders and cores with [six] [seven] pin tumblers. Provide cylinders from the products of one manufacturer, and provide cores from the products of one manufacturer.[Rim cylinders, mortise cylinders, and knobs of bored locksets have interchangeable cores which are removable by special control keys. Stamp each interchangeable core with a key control symbol in a concealed place on the core.]

[Provide cylinders for new locks, including locks provided under other sections of this specification. Provide fully compatible cylinders of

Grade 1 products from products of one manufacturer with interchangeable cores that are removable by a special control key. Factory set the cores with [six] [seven] pin tumblers. Submit a core code sheet with the cores. Provide master keyed cores in one system for this project. Provide construction interchangeable cores.

][For medical projects, key pharmacy door locks separately from building master key system.

]2.3.8.1 High Security Cylinders

Provide high security cylinder with locking technology that limits the duplication of unauthorized keys or unauthorized electronic credentials that would operate the locks. High security cylinder must be able to stand up to forcing, drilling, sawing, prying, pulling, plug driving, picking and have corrosion resistance. [High security cylinder to comply with UL 437].

2.3.9 Push Button Mechanisms

Provide in accordance with JIS A 1541-1.

2.3.10 Electrified Hardware

Comply with the requirements of NFPA 70 for wiring of electrified hardware.

2.3.10.1 Electric Strikes and Frame Mounted Actuators

Provide electric strikes and actuators as required to meet operational requirements. Provide electric strikes that [release automatically] [remain secure] [remain maintained] during power failure.[Provide a separate power supply for electric strikes, other locking devices and ancillary parts.][Provide battery backup for continued operation during power failure.] Provide strikes and actuators with a minimum opening force of 101 kilonewtons (kN).

Provide facility interface devices that use direct current (dc) power to energize the solenoids. Provide electric strikes and actuators that incorporate end-of-line resistors to facilitate line supervision by the system. If not incorporated into the electric strike or local controller, provide metal oxide resistors (MOVs) to protect the controller from reverse current surges.

2.3.10.1.1 Solenoid

Provide actuating solenoid for strikes and actuators that are rated for continuous duty, cannot dissipate more than 12 Watts and must operate on 12 or 24 Volts dc. Inrush current cannot exceed 1 ampere and the holding current cannot be greater than 500 milliamperes. Actuating solenoid must move from fully secure to fully open positions in less than 500 milliseconds.

2.3.10.1.2 Signal Switches

Provide strikes and actuators with signal switches to indicate to the system when the bolt is not engaged or the strike mechanism is unlocked. Signal switches must report a forced entry to the system.

2.3.10.1.3 Tamper Resistance

[Provide strike guards that prevent tampering with the latch bolt of the locking hardware or the latch bolt keeper of the electric strike. Strike guards to bolt through the door using tamper resistant screws. Provide strike guards made of 3 mm thick brass and that are 286 mm high by 41 mm, with a minimum 4 mm wide offset.

]2.3.10.1.4 Coordination

Provide electric strikes and actuators of a size, weight and profile compatible with each specified door frame. Field verify installation clearances prior to procurement.

2.3.10.1.5 Mounting Method

Provide electric strikes and actuators suitable for use with single and double doors, with mortise or rim type hardware specified, and for right or left hand mounting as specified. In double door installations, locate the lock in the active leaf and monitor the fixed leaf.

2.3.10.2 Electrified Mortise Locks

Provide electrified mortise locks that [release automatically] [remain secure] [remain maintained] during power failure. Provide facility interface devices that use dc power to energize solenoids. Provide solenoids, resisters, and signal switches in accordance with paragraph ELECTRIC STRIKES AND FRAME MOUNTED ACTUATORS.

2.3.10.2.1 Power Transfer Hinges

Provide power transfer hinges with each electrified lock that route power and monitoring signals from the lockset to the door frame. Coordinate power transfer hinges with door frames.

2.3.10.3 Card Readers and Keypad Access Control Hardware

Provide devices that are tamper alarmed, tamper and vandal resistant, solid state, and do not contain electronics which could compromise the access control subsystem should the subsystem be attacked. Provide surface, semi-flush, pedestal, or weatherproof mountable devices as specified for each individual location.[Each device to contain a visual display, either mounted on the face, or on an integral part of the device, to indicate access or exit request processing, request approval, and request denial.] Provide [proximity] [insertion] [swipe through] type card readers capable of reading [magnetic stripe] [high coercivity magnetic stripe] [Wiegand] [Hollerith] [proximity] [Transmissive Infrared] [Keypad] [[_____]/Keypad] [Smart Card] [Biometric] [_____] type access control cards. Provide keypads that contain an integral 12-digit tactile keyboard with digits [arranged in numerical order]. Provide keypads that are [a standalone device] [or] [integrated into the card reader]. Coordinate access control hardware with corresponding devices and systems specified in Division 28 ELECTRONIC SECURITY SYSTEMS (ESS).

2.3.10.4 Power Operated Pedestrian Door Hardware

Provide in accordance with JIS A 4722.

2.3.10.5 Release Devices

In accordance with JIS A 1510-3.

2.3.10.5.1 Closer Holders

Provide [floor] [door] [header] mounted closer holder devices connected by [separate releasing] [integral releasing] to [fire] [smoke] detecting devices.

2.3.10.5.2 Release Devices

Provide [wall] [floor] [door] mounted [Electromagnetic] [electromechanical] [free swinging] release devices connected to [fire] [smoke] detecting devices.

2.3.10.6 Power Assist and Low Energy Power Operated Doors

Provide in accordance with JIS A 4722.

2.3.10.7 Electromagnetic Locks

Provide electromagnetic locks that do not contain any moving parts and depend solely upon electromagnetism to secure a portal by generating at least 5.3 kN of holding force. The lock must interface with the local processors without external, internal or functional alteration of the local processor. The electromagnetic lock must incorporate an end of line resistor to facilitate line supervision by the system. Provide metal-oxide resistors (MOVs) to protect controllers from reverse current surges, if not incorporated into the electromagnetic lock or local controller.

2.3.10.7.1 Armature

Provide electromagnetic locks with internal circuitry to eliminate residual magnetism and inductive kickback. Provide atuating armature that operates on 12 or 24 Volts dc and cannot dissipate more than 12 Watts. Holding current must be less than 500 milliamperes. Actuating armature must take less than 300 milliseconds to change the status of the lock from fully secure to fully open or fully open to fully secure.

2.3.10.7.2 Tamper Resistance

Provide lock mechanism encased in hardened guard barriers to deter forced entry.

2.3.10.7.3 Mounting Method

Provide electromagnetic lock suitable for use with single and double door with mortise or rim type hardware and compatible with right or left hand mounting.

2.3.10.8 Delayed Egress Locking System

Provide delayed egress product capable of allowing the door to be opened by actuating the lock which is equipped with a 15-second maximum delayed feature including a zero-to-three second pre-delay. The door shall be allowed to close by action of the door closer. Electrically re-lock the system so that the time delay is operative. A force, not to exceed 67 N,

shall be continuously applied on the door or release device allowing the door to be opened after not more than 15 seconds.

2.3.10.9 Power and Manual Operated Revolving Pedestrian Doors

Provide in accordance with JIS A 1551 for powered revolving pedestrian doors and JIS A 4721 for manual operated revolving pedestrian doors.

2.3.11 Keying System

Provide[a [great][grand] master keying system][an extension of the existing keying system. Existing locks were manufactured by [_____] and [do not] have interchangeable cores.][Provide[a construction master keying system][construction interchangeable cores].][Provide key cabinet as specified.]

2.3.12 Lock Trim

Provide cast, forged, or heavy wrought construction and commercial plain design for lock trim.

2.3.12.1 Knobs and Roses

Provide in accordance with JIS A 4702 and JIS A 1541-1 for knobs, roses, and escutcheons. For unreinforced knobs, roses, and escutcheons, provide a 1.25 mm thickness. For reinforced knobs, roses, and escutcheons, provide an outer shell thickness of 0.89 mm and a combined total thickness of 1.78 mm, except at knob shanks. Provide knob shanks 1.52 mm thick.

2.3.12.2 Lever Handles

Provide lever handles [where indicated in the Hardware Schedule]. Provide lever handle locks with a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when force in excess of that specified in JIS A 1541-1 is applied to the lever handle. Provide lever handles return to within 13 mm of the door face.

2.3.12.3 Texture

Provide knurled or abrasive coated knobs or lever handles for doors which are accessible to blind persons and which lead to dangerous areas.

2.3.13 Keys

[Furnish][Provide] one file key, one duplicate key, and one working key for each key change [and for each master [and grand master] keying system]. [Furnish][Provide] one additional working key for each lock of each keyed-alike group.[[Furnish][Provide] two additional keys for each sleeping room.][[Furnish][Provide] [[_____] great grand master keys,] [[_____] construction master keys,] [and [_____] control keys for removable cores].][[Furnish][Provide] a quantity of key blanks equal to 20 percent of the total number of file keys.] Stamp each key with appropriate key control symbol and "U.S. property - do not duplicate." Do not place room number on keys.

2.3.14 Door Bolts

Provide in accordance with JIS A 4702. Provide dustproof strikes for bottom bolts, except at doors having metal thresholds. Provide automatic

latching flush bolts to meet operational requirements.

2.3.15 Closers

Provide in accordance with JIS A 1510-3. Provide with brackets, arms, mounting devices, fasteners, [full size covers, except at storefront mounting,] [pivots,] [cement cases,] and other features necessary for the particular application. Size closers in accordance with manufacturer's printed recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule. Provide manufacturer's 10 year warranty.

[Use stainless steel inside bracketed or door mounted closers on exterior doors. Non-ferrous closers, such as aluminum or cast bronze, are permissible where door utilization is minimal. On interior doors use closers of 302 or 304 stainless steel or non-ferrous materials. On surface-mounted closers use or apply rust inhibiting finish on all ferrous parts. Also apply this finish on concealed closers.

]2.3.15.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation in locations that will be visible after installation.

2.3.16 Overhead Holders

Provide in accordance with JIS A 1510-3.

2.3.17 Door Protection Plates

Provide in accordance with JIS A 4702.

2.3.17.1 Sizes of [Armor] [Mop] [and] Kick Plates

50 mm less than door width for single doors; 25 mm less than door width for pairs of doors. Provide [[200] [1200] mm kick plates for flush doors] [and] [125 mm less than height of bottom rail for panel doors]. Provide a minimum [900] [1200] [_____] mm armor plates for flush doors [and] completely cover lower panels of panel doors, except 400 mm high armor plates on fire doors. Provide [100] [150] mm mop plates.

2.3.17.2 Edge Guards

Stainless steel, of same height as armor plates. Apply to [hinge stile] [lock stile] [meeting stiles].

2.3.18 Door Stops and Silencers

Provide in accordance with JIS A 4702. Provide three silencers for each single door, two for each pair.

2.3.19 Padlocks

Provide padlock of [solid extruded brass] [stainless steel]. [Shackle to be cut-resistant]. Provide lock functions consisting of [key retained], [non-key retained], [frangible shackle], [double lockout], [weather cover], [car seal slot].

2.3.20 Thresholds

Use vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

2.3.21 Weatherstripping Gasketing

Provide in accordance with JIS A 5756. Provide the type and function designation where specified in paragraph HARDWARE SCHEDULE. Provide a set to include head and jamb seals[, sweep strips,] [and, for pairs of doors, astragals]. Air leakage of weatherstripped doors not to exceed [2.19 by 10-5] [5.48 by 10-5] cms per minute of air per square meter of door area when tested in accordance with JIS A 1516. Provide weatherstripping with one of the following:

2.3.21.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 1.25 mm wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Provide [clear (natural)] [bronze] anodized aluminum.

2.3.21.2 Interlocking Type

Zinc or bronze not less than 0.45 mm thick.

2.3.21.3 Spring Tension Type

Spring bronze or stainless steel not less than 0.20 mm thick.

2.3.22 [Lightproofing] [and] [Soundproofing] Gasketing

Provide in accordance with JIS A 5756. Provide adjustable doorstops at heads,jambs and automatic door bottoms in accordance with the hardware set, of extruded aluminum, [clear (natural)] [bronze] anodized, surface applied, with vinyl fin seals between plunger and housing. Provide doorstops with solid neoprene tube, silicone rubber, or closed cell sponge gasket. Provide door bottoms with adjustable operating rod and silicone rubber or closed cell sponge neoprene gasket. Provide doorstops that are mitered at corners. Provide type and function designation where specified in paragraph HARDWARE SETS.

2.3.23 Rain Drips

Provide extruded aluminum rain drips, not less than 2.03 mm thick, [clear anodized] [bronze anodized] [factory painted] [factory primed] finish. Provide the manufacturer's full range of color choices to the Contracting Officer for color selection.[Provide rain drips with a 102 mm overlap on each side of each exterior door that is not protected by an awning, roof, eave or other horizontal projection.] Set drips in sealant and fasten with stainless steel screws.

2.3.23.1 Door Rain Drips

Approximately 38 mm high by 16 mm projection. Align bottom with bottom edge of door.

2.3.23.2 Overhead Rain Drips

Approximately 38 mm high by 64 mm projection. Align bottom with door

frame rabbet.

2.3.24 Auxiliary Hardware (Other than locks)

Provide in accordance with JIS A 4702.

2.3.25 Sliding and Folding Door Hardware

Provide in accordance with JIS A 1525. Finishes to match other hardware specified herein.

2.3.26 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, as required to service and adjust hardware items.

2.4 FASTENERS

Provide fasteners of type, quality, size, and quantity appropriate to the specific application. Fastener finish to match hardware. Provide stainless steel or nonferrous metal fasteners in locations exposed to weather. Verify metals in contact with one another are compatible and will avoid galvanic corrosion when exposed to weather.

2.5 FINISHES

[Provide in accordance with JIS A 1541-2. Provide hardware in satin stainless steel, unless specified otherwise. Provide items not manufactured in stainless steel in satin chromium plated over brass or bronze, except [aluminum paint] [prime coat] finish for surface door closers, and except satin chromium plated [primed for painting] for steel hinges. Provide hinges for exterior doors in stainless steel finish [or chromium plated brass or bronze finish]. Furnish exit devices in satin chrome finish in lieu of stainless steel finish [except where specified under paragraph HARDWARE SETS]. Match exposed parts of concealed closers to lock and door trim. Match hardware finish for aluminum doors to the doors.

][Provide in accordance with JIS A 1541-2. Provide hardware in satin bronze, unless specified otherwise. Finish surface door closers [bronze paint] [prime coat] finish. Provide steel hinges in [satin bronze plated] [primed for painting]. Provide exposed parts of concealed closers finish to match lock and door trim. Match hardware finish for aluminum doors to match the doors. Provide hardware showing on interior of [bathrooms] [shower rooms] [toilet rooms] [washrooms] [laundry rooms] [and kitchens] in bright stainless steel or bright chromium plated.

]2.6 KEY CABINET AND CONTROL SYSTEM

Provide in accordance with project requirements, [[(25 hooks)] [(125 hooks)] [(150 hooks)] [(600 hooks)] [(700 hooks)].] [Type required to yield a capacity (number of hooks) 50 percent greater than the number of key changes used for door locks.]

PART 3 EXECUTION

3.1 INSTALLATION

Provide hardware in accordance with manufacturers' printed installation

instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

3.1.1 Weatherstripping Installation

Provide full contact, weathertight seals that allow operation of doors without binding the weatherstripping.

3.1.1.1 Stop Applied Weatherstripping

Fasten in place with color matched sheet metal screws not more than 225 mm on center after doors and frames have been finish painted.

3.1.1.2 Interlocking Type Weatherstripping

Provide interlocking, self adjusting type on heads and jambs and flexible hook type at sills. Nail weatherstripping to door 25 mm on center and to heads and jambs at 100 mm on center.

3.1.1.3 Spring Tension Type Weatherstripping

Provide spring tension type on heads and jambs. Provide bronze nails with bronze. Provide stainless steel nails with stainless steel. Space nails not more than 38 mm on center.

3.1.2 [Lightproofing] [and] [Soundproofing] Installation

Provide as specified for stop applied weatherstripping.

3.1.3 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws[in expansion sleeves]. For aluminum thresholds placed on top of concrete surfaces, coat the underside surfaces that are in contact with the concrete with fluid applied waterproofing as a separation measure prior to placement.

3.2 FIRE DOORS AND EXIT DOORS

Provide hardware in accordance with NFPA 72 for door alarms, NFPA 80 for fire doors, NFPA 101 for exit doors, and NFPA 252 for fire tests of door assemblies. [Provide tin-clad fire doors in accordance with UL 14C].

3.3 HARDWARE LOCATIONS

Provide as indicated or specified otherwise.

a. Kick and Armor Plates: Push side of single-acting doors. Both sides of double-acting doors.

b. Mop Plates: Bottom flush with bottom of door.

3.4 KEY CABINET AND CONTROL SYSTEM

Locate where [directed][indicated]. Tag one set of file keys and one set of duplicate keys. Place other keys in appropriately marked envelopes, or tag each key. Provide complete instructions for setup and use of key control system. On tags and envelopes, indicate door and room numbers or master or grand master key.

3.5 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, errors in cutting and fitting and damage to adjoining work.

3.6 HARDWARE SETS

Provide [hardware for aluminum doors under this section. Deliver Hardware templates and hardware, except field applied hardware, to the aluminum door and frame manufacturer for use in fabricating doors and frames.]

-- End of Section --

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SECTION 08 81 00

GLAZING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(2017) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM E2226	(2015a; R 2019b) Standard Practice for Application of Hose Stream

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 15099	(2003) Thermal Performance of Windows, Doors and Shading Devices - Detailed Calculations
ISO 16932	(2007) Glass in Buildings - Destructive Windstorm-Resistant Security Glazing - Test and Clarification
ISO 16933	(2007) Glass in Building - Explosion-Resistant Security Glazing - Test and Clarification for Arena Air-Blast Loading
ISO 16934	(2007) Glass in Building - Explosion-Resistant Security Glazing - Test and Clarification by Shock-Tube Loading
ISO 28278	(2011) Glass in Building - Glass Products for Structural Sealant Glazing

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1304	(2017) Method of Fire Resistance Test for Elements of Building Construction
JIS A 1418	(2000) Acoustics - Measurement of Floor Impact Sound Insulation of Buildings - Method Using Standard Light Impact Source
JIS A 1419	(2000) Acoustics - Rating of Sound Insulation in Buildings and of Building Elements - Airborne Sound Insulation

JIS A 1439	(2016) Testing Methods of Sealants for Sealing and Glazing in Buildings
JIS A 5756	(2013) Preformed Gaskets Used in Buildings - Classification, Specifications and Test Methods
JIS A 5758	(2016) Sealants for Sealing and Glazing in Buildings
JIS K 6262	(2013) Rubber, Vulcanized or Thermoplastic - Determination of Compression Set at Ambient, Elevated or Low Temperatures
JIS K 6718	(2015) Plastics - Poly (Methyl Methacrylate) Sheets - Types, Dimensions and Characteristics
JIS K 7366	(1999) Plastic-plasticized polyvinyl chloride (PVC-P) Molding and extrusion materials
JIS R 3109	(2018) Glass in Building - Destructive-Windstorm-Resistant Security Glazing - Test Method
JIS R 3202	(2011) Float Glass and Polished Plate Glass
JIS R 3205	(2005) Laminated Glass
JIS R 3206	(2014) Tempered Glass
JIS R 3220	(2011) Glass in Building - Silvered, Flat-Glass Mirror
JIS R 3221	(2002) Solar Reflective Glass
JIS R 3222	(2003) Heat-Strengthened Glass

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT-SS Ch 16, Sec 14	(2019) Building Construction Standard Specifications - Chapter 16 Openings Construction, Section 14 Glazing

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 252	(2017) Standard Methods of Fire Tests of Door Assemblies
NFPA 257	(2012; ERTA 2017) Standard on Fire Test for Window and Glass Block Assemblies
NFPA 80	(2016; TIA 16-1) Standard for Fire Doors and Other Opening Protectives

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201	Safety Standard for Architectural Glazing Materials

UNDERWRITERS LABORATORIES (UL)

UL 752	(2005; Reprint Dec 2015) Standard for Bullet-Resisting Equipment
UL MEAPD	(2011) Mechanical Equipment and Associated Products Directory (online version is listed under Certifications at www.ul.com)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Insulating Glass

Sealants

Joint Backer

SD-08 Manufacturer's Instructions

Setting and Sealing Materials

Glass Setting

SD-11 Closeout Submittals

Warranty for Insulated Glass Units

[Warranty for Polycarbonate Sheet

][Warranty for Monolithic Reflective Glass

][Warranty for Monolithic Opacified Spandrel
]

[1.3 SYSTEM DESCRIPTION

Fabricate and install watertight and airtight glazing systems to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, or defects in the work. Glazed panels must comply with the safety standards, in accordance with JIS R 3205 for Laminated Glass or JIS R 3206 for Tempered Glass, comply with indicated wind/snow loading in accordance with ISO 28278, and relative displacement requirements in accordance with ASCE 7, section 13.5.9.1. Provide insulated laminated heat-strengthened exterior glazing with a

minimum interlayer thickness as indicated on the drawings or as required to meet performance requirements.[Sloped glazing must comply with MLIT-SS Ch 16, Sec 14.]

1.3.1 Wind Pressure Requirements

Exterior glazing to withstand an allowable wind-loading design pressure of [_____] kPa in Zone [_____] and [_____] kPa in Zone [_____]. Zones [_____] and [_____] are defined by ASCE 7-10.

1.3.2 Windborne Debris Requirement

Exterior glazing shall be tested and certified for impact resistance with the window or door as applicable under JIS R 3109 to comply with minimum Missile Type [_____] and ICC IBC Section 1609, Wind Loads or tested and certified for impact resistance under ISO 16932 to comply with minimum Missile Type [_____] and Wind Zone [_____].

]1.4 QUALITY CONTROL

Submit two 203 by 254 mm samples of each of the following: tinted glass, patterned glass, heat-absorbing glass, [_____] and insulating glass units.

Submit three samples of each other material. Samples of plastic sheets must be minimum 125 by 175 mm.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, enclosed dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not start glazing work until the outdoor temperature is above 4 degrees C and rising, unless procedures recommended by the glass manufacturer and approved by the Contracting Officer are made to warm the glass and rabbet surfaces. Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

1.7 WARRANTY

1.7.1 Warranty for Insulated Glass Units

Warranty insulating glass units against development of material obstruction to vision (such as dust, fogging, or film formation on the inner glass surfaces) caused by failure of the hermetic seal, other than through glass breakage, for a 10-year period following acceptance of the work. Provide new units for any units failing to comply with terms of this warranty within 45 working days after receipt of notice from the Government.

1.7.2 Warranty for Polycarbonate Sheet

For a 5-year period following acceptance of the work:

a. Warranty Type I, Class A (UV stabilized) sheets against breakage;

b. Warranty Type III (coated, mar-resistant) sheets against breakage and against coating delamination;

c. Warranty Type IV (coated sheet) against breakage and against yellowing;

d. Warranty extruded polycarbonate profile sheet against breakage.

For a 10-year period following acceptance of the work, warranty Type IV against yellowing and loss of light transmission.

[1.7.3 Monolithic Reflective Glass

Manufacturer must warrant the monolithic reflective glass to be free of peeling or deteriorating of coating for a period of 10 years after Date of Substantial Completion. Warranty must be signed by manufacturer.

][1.7.4 Monolithic Opacified Spandrel

Manufacturer must warrant the opacifier film on the spandrel to be free of peeling for a period of five years after Date of Substantial Completion. Warranty must be signed by manufacturer.

]PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

[2.1.1 Energy Efficient Equipment for Residential Windows

Provide energy efficient residential windows in accordance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph ENERGY EFFICIENT PRODUCTS.

]2.2 GLASS

JIS R 3202, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to 16 CFR 1201.

2.2.1 Clear Glass

[For interior glazing (i.e., pass and observation windows), 6 mm thick glass should be used.

] Provide for glazing openings not indicated or specified otherwise. Use double-strength sheet glass or 3 mm float glass for openings up to and including 1.39 square meters, 4.5 mm for glazing openings over 1.39 square meters but not over 2.79 square meters, and 6 mm for glazing openings over 2.79 square meters but not over 4.18 square meters.

2.2.2 Annealed Glass

Annealed glass must be Type I transparent flat type, [Class 1 - clear,] Quality q3 - glazing select, [_____] percent light transmittance, [_____] percent shading coefficient, conforming to JIS R 3202.

2.2.3 Heat-Absorbing Glass

[Tinted], [_____] mm thick, [blue][green] in color, [_____] percent light transmittance, [_____] percent shading coefficient, conforming to

JIS R 3202.

2.2.4 Reflective Coating Vision Glass

JIS R 3221.

2.2.5 Wired Glass

Provide UL listed glass for fire-rated windows rated for [45] [20] minutes when tested in accordance with ASTM E2226. Wired glass must be Type II flat type, Class [1 - translucent] [2 - tinted, heat-absorbing] [3 - tinted, light-reducing], Quality [q7 - decorative] [q8 - glazing], Form [1 - wired and polished both sides] [2 - patterned and wired], [_____] percent light transmittance, [_____] percent shading coefficient, conforming to JIS R 3202. Wire mesh must be polished stainless steel Mesh [1 - diamond] [2 - square] [3 - parallel]. Wired glass for fire-rated windows must bear an identifying UL label or the label of a nationally recognized testing agency, and be rated for [20] [45] minutes when tested in accordance with NFPA 257. Wired glass for fire-rated doors must be tested as part of a door assembly in accordance with NFPA 252.

2.2.6 Patterned Glass

[Translucent], [patterned], [decorative], [patterned one side], [patterned two sides], [linear], [geometric], [random], [special], [[_____] percent light transmittance, [_____] percent shading coefficient.] [3] [6] mm thick.[Provide [_____].]

2.2.7 Laminated Glass

[JIS R 3205, Laminated glass fabricated from two nominal [3] [_____] mm pieces of flat annealed [ultraclear]; [clear] [_____] glass conforming to JIS R 3202.] [JIS R 3205, Laminated glass fabricated from two nominal [3] [_____] mm pieces of [HS] [FT], flat [heat strengthened] [fully tempered] [clear] [_____] glass conforming to JIS R 3222.] Flat glass to be laminated together with a minimum of 0.75 mm [_____] mm thick, clear [polyvinyl butyral] [ionoplast] [cast-in-place liquid resin] laminate, conforming to requirements of JIS R 3205. The total thickness of nominally 6 [_____] mm. Color to be [clear] [gray] [bronze] [_____]. The total thickness of nominally [_____] mm.

[Design window glazing using a dynamic analysis[testing from airblast loading in accordance with ISO 16933, or ISO 16934 by an independent testing agency regularly engaged in blast testing] to prove the glazing will provide performance equivalent to or better than a [low] [very low] [_____] hazard rating in accordance with ISO 16933 for the peak positive pressure of [_____] kilopascals (kPa) and peak positive phase impulse of [_____] kilopascal-millisecond (kPa-msec).

]2.2.8 Bullet-Resisting Glass

Fabricated from Type I, Class 1, Quality q3 glass with polyvinyl butyral plastic interlayers between the layers of glass and listed by UL MEAPD as bullet resisting, with a rating Level of [Level 1] [Level 2] [Level 3] [Level 4] [Level 5] [_____] in accordance with UL 752. Provide [_____] [where indicated].

[2.2.9 Mirrors

2.2.9.1 Glass Mirrors

Glass for mirrors must be transparent flat type, clear, 6 mm thick conforming to JIS R 3220. Glass must be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating must be highly adhesive pure silver coating of a thickness which must provide reflectivity of 83 percent or more of incident light when viewed through 6 mm thick glass, and must be free of pinholes or other defects. Copper protective coating must be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and must be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint must consist of two coats of special scratch and abrasion-resistant paint , and must be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

]2.2.10 One-Way Vision Glass (Transparent Mirrors)

6 mm thick, coated on one face with a hard, adherent film of chromium or other approved coating of equal durability. Glass must transmit not less than 5 percent or more than 11 percent of total incident visible light and must reflect from the front surface of the coating not less than 45 percent of the total incident visible light.[Provide [_____].]

2.2.11 Tempered Glass

Per fully tempered, uncoated, transparent per JIS R 3222 [2 tinted heat absorbing], [_____] mm thick, [_____] percent light transmittance, [_____] percent shading coefficient conforming to JIS R 3206 or MLIT-SS Ch 16, Sec 14. Color must be [[clear] [bronze] [gray] [_____]]. [Provide [_____]] [and wherever safety glazing material is indicated or specified].

2.2.12 Heat-Strengthened Glass

HS (heat strengthened), uncoated, [clear JIS R 3222] [tinted heat absorbing], [_____] mm thick. [Provide [_____].]

2.2.13 Spandrel Glass

2.2.13.1 Ceramic-Opacified Spandrel Glass

Ceramic-opacified spandrel glass must be Kind HS heat-strengthened transparent flat type, coated with a colored ceramic material on No. 2 surface, [_____] mm thick, conforming to JIS R 3222. Glass performance must be K-Value/Winter Nighttime [_____], shading coefficient [_____]. Color must be [_____].

2.2.13.2 Film-Opacified Spandrel Glass

Film-opacified spandrel glass must be Kind HS heat-strengthened transparent flat type glass with a polyester or polyethylene film 0.025 mm to 0.127 mm thick attached to No. 2 surface of a sputtered solar-reflective film, conforming to JIS R 3222. Film opacification must be compatible to and specifically developed for application to solar reflective films. Glass performance must be K-Value/Winter Nighttime [_____], shading coefficient [_____]. Color must be [_____].

2.2.13.3 Spandrel Glass With Adhered Backing

Kind HS or FT, ceramic coated, JIS R 3222, [_____] mm thick and must pass the fallout resistance test specified in JIS R 3222. [Provide [_____].]

[2.2.14 Fire/Safety Rated Glass

[2.2.14.1 Fire Protection Rated Glass

Clear tempered and meet 16 CFR 1201 Category I (under 0.836 sqm) or II (over 0.836 sqm) impact safety standard. Glass to make [20] [45] minute rating when tested in accordance with NFPA 257 and NFPA 252. Glass to be permanently labeled with appropriate markings.

][2.2.14.2 Fire Resistive Rated Glazing

Fire resistive glass must be laminated, with intumescent interlayer, Type I transparent flat type, Class 1-clear and meet 16 CFR 1201 Category I (under 0.836 sqm) or II (over 0.836 sqm). Glass must have a [60] [90] [120] minute rating when tested in accordance with JIS A 1304. Glass must be permanently labeled with appropriate markings.

]]2.3 INSULATING GLASS UNITS

[Two][Three] panes of glass separated by a dehydrated airspace[, filled with argon gas][, filled with krypton gas,][, filled with aerogel] and hermetically sealed, conforming to ISO 28278. Submit performance and compliance documentation for each type of insulating glass.

[Insulated glass units must have a Solar Heat Gain Coefficient (SHGC) maximum of [_____] determined according to ISO 15099 and a U-factor maximum of [_____] W per square m by K in accordance with ISO 15099.

] [See section[s][_____] for energy performance requirements for glazed systems (glazing and frames).] [Glazed panels must be rated for not less than [26] [30] [35] [_____] Sound Transmission Class (STC) or equivalent Weighted Sound Reduction Index (Rw) when tested for laboratory sound transmission loss according to JIS A 1418 and determined by JIS A 1419.]

Spacer must be black, roll-formed, [thin-gauge, C-section steel] [steel-reinforced butyl rubber] [thermally broken aluminum] [polyurethane and silicon foams], with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal must be compressed polyisobutylene and the secondary seal must be a specially formulated silicone.

The inner light must be clear annealed flat glass JIS R 3205, JIS R 3202 [_____] mm thick, fully tempered, uncoated, transparent, JIS R 3222 [_____] mm thick. The intermediate light must be clear annealed flat glass, JIS R 3202, fully tempered, uncoated, transparent, JIS R 3222 [_____] mm thick. The outer light must be transparent, JIS R 3202, [2 (tinted heat absorbing)], [2 (solar-reflective)], [_____] mm thick, fully tempered, uncoated, clear JIS R 3202 [2 (tinted heat absorbing)][solar-reflective], [_____] mm thick.

2.3.1 Low Emissivity Coatings

Interior and exterior glass panes for Low-E insulating units must be annealed flat glass, Class [1-clear] [2-tinted] with anti-reflective low-emissivity coating or heat-strengthened or fully tempered glass complying with JIS R 3222, Condition C on [No. 2 surface (inside surface of exterior pane) JIS R 3222][No. 3 surface (inside surface of interior pane)], conforming to JIS R 3202. Glass performance must be U value maximum of [_____] [W/m2-K], Solar Heat Gain Coefficient (SHGC) maximum of [_____]. Color must be [green] [gray] [bronze] [blue] [_____] .

2.4 PLASTIC GLAZING

Plastic glazing must have a U-factor maximum of [_____] W per square m by K. [Plastic glazing must include a [16][32][_____] mm layer of aerogel between panels.]

Certificates stating that the plastic glazing meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

2.4.1 Acrylic Sheet

JIS K 6718, [regular] [heat resistant,] [clear and smooth on both sides] [translucent, textured on both sides,] [gray tint,] [bronze tint,] ultraviolet stabilized, [scratch resistant,] [_____] [6] [_____] mm thick.

2.4.2 Polycarbonate Sheet

[Clear and smooth both sides] [Translucent, textured both sides] [Gray tint] [Bronze tint] [mar-resistant] [high abrasion resistant], ultraviolet stabilized, [_____] mm thick and listed in UL MEAPD as burglar resisting.

2.4.3 Extruded Polycarbonate Profiled Sheet

Provide [double] [triple] walled, surface treated for improved UV resistance, offering thermal efficiency and impact strength.

2.4.4 Bullet-Resistant Plastic Sheet

Cast acrylic sheet or mar-resistant polycarbonate sheet laminated with a special interlayer, and listed in UL 752 as bullet resisting, Class [I] [II] [III], [clear] [_____] in color.[Provide [_____].]

2.5 SETTING AND SEALING MATERIALS

Provide as specified in the MLIT-SS Ch 16, Sec 14, and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted must be gray or neutral color. Sealant testing must be performed by a qualified testing agency.

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified.[Include cleaning instructions for plastic sheets.]

2.5.1 Putty and Glazing Compound

Provide glazing compound as recommended by manufacturer for face-glazing metal sash. Putty must be linseed oil type. Do not use putty and glazing compounds with insulating glass or laminated glass.

2.5.2 Glazing Compound

Use for face glazing metal sash. Do not use with insulating glass units or laminated glass.

2.5.3 Sealants

Provide elastomeric [and structural] sealants.

2.5.3.1 Elastomeric Sealant

JIS A 5758. Use for channel or stop glazing [wood] [and] [metal] sash. Sealants must be chemically compatible with setting blocks, edge blocks, and sealing tapes[, with sealants used in manufacture of insulating glass units] [, and with plastic sheet]. Color of sealant must be white.

2.5.3.2 Structural Sealant

JIS A 5758.

2.5.4 Joint Backer

Joint backer must have a diameter size at least 25 percent larger than joint width; type and material as recommended in writing by glass and sealant manufacturer.

2.5.5 Glazing Tapes

2.5.5.1 Back-Bedding Mastic Glazing Tapes

Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with JIS A 5758.

2.5.5.2 Expanded Cellular Glazing Tapes

Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with JIS A 5758 as recommended by tape and glass manufacturers.

2.5.6 Sealing Tapes

Preformed, semisolid, PVC-based material of proper size and compressibility for the particular condition, complying with JIS K 7366. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer. Provide spacer shims for use with compressible tapes. Tapes must be chemically compatible with the product being set.

2.5.7 Setting Blocks and Edge Blocks

Closed-cell neoprene setting blocks must be dense extruded type conforming

to JIS A 5756 and JIS K 6262. Edge blocking as recommended by glazing manufacturer. Provide silicone setting blocks when blocks are in contact with silicone sealant. Profiles, lengths and locations must be as required and recommended in writing by glass manufacturer. Block color must be [black][_____].

2.5.8 Glazing Gaskets

Glazing gaskets must be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening must be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets must be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Provide glazing gasket profiles as recommended by the manufacturer for the intended application.

2.5.8.1 Fixed Glazing Gaskets

Fixed glazing gaskets must be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to JIS A 5756.

2.5.8.2 Wedge Glazing Gaskets

Wedge glazing gaskets must be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to JIS A 5756.

2.5.8.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing must be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

2.5.9 Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers. Use JIS A 1439 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to surface.

[2.6 MIRROR ACCESSORIES

2.6.1 Mastic

Mastic for setting mirrors must be a [polymer] [_____] type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Provide mastic compatible with mirror backing paint, and as approved by mirror manufacturer.

2.6.2 Mirror Frames

Provide mirrors with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames must be 32 by 6 by 6 mm continuous at top and bottom of mirrors. Concealed fasteners of type to suit wall construction material must be

provided with mirror frames.

2.6.3 Mirror Clips

Provide clips with concealed fasteners of type to suit wall construction material.

]PART 3 EXECUTION

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

3.1 PREPARATION

Preparation, unless otherwise specified or approved, must conform to applicable recommendations in MLIT-SS Ch 16, Sec 14 and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

3.2 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, must conform to applicable recommendations in MLIT-SS Ch 16, Sec 14 and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place. Verify products are properly installed, connected, and adjusted.

3.2.1 Sheet Glass

Cut and set with the visible lines or waves horizontal.

3.2.2 Patterned Glass

Set glass with one patterned surface with smooth surface on the weather side. When used for interior partitions, place the patterned surface in same direction in all openings.

3.2.3 Insulating Glass Units

Do not grind, nip, or cut edges or corners of units after the units have left the factory. Springing, forcing, or twisting of units during setting will not be permitted. Handle units so as not to strike frames or other objects. Installation must conform to applicable recommendations of MLIT-SS Ch 16, Sec 14.

3.2.4 Installation of Wire Glass

Install glass for fire doors in accordance with installation requirements

of NFPA 80.

3.2.5 Installation of Heat-Absorbing Glass

Provide glass with clean-cut, factory-fabricated edges. Field cutting will not be permitted.

3.2.6 Installation of Laminated Glass

Sashes which are to receive laminated glass must be weeped to the outside to allow water drainage into the channel.

3.2.7 Plastic Sheet

Conform to manufacturer's recommendations for edge clearance, type of sealant and tape, and method of installation.

3.3 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass must be clean at the time the work is accepted.[Clean plastic sheet in accordance with manufacturer's instructions.]

3.4 PROTECTION

Protect glass work immediately after installation. Identify glazed openings with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Protect reflective glass with a protective material to eliminate any contamination of the reflective coating. Place protective material far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Upon removal, separate protective materials for reuse or recycling. Remove and replace glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities with new units.

-- End of Section --

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SECTION 08 91 00

METAL [WALL] [AND] [DOOR] LOUVERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-L	(2015) Laboratory Methods of Testing Louvers for Rating
AMCA 511	(2010; R 2016) Certified Ratings Program for Air Control Devices

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611	(2014) Voluntary Specification for Anodized Architectural Aluminum
AAMA 2603	(2020) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
AAMA 2605	(2020) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural,

	High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM B209M	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B221M	(2021) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS H 4000	(2017) Aluminum and Aluminum Alloy Sheets, Strips, and Plates
JIS H 4100	(2015) Aluminum and Aluminum Alloy Extruded Profiles

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wall Louvers

SD-03 Product Data

Metal Wall Louvers

Door Louvers

SD-04 Samples

Wall Louver Samples; G[, [_____]]

Door Louver Samples; G[, [_____]]

1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers must be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

1.4 DETAIL DRAWINGS

Show all information necessary for fabrication and installation of wall louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

1.5 COLOR SAMPLES

Colors of finishes for wall louver samples and door louver samples must

closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard colors to the Contracting Officer for selection.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Galvanized Steel Sheet

ASTM A653/A653M, coating designation Z275.

2.1.2 Aluminum Sheet

ASTM B209M or JIS H 4000, alloy 3003 or 5005 with temper as required for forming.

2.1.3 Extruded Aluminum

ASTM B221M or JIS H 4100, alloy 6063-T5 or -T52.

[2.1.4 Stainless Steel

Type 302 or 304, with 2B finish.

]2.1.5 Cold Rolled Steel Sheet

ASTM A1008/A1008M, Class 1, with matte finish. Use for interior louvers only.

2.2 METAL WALL LOUVERS

[Weather][Wind driven rain] resistant type, with bird screens and made to withstand a wind load of not less than [1.44] [_____] kilopascals. Wall louvers must bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500-L and AMCA 511. The rating must show a water penetration of 0.06 kilograms or less per square meter of free area at a free velocity of 244 meters per minute.

2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 2 mm.

2.2.2 Formed Metal Louvers

Formed of [zinc-coated] [stainless] steel sheet not thinner than 16 U.S. gage, or aluminum sheet not less than 2 mm thick.

2.2.3 Mullions and Mullion Covers

Same material and finish as louvers. Provide mullions [where indicated] [for all louvers more than 1500 mm in width at not more than 1500 mm on centers]. Provide mullion covers on both faces of joints between louvers.

2.2.4 Screens and Frames

For aluminum louvers, provide 12.5 mm square mesh, 1.8 or 1.5 mm aluminum

or 6 mm square mesh, 1.5 mm aluminum bird screening. For steel louvers, provide 12.5 mm square mesh, 2.5 or 1.5 mm zinc-coated steel; 12.5 mm square mesh, 1.5 mm copper; or 6 mm square mesh, 1.5 mm thick zinc-coated steel or copper bird screening. Mount screens in removable, rewirable frames of same material and finish as the louvers.

2.3 DOOR LOUVERS

[Inverted "Y"][or][Inverted "V"] sightproof type not less than 25 mm thick with matching metal trim. Louvers for exterior doors must be weather resistant type.

2.3.1 Extruded Aluminum Door Louvers

Fabricate of 6063-T5 or -T52 aluminum alloy with a wall thickness of not less than 1.25 mm thick. Frames and trim must be clamp-in "L" type.

2.3.2 Formed Metal Door Louvers

Fabricate of [0.9 mm thick steel sheet][or][sheet aluminum not less than 1.25 mm thick]. Trim must be beveled "Z" molding both sides.

2.3.3 Screens and Frames

For exterior doors, provide aluminum insect screens, 18 by 16 or 18 by 14 mesh. Mount screens in removable, rewirable frames of same material and finish as the louvers.

2.4 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers and zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories as required for complete and proper installation.

2.5 FINISHES

2.5.1 Aluminum

Exposed aluminum surfaces must be factory finished with an [anodic coating][or][organic coating].[Color must be [_____][as indicated].] Louvers [for each building] must have the same finish.

2.5.1.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish must be:

[a. Architectural Class II (0.01 to 0.0175 mm), designation AA-M10-C22-[A31, clear (natural)] [A32, integral color] [A34, electrolytically deposited color] anodized.

][b. Architectural Class I (0.0175 mm or thicker), designation AA-M10-C22-[A41, clear (natural)] [A42, integral color] [A44, electrolytically deposited color] anodized.

]

2.5.1.2 Organic Coating

Clean and prime exposed aluminum surfaces. Provide a [baked enamel finish conforming to AAMA 2603, with total dry film thickness not less than 0.02

mm] [superior performance finish in accordance with AAMA 2605 with total dry film thickness of not less than 0.03 mm], color [_____].

2.5.2 Steel

Surfaces specified must have a zinc coating, a phosphate treatment, and a shop prime coat of rust-inhibitive paint. The galvanized coating must conform to ASTM A653/A653M, coating designation Z275 (G90)[, except that louvers located in conditioned spaces on interior of the building may be Z180 (G60)]. The weight of zinc coatings must be as designated in Table I of ASTM A123/A123M for the thickness of base metal to be coated. The prime coat must be a type especially developed for materials treated by phosphates and adapted to application by dipping or spraying. Repair damaged zinc-coated surfaces by the materials and methods conforming to ASTM A780/A780M and spot prime. At the option of the Contractor, a two-part system including bonderizing, baked-on epoxy primer, and baked-on enamel top coat may be applied before forming, in lieu of prime coat specified.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

3.1.2 Door Louvers

Install louvers in wood doors by using metal "Z" or "L" moldings. Fasten moldings to door with screws.

3.1.3 Screens and Frames

Attach frames to louvers with screws or bolts.

3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

3.2.1 Copper or Copper-Bearing Alloys

Paint copper or copper-bearing alloys in contact with dissimilar metal with heavy-bodied bituminous paint or separate with inert membrane.

3.2.2 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

3.2.3 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.2.4 Wood

Paint wood or other absorptive materials that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

-- End of Section --

SECTION 09 22 00

SUPPORTS FOR PLASTER AND GYPSUM BOARD

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

BUILDING STANDARD LAW OF JAPAN

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5505	(2014) Metal Laths
JIS A 6517	(2010) Steel Furrings for Wall and Ceiling in Buildings
JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS G 3314	(2010) Hot-Dip Aluminum-Coated Steel Sheet and Strip
JIS G 3321	(2012) Molten 55 Percent Aluminum Zinc Alloy Plated Steel Sheet and Strip
JIS G 3505	(2017) Mild Steel Wire Rod

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Metal Support Systems; G[, [_____]]

Submit for the erection of metal[framing,][furring,][and][ceiling suspension systems]. Indicate materials, sizes, thicknesses, and fastenings.

SD-03 Product Data

Metal Support Systems

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site and store in ventilated dry locations permitting easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

PART 2 PRODUCTS

2.1 MATERIALS

Provide steel materials for metal support systems with galvanized coating JIS G 3302, Z18; aluminum coating JIS G 3314, with a plating adhesion amount of 80, or JIS G 3321. Provide support systems, bracing and attachments per Building Standard Law of Japan.

Provide metal support systems containing a minimum of 20 percent recycled content.

2.1.1 Materials for Attachment of Lath

2.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

JIS A 5505.

2.1.1.2 Non-loadbearing Wall Framing and Furring

JIS A 6517.

2.1.2 Materials for Attachment of Gypsum Wallboard

2.1.2.1 Suspended and Furred Ceiling Systems

JIS A 6517. JIS G 3505 for hanger rod and nut.

2.1.2.2 Nonload-Bearing Wall Framing and Furring

JIS A 6517, but not thinner than[0.45 mm thickness, with 0.85 mm minimum thickness supporting wall hung items such as cabinetwork, equipment and fixtures][0.85 mm thickness regardless of the ASTM certified third party testing statement for equivalent thicknesses].

2.1.2.3 Furring Structural Steel Columns

JIS A 6517.

2.1.2.4 Z-Furring Channels with Wall Insulation

Not lighter than 0.5 mm thick galvanized steel, Z-shaped, with 32 mm and 19 mm flanges and [[25] [38] [50] [75] mm furring depth] [depth as required by the insulation thickness provided].

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Systems for Attachment of Gypsum Board or Lath

Follow manufacturer's instructions.

3.2 ERECTION TOLERANCES

Provide framing members which will be covered by finish materials such as wallboard, plaster, or ceramic tile set in a mortar setting bed, within the following limits:

a. Layout of walls and partitions: 6 mm from intended position;

b. Plates and runners: 5 mm in 1.9 meters from a straight line;

c. Studs: 5 mm in 1.9 meters out of plumb, not cumulative; and

d. Face of framing members: 5 mm in 1.9 meters from a true plane.

Provide framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive within the following limits:

a. Layout of walls and partitions: 6 mm from intended position;

b. Plates and runners: 5 mm in 3.8 meters from a straight line;

c. Studs: 5 mm in 3.8 meters out of plumb, not cumulative; and

d. Face of framing members: 5 mm in 3.8 meters from a true plane.

-- End of Section --

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SECTION 09 29 00

GYPSUM BOARD

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

GYPSUM BOARD ASSOCIATION OF JAPAN (GRAJ)

GRAM	Gypsum Board Application Manual

JAPAN ADHESIVE INDUSTRY ASSOCIATION (JAIA)

JAIA 4VOC	Voluntary VOC Regulating Rule for Indoor Air Pollution Control

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1408	(2017) Test Methods of Bending and Impact for Building Boards
JIS A 1453	(2017) Abrasion Test Method for Building Materials and Building Components (Abrasive Paper Method)
JIS A 1901	(2015) Determination of the Emission of Volatile Organic Compounds and Aldehydes by Building Products - Small Chamber Test Method
JIS A 5430	(2018) Fiber Reinforced Cement Boards
JIS A 5508	(2009) Nails
JIS A 6005	(2005) Asphalt Roofing Felts
JIS A 6901	(2014) Gypsum Boards
JIS A 6914	(2008) Jointing Materials for Gypsum Plasterboards
JIS B 1125	(2015) Self Drilling Tapping Screws
JIS Z 2911	(2018) Methods of Test for Fungus Resistance

UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance (2014) Fire Resistance Directory

1.2 SUBMITTALS

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SD-08 Manufacturer's Instructions

Safety Data Sheets

SD-10 Operation and Maintenance Data

Manufacturer Maintenance Instructions

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Deliver materials in the original packages, containers, or bundles with each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

1.3.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board and cementitious backer units outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation. Store per manufacturer's recommendations for allowable temperature and humidity range. Do not store gypsum wallboard with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants, including [_____]. Do not store panels near materials that may off gas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives. Do not use materials that have visible moisture or biological growth.

1.3.3 Handling

Neatly stack gypsum board and cementitious backer units flat to prevent sagging or damage to the edges, ends, and surfaces.

1.4 QUALIFICATIONS

Furnish type of gypsum board work specialized by the installer with a minimum of [3] [_____] years of documented successful experience.

1.5 SCHEDULING

[The gypsum wallboard must be taped, finished and primed before the

installation of the highly emitting materials, including [_____].] [The gypsum wallboard must be installed after the installation and ventilation period of the highly emitting materials, including [_____].]

Commence application only after the area scheduled for gypsum board work is completely weathertight. The heating, ventilating, and air-conditioning systems must be complete and in operation prior to application of the gypsum board. If the mechanical system cannot be activated before gypsum board is begun, the gypsum board work may proceed in accordance with an approved plan to maintain the environmental conditions specified below. Apply gypsum board prior to the installation of finish flooring and acoustic ceiling.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not expose the gypsum board to excessive sunlight prior to gypsum board application. Maintain a continuous uniform temperature of not less than 10 degrees C and not more than 27 degrees C for at least one week prior to the application of gypsum board work, while the gypsum board application is being done, and for at least one week after the gypsum board is set. Shield air supply and distribution devices to prevent any uneven flow of air across the plastered surfaces. Provide ventilation to exhaust moist air to the outside during gypsum board application, set, and until gypsum board jointing is dry. In glazed areas, keep windows open top and bottom or side to side 75 to 100 mm. Reduce openings in cold weather to prevent freezing of joint compound when applied. For enclosed areas lacking natural ventilation, provide temporary mechanical means for ventilation. In unglazed areas subjected to hot, dry winds or temperature differentials from day to night of 10 degrees C or more, screen openings with cheesecloth or similar materials. Avoid rapid drying. During periods of low indoor humidity, provide minimum air circulation following gypsum boarding and until gypsum board jointing complete and is dry.

[1.7 FIRE RESISTIVE CONSTRUCTION

Comply with specified fire-rated assemblies for design numbers indicated.

]# PART 2 PRODUCTS

2.1 MATERIALS

Conform to specifications, standards and requirements specified. Provide gypsum board types, gypsum backing board types, cementitious backing units, and joint treating materials manufactured from asbestos free materials only. Submit Safety Data Sheets and manufacturer maintenance instructions for gypsum materials including adhesives.

2.1.1 Gypsum Board

JIS A 6901.

2.1.1.1 Regular

900 mm wide, [12.5] [15] mm thick, [tapered][, tapered and featured] edges. [Provide tapered and featured edge gypsum board [in Rooms [_____]] [as indicated].]

2.1.1.2 Foil-Backed

900 mm wide,[12.5] [15] mm thick, square, [tapered] [tapered and featured] edges.

2.1.1.3 Type X or Type Z (Special Fire-Resistant)

900 mm wide, [12.5] [15] mm thick, [tapered] [tapered and featured] edges.

2.1.1.4 Mold Resistant / Anti-Microbial Gypsum

JIS Z 2911. 900 mm wide, [12.5] [15] mm thick, square, tapered or beveled edges.

2.1.2 Gypsum Backing Board

JIS A 6901, gypsum backing board must be used as a base in a multilayer system.

2.1.2.1 Regular

900 mm wide, [12.5] [15] mm thick, square, tapered or beveled edges.

2.1.2.2 Type Z (Special Fire-Resistant)

1200 mm wide, [12.5] [15] mm thick, square or tapered edges.

2.1.3 Regular Water-Resistant Gypsum Backing Board

2.1.3.1 Regular

900 mm wide, [12.5] [15] mm thick, tapered or beveled edges.

2.1.3.2 Type X or Type Z (Special Fire-Resistant)

900 mm wide, [12.5] [15] mm thick, tapered or beveled edges.

2.1.4 Glass Mat Water-Resistant Gypsum Tile Backing Board

Water absorption rate of less than 5 percent.

2.1.4.1 Regular

1200 mm wide, [12.5] [15] mm thick, square, tapered or beveled edges.

2.1.4.2 Type Z (Special Fire-Resistant)

900 mm wide, [12.5] [15] mm thick, square, tapered or beveled edges.

2.1.5 Abuse Resistant Gypsum Board

900 mm wide, [15] mm thick, tapered edges. Reinforced gypsum panel with imbedded fiber mesh or lexan backing tested in accordance with the following tests. Hard body impact test must attain a maximum indentation depth of 2.5 mm in accordance with JIS A 1408. Provide fasteners that meet manufacturer requirements and specifications stated within this section. Abuse resistant gypsum board, when tested in accordance with ASTM E84, have [a flame spread rating of 25 or less and a smoke developed rating of 50 or less for [_____]] [and] [a flame spread rating of 75 or

less and a smoke developed rating of 100 or less for [_____]].

2.1.5.1 Hard Body Impact Test

Comply with hard body impact test in accordance with JIS A 1408 with a maximum indentation depth of 2.5 mm.

2.1.5.2 Surface Abrasion Test

Comply with test surface abrasion test in accordance with JIS A 1453.

2.1.5.3 Indentation Test

JIS A 1408 for indentation resistance.

2.1.6 Cementitious Backer Units

In accordance with JIS A 5430.

2.1.7 Joint Treatment Materials

JIS A 6914. Product must be low emitting VOC types with VOC limits not exceeding 50 g/L. Provide data identifying VOC content of joint compound. [Use all-purpose joint and texturing compound containing inert fillers and natural binders, including lime compound. Pre-mixed compounds must be free of antifreeze, vinyl adhesives, preservatives, biocides and other slow releasing compounds.]

2.1.7.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

2.1.7.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

2.1.7.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

2.1.7.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

2.1.7.5 Joint Tape

Use cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

2.1.8 Fasteners

2.1.8.1 Nails

JIS A 5508.

2.1.8.2 Screws

JIS B 1125 steel drill screws for fastening gypsum board to gypsum board, wood framing members and steel framing members less than 0.84 mm thick. JIS B 1125 steel drill screws for fastening gypsum board to steel framing members 0.84 to 2.84 mm thick. Provide cementitious backer unit screws with a polymer coating.

2.1.8.3 Staples

1.5 mm thick flattened galvanized wire staples with 11.1 mm wide crown outside measurement and divergent point for base ply of two-ply gypsum board application. Use as follows:

Length of Legs	Thickness of Gypsum Board
28.6 mm	12.5 mm
31.8 mm	15 mm

2.1.9 Adhesives

Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of UL 2818(Greenguard) Gold, SCS Global SErvices Indoor ADvantage Gold, or F 4-Star and JAIA 4VOC . Provide aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of JIS A 1901 (limit requirements for either office or classroom spaces regardless of space type. Provide certification or validation of indoor air quality for non-aerosol adhesives applied on the interior of the building (inside of the weatherproofing system). Provide certification or validation of indoor air quality for aerosol adhesives used on the interior of the building (inside of the weatherproofing system).

2.1.9.1 Adhesive for Laminating

[Not permitted.][Adhesive attachment is not permitted for multi-layer gypsum boards. For laminating gypsum studs to face panels, provide adhesive recommended by gypsum board manufacturer.]

2.1.10 Gypsum Studs

Provide 25 mm minimum thickness and 150 mm minimum width. Studs may be of 25 mm thick gypsum board or multilayers fastened to required thickness. Conform to JIS A 6901 for material and Gypsum Board Application Manual (GRAM) for installation.

2.1.11 Shaftwall Liner Panel

Conform to the UL Fire Resistance or MLIT for the Design Numbers(s) indicated for shaftwall liner panels. Manufacture liner panel for cavity shaftwall system, with water-resistant paper faces, bevel edges, single lengths to fit required conditions, as indicated.

2.1.12 Accessories

Fabricate from [corrosion protected steel][or][plastic] designed for

intended use. Accessories manufactured with paper flanges are not acceptable. Flanges must be free of dirt, grease, and other materials that may adversely affect bond of joint treatment. Provide prefinished or job decorated materials.

2.1.13 Asphalt Impregnated Building Felt

Provide a 6.7 kg asphalt moisture barrier over glass mat covered or reinforced gypsum sheathing. Conforming to JIS A 6005 for asphalt impregnated building felt.

2.1.14 Water

Provide clean, fresh, and potable water.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grab bars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

3.1.2 [Gypsum Board] [and] [Framing]

Verify that surfaces of [gypsum board] [and] [framing] to be bonded with an adhesive are free of dust, dirt, grease, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

3.1.3 [Masonry] [and] [Concrete] Walls

Verify that surfaces of [masonry] [and] [concrete] walls to receive gypsum board applied with adhesive are dry, free of dust, oil, form release agents, protrusions and voids, and any other foreign matter. Do not proceed with work until surfaces are acceptable for application of gypsum board with adhesive.

3.1.4 Building Construction Materials

Do not install building construction materials that show visual evidence of biological growth.

3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with Gypsum Board Application Manual (GRAM), Gypsum Board Association of Japan or Manufacturers instructions and the requirements specified. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length; select panel sizes to minimize waste. Cut out gypsum board to make neat, close, and tight joints around openings. In vertical application of gypsum

board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Lay out panels to minimize waste; reuse cutoffs whenever feasible. Surfaces of gypsum board and substrate members may [not]be bonded together with an adhesive[, except where prohibited by fire rating(s)]. Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer. Minimize framing by floating corners with single studs and drywall clips. [Install [16 mm][_____] gypsum or [13 mm][_____] ceiling board over framing at [610 mm][_____] on center.] Provide type of gypsum board for use in each system specified herein as indicated.

3.2.1 Application of Single-Ply Gypsum Board to Wood Framing

Apply in accordance with Gypsum Board Application Manual (GRAM), Gypsum Board Association of Japan or Manufacturer's Instructions.

3.2.2 Application of Two-Ply Gypsum Board to Wood Framing

Apply in accordance with Gypsum Board Application Manual (GRAM), Gypsum Board Association of Japan or Manufacturer's Instructions.

3.2.3 Adhesive Application to Interior Masonry or Concrete Walls

Apply in accordance with Gypsum Board Application Manual (GRAM), Gypsum Board Association of Japan or Manufacturer's Instructions.

3.2.4 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with Gypsum Board Application Manual (GRAM), Gypsum Board Association of Japan or Manufacturer's Instructions.

3.2.5 Arches and Bending Radii

Apply in accordance with Gypsum Board Application Manual (GRAM), Gypsum Board Association of Japan or Manufacturer's Instructions.

3.2.6 Gypsum Board for Wall Tile or Tile Base Applied with Adhesive

In dry areas (areas other than tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply glass mat water-resistant gypsum tile backing board [or water-resistant gypsum backing board] in accordance with Gypsum Board Application Manual (GRAM), Gypsum Board Association of Japan or Manufacturer's Instructions.

3.2.7 Exterior Application

Apply exterior gypsum board (such as at soffits) in accordance with Gypsum Board Application Manual (GRAM), Gypsum Board Association of Japan or Manufacturer's Instructions.

3.2.8 Floating Interior Angles

Minimize framing by floating corners with single studs and drywall clips. Locate the attachment fasteners adjacent to ceiling and wall intersections in accordance with Gypsum Board Application Manual (GRAM), Gypsum Board Association of Japan or Manufacturer's Instructions, for [single-ply] [and] [two-ply] applications of gypsum board to wood framing.

3.2.9 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with Gypsum Board Application Manual (GRAM), Gypsum Board Association of Japan or Manufacturer's Instructions. Fill control joints between studs in fire-rated construction with firesafing insulation to match the fire-rating of construction.

3.2.10 Application of Abuse Resistant Gypsum Board

Apply in accordance with applicable system of Gypsum Board Application Manual (GRAM), Gypsum Board Association of Japan or Manufacturer's Instructions. Follow manufacturers written instructions on how to cut, drill and attach board.

3.3 APPLICATION OF CEMENTITIOUS BACKER UNITS

3.3.1 Application

In wet areas (tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply cementitious backer units. Place a 7.6 kg asphalt impregnated, continuous felt paper membrane behind cementitious backer units, between backer units and studs or base layer of gypsum board. Place membrane with a minimum 150 mm overlap of sheets laid shingle style.

3.3.2 Joint Treatment

Gypsum Board Application Manual (GRAM), Gypsum Board Association of Japan or Manufacturer's Instructions.

3.4 FINISHING OF GYPSUM BOARD

Finish plenum areas above ceilings to Level 1. Finish water resistant gypsum backing board to receive ceramic tile to Level 2. Finish walls and ceilings to receive a heavy-grade wall covering or heave textured finish before painting to Level 3. Finish walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings to Level 4. Unless otherwise specified, finish all gypsum board walls, partitions and ceilings to Level 5. Provide joint, fastener depression, and corner treatment. Tool joints as smoothly as possible to minimize sanding and dust. Do not use self-adhering fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer. Protect workers, building occupants, and HVAC systems from gypsum dust.

3.4.1 Uniform Surface

Wherever gypsum board is to receive eggshell, semigloss or gloss paint finish, or where severe, up or down lighting conditions occur, finish gypsum wall surface in accordance to Level 5. Apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.

3.4.2 Gypsum Board Finish Levels

3.4.2.1 Level 1

All joints and interior angles shall have tape set in joint compound.

Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.

3.4.2.2 Level 2

All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.

3.4.2.3 Level 3

All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. One additional coat of joint compound shall be applied over all joints and interior angles. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a drywall primer prior to the application of final finishes.

3.4.2.4 Level 4

All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied overall flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a drywall primer prior to the application of final finishes.

3.4.2.5 Level 5

All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.

Note: It is recommended that the prepared surface be coated with a drywall primer prior to the application of finish paint.

3.5 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07 92 00 JOINT SEALANTS. Apply material with exposed surface flush with gypsum board or cementitious backer units.

[3.5.1 Sealing for Glass Mat or Reinforced Gypsum Board Sheathing

Apply silicone sealant in a 9.5 mm bead to all joints and trowel flat. Apply enough of the same sealant to all fasteners penetrating through the glass mat gypsum board surface to completely cover the penetration when troweled flat. [Do not place construction and materials behind sheathing until a visual inspection of sealed joints during daylight hours has been completed by Contracting Officer.]

]3.6 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners,[wall and ceiling framing] in accordance with the specifications contained in [UL Fire Resistance for the Design Number(s) indicated] or [GA 600 for the File Number(s) indicated]. Seal penetrations through rated partitions and ceilings tight in accordance with tested systems.

3.7 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finishes.

3.8 SHAFTWALL FRAMING

Install the shaftwall system in accordance with the system manufacturer's published instructions. Coordinate bucks, anchors, blocking and other items placed in or behind shaftwall framing with electrical and mechanical work. Patch or replace fireproofing materials which are damaged or removed during shaftwall construction.

-- End of Section --

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SECTION 09 30 10

CERAMIC, QUARRY, AND GLASS TILING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1509-3	(2014) Test Method for Ceramic Tiles - Part 3: Determination of Water Absorption, Apparent Porosity and Bulk Density
JIS A 1509-4	(2008) Test Methods for Ceramic Tiles - Part 4: Determination of Modulus of Rupture and Breaking strength
JIS A 1509-8	(2014) Test Methods for Ceramic Tiles - Part 8: Determination for crazing resistance for glazed tiles
JIS A 1509-9	(2014) Test Methods for Ceramic Tiles - Part 9: Determination for frost resistance
JIS A 5005	(2009) Crushed Stone and Manufactured Sand for Concrete
JIS A 5209	(2010) Ceramic Tiles
JIS A 5403	(1989) Asbestos Cement Sheets
JIS A 5505	(2014) Metal Laths
JIS A 5548	(2015) Interior Organic Adhesives for Ceramic Tiles
JIS A 5557	(2010) Organic Adhesives for Exterior Tile Finishing
JIS A 6022	(2010) Stretchy Asphalt Roofing Felts (Synthetic Fiber Base)
JIS A 6902	(1995) Plastering Lime
JIS G 3551	(2005) Welded Wire Mesh and Rebar Grid
JIS R 5210	(2009) Portland Cement

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT-SS Chapter 11	(2019) Public Building Construction Standard Specifications - Ch.11 Tile Work and Wood Work

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G

SD-10 Operation and Maintenance Data

Installation; G

1.3 CERTIFICATIONS

1.3.1 Indoor Air Quality Certifications

1.3.1.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements by providing the certification or validation by other third-party program that products meet the requirements of this Section. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.4 QUALITY ASSURANCE

Provide installers having a minimum of two years experience with a company specializing in performing the type of work described. Each type and color of tile to be provided from a single source. Each type and color of mortar, adhesive, and grout to be provided from the same source.

1.5 DELIVERY, STORAGE, AND HANDLING

Ship tiles in sealed packages and clearly marked with the grade, type of tile, producer identification, and country of origin. Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Protect materials from weather, and store them under cover in accordance with manufacturer's printed instructions.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not perform ceramic tile work unless the substrate and ambient temperature is at least 10 degrees C and rising. Maintain temperature above 10 degrees C while the work is being performed and for at least 7

days after completion of the work. When temporary heaters are used, ventilate the area to the outside to avoid carbon dioxide damage to new tilework.

1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period.

1.8 EXTRA MATERIALS

Supply an extra 2 percent of each type tile used in clean and marked cartons.

PART 2 PRODUCTS

2.1 TILE

Provide tiles that comply with JIS A 5209 and are standard grade tiles. Provide a minimum breaking strength for floor tile in accordance with JIS A 1509-4. Provide exterior building tile for cold climate projects that is approved by the manufacturer for exterior use in accordance with JIS A 1509-9 and JIS A 5209. Provide floor tiles with a wet dynamic coefficient of friction value per JIS A 5209 requirements. Provide glazed floor tile with commercial rating by the manufacturer per JIS A 1509-8, for visible abrasion resistance as related to foot traffic. For materials like tile, accessories, and transition strips submit samples of sufficient size to show color range, pattern, type and joints. Submit manufacturer's catalog data. Tiles and tile works shall comply with MLIT-SS Chapter 11.

2.1.1 Porcelain Tile

Provide [[unglazed] [or] [glazed],] [rectified] porcelain tile, [cove] [bullnose] base and trim pieces[with color extending uniformly through the body of the tile]. [Provide tile with a [V0] [V1] [V2] [V3] [V4] aesthetic classification. Blend tiles in factory and in a packages to have same color range and continuous blend for installation.] Provide nominal tile size(s) of [150 by 150] [300 by 300] [450 by 450] [300 by 450] [_____] mm and [8] [10] [_____] mm thick. Provide a 0.50 percent maximum water absorption in accordance with JIS A 1509-3.

Provide Porcelain Tiling Materials that contain a minimum of 10 percent recycled content.

2.1.2 Quarry Tile

Furnish an unglazed quarry tile, [cove] [bullnose] base and trim pieces. Provide tile with [smooth] [abrasive] surface. Provide nominal tile size(s) of [150 by 150] [_____] mm and 13 mm thick. Provide maximum water absorption in accordance with JIS A 5209 or JIS A 1509-3.

Provide Quarry Tiling Materials that contain a minimum of 10 percent recycled content.

2.1.3 Mosaic Tile

Furnish [unglazed] [glazed], mosaic tile[, [cove] [bullnose] [base] and trim composed of [natural clay] [porcelain]. Blend tiles in factory and in a packages to have same color range and continuous blend for

installation.] Provide [nominal tile size(s) of [25 by 25] [25 by 50] [50 by 50] [_____] mm][a mixture of standard sizes in a stock pattern]. [Provide porcelain mosaics with a water absorption up to 0.50 percent] [Provide natural clay mosaics with a water absorption up to [3.0] [_____] percent] per JIS A 1509-3.

Provide Mosaic Tiling Materials that contain a minimum of 3 percent recycled content.

2.1.4 Glass Tile

Furnish glass mosaic tile that requires thermal shock resistance and can withstand the range of temperatures outdoors. Provide nominal tile size(s) of [25 by 25] [_____] mm.

2.1.5 Glazed Wall Tile

Furnish glazed wall tile that has cushioned edges and trim with lead-free [bright] [matte] finish. Provide nominal tile size(s) of [106 by 106] [106 by 150] [150 by 150] mm.

2.1.6 Accessories

Provide built-in type accessories of the same materials and finish as the wall tile. Provide accessories as follows:

	Quantity	Location
Recessed soap holders	[_____]	[_____]
Tumbler holders	[_____]	[_____]
Combination tumbler and toothbrush holders	[_____]	[_____]
Towel bars, [stainless steel][ceramic] [600] [750] mm long, two towel posts	[_____]	[_____]
Robe hooks	[_____]	[_____]
Roll paper holder	[_____]	[_____]
Recessed soap holder and hand hold combination	[_____]	[_____]

2.2 SETTING-BED

Submit manufacturer's catalog data. Compose the setting-bed of the following materials:

2.2.1 Aggregate for Concrete Fill

Conform to JIS A 5005, for aggregate fill. Do not exceed one-half the thickness of concrete fill for maximum size of coarse aggregate.

2.2.2 Portland Cement

Conform to JIS R 5210, for cement, Type I, white for wall mortar and gray for other uses.

2.2.3 Sand

Conform to JIS A 5005, for sand.

2.2.4 Hydrated Lime

Conform to JIS A 6902, for hydrated lime.

2.2.5 Metal Lath

Conform to JIS A 5505, for flat expanded type metal lath, and weighing a minimum 1.4 kg/square meter.

2.2.6 Reinforcing Wire Fabric

Conform to JIS G 3551 for wire fabric. Provide [50 by 50 mm mesh, 16/16 wire] [or] [38 by 50 mm mesh, 16/13 wire].

2.3 WATER

Provide potable water.

2.4 MORTAR, GROUT, AND ADHESIVE

[Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting formaldehyde emission rate below 0.005 mg/m2h or meeting requirements of F 4-Star and 4VOC .]

2.4.1 Dry-Set Portland Cement Mortar

MLIT-SS Chapter 11 Tile Work.

2.4.2 Latex-Portland Cement Mortar

MLIT-SS Chapter 11 Tile Work.

2.4.3 Ceramic Tile Grout

MLIT-SS Chapter 11 Tile Work; petroleum-free and plastic-free [sand portland cement grout] [dry-set grout] [latex-portland cement grout] [commercial portland cement grout].

2.4.4 Organic Adhesive

MLIT-SS Chapter 11 Tile Work. Comply with JIS A 5557 for exterior tile and JIS A 5548 for interior tile.

2.4.5 Sealants

Comply with applicable regulations regarding toxic and hazardous materials and as specified. Grout sealant must not change the color or alter the appearance of the grout. Refer to Section 07 92 00 JOINT SEALANTS.

[Provide sealants used on the interior of the building (defined as inside of the weatherproofing system) meeting formaldehyde emissions rate below 0.005 mg/m2h or meet the requirements of F 4-Star and 4VOC

2.5 SUBSTRATES

2.5.1 Cementitious Backer Board

Provide cementitious backer units, for use as tile substrate over wood sub-floors, in accordance with MLIT-SS Chapter 11 Tile Work. Furnish [6.35] [12.7] mm thick cementitious backer units.

2.5.2 Glass Mat Gypsum Backer Panel

Provide glass mat water-resistant gypsum backer board, for use as tile substrate over wood subfloors, in accordance with JIS A 5403. Provide [6.35][12.7] mm thick glass mat gypsum backer board.

2.6 TRANSITION STRIPS

Provide [[clear] [_____] anodized aluminum transitions between tile and carpet or resilient flooring. Provide types as recommended by flooring manufacturer for both edges and transitions of flooring materials specified] [marble transitions appropriate for conditions].

2.7 MEMBRANE MATERIALS

Conform to JIS A 6022, Type 1 for 33 kg waterproofing membrane, asphalt-saturated building felt.

2.8 COLOR, TEXTURE, AND PATTERN

Provide color, pattern and texture in accordance with [Section 09 06 00 SCHEDULES FOR FINISHES][as indicated][[_____]. Color listed is not intended to limit the selection of equal colors from other manufacturers].[Provide floor patterns as specified on the drawings.]

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Inspect surface to receive tile in conformance to the requirements of MLIT-SS Chapter 11 Tile Work for surface conditions for the type setting bed specified and for workmanship. Provide variations of tiled surfaces that fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	3 mm in 2.4 meter	3.0 mm in 3 meter
Organic Adhesives	3 mm in 2.4 meter	1.5 mm in 1 meter
Latex Portland Cement Mortar	3 mm in 2.4 meter	3.0 mm in 3 meter
Epoxy	3 mm in 2.4 meter	3.0 mm in 3 meter

3.2 GENERAL INSTALLATION REQUIREMENTS

Do not start tile work until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Close space, in which tile is being set, to traffic and other work. Keep closed until tile is firmly set. Do not start floor tile installation in spaces requiring wall tile until after wall tile has been installed. Apply tile in colors and patterns indicated in the area shown on the drawings. Install tile with the respective surfaces in true even planes to the elevations and grades shown. Provide special shapes as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Solidly back tile bases and coves with mortar. Do not walk or work on newly tiled floors without using kneeling boards or equivalent protection of the tiled surface. Keep traffic off horizontal portland cement mortar installations for at least 72 hours. Keep all traffic off epoxy installed floors for at least 40 hours after grouting, and heavy traffic off for at least 7 days, unless otherwise specifically authorized by manufacturer. Dimension and draw detail drawings at a minimum scale of 6 mm = 300 mm. Include drawings of pattern at inside corners, outside corners, termination points and location of all equipment items such as thermostats, switch plates, mirrors and toilet accessories mounted on surface. Submit drawings showing ceramic tile pattern [elevations][and][floor plans]. Submit manufacturer's preprinted installation instructions.

Do not install building construction materials that show visual evidence of biological growth.

3.3 INSTALLATION OF WALL TILE

Install wall tile in accordance with the MLIT-SS Chapter 11 Tile Work, method [_____] and with grout joints [[as recommended by the manufacturer for the type of tile][of [_____] mm]. [Install thinner wall tile flush with thicker wall tile applied on same wall and provide installation materials as recommended by the tile and setting materials manufacturer's to achieve flush installation.]]

3.3.1 Workable or Cured Mortar Bed

Install tile over workable mortar bed or a cured mortar bed at the option of the Contractor. Install a 0.102 mm polyethylene membrane, metal lath, and scratch coat.

3.3.2 Dry-Set Mortar and Latex-Portland Cement Mortar

Use [Dry-set] [or] [Latex-Portland Cement] to install tile in accordance with MLIT-SS Chapter 11 Tile Work. Use Latex Portland Cement when installing porcelain ceramic tile.

3.3.3 Organic Adhesive

Conform to JIS A 5557 for exterior tile and JIS A 5548 for interior tile for the organic adhesive installation of ceramic tile.

3.3.4 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with MLIT-SS Chapter 11 Tile Work. [Provide and apply manufacturer's standard

[_____] product for sealing grout joints in accordance with manufacturer's recommendations.]

3.4 INSTALLATION OF FLOOR TILE

Install floor tile in accordance with MLIT-SS Chapter 11 Tile Work method [_____] and with grout joints [as recommended by the manufacturer for the type of tile][of [_____] mm]. Install shower receptors in accordance with manufacturer recommendations.

3.4.1 Workable or Cured Mortar Bed

Install floor tile over a workable mortar bed or a cured mortar bed at the option of the Contractor. Install in accordance with MLIT-SS Chapter 11 Tile Work. Provide minimum 6.35 mm to maximum 9.53 mm.

3.4.2 Dry-Set and Latex-Portland Cement

Use [dry-set] [or] [Latex-Portland cement] mortar to install tile directly over properly cured, plane, clean concrete slabs in accordance with Install in accordance with MLIT-SS Chapter 11 Tile Work. Use Latex Portland cement when installing porcelain ceramic tile.

3.4.3 Resinous Grout

When resinous grout is indicated, grout quarry tile with either furan or epoxy resin grout. Rake and clean joints to the full depth of the tile and neutralize when recommended by the resin manufacturer. Install epoxy resin grout in conformance with MLIT-SS Chapter 11 Tile Work. Install resin grout in accordance with manufacturer's printed installation instructions. Provide a coating of wax applied from the manufacturer on all tile installed and furan resin. Follow manufacturer's printed installation instructions of installed resin grout for proportioning, mixing, installing, and curing. Maintain the recommended temperature in the area and on the surface to be grouted. Protect finished grout of grout stain.

3.4.4 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with MLIT-SS Chapter 11 Tile Work. Provide and apply manufacturer's standard product for sealing grout joints in accordance with manufacturer's recommendations.

3.4.5 Waterproofing

Shower pans are specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE. Conform to the requirements of Section 07 12 00 BUILT-UP BITUMINOUS WATERPROOFING for waterproofing under concrete fill.

3.4.6 Concrete Fill

Provide a 24.1 MPa concrete fill mix to dry as consistency as practicable. [Compose concrete fill by volume of 1 part Portland cement to 3 parts fine aggregate to 4 parts coarse aggregate, and mix with water to as dry a consistency as practicable.] Spread, tamp, and screed concrete fill to a true plane, and pitch to drains or levels as shown. Thoroughly damp concrete fill before applying setting-bed material. Reinforce concrete fill with one layer of reinforcement, with the uncut

edges lapped the width of one mesh and the cut ends and edges lapped a minimum 50 mm. Tie laps together with 1.3 mm wire every 250 mm along the finished edges and every 150 mm along the cut ends and edges. Provide reinforcement with support and secure in the centers of concrete fills. Provide a continuous mesh; except where expansion joints occur, cut mesh and discontinue across such joints. Provide reinforced concrete fill under the setting-bed where the distance between the under-floor surface and the finished tiles floor surface is a minimum of 50 mm, and of the same thickness that the mortar setting-bed over the concrete fill with the thickness required.

3.5 INSTALLATION OF TRANSITION STRIPS

Install transition strips where indicated, in a manner similar to that of the ceramic tile floor and as recommended by the manufacturer. Provide thresholds full width of the opening. Install head joints at ends not exceeding 6 mm in width and grouted full.

3.6 EXPANSION JOINTS

Form and seal joints as specified in Section 07 92 00 JOINT SEALANTS.

3.6.1 Walls

Provide expansion joints at control joints in backing material. Wherever backing material changes, install an expansion joint to separate the different materials.

3.6.2 Floors

Provide expansion joints over construction joints, control joints, and expansion joints in concrete slabs. Provide expansion joints where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 7 to 11 m each way in large interior floor areas and 3 to 5 m each way in large exterior areas or areas exposed to direct sunlight or moisture. Extend expansion joints through setting-beds and fill.

3.7 CLEANING AND PROTECTING

Upon completion, thoroughly clean tile surfaces in accordance with manufacturer's approved cleaning instructions. Do not use acid for cleaning glazed tile. Clean floor tile with resinous grout or with factory mixed grout in accordance with printed instructions of the grout manufacturer. After the grout has set, provide a protective coat of a noncorrosive soap or other approved method of protection for tile wall surfaces. Cover tiled floor areas with building paper before foot traffic is permitted over the finished tile floors. Provide board walkways on tiled floors that are to be continuously used as passageways by workmen. Replace damaged or defective tiles. Submit copy of manufacturer's printed maintenance instructions.

-- End of Section --

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SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E119	(2018) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E580/E580M	(2017) Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5758	(2016) Sealants for Sealing and Glazing in Buildings
JIS A 1409	(1998) Method for Measurement of Sound Absorption Coefficients in a Reverberation Room
JIS A 1445	(2007) Testing Methods of Materials for Ceiling Suspension System
JIS A 6301	(2007) Sound Absorbing Materials
JIS A 6517	(2010) Steel furrings for wall and ceiling in buildings
JIS B 1168	(1994) Eyebolts
JIS G 3537	(2011)Zinc-coated steel wire strands
JIS G 4309	(2013) Stainless Steel Wires
JIS G 5111	(1991) High Tensile Strength Carbon Steel castings and low alloy steel castings for structural purposes
JIS H 8610	(1999) Electroplated-Coatings of Zinc on Iron or Steel

JAPANESE ARCHITECTURAL STANDARD SPECIFICAITONS(JASS)

JASS 26	(2006) Interior Work

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT Notification No. 771	(2013) Establishment of specified ceilings and a construction method that is effective for structural resistance of specified ceilings

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-310-04	(2013; with Change 1, 2016) Seismic Design of Buildings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings; G[, [_____]]

[1.3 ADHESIVES AND SEALANTS

Provide products certified to meet indoor air quality requirements by providing the certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

]1.4 DELIVERY, STORAGE. AND HANDLING

Deliver materials to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Carefully handle and store materials in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.5 ENVIRONMENTAL REQUIREMENTS

Maintain a uniform temperature of not less than 16 degrees C nor more than 29 degrees C and a relative humidity of not more than 70 percent for 24 hours before, during, and 24 hours after installation of acoustical units.

1.6 SCHEDULING

Complete and dry interior finish work such as plastering, concrete and terrazzo work before ceiling installation. Complete mechanical, electrical, and other work above the ceiling line; install and start operating heating, ventilating, and air conditioning systems in order to maintain temperature and humidity requirements.

1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period. Include an agreement to repair or replace acoustical panels that fail within the warranty period in the standard performance guarantee or warranty. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

1.8 EXTRA MATERIALS

Furnish spare tiles, from the same lot as those installed, of each color at the rate of 5 tiles for each 1000 tiles installed.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide sound controlling units mechanically mounted on a ceiling suspension system for acoustical treatment. The unit size, texture, finish, and color must be as specified. Coordinate the whole ceiling system with other details, like the location of access panels and ceiling penetrations, etc., shown on the drawings. The Contractor is responsible for all associated labor and materials and for the final assembly and performance of the specified work and products are used. The location and extent of acoustical treatment must be as shown on the approved detail drawings. Submit drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan. Coordinate with paragraph RECLAMATION PROCEDURES for reclamation of mineral fiber acoustical ceiling panels to be removed from the job site.

2.1.1 Fire Resistive Ceilings

Rate acoustical ceiling systems, indicated as fire resistant, for fire endurance as specified when tested in accordance with ASTM E119. Test suspended ceiling with a specimen [roof][floor] assembly representative of the indicated construction, including mechanical and electrical work within ceiling space openings for light fixtures, and air outlets, and access panels. Provide ceiling assembly rating for [[1][1-1/2][2][3][4] hour [concealed grid system][exposed grid system]][as shown on drawings]. Provide acoustical units with a flame spread of 25 or less and smoke development of 50 or less when tested in accordance with ASTM E84.

2.1.2 Ceiling Attenuation Class and Test

Provide a ceiling system with an attenuation class (CAC) of [36] for [_____] [and _____ for _____]. Provide fixture attenuators over light fixtures and other ceiling penetrations, and provide acoustical blanket insulation adjacent to partitions, as required to achieve the specified CAC. Provide test ceiling continuous at the partition and assembled in the suspension system in the same manner that the ceiling will be

installed on the project.

2.1.3 Ceiling Sound Absorption

Determine the sound reduction rate in accordance with JIS A 1409.

2.1.4 Light Reflectance

Light reflectance to be 0.75 or above.

2.2 ACOUSTICAL UNITS

Submit two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color. Conform acoustical units to JIS A 6301 and the following requirements:

2.2.1 Units for Exposed-Grid System [A] [_____]

2.2.1.1 Type

[III (non-asbestos mineral fiber with painted finish). Provide Type III Acoustical Ceiling Tiles containing a minimum of 30 percent recycled content.]

[IV (non-asbestos mineral fiber with membrane-faced overlay). Provide Type IV Acoustical Ceiling Tiles containing a minimum of 60 percent recycled content.]

[IX (mineral fiber with scrubbable finish). [Provide Type IX Acoustical Ceiling Tiles containing a minimum [50] [_____] percent recycled content.]]

[X (mineral composition with plastic membrane).]

[XI (mineral fiber with fabric faced overlay).]

[XII (fiberglass base with membrane-faced overlay). [Provide Type XII Acoustical Ceiling Tiles containing a minimum of [25] [_____] percent recycled content.]]

2.2.1.2 Flame Spread

Class A, 25 or less

2.2.1.3 Pattern

[A] [B] [C] [D] [E] [F] [G] [I] [J] [K] [_____]

2.2.1.4 Minimum NRC

[0.75] [_____] in open office areas; [0.60] [_____] in conference rooms, executive offices, teleconferencing rooms, and other rooms as designated; [0.50] [_____] in all other rooms and areas.

2.2.1.5 Minimum Light Reflectance Coefficient
[LR-1, 0.75 or greater] [_____]

2.2.1.6 Nominal Size

[600 by 1200] [_____] mm

2.2.1.7 Edge Detail

[Square] [Reveal] [Trimmed and butt] [_____]

2.2.1.8 Finish

Factory-applied [standard finish] [color finish].

2.2.1.9 Minimum CAC

[40] [36]

2.2.2 Units for Concealed-Grid System [A] [_____]

2.2.2.1 Type

[III (non-asbestos mineral fiber with painted finish). Provide Type III Acoustical Ceiling Tiles containing a minimum of 30 percent recycled content.]

[IV (non-asbestos mineral fiber with membrane-faced overlay). Provide Type IV Acoustical Ceiling Tiles containing a minimum of 60 percent recycled content.]

[IX (mineral fiber with scrubbable finish). [Provide Type IX Acoustical Ceiling Tiles containing a minimum of [50][_____] percent recycled content.]]

[X (mineral composition with plastic membrane).]

[XI (mineral fiber with fabric faced overlay).]

[XII (fiberglass base with membrane-faced overlay). [Provide Type XII Acoustical Ceiling Tiles containing a minimum of [25][_____] percent recycled content.]]

2.2.2.2 Flame Spread

Class A, 25 or less

2.2.2.3 Pattern

[A] [B] [C] [D] [E] [F] [G] [I] [J] [K] [_____]

2.2.2.4 Minimum NRC

[0.50] [_____]

2.2.2.5 Minimum Light Reflectance Coefficient

[LR-1, 0.75 or greater] [_____]

2.2.2.6 Nominal Size

[300 by 300] [_____] mm

2.2.2.7 Edge Detail

[Beveled] [Square]

2.2.2.8 Joint Detail

[kerfed and rabbeted] [tongue and grooved]

2.2.2.9 Finish

Factory-applied [standard finish] [color finish]

2.2.2.10 Minimum CAC

[40] [_____]

2.2.3 Metal Pans [A] [_____]

2.2.3.1 Type

[V, steel.]

[VI, stainless steel.]

[VII, aluminum perforated pans with acoustical, non-asbestos, insulation backing.]

2.2.3.2 Flame Spread

Class: A, 25 or less

2.2.3.3 Pattern

[A] [C] [I] [_____]

2.2.3.4 Minimum NRC

[0.75] [_____] in open office areas; [0.60] [_____] in conference rooms, executive offices, teleconferencing rooms, and other rooms as designated; [0.50] [_____] in all other rooms.

2.2.3.5 Minimum Light Reflectance Coefficient

[LR-1, 0.75 or greater] [_____]

2.2.3.6 Nominal Size

[600 by 600] [_____] mm

2.2.3.7 Edge Detail

Manufacturer's standard.

2.2.3.8 Joint Detail

[Beveled] [_____]

2.2.3.9 Finish

Factory-applied standard finish

2.2.3.10 Pads

[Completely enclosed, of material and thickness required for acoustical and fire test ratings] [_____].

2.2.4 Impact/Abrasion Resistant Units

2.2.4.1 Type

Non-asbestos mineral composition with a hardened mineral surface and factory applied white paint finish. Provide a surface resistant to impact and abrasion.

2.2.4.2 Flame Spread

Class A, 25 or less

2.2.4.3 Pattern

[_____]

2.2.4.4 Minimum NRC

[0.50] [_____].

2.2.4.5 Minimum Light Reflectance Coefficient

LR-1, 0.75 or greater

2.2.4.6 Nominal Size

[300 by 300] [600 by 600] [600 by 1200] mm

2.2.4.7 Edge Detail

[Square] [Beveled]

2.2.4.8 Joint Detail

[Trimmed and butted] [Kerfed and rabbeted]

2.2.5 Humidity Resistant Composition Units

2.2.5.1 Type

Non-asbestos mineral or glass fibers bonded with ceramic, moisture resistant thermo-setting resin, or other moisture resistant material and having a factory applied white paint finish. Provide panels that do not sag or warp under conditions of heat, high humidity or chemical fumes.

2.2.5.2 Flame Spread

Class: A, 25 or less

2.2.5.3 Pattern

[_____]

2.2.5.4 Minimum NRC

Minimum [0.50] [_____].

2.2.5.5 Minimum Light Reflectance Coefficient

LR-1, 0.75 or greater

2.2.5.6 Nominal Size

[600 by 1200] [_____] mm

2.2.5.7 Edge Detail

Square

2.2.6 Metal Faced Composition Units

2.2.6.1 Type

[Type V (Steel facings with non-asbestos mineral composition absorbent backing).]

[Type VI (Stainless steel facings with non-asbestos mineral composition absorbent backing)]

[Type VII (Aluminum facings with non-asbestos mineral composition absorbent backing) with [anodized] [baked enamel] [acrylic] finish color [white] [_____].]

2.2.6.2 Flame Spread

Class: A, flame spread 25 or less

2.2.6.3 Pattern

[_____]

2.2.6.4 Minimum (NRC)

[0.75] [_____] in open office areas. [0.60] [_____] in conference rooms, executive offices, teleconferencing rooms, and other rooms as designated. [0.50] [_____] in all other rooms and areas.

2.2.6.5 Minimum Light Reflectance Coefficient

LR-1, 0.75 or greater

2.2.6.6 Nominal Size

600 by [600] [1200] mm

2.2.6.7 Edge Detail

Square

2.2.6.8 Joint Detail

Trimmed and butted

2.2.7 Unit Acoustical Absorbers

Absorbers must be individually mounted sound absorbing plaques composed of glass fibers or non-asbestos mineral fibers and having a NRC range of not less than 0.60 - 0.70 when tested in accordance with JIS A 1409 and reported as a 4 frequency average.

2.3 SUSPENSION SYSTEM

Provide [[standard] [fire-resistive] [snap-in metal pan]] [[exposed-grid] [indirect hung concealed H and T or Zee] [direct hung, concealed, downward access] [direct hung, concealed, upward access]] [[standard width flange] [narrow width flange] [narrow width slotted flange]] [as shown on drawings] suspension system conforming to JIS A 1445 [for intermediate-duty systems] [for heavy-duty systems]. Provide surfaces exposed to view of [aluminum or [galvanized]steel with a factory-applied [white] [black] [color] baked-enamel finish] [aluminum with a clear anodized finish] [aluminum with colored factory-applied vinyl paint finish]. Provide wall molding having a flange of not less than [23 mm] [_____]. Provide [inside and outside corner caps] [[standard] [overlapped] [mitered] corners]. Suspended ceiling framing system must have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. Provide a suspension system with a maximum deflection of 1/360 of the span length. Conform seismic details to the [guidance in UFC 3-310-04 and ASTM E580/E580M or JIS A 1445] [contract drawings], and in accordance with "Practical Guide on the Technical Standards concerning Measures to Prevent the Fall of Buildings" based on MLIT Notification No. 771 of the Ministry of Land, Infrastructure, Transport and Tourism.

For gypsum board ceilings greater than 5994mm AFF, with an area greater than 200 SM, and weight of 2 kg/SM, refer to the detail in the Ministry of Land, Infrastructure, Transport and Tourism, MLIT Notification No. 771, and JIS A 1445 and JIS A 6517 for testing method. For gypsum board ceilings less than or equal to 5994mm AFF, refer to detail in JASS 26 Section 4, and JIS A 6517 for testing method. For lay-in acoustical ceilings refer to detail in JASS 26, Section 4.4 and JIS A 1445 for testing method.

Provide Suspension System containing a minimum of 15 percent recycled content.

2.4 HANGERS

Provide hangers and attachment capable of supporting a minimum 1330 N ultimate vertical load without failure of supporting material or attachment.

2.4.1 Wires

Conform wires to JIS G 3537, [JIS G 4309 condition annealed stainless steel, [2.0] [_____] mm in diameter.]

2.4.2 Straps

Provide straps of 25 by 5 mm galvanized steel with a light commercial zinc coating or JIS G 5111 with an electrodeposited zinc coating conforming to JIS H 8610.

2.4.3 Rods

Provide 5 mm diameter threaded steel rods, zinc or cadmium coated.

2.4.4 Eyebolts

Provide eyebolts of weldless, forged-carbon-steel, with a straight-shank in accordance with JIS B 1168. Eyebolt size must be a minimum [_____] [7] mm, [zinc coated][cadmium plated].

2.4.5 Anchorage Devices

Comply with JIS A 1445 for anchorage devices for [eyebolts] [machine screws] [wood screws]. Where aluminum is in contact with concrete, coat aluminum with bituminous paint or where exposed, with a chromatic primer and 2-coats of enamel paint.

2.5 ACCESS PANELS

Provide access panels that match adjacent acoustical units, designed and equipped with suitable framing and fastenings for removal and replacement without damage. Size panel to be not less than 300 by 300 mm or more than 300 by 600 mm.

a. Attach an identification plate of 0.8 mm thick aluminum, 19 mm in diameter, stamped with the letters "AP" and finished the same as the unit, near one corner on the face of each access panel.

b. Identify ceiling access panel by a number utilizing white identification plates or plastic buttons with contrasting numerals. Provide plates or buttons of minimum 25 mm diameter and securely attached to one corner of each access unit. Provide a typewritten card framed under glass listing the code identification numbers and corresponding system descriptions listed above. Mount the framed card where directed and furnish a duplicate card to the Contracting Officer. Code identification system is as follows:

1 Fire detection/alarm system

2 Air conditioning controls

3 Plumbing system

4 Heating and steam systems

5 Air conditioning duct system

6 Sprinkler system

7 Intercommunication system

8 Nurse's call system

9 Pneumatic tube system

10 Medical piping system

11 Program entertainment

12 Telephone junction boxes

13 Detector X-ray

14 [_____]

2.6 ADHESIVE

Use adhesive as recommended by tile manufacturer. Meet emissions requirements of F 4-STar and JAIA 4VOC.

2.7 FINISHES

Use manufacturer's standard textures, patterns and finishes as specified for acoustical units and suspension system members. Treat ceiling suspension system components to inhibit corrosion.

2.8 COLORS AND PATTERNS

Use colors and patterns for acoustical units and suspension system components as indicated.

2.9 ACOUSTICAL SEALANT

Conform acoustical sealant to JIS A 5758, nonstaining.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Rid areas, where acoustical units will be cemented, of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Complete and dry interior finish work such as plastering, concrete, and terrazzo work before installation. Complete and approve mechanical, electrical, and other work above the ceiling line prior to the start of acoustical ceiling installation. Provide acoustical work complete with necessary fastenings, clips, and other accessories required for a complete installation. Do not expose mechanical fastenings in the finished work. Lay out hangers for each individual room or space. Provide hangers to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span. Wherever required to bypass an object with the hanger wires, install a subsuspension system so that all hanger wires will be plumb.

3.1.1 Suspension System

Install suspension system in accordance with JIS A 1445 and in accordance with "Practical Guide on the Technical Standards concerning Measures to Prevent the Fall of Buildings" based on MLIT Notification No. 771 of the Ministry of Land, Infrastructure, Transport and Tourism and as specified herein. The suspension system shall conform to allowable stress performance per the static pressurization test designed by the Japan Ministry of Construction. Do not suspend hanger wires or other loads from underside of steel decking.

3.1.1.1 Plumb Hangers

Install hangers plumb and not pressing against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, provide hangers at a minimum of four hangers per fixture and located not more than 150 mm from each corner of each fixture.

3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, offset the resulting horizontal force by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Provide wall molding where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Secure wall molding not more than 75 mm from ends of each length and not more than 400 mm on centers between end fastenings. Provide wall molding springs at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Install acoustical units in accordance with the approved installation instructions of the manufacturer. Ensure that edges of acoustical units are in close contact with metal supports, with each other, and in true alignment. Arrange acoustical units so that units less than one-half width are minimized. Hold units in exposed-grid system in place with manufacturer's standard hold-down clips, if units weigh less than 5 kg/square meter or if required for fire resistance rating.

3.1.4 Caulking

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings.

3.1.5 Adhesive Application

Wipe back of tile to remove accumulated dust. Daub acoustical units on back side with four equal daubs of adhesive. Apply daubs near corners of tiles. Ensure that contact area of each daub is at least 50 mm diameter in final position. Press units into place, aligning joints and abutting units tight and uniform without differences in joint widths.

3.2 CEILING ACCESS PANELS

Locate ceiling access panels directly under the items which require access.

3.3 CLEANING

Following installation, clean dirty or discolored surfaces of acoustical units and leave them free from defects. Remove units that are damaged or improperly installed and provide new units as directed.

3.4 RECLAMATION PROCEDURES

Neatly stack ceiling tile, designated for recycling by the Contracting Officer, on 1220 by 1220 mm pallets not higher than 1220 mm. Panels must be completely dry. Shrink wrap and symmetrically stack pallets on top of each other without falling over.

-- End of Section --

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SECTION 09 65 00

RESILIENT FLOORING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E648	(2017a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5536	(2015) Adhesives for Resilient Textile or Laminate Floor Coverings
JIS A 5705	(2010) Polyvinyl Chloride Floorcoverings

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT SS Chapter 19	(2019) Public Building Construction Standard Specifications Chapter 19: Interior Finishing Works

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Resilient Flooring and Accessories; G[, [_____]]

SD-10 Operation and Maintenance Data

Resilient Flooring and Accessories; G[, [_____]]

1.3 JAPAN PUBLIC BUILDING CONSTRUCTION STANDARDS

Follow MLIT SS Chapter 19 for interior finishing works.

1.4 INDOOR AIR QUALITY

1.4.1 Floor Covering Materials

Provide [Vinyl Composition Tile][Sheet Vinyl Flooring][Rubber Tile][Rubber Sheet Flooring][Luxury Vinyl Tile][Solid Vinyl Tile][Sheet Linoleum][Linoleum Tile][Cork Flooring], and wall base products certified to meet indoor air quality requirements of third-party programs.

1.4.1.1 Adhesives, Caulking and Sealants

Provide products certified to meet emission requirement of F 4-Star and JAIA 4VOC.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the building site in original unopened containers bearing the manufacturer's name, style name, pattern color name and number, production run, project identification, and handling instructions. Store materials in a clean, dry, secure, and well-ventilated area free from strong contaminant sources and residues with ambient air temperature maintained above 20 degrees C and below 30 degrees C, stacked according to manufacturer's recommendations. Remove resilient flooring products from packaging to allow ventilation prior to installation. Protect materials from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances. Observe ventilation and safety procedures specified in the MSDS. Do not store rubber surface products with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions, including [_____]. Do not store exposed rubber surface materials in occupied spaces. [Do not store [_____] near materials that may off gas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.]

1.6 ENVIRONMENTAL REQUIREMENTS

Maintain areas to receive resilient flooring at a temperature above 20 degrees C and below 30 degrees C for 3 days before application, during application and 2 days after application, unless otherwise directed by the flooring manufacturer for the flooring being installed. Maintain a minimum temperature of 13 degrees C thereafter. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

1.7 SCHEDULING

Schedule resilient flooring application after the completion of other work which would damage the finished surface of the flooring.

1.8 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period.

1.9 EXTRA MATERIALS

Provide extra flooring material of each color and pattern at the rate of 5 tiles for each 1000 tiles. Provide extra wall base material composed of 6 m of each type, color and pattern. Package all extra materials in original properly marked containers bearing the manufacturer's name, brand

name, pattern color name and number, production run, and handling instructions. Provide extra materials from the same lot as those installed. Leave extra stock at the site in location assigned by Contracting Officer.

PART 2 PRODUCTS

2.1 VINYL COMPOSITION TILE [TYPE [A][_____]]

Conform to JIS A 5705, asbestos-free, [300] [_____] mm square and [2.4] [3.2] mm thick. Provide color and pattern uniformly distributed throughout the thickness of the tile.

[Provide Vinyl Composition Tile containing a minimum of 10 percent recycled content.]

2.2 SHEET VINYL FLOORING [TYPE [A] [_____]]

Conform to JIS A 5705 and a minimum [1800 mm] [3660 mm] wide. Extend color and pattern through the total thickness of the material. As required, provide welding rods as recommended by the manufacturer for heat welding of joints.

2.3 LUXURY VINYL TILE [TYPE [A][_____]]

Conform to JIS A 5705 printed film with a minimum wear layer thickness [0.50 mm (20 mil)][0.70 mm (30 mil)][_____] and minimum overall thickness [[2.5 mm] [or] [3 mm]] [5 mm[with non slip/skid backing]]. Provide[[300 by 600] [_____] mm][[300] [400] [450] [600] [900] [_____] mm square][_____] tile.[Provide tile with a factory protective finish that enhances cleanability and durability.]

2.4 SOLID VINYL TILE [TYPE [A][_____]]

Conform to JIS A 5705 Class I monolithic (minimum wear layer thickness 3 mm and minimum overall thickness 3 mm, Type [A (smooth)] [B (embossed)]. Provide [300] [400] [450] [600] [900] [_____] mm square tile.

2.5 WALL BASE

Provide [100] [150] mm high and a minimum 3.175 mm thick wall base. Provide [preformed] [job formed] corners in matching height, shape, and color.

2.6 INTEGRAL COVE BASE

Extend integral coved base for [[sheet vinyl] [and] [sheet linoleum] flooring up the wall [100] [150] mm]. Provide a [vinyl] [or] [rubber] [clear anodized aluminum], [square] [round] cap strip and vinyl, rubber, or wood fillet strip with a minimum radius of 19 mm for integral coved bases [at perimeter and fixed vertical interruptions to flooring] [as shown]. Provide integral cove of the same material as flooring. [Provide inside and outside corner protectors of [[_____]-colored anodized aluminum] [clear anodized aluminum] [or] [plastic] approved by flooring manufacturer.]

2.7 STAIR TREADS, RISERS AND STRINGERS

Provide either a one piece nosing/tread/riser or a two piece nosing/tread

design with a matching coved riser.

2.8 MOULDING

Provide tapered mouldings of [[vinyl] [or] [rubber]] [[_____]-colored anodized aluminum] [clear anodized aluminum] and types as recommended by flooring manufacturer for both edges and transitions of flooring materials specified. Provide vertical lip on moulding of maximum 6 mm. Provide bevel change in level between 6 and 13 mm with a slope no greater than 1:2.

2.9 ADHESIVES

Provide adhesives for flooring, base and accessories as recommended by the manufacturer or per JIS A 5536 and comply with local indoor air quality standards. Submit manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics.

2.10 SURFACE PREPARATION MATERIALS

Provide surface preparation materials, such as panel type underlayment, lining felt, and floor crack fillers as recommended by the flooring manufacturer for the subfloor conditions. Use one of the following substrates:

[a. Particleboard: As specified in Section 06 10 00 ROUGH CARPENTRY.]

[b. Fiberboard: As specified in Section 06 10 00 ROUGH CARPENTRY.]

[c. Cork: As specified in Section 06 10 00 ROUGH CARPENTRY.]

[d. Cement-fiber board: As specified in Section 09 29 00 GYPSUM BOARD.]

[e. Plywood: As specified in Section 06 10 00 ROUGH CARPENTRY.]

[f. Concrete.]

2.11 POLISH/FINISH

Provide polish finish as recommended by the manufacturer.

2.12 CAULKING AND SEALANTS

Provide caulking and sealants in accordance with Section 07 92 00 JOINT SEALANTS.

2.13 MANUFACTURER'S COLOR, PATTERN AND TEXTURE

Provide color, pattern and texture for resilient flooring and accessories [selected from manufacturer's standard colors] [[_____]. Color listed is not intended to limit the selection of equal colors from other manufacturers].[Provide floor patterns as specified on the [drawings Sheet No. [_____]] [_____].] Provide flooring in any one continuous area or replacement of damaged flooring in continuous area from same production run with same shade and pattern. Submit scaled drawings indicating patterns (including location of patterns and colors) and dimensions. Submit manufacturer's descriptive data and [three] [_____] samples of each indicated color and type of flooring, base, mouldings, and accessories sized a minimum 60 by 100 mm. Submit Data Package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

2.14 FIRE RESISTANCE TESTING REQUIREMENTS

Provide a minimum average critical radiant flux of [0.22][0.45] watts per square centimeter for flooring in corridors and exits when tested in accordance with ASTM E648.

PART 3 EXECUTION

3.1 EXAMINATION

Examine and verify that site conditions are in agreement with the design package. Report all conditions that will prevent a proper installation. Do not take any corrective action without written permission from the Government. Work will proceed only when conditions have been corrected and accepted by the installer. Submit manufacturer's printed installation instructions for all flooring materials and accessories, including preparation of substrate, seaming techniques, and recommended adhesives.

3.2 SURFACE PREPARATION

Provide a smooth, true, level plane for surface preparation of the flooring, except where indicated as sloped. Floor to be flat to within 4.75 in 3048 mm. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Prepare the surfaces of lightweight concrete slabs (as defined by the flooring manufacturer) as recommended by the flooring manufacturer. Floor fills or toppings may be required as recommended by the flooring manufacturer. Install underlayments, when required by the flooring manufacturer, in accordance with manufacturer's recommended printed installation instructions. Before any work under this section is begun, correct all defects such as rough or scaling concrete, chalk and dust, cracks, low spots, high spots, and uneven surfaces. Repair all damaged portions of concrete slabs as recommended by the flooring manufacturer. Remove concrete curing and sealer compounds from the slabs, other than the type that does not adversely affect adhesion. Remove paint, varnish, oils, release agents, sealers, waxes, and adhesives, as required by the flooring product in accordance with manufacturer's printed installation instructions.

3.3 MOISTURE, ALKALINITY AND BOND TESTS

Determine the suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content and pH level by moisture and alkalinity tests. Conduct moisture testing recommended by the flooring manufacturer. Conduct alkalinity testing as recommended by the flooring manufacturer. Determine the compatibility of the resilient flooring adhesives to the concrete floors by a bond test in accordance with the flooring manufacturer's recommendations. Submit copy of test reports for moisture and alkalinity content of concrete slab, and bond test stating date of test, person conducting the test, and the area tested.

3.4 GENERAL INSTALLATION

Do not install building construction materials that show visual evidence of biological growth. Installation shall comply with MLIT SS Chapter 19.

3.5 PLACING VINYL COMPOSITION, LINOLEUM AND SOLID VINYL TILES

Install tile flooring and accessories in accordance with manufacturer's

printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's directions. Keep tile lines and joints square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary edge width as necessary to maintain full-size tiles in the field, no edge tile to be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit, and scribe edge tile to walls and partitions after field flooring has been applied.

3.6 PLACING LUXURY VINYL TILES

[Install luxury vinyl tile flooring using [glue down] [loose lay (room perimter adhesive only)] installation.]Install flooring and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's directions for installation method specified. Keep tile lines and joints square, symmetrical, tight, and even. Keep each floor in true, level plane, except where slope is indicated. Vary edge width as necessary to maintain full-size tiles in the field, no edge tile to be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit, and scribe edge tile to walls and partitions after field flooring has been applied.

3.7 PLACING SHEET VINYL FLOORING

Install sheet vinyl flooring and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Provide square, symmetrical, tight, and even flooring lines and joints. Keep each floor in true, level plane, except where slope is indicated. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Lay out sheets to minimize waste. Cut, fit, and scribe flooring to walls and partitions after field flooring has been applied.[Provide [chemically bonded] [or] [heat welded] seams and edges [in rooms [_____]] [shown on the drawings] in accordance with the manufacturer's written installation instructions. Finish joints flush, free from voids, recesses, and raised areas.] [Install flooring with an integral coved base.]

3.8 PLACING SHEET LINOLEUM FLOORING

Install sheet linoleum flooring and accessories in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Provide square, symmetrical, tight, and even flooring lines and joints. Keep each floor in true, level plane, except where slope is indicated. Cut flooring to fit around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Lay out sheets to minimize waste. Cut, fit, and scribe flooring to walls and partitions after field flooring has been applied. Cut seams by overlapping or underscribing as recommended by the manufacturer. [Provide heat welded seams [in rooms [_____]] [as shown on the drawings] in accordance with there manufacturer's written installation instructions.] Finish joints flush, free from voids, recesses, and raised areas. [Install flooring with an integral coved base.]

3.9 PLACING CORK FLOORING

Install cork [tile] [plank flooring] and accessories in accordance with manufacturer's installation instructions. Prepare and apply adhesives in accordance with manufacturer's directions. Provide square, symmetrical, tight, and even flooring lines and joints except where slope is indicated. Keep each floor in true, level plane, except where slope is indicated. [Vary width of edge tiles as necessary to maintain full-size tiles in field, while keeping edge tiles larger than one-half full size, except where irregular-shaped rooms make it impossible.] Cut and fit flooring around all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Cut, fit and scribe flooring to walls and partitions after field flooring has been applied.

3.10 PLACING FEATURE STRIPS

Install feature strips in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions.

3.11 PLACING MOULDING

Provide moulding where flooring termination is higher than the adjacent finished flooring and at transitions between different flooring materials. When required, locate moulding under door centerline. Moulding is not required at doorways where thresholds are provided. [Secure moulding with adhesive as recommended by the manufacturer. Prepare and apply adhesives in accordance with manufacturer's printed directions.] [Anchor aluminum moulding to floor surfaces as recommended by the manufacturer.]

3.12 PLACING WALL BASE

Install wall base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Tighten base joints and make even with adjacent resilient flooring. Fill voids along the top edge of base at masonry walls with caulk. Roll entire vertical surface of base with hand roller, and press toe of base with a straight piece of wood to ensure proper alignment. Avoid excess adhesive in corners.

3.13 PLACING STAIR TREADS, RISERS, AND STRINGERS

Secure and install stair treads, risers, and stringers in accordance with manufacturer's printed installation instructions. Cover the surface of treads and risers[the full width of the stairs][within 150 mm to the stair edges]. Provide equal length pieces butted together to cover the treads and risers for stairs wider than manufacturer's standard lengths. [Provide stringer angles on both the wall and banister sides of the stairs, and landing trim.]

3.14 PLACING INTEGRAL COVED BASE

Install integral cove base in accordance with manufacturer's printed installation instructions. Prepare and apply adhesives in accordance with manufacturer's printed directions. Shape integral coved base by extending the flooring material [100] [150] [_____] mm onto the wall surface. Support cove by a filler. Provide a cap strip at the top of the base. Fill voids along the top edge of base at masonry walls with caulk.

3.15 CLEANING

Immediately upon completion of installation of flooring in a room or an area, dry and clean the flooring and adjacent surfaces to remove all surplus adhesive. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions and within the recommended time frame. As required by the manufacturer, apply the recommended number of coats and type of polish and finish in accordance with manufacturer's written instructions.

3.16 PROTECTION

From the time of installation until acceptance, protect flooring from damage as recommended by the flooring manufacturer. Remove and replace flooring which becomes damaged, loose, broken, or curled and wall base which is not tight to wall or securely adhered.

-- End of Section --

SECTION 09 68 00

CARPETING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E648	(2017a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 2551	(1981) Machine-made Textile Floor Coverings - Determination of Dimensional Changes Due to the Effects of Varied Water and Heat Conditions

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1125	(2015) Methods Of Test For Moisture Content Of Aggregate And Surface Moisture In Aggregate By Drying
JIS K 2265-1	(2007)Determination of flash point - Part 1: Tag closed cup method
JIS K 7134	(1999)Cellular rubber and plastics - Determination of dynamic cushioning performance
JIS L 0805	(2005)Gray Scale for Assessing Staining
JIS L 0849	(2013) Test Methods for color fastness to rubbing
JIS L 1021-3	(2007)Textile floor coverings - Part 3: Determination of thickness
JIS L 1021-4	(2007)Textile floor coverings - Part 4: Methods for determination of mass
JIS L 1021-5	(2007)Textile floor coverings - Part 5: Determination of number of tufts and/or loops per unit.
JIS L 1021-10	(2007)Textiles floor coverings - Part 10: Test Methods for dimensional changes due to water and heat effects

JIS L 1021-13	(2007)Textile floor coverings - Part 13: Assessment of changes in appearance
JIS L 1902	(2015)Antimicrobial Fabric Test
JIS L 4405	(2008) Tufted Pile Carpet
JIS L 4406	(2008) Tile Carpet

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT SS Chapter 19	(2019) Public Building Construction Standard Specifications Chapter 19: Interior Finishing Works

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings; G[, [_____]]

SD-10 Operation and Maintenance Data

Cleaning and Protection

Maintenance Service

SD-11 Closeout Submittals

Warranty

1.3 CERTIFICATIONS

1.3.1 Indoor Air Quality Certifications

1.3.1.1 Floor Covering Materials

Provide products certified to meet indoor air quality requirements by providing the certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size,

dye lot number, and related information. Remove materials from packaging and store them in a clean, dry, well ventilated area (100 percent outside air supply, minimum of 1.5 air changes per hour, and no recirculation), protected from damage, soiling, and moisture, and strong contaminant sources and residues, and maintain at a temperature above 16 degrees C for 2 days prior to installation. Do not store carpet or carpet tiles with materials which have high emissions of volatile organic compounds (VOCs) or other contaminants, including paints and adhesives. Do not store carpet near materials that may off gas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives.

1.5 AMBIENT CONDITIONS

Maintain areas in which carpeting is to be installed at a temperature above 16 degrees C and below 32 degrees C for 2 days before installation, during installation, and for 2 days after installation. Provide temporary ventilation during work of this section. Maintain a minimum temperature of 13 degrees C thereafter for the duration of the contract.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties including minimum ten year wear warranty, two year material and workmanship and ten year tuft bind and delamination.

PART 2 PRODUCTS

2.1 CARPET

Furnish first quality carpet that is free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and manufacturing defects. Provide carpet materials and treatments as reasonably nonallergenic and free of other recognized health hazards. Provide a static control construction on all grade carpets which gives adequate durability and performance. Submit manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory. Submit manufacturer's Product Data for 1) Carpet, 2) Moldings, and 3) Carpet Cushion. Also, submit Samples of the following:

a. Carpet: [Two] [_____] "Production Quality" samples 450 by 450 mm of each carpet proposed for use, showing quality, pattern, and color specified

b. Moldings: [Two] [_____] samples of each type minimum 300 mm long

c. Carpet Cushion: [Two] [_____] samples minimum 150 by 150 mm

2.1.1 Indoor Air Quality Requirements

Products must meet emissions requirements of CDPH SECTION 01350. Provide certification or validation of indoor air quality for carpet.

2.1.2 Physical Characteristics for [Broadloom] [Modular Tile] [Entrance] Carpet

2.1.2.1 Carpet Construction

[Tufted] [Woven] [Bonded] [Needlebond] [Needle Felt] [_____]

2.1.2.2 Type

[Broadloom [3.6] [1.8] m minimum usable carpet width [with exception of corridors] [and] [stairs] [_____].][Modular tile [450 by 450] [500 by 500] [600 by 600] [914 by 305] [1219 by 305] [_____] mm square with 0.15 percent growth/shrink rate in accordance with ISO 2551 or JIS L 1021-10.] [Entrance [450 by 450] [_____] mm square [3.6] [1.8] m width [_____] mat size.]

2.1.2.3 Pile Type

[Level-loop] [Multilevel loop] [Cut and loop] [Frieze] [Cut pile] [Random sheared] [Level tip shear]

2.1.2.4 Pile Fiber

Commercial 100 percent branded (federally registered trademark) [nylon continuous filament] [nylon staple].

2.1.2.5 Gauge or Pitch

Minimum [_____] mm in accordance with JIS L 1021-5.

2.1.2.6 Stitches or Rows/Wires

Minimum [_____] per square meter

2.1.2.7 Surface Pile Weight

Minimum [_____] kg/square meter. This does not include weight of backings. Determine weight in accordance with JIS L 1021-4.

2.1.2.8 Pile Thickness

Minimum [_____] mm in accordance with JIS L 1021-3.

2.1.2.9 Pile Density

Minimum [_____]

2.1.2.10 Dye Method

[Solution dyed] [Stock dyed] [Yarn (or Skein) dyed] [Piece dyed] [Space dyed] [Continuous dyed]

2.1.2.11 Backing Materials

Provide primary backing materials like [those customarily used and accepted by the trade for each type of carpet] [polypropylene] [synthetic material] [rubber] [jute] [cotton] [_____]. Provide secondary backing to suit project requirements of those customarily used and accepted by the trade for each type of carpet.

2.1.2.12 Attached Cushion

Provide an attached cushion [chemically frothed polyurethane with minimum weight of 0.610 kg/sq. m, minimum density of 176 kg/cubic m] [mechanically frothed polyurethane with minimum weight of 0.745 kg/sq. m, minimum density of 224 kg/cubic m, minimum thickness of 2.5 mm, and maximum compression resistance of 34.5 kPa, and compression set of 15 percent in accordance with JIS K 7134]. Do not exceed the maximum ash content of 50 percent. Pass the accelerated aging test in accordance with [JIS K 7134] for the cushion.

2.2 PERFORMANCE REQUIREMENTS

2.2.1 Texture Appearance Retention Rating (TARR)

Provide carpet with a greater than or equal to [3.0 (Heavy)] [3.5 (Severe)] TARR traffic level classification in accordance with JIS L 1021-13.

2.2.2 Static Control

Provide static control to permanently regulate static buildup to less than [3.5] [2.0] [_____] kV when tested at 20 percent relative humidity and 21 degrees C in accordance with JIS L 4406.

2.2.3 Flammability and Critical Radiant Flux Requirements

Comply with ASTM E648. Provide carpet in corridors and exits with a minimum average critical radiant flux of [0.22] [0.45] watts per square centimeter when tested in accordance with ASTM E648. Flame time earlier than 20 seconds, burned yarn shorter than 10 mm in accordance with JIS L 4406. Carpet shall be flameproof in accordance with Japan Fire Defense Law and prescribed in Fire Service Act (Act No. 186 of 1948).

2.2.4 Tuft Bind

Comply with JIS L 4405 for tuft bind force required to pull a tuft or loop free from carpet backing with a minimum [40 N average force for loop pile broadloom] [18 N average force for cut pile broadloom] [36 N average force for modular carpet tile]. Provide tuft bind force required to pull a tuft or loop free from carpet backing with a minimum 24.5 N average force for loop pile in accordance with JIS L 4406.

2.2.5 Colorfastness to Crocking

Comply dry and wet crocking with JIS L 0849 for all colors.

2.2.6 Colorfastness to Light

Comply colorfastness to light with JIS L 0805/ JIS L 4406.

2.2.7 Colorfastness to Water

Comply colorfastness to water with JIS L 1021-10 and with a minimum 4.0 gray scale rating and a minimum 4.0 transfer scale rating.

2.2.8 Delamination Strength

Provide delamination strength for tufted carpet with a secondary back of minimum 440 N/m.

2.2.9 Antimicrobial

Nontoxic antimicrobial treatment in accordance with JIS L 1902 guaranteed by the carpet manufacturer to last the life of the carpet.

2.3 CARPET CUSHION

[2.3.1 Fiber Cushion

[Rubberized hair, mothproofed and sterilized] [Rubberized jute [with minimum 40 percent recycled content], mothproofed and sterilized] [Synthetic with minimum [___] percent recycled content] [Resinated, recycled textile].

2.3.1.1 Weight

[_____] g/sq.m

2.3.1.2 Thickness

[_____] mm plus 5 percent maximum

2.3.1.3 Density

[_____] kg/cu.m

][2.3.2 Rubber Cushion

[Flat] [Rippled waffle] [Textured flat] [Reinforced] [, with minimum 60 percent recycled content.]

2.3.2.1 Weight

[_____] g/sq.m

2.3.2.2 Thickness

[_____] mm plus 5 percent maximum

2.3.2.3 Density

[_____] kg/cu.m

][2.3.3 Polyurethane-Foam Cushion

[Grafted prime] [Densified] [Bonded] [Mechanically frothed] [, with minimum 15 percent recycled content].

2.3.3.1 Thickness

[_____] mm plus 5 percent maximum

2.3.3.2 Density

[_____] kg/cu.m

]2.3.4 Performance Requirements - Critical Radiant Flux

Provide carpet cushion in corridors and exits with a minimum average critical radiant flux of [0.22][0.45] watts per square centimeter when tested in accordance with ASTM E648.

2.4 ADHESIVES AND CONCRETE PRIMER

Comply with applicable regulations regarding toxic and hazardous materials. Provide water resistant, mildew resistant, nonflammable, and nonstaining adhesives and concrete primers for carpet installation as required by the carpet manufacturer. Provide release adhesive for modular tile carpet as recommended by the carpet manufacturer. Provide adhesives flashpoint of minimum 60 degrees C in accordance with JIS K 2265-1. Non-aerosol adhesive, aerosol adhesives, and concrete primer products used on the interior of the building (defined as inside of the weatherproofing system) must meet emission requirements of F 4-Star.

2.5 MOLDINGS

Provide carpet moldings where floor covering material changes or carpet edge does not abut a vertical surface. Provide [a heavy-duty [vinyl] [rubber] molding designed for the type of carpet being installed. Provide floor flange of a minimum [38 mm] wide. Provide color to match [resilient base] [_____].] [an aluminum molding, pinless clamp-down type, designed for the type of carpet being installed. Provide [natural color anodized] [prefinished color [_____] finish. Provide a floor flange of a minimum 38 mm wide and face a minimum 16 mm wide.]]

2.6 TAPE

Provide tape for seams as recommended by the carpet manufacturer for the type of seam used in broadloom installation. Seam sealant must have a maximum VOC content of no more than 50 grams/liter. Do not use sealants that contain 1,1,1-trichloroethane or toluene.

2.7 COLOR, TEXTURE, AND PATTERN

Provide color, texture, and pattern in accordance with this section or as indicated on the drawings.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Do not install carpet on surfaces that are unsuitable and will prevent a proper installation. Prepare subfloor in accordance with flooring manufacturer's recommended instructions. Repair holes, cracks, depressions, or rough areas using material recommended by the carpet or adhesive manufacturer. Free floor of any foreign materials and sweep clean. Before beginning work, test subfloor with glue and carpet to determine "open time" and bond. Submit [three] [_____] copies of the manufacturer's printed Installation instructions for the carpet, including Surface Preparation, seaming techniques, and recommended adhesives and tapes.

3.2 MOISTURE AND ALKALINITY TESTS

Test concrete slab for moisture content in accordance with JIS A 1125. Conform to manufacturer recommendations for pH level and alkalinity of the concrete substrate. Submit [three] [_____] copies of reports of Moisture and Alkalinity Tests including content of concrete slab stating date of test, person conducting the test, and the area tested.

3.3 PREPARATION OF CONCRETE SUBFLOOR

Do not commence installation of the carpeting until concrete substrate is at least 90 days old. Prepare the concrete surfaces in accordance with the carpet manufacturer's instructions. Match carpet, when required, and adhesives to prevent off-gassing to a type of curing compounds, leveling agents, and concrete sealer.

3.4 INSTALLATION

Installation shall comply with MLIT SS Chapter 19. Isolate area of installation from rest of building. Perform all work by manufacturer's approved installers. Conduct installation in accordance with the manufacturer's printed instructions. Protect edges of carpet meeting hard surface flooring with molding and install in accordance with the molding manufacturer's printed instructions. Use autofoam mothproofing system for wool carpets. Follow ventilation, personal protection, and other safety precautions recommended by the adhesive manufacturer. Continue ventilation during installation and for at least 72 hours following installation. Do not permit traffic or movement of furniture or equipment in carpeted area for 24 hours after installation. Complete other work which would damage the carpet prior to installation of carpet. Submit [three] [_____] copies of Installation Drawings for 1) Carpet, 2) Carpet Cushion, and 3) Moldings indicating areas receiving carpet, carpet types, patterns, direction of pile, location of seams, and locations of edge molding.

Do not install building construction materials that show visual evidence of biological growth.

3.4.1 Broadloom Installation

Install broadloom carpet [direct glue down] [pre-applied adhesive glue down] smooth, uniform, and secure, with a minimum of seams. Apply regular, unnoticeable, and treated seams with a seam adhesive. Run side seams toward the light, where practical, and where such layout does not increase the number of seams. Install breadths parallel, with carpet pile in the same direction. Match patterns accurately. Neatly cut and fit cutouts, at door jambs, columns and ducts securely. Locate seams at doorways parallel to and centered directly under doors. Do not make seams perpendicular to doors or at pivot points. Provide seams at changes in directions of corridors to follow the wall line parallel to the carpet direction. Lay the carpet lengthwise down the corridors with widths less than 1.8 m.

3.4.2 Modular Tile Installation

Install modular tiles with [releasable] [manufacturer approved adhesive tab system] [permanent vinyl-compatible] [_____] adhesive and snug joints. Use [monolithic] [1/4 turn] [ashlar] [brick] [herringbone]

[random] [_____] installation method. Comply with manufacturer installation instructions for required drying time of releasable adhesive so it sets up properly. Provide accessibility to the subfloor where required. Carpet tile on stairs and sloped surfaces must be installed with a more permanent installation method in accordance with the manufacturer's instructions and with manufacturer recommended adhesives for this application.

3.4.3 Entrance Carpet Installation

[Install tiles with [permanent vinyl-compatible] [releasable] adhesive and snug joints. Use [monolithic] [1/4 turn] [ashlar] [brick] [random] installation method.] [Install roll goods [direct glue down] [pre-applied adhesive glue down] and smooth, uniform, and secure, with a minimum of seams. Prepare regular, unnoticeable, and treated seams with a seam adhesive. Install breadths parallel, with carpet pile in the same direction. Match patterns accurately. Neatly cut and fit, securely, cutouts at door jambs, columns, and ducts. Locate seams at doorways parallel to and centered directly under doors. Do not make seams perpendicular to doors or at pivot points.] [Cut mats to specified size and finish them with a tapered vinyl edge that is glued and sewn on.]

[3.4.4 Stretch-in Installation

Provide carpet tack strips wherever carpeting abuts vertical surfaces. Install tackless carpet stripping by nailing. Place carpet cushion face-up, as recommended by cushion manufacturer, over entire floor area to be carpeted with joints butted. Do not use adhesives to attach carpet, cushion, or substrate. Comply with carpet manufacturer's instructions for installation. Attach rubber or metal edge strip to substrate with adhesive for transition when carpet meets other flooring materials or to finish carpet edge when required.

]3.5 CLEANING AND PROTECTION

Submit [three] [_____] copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

3.5.1 Cleaning

As specified in Section 01 78 00 CLOSEOUT SUBMITTALS. After installation of the carpet, remove debris, scraps, and other foreign matter. Remove soiled spots and adhesive from the face of the carpet with appropriate spot remover. Cut off and remove protruding face yarn. Vacuum carpet clean with a high-efficiency particulate air (HEPA) filtration vacuum.

3.5.2 Protection

Protect the installed carpet from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Lap and secure edges of kraft paper protection to provide a continuous cover. Restrict traffic for at least 48 hours. Remove protective covering when directed by the Contracting Officer.

3.6 REMNANTS

Manage waste as specified in the Waste Management Plan. [Provide remnants remaining from the installation, consisting of scrap pieces more than 600

mm in dimension with more than 0.6 square meters total [to the Government] [to local non-profit such as Habitat for Humanity as directed by the Government]]. [Set aside and return non-retained scraps to manufacturer for recycling into new product] [Remove non-retained scraps from site and recycle appropriately].

3.7 MAINTENANCE

3.7.1 Extra Materials

Provide extra material from same dye lot consisting of [full width continuous broadloom] [and] [uncut carpet tiles] for future maintenance. Provide a minimum of [three] [_____] percent of total square meters of each carpet type, pattern, and color. [Furnish [three] [____] percent extra of total adhesive tabs.]

3.7.2 Maintenance Service

Collect information from the manufacturer about [maintenance agreement] [green lease] options, and submit to Contracting Officer. Service must reclaim materials for recycling and/or reuse. Service must not landfill or burn reclaimed materials. When such a service is not available, seek local recyclers to reclaim the materials. Submit documentation of manufacturer's [maintenance agreement] [take-back program] [green lease] for carpet. Include contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and reuse.

-- End of Section --

SECTION 09 90 00

PAINTS AND COATINGS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5758	(2016) Sealants for Sealing and Glazing in Buildings
JIS A 6909	(2014) Coating Materials for Textured Finishes of Buildings
JIS K5600	(1999) Testing Methods for Paints
JIS K5670	(2008) Non-Aqueous Dispersion Acrylic Paint

MASTER PAINTERS INSTITUTE (MPI)

MPI 77	(2012) Epoxy, Gloss

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT SS Chapter 18	(2019) Public Building Construction Standard Specification: Chapter 18 Painting Work

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

AMS-STD-595	(2017) Colors Used in Government Procurement

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.]

Samples of specified materials may be taken and tested for compliance with specification requirements.

SD-02 Shop Drawings

Piping Identification

SD-08 Manufacturer's Instructions

Application Instructions

Mixing

SD-10 Operation and Maintenance Data

Coatings

1.3 CERTIFICATES

1.3.1 Indoor Air Quality

Submit required indoor air quality certifications in one submittal package.

1.3.1.1 Paints and Coatings

Provide paint and coating products certified to meet formaldehyde emission class F****.

1.4 APPLICATOR'S QUALIFICATIONS

[1.4.1 Contractor Qualification

Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on [_____] on a minimum of three similar projects within the past three years. List information by individual and include the following:

a. Name of individual and proposed position for this work.

b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address, telephone number, and telex number (if non-US) of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

]1.5 QUALITY ASSURANCE

1.5.1 Field Samples and Tests

The Contracting Officer may choose up to two coatings that have been delivered to the site to be tested at no cost to the Government. Take samples of each chosen product as specified in the paragraph SAMPLING PROCEDURES. Test each chosen product as specified in the paragraph TESTING PROCEDURE. Remove products from the job site which do not conform, and replace with new products that conform to the referenced specification. Test replacement products that failed initial testing at no cost to the Government.

1.5.1.1 Sampling Procedure

The Contracting Officer will select paint at random from the products that have been delivered to the job site for sample testing. The Contractor will provide one liter samples of the selected paint materials. Take samples in the presence of the Contracting Officer, and label, and identify each sample. Provide labels in accordance with the paragraph PACKAGING, LABELING, AND STORAGE of this specification.

1.5.1.2 Testing Procedure

Qualification testing of coated surfaces per MLIT SS Chapter 18 Painting Work, Table 18.1.1 and Section 18.1.7 and JIS K5600.

Testing of film thickness per JIS K5600.

1.6 REGULATORY REQUIREMENTS

1.6.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, indoor coating materials to conform to formaldehyde emission class F****. Notify Contracting Officer of any paint specified herein which fails to conform.

1.6.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.6.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.6.4 Asbestos Content

Provide asbestos-free materials.

1.6.5 Mercury Content

Provide materials free of mercury or mercury compounds.

1.6.6 Silica

Provide abrasive blast media containing no free crystalline silica.

1.6.7 Human Carcinogens

Provide materials that do not contain confirmed human carcinogens or suspected human carcinogens.

1.7 PACKAGING, LABELING, AND STORAGE

Provide paints in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Furnish pigmented paints in containers not larger than 20 liters. Store paints and thinners in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 4 to 35 degrees C. Do not store paint, polyurethane, varnish, or wood stain products with materials that have a high capacity to adsorb VOC emissions, [including [_____]]. Do not store paint, polyurethane, varnish, or wood stain products in occupied spaces.

1.8 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Comply with applicable local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in Section 01 35 26 GOVERNMENT SAFETY REQUIREMENTS and in Appendix A of EM 385-1-1. Include in the Activity Hazard Analysis the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.8.1 Safety Methods Used During Coating Application

Comply with the requirements of MLIT SS Chapter 18.

1.8.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

a. The applicable manufacturer's Safety Data Sheets (SDS) or local regulation.

[b. Removal and disposal of coatings which contain lead is specified in Section 02 83 00 LEAD REMEDIATION[_____]. Refer to drawings for list of hazardous materials located on this project. Coordinate paint preparation activities with this specification section.
]
[c. Removal and disposal of coatings which contain asbestos materials is specified in Section 02 82 00 ASBESTOS REMEDIATION. Refer to drawings for list of hazardous materials located on this project. Coordinate paint preparation activities with this specification section.

] Submit manufacturer's Safety Data Sheets for coatings, solvents, and other potentially hazardous materials.

1.9 ENVIRONMENTAL CONDITIONS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation.[Isolate area of application from rest of building when applying high-emission paints or coatings.]

1.9.1 Coatings

Do not apply coating when air or substrate conditions are:

a. Unsuitable for drying, including when the air temperature at a location for coating is below 5 degrees C, the humidity is 85 percent or more and condensation occurs due to inadequate ventilation. Where it is not possible to avoid coating, curing measures, such as warming and ventilation, shall be performed.

b. External coatings shall generally not be performed if rain is likely to occur or during strong winds.

1.9.2 Post-Application

Vacate space for as long as possible after application. Wait a minimum of 48 hours before occupying freshly painted rooms. Maintain one of the following ventilation conditions during the curing period, or for 72 hours after application:

a. Supply 100 percent outside air 24 hours a day.

b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 13 degrees C and 29 degrees C and humidity is between 30 percent and 60 percent.

c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

1.10 SCHEDULING

Allow paint, polyurethane, varnish, and wood stain installations to cure prior to the installation of materials that adsorb VOCs, including [_____].

1.11 COLOR SELECTION

Provide colors of finish coats as indicated or specified. Allow Contracting Officer to select colors not indicated or specified. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

Tint each coat progressively darker to enable confirmation of the number of coats.

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated. Submit color stencil codes.

1.12 LOCATION AND SURFACE TYPE TO BE PAINTED

1.12.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.

b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.

c. Existing coated surfaces that are damaged during performance of the work.

1.12.1.1 Exterior Painting

Includes new surfaces[, existing coated surfaces,] [and] [existing uncoated surfaces,] of the building[s] and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

1.12.1.2 Interior Painting

Includes new surfaces[, existing uncoated surfaces,] [and] [existing coated surfaces] of the building[s] and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

a. Exposed columns, girders, beams, joists, and metal deck; and

b. Other contiguous surfaces.

1.12.2 Painting Excluded

Do not paint the following unless indicated otherwise.

a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.

b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.

c. Steel to be embedded in concrete.

d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.

e. Hardware, fittings, and other factory finished items.

[f. Do not paint surfaces in the following areas: [_____].

]1.12.3 Mechanical and Electrical Painting

Includes field coating of [interior] [and] [exterior] new [and existing] surfaces.

a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.

(1) Exposed piping, conduit, and ductwork;

(2) Supports, hangers, air grilles, and registers;

(3) Miscellaneous metalwork and insulation coverings.

[b. Do not paint the following, unless indicated otherwise:

[(1) New zinc-coated, aluminum, and copper surfaces under insulation

][(2) New aluminum jacket on piping

][(3) New interior ferrous piping under insulation.

]][1.12.3.1 Fire Extinguishing Sprinkler Systems

Clean, pretreat, prime, and paint new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories. Apply coatings to clean, dry surfaces, using clean brushes. Clean the surfaces to remove dust, dirt, rust, and loose mill scale. Immediately after cleaning, provide the metal surfaces with one coat primer per schedules. Shield sprinkler heads with protective covering while painting is in progress. Upon completion of painting, remove protective covering from sprinkler heads. Remove sprinkler heads which have been painted and replace with new sprinkler heads. Provide primed surfaces with the following:

a. Piping in Unfinished Areas: Provide primed surfaces with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 0.025 mm in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.[In lieu of red enamel finish coat, provide piping with 50 mm wide red enamel bands or self-adhering red plastic bands spaced at maximum of 6 meters intervals.]

b. Piping in Finished Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel applied to a minimum dry film thickness of 0.025 mm. Provide piping with 50 mm wide red enamel bands or self-adhering red plastic bands spaced at maximum of 6 meters intervals throughout the piping systems.

][1.12.4 Exterior Painting of Site Work Items

Field coat the following items:

	New Surfaces	Existing Surfaces
a.	[_____]	[_____]
b.	[_____]	[_____]
c.	[_____]	[_____]

]1.12.5 MISCELLANEOUS PAINTING

Lettering [Building][Room Number(s)]

Provide lettering [as scheduled on the drawings] [block] [Gothic] type, [black enamel] [water-type decalcomania, finished with a protective coating of spar varnish]. Samples must be approved before application.

1.12.6 Definitions and Abbreviations

1.12.6.1 Coating

A film or thin layer applied to a base material called a substrate. A coating may be a metal, alloy, paint, or solid/liquid suspensions on various substrates (such as metals, plastics, wood, paper, leather, cloth). They may be applied by electrolysis, vapor deposition, vacuum, or mechanical means such as brushing, spraying, calendaring, and roller coating. A coating may be applied for aesthetic or protective purposes or both. The term "coating" as used herein includes emulsions, enamels, stains, varnishes, sealers, epoxies, and other coatings, whether used as primer, intermediate, or finish coat. The terms paint and coating are used interchangeably.

1.12.6.2 Dry Film Thickness

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.12.6.3 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

1.12.6.4 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

1.12.6.5 Gloss Levels

Gloss Level	Description	Units at 60 degrees	Units at 85 degrees
Gloss 30	Semi-Gloss	15	30
Gloss 50	Semi-Gloss	35	50
Gloss 70	Gloss	60	70
Glossy	High-Gloss	70+	80+

Gloss is tested in accordance with JIS K5600. Historically, the Government has used Flat(Matte), Gloss 30(Eggshell), Gloss 50 (Semi-Gloss), and Gloss 70 (Gloss).

1.12.6.6 Paint

See Coating definition.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit product data sheets for specified coatings and solvents. Provide preprinted cleaning and maintenance instructions for all coating systems.

Submit Manufacturer's Instructions on Mixing: Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.

Provide certification of Indoor Air Quality for paints and primers.

[Provide certification of Indoor Air Quality for consolidated latex paints.

]PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, reinstall removed items by workmen skilled in the trades. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

[3.2 REPUTTYING AND REGLAZING

Remove cracked, loose, and defective putty or glazing compound on glazed sash and provide new putty or glazing compound. Where defective putty or glazing compound constitutes 30 percent or more of the putty at any one light, remove the glass and putty or glazing compound and reset the glass. Remove putty or glazing compound without damaging sash or glass. Clean rabbets to bare wood or metal and prime prior to reglazing. Provide linseed oil putty for wood sash. Patch surfaces to provide smooth transition between existing and new surfaces. Finish putty or glazing compound to a neat and true bead. Allow glazing compound time to cure, in accordance with manufacturer's recommendation, prior to coating application. Allow putty to set one week prior to coating application.

][3.3 RESEALING OF EXISTING EXTERIOR JOINTS

3.3.1 Surface Condition

Begin with surfaces that are clean, dry to the touch, and free from frost and moisture; remove grease, oil, wax, lacquer, paint, defective backstop, or other foreign matter that would prevent or impair adhesion. Where adequate grooves have not been provided, clean out to a depth of 13 mm and grind to a minimum width of 6 mm without damage to adjoining work. Grinding is not required on metal surfaces.

3.3.2 Backstops

In joints more than 13 mm deep, install glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free of oil or other staining elements as recommended by sealant manufacturer. Provide backstop material compatible with sealant. Do not use oakum and other types of

absorptive materials as backstops.

3.3.3 Primer and Bond Breaker

Install the type recommended by the sealant manufacturer.

3.3.4 Ambient Temperature

Between 4 degrees C and 35 degrees C when applying sealant.

3.3.5 Exterior Sealant

For joints, provide JIS A 5758. Color(s) will be selected by the Contracting Officer. Apply the sealant in accordance with the manufacturer's printed instructions. Force sealant into joints with sufficient pressure to fill the joints solidly. Apply sealant uniformly smooth and free of wrinkles.

3.3.6 Cleaning

Immediately remove fresh sealant from adjacent areas using a solvent recommended by the sealant manufacturer. Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean condition. Allow sealant time to cure, in accordance with manufacturer's recommendations, prior to coating.

]3.4 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, [disintegrated coatings,] and other foreign matter and substances deleterious to coating performance per MLIT SS Chapter 18 for each substrate before application of paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Schedule cleaning so that dust and other contaminants will not fall on wet, newly painted surfaces. Spot-prime exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

[3.4.1 Additional Requirements for Preparation of Surfaces With Existing Coatings

Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:

a. Test existing finishes for lead before sanding, scraping, or removing. If lead is present, refer to paragraph Toxic Materials.

b. Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits or per paint manufacturer's requirements. Allow surface to dry. Wipe immediately preceding the application of the first coat of any coating, unless specified otherwise.

c. Sand existing glossy surfaces to be painted to reduce gloss. Brush, and wipe clean with a damp cloth to remove dust.

d. The requirements specified are minimum. Comply also with the application instructions of MLIT SS Chapter 18 and the paint manufacturer.

e. Thoroughly clean previously painted surfaces [specified to be repainted] [damaged during construction] of all grease, dirt, dust or other foreign matter.

f. Remove blistering, cracking, flaking and peeling or otherwise deteriorated coatings.

g. Roughen slick surfaces. Repair damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls with suitable material to match adjacent undamaged areas.

h. Feather and sand smooth edges of chipped paint.

i. Clean rusty metal surfaces per MLIT SS Chapter 18 and per paint manufacturer's instructions. Use solvent, mechanical, or chemical cleaning methods to provide surfaces suitable for painting.

j. Provide new, proposed coatings that are compatible with existing coatings.

][3.4.2 Existing Coated Surfaces with Minor Defects

[Sand, spackle, and treat minor defects to render them smooth. Minor defects are defined as scratches, nicks, cracks, gouges, spalls, alligatoring, chalking, and irregularities due to partial peeling of previous coatings.][Remove chalking by sanding [or blasting].]

][3.4.3 Removal of Existing Coatings

Remove existing coatings from the following surfaces:

a. Surfaces containing large areas of minor defects;

b. Surfaces containing more than 20 percent peeling area; and

c. Surfaces designated by the Contracting Officer, such as surfaces where rust shows through existing coatings.

][3.4.4 Substrate Repair

a. Repair substrate surface damaged during coating removal;

b. Sand edges of adjacent soundly-adhered existing coatings so they are tapered as smooth as practical to areas involved with coating removal; and

c. Clean and prime the substrate as specified.

]3.5 PREPARATION OF METAL SURFACES

3.5.1 Existing and New Ferrous Surfaces

Base surface preparation per MLIT SS Chapter 18 or per paint manufacturer's recommendations.

3.6 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.6.1 Concrete and Masonry

Base surface preparation per MLIT SS Chapter 18 or per paint manufacturer's recommendations.

a. Curing: Allow concrete, stucco and masonry surfaces to cure at least 30 days before painting, and concrete slab on grade to cure at least 90 days before painting.

b. Surface Cleaning: Remove the following deleterious substances.

(1) Dirt,[Chalking,] Grease, and Oil: Wash new[and existing uncoated] surfaces with a solution per paint manufacturer's recommendations. Then rinse thoroughly with fresh water.[Wash existing coated surfaces with a suitable detergent and rinse thoroughly.] For large areas, water blasting may be used.

(2) Fungus and Mold: Wash [new][, existing coated,] [and existing uncoated] surfaces with a solution per paint manufacturer's recommendations. Rinse thoroughly with fresh water.

(3) Paint and Loose Particles: Remove by wire brushing.

(4) Efflorescence: Remove by scraping or wire brushing followed by washing with a solution per paint manufacturer's recommendations.

[(5) Removal of Existing Coatings: For surfaces to receive textured coating, remove existing coatings including soundly adhered coatings if recommended by textured coating manufacturer.

] c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.

d. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical or horizontal surfaces as determined manufacturer's recommendations. In all cases follow manufacturers recommendations. Allow surfaces to cure a minimum of 30 days before painting.

3.6.2 Gypsum Board

Base surface preparation per MLIT SS Chapter 18 or per paint manufacturer's recommendations.

a. Surface Cleaning: Verify that plaster and stucco surfaces are free from loose matter and that gypsum board is dry. Remove loose dirt and dust by brushing with a soft brush, rubbing with a dry cloth, or vacuum-cleaning prior to application of the first coat material. A damp cloth or sponge may be used if paint will be water-based.

b. Repair of Minor Defects: Prior to painting, repair joints, cracks, holes, surface irregularities, and other minor defects with patching plaster or spackling compound and sand smooth.

c. Allowable Moisture Content: Latex coatings may be applied to damp

surfaces, but not surfaces with droplets of water. Do not apply epoxies to damp surfaces as determined by the paint manufacturer. Verify that new plaster to be coated does not exceed maximum moisture content per manufacturer's recommendations. In addition to moisture content requirements, allow new plaster to age a minimum of 30 days before preparation for painting or as recommended by paint manufacturer.

3.6.3 Existing Asbestos Cement Surfaces

Remove oily stains by solvent cleaning with mineral spirits, per manufacturer's recommendations. Remove loose dirt, dust, and other deleterious substances by brushing with a soft brush or rubbing with a dry cloth prior to application of the first coat material. Do not wire brush or clean using other abrasive methods. Verify surfaces are dry and clean prior to application of the coating.

3.7 PREPARATION OF WOOD AND PLYWOOD SURFACES

3.7.1 New [, Existing Uncoated,] [and] [Existing Coated] Plywood and Wood Surfaces, Except Floors:

Base surface preparation per MLIT SS Chapter 18 or per paint manufacturer's recommendations.

a. Clean wood surfaces of foreign matter.

Surface Cleaning: Verify that surfaces are free from dust and other deleterious substances and in a condition approved by the Contracting Officer prior to receiving paint or other finish. Do not use water to clean uncoated wood.[Scrape to remove loose coatings. Lightly sand to roughen the entire area of previously enamel-coated wood surfaces.]

[b. Removal of Fungus and Mold: Wash existing coated surfaces with a solution as recommended by paint manufacturer. Rinse thoroughly with fresh water.

] c. Do not exceed 12 percent moisture content of the wood as measured by a moisture meter in accordance with paint manufacturer's recommendations.

d. Prime or touch up wood surfaces adjacent to surfaces to receive water-thinned paints before applying water-thinned paints.

e. Cracks and Nailheads: Set and putty stop nailheads and putty cracks after the prime coat has dried.

f. Cosmetic Repair of Minor Defects:

(1) Knots and Resinous Wood [and Fire, Smoke, Water, and Color Marker Stained Existing Coated Surface]: Prior to application of coating, cover knots and stains with two or more coats of 1.3-kg-cut shellac varnish, plasticized with 0.14 liters of castor oil per liter or as recommended by coating manufacturer. . Scrape away existing coatings from knotty areas, and sand before treating. Prime before applying any putty over shellacked area.

(2) Open Joints and Other Openings: Fill with whiting putty, linseed oil putty. Sand smooth after putty has dried.

(3) Checking: Where checking of the wood is present, sand the surface, wipe and apply a coat of pigmented orange shellac. Allow to dry before paint is applied.

g. Prime Coat For New Exterior Surfaces: Prime coat [wood doors,] [windows,] [frames,] [and] [trim] before wood becomes dirty, warped, [or weathered].

3.7.2 Wood Floor Surfaces, Natural Finish

Base surface preparation per MLIT SS Chapter 18 or per paint manufacturer's recommendations.

a. Initial Surface Cleaning: As specified in paragraph entitled "Surface Preparation."

[b. Existing Loose Boards and Shoe Molding: Before sanding, renail loose boards. Countersink nails and fill with an approved wood filler. Remove shoe molding before sanding and reinstall after completing other work. At Contractor's option, new shoe molding may be provided in lieu of reinstalling old. Provide new wood molding of the same size, wood species, and finish as the existing.

] c. Sanding and Scraping: Sanding of wood floors is specified in Section [09 64 29 WOOD STRIP AND PLANK FLOORING] [09 64 23 WOOD PARQUET FLOORING] [09 64 66 WOOD ATHLETIC FLOORING] [09 64 00 PORTABLE (DEMOUNTABLE) WOOD FLOORING]. Fill floors of oak or similar open-grain wood with wood filler recommended by the finish manufacturer and the excess filler removed.

d. Final Cleaning: After sanding, sweep and vacuum floors clean. Do not walk on floors thereafter until specified sealer has been applied and is dry.

3.7.3 Interior Wood Surfaces, Stain Finish

Sand interior wood surfaces to receive stain. Fill oak and other open-grain wood to receive stain with a coat of wood filler not less than 8 hours before the application of stain; remove excess filler and sand the surface smooth. Ensuing base surface preparation per MLIT SS Chapter 18 or per paint manufacturer's recommendations.

3.7.4 Water Blasting of Existing Coated Wood Surfaces:

Provide water blasting for the following surfaces: [_____].

a. Sample Panel: Prior to the initial surface cleaning, water blast a representative surface designated by the Contracting Officer. Provide surface cleaning of the remaining work to match the sample panel approved by the Contracting Officer.

b. Initial Surface Cleaning: Water blast surfaces to receive paint with a high pressure spray, to remove loose paint, dirt, and other foreign or deleterious materials. Do not flood vents or damage windows and floors. If the pressure specified will cause damage to existing wood, advise the Contracting Officer. Direct the wash nozzle at the surface at an angle of approximately 75 degrees with the surface and at a distance not greater than 1500 mm to apply water pressure required to remove loose paint, dirt, chalking, and other foreign matter.

c. Final Surface Cleaning: After allowing the surfaces to dry for a minimum of 24 hours, remove remaining dirt, splinters, loose particles, disintegrated and loose paint, grease, oil, and other foreign matter from the surface.

3.8 APPLICATION

3.8.1 Coating Application

Application of paint per MLIT SS Chapter 18. At the time of application, paint must show no signs of deterioration. Maintain uniform suspension of pigments during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Use trigger operated spray nozzles for water hoses. Use rollers for applying paints and enamels of a type designed for the coating to be applied and the surface to be coated. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.

Only apply paints, except water-thinned types to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Pay special attention to ensure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Apply each coat of paint so that dry film is of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Completely hide all blemishes.

Touch up damaged coatings before applying subsequent coats.[Broom clean and clear dust from interior areas before and during the application of coating material.]

[Apply paint to new fire extinguishing sprinkler systems including valves, piping, conduit, hangers, supports, miscellaneous metal work, and accessories. Shield sprinkler heads with protective coverings while painting is in progress. Remove sprinkler heads which have been painted and replace with new sprinkler heads. For piping in unfinished spaces, provide primed surfaces with one coat of red alkyd gloss enamel to a minimum dry film thickness of 0.025 mm. Unfinished spaces include attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and space where walls or ceiling are not painted or not constructed of a prefinished material. For piping in finished areas, provide prime surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of red alkyd gloss enamel. Upon completion of painting, remove protective covering from sprinkler heads.

] a. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.

b. Primers, and Intermediate Coats: Do not allow primers or intermediate

coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Cover each preceding coat or surface completely by ensuring visually perceptible difference in shades of successive coats.

c. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.

d. Thermosetting Paints: Topcoats over thermosetting paints (epoxies and urethanes) should be applied within the overcoating window recommended by the manufacturer.

e. Floors: [For nonslip surfacing on level floors, as the intermediate coat is applied, cover wet surface completely with almandite garnet, Grit No. 36, with maximum passing .420 mm less than 0.5 percent. When the coating is dry, use a soft bristle broom to sweep up excess grit, which may be reused, and vacuum up remaining residue before application of the topcoat.] [For nonslip surfacing on ramps, provide MPI 77 with non-skid additive, applied by roller in accordance with manufacturer's instructions.]

3.8.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. Verify that the written permission includes quantities and types of thinners to use.

The use of thinner does not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning cannot cause the paint to exceed limits on volatile organic compounds. Do not mix paints of different manufacturers.

3.8.3 Two-Component Systems

Mix two-component systems in accordance with manufacturer's instructions. Follow recommendation by the manufacturer for any thinning of the first coat to ensure proper penetration and sealing for each type of substrate.

3.8.4 Coating Systems

a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in MLIT SS Chapter 18.

b. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness as specified in MLIT SS Chapter 18. Coating thickness where specified, refers to the minimum dry film thickness.

c. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.

d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:

(1) One coat of primer.

(2) One coat of undercoat or intermediate coat.

(3) One topcoat to match adjacent surfaces.

e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.9 COATING SYSTEMS FOR METAL

Apply coatings per MLIT SS Chapter 18 for Exterior and Interior.

a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.

b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.

c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.

d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 0.038 mm DFT immediately prior to application of epoxy or urethane coatings.

e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat. Overcoat these items with the specified ferrous-metal primer prior to application of finish coats.

f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal per paint manufacturer's recommendations.

3.10 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings per MLIT SS Chapter 18 for Exterior and Interior.

3.11 COATING SYSTEMS FOR WOOD AND PLYWOOD

a. Apply coatings per MLIT SS Chapter 18 for Exterior and Interior.

b. Apply stains in accordance with manufacturer's printed instructions.

[c. Wood Floors to Receive Natural Finish: Thin first coat 2 to 1 using thinner recommended by coating manufacturer. Apply second coat not less than 2 hours and not over 24 hours after first coat has been applied. Apply with applicators as recommended by coating manufacturer. Buff or lightly sand between intermediate coats as recommended by coating manufacturer's printed instructions.

]3.12 PIPING IDENTIFICATION

Piping Identification, Including Surfaces In Concealed Spaces: Provide per the following.

a. Flammable Materials: Defined as all materials known ordinarily as flammables or combustibles. AMS-STD-595, Yellow, No. 13655.

b. Toxic and Poisonous Materials: Defined as all materials extremely hazardous to life or health under normal conditions as toxics or poisons. AMS-STD-595, Brown, No. 10080.

c. Anesthetics and Harmful Materials: Defined as all materials productive of anesthetic vapors and all liquid chemicals and compound hazardous to life and property but not normally productive of dangerous quantities of fumes or vapors. AMS-STD-595, Blue, No. 15102.

d. Oxidizing Materials: Defined as all materials which readily furnish oxygen for combustion and fire producers which react explosively or with the evolution of heat in contact with many other materials. AMS-STD-595, Green, No. 14187.

e. Physically Dangerous Materials: Defined as all materials, not dangerous in themselves, which are asphyxiating in confined areas or which are generally handled in a dangerous physical state of pressure or temperature. AMS-STD-595, Gray, No. 16187.

f. Fire Protection Materials: Defined as all materials provided in piping systems or in compressed gas cylinders exclusively for use in fire protection. AMS-STD-595, Red, No. 11105.

g. Water: Piping system containing water suitable for human consumption and installed for this purpose. AMS-STD-595, White, No. 1787 or painted to match surroundings when not in conflict with other color designations.

Place stenciling in clearly visible locations. On piping not covered by the aforementioned stencil approved names or code letters, in letters a minimum of 13 mm high for piping and a minimum of 50 mm high elsewhere. Stencil arrow-shaped markings on piping to indicate direction of flow using black stencil paint.

3.13 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.14 WASTE MANAGEMENT

As specified in the Waste Management Plan and as follows. Do not use kerosene or any such organic solvents to clean up water based paints. Properly dispose of paints or solvents in designated containers. Close and seal partially used containers of paint to maintain quality as necessary for reuse. Store in protected, well-ventilated, fire-safe area at moderate temperature. Place materials defined as hazardous or toxic waste

in designated containers.

3.15 PAINT TABLES

3.15.1 Exterior Paint Tables

DIVISION 3: EXTERIOR CONCRETE PAINT TABLE

A. [New and uncoated existing] [and Existing, previously painted] concrete; vertical surfaces, including undersides of balconies, soffits, roofs, columns and beams but excluding tops of slabs:

1. Paint system shall be formaldehyde emission class F**** minimum, Weatherproof Class 3 Type. Coatings shall comply with JIS A 6909, Multi-Layer, Type E:

Spray Tile Finish System (4-Layer System):

(1)	Base Coat 1:	Not less than 0.1 kg/sm
(2)	Texture Base Coat 1:	Not less than 0.7 kg/sm
(3)	Texture Top Coat:	Not less than 0.8 kg/sm
(4)	Top Coat, Acrylic, Resin, Emulsion Type, High Gloss Finish, 2 times:	Not less than 0.25 kg/sm

Primer as recommended by manufacturer. Coating system shall be applied by spray application in accordance with manufacturer's instructions.

B. [New and uncoated existing] [and Existing, previously painted] concrete, textured system; vertical surfaces, including undersides of balconies and soffits but excluding tops of slabs:

1. MLIT SS Chapter 18

Texture - [Fine] [Medium] [Coarse]. Surface preparation and number of coats in accordance with manufacturer's instructions.
Topcoat: Coating to match adjacent surfaces.

C. [New and uncoated existing] [and Existing, previously painted] concrete, elastomeric System; vertical surfaces, including undersides of balconies and soffits but excluding tops of slabs:

1. MLIT SS Chapter 18

Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces. Surface preparation and number of coats in accordance with manufacturer's instructions.

D. [New and uncoated existing] [and Existing, previously painted] concrete: walls and bottom of swimming pools.

1. MLIT SS Chapter 18

E. [New] [and Existing] Cementitious composition board (including Asbestos cement board):

1. MLIT SS Chapter 18

Topcoat: Coating to match adjacent surfaces.

DIVISION 4: EXTERIOR CONCRETE MASONRY UNITS PAINT TABLE

A. [New] [and Existing] concrete masonry on uncoated surface:

1. MLIT SS Chapter 18

Topcoat: Coating to match adjacent surfaces.

B. [New] [and Existing] concrete masonry, textured system; on uncoated surface:

1. MLIT SS Chapter 18

Texture - [Fine] [Medium] [Coarse]. Surface preparation and number of coats in accordance with manufacturer's instructions. Topcoat: Coating to match adjacent surfaces.

C. [New] [and Existing] concrete masonry, elastomeric system; on uncoated surface:

1. MLIT SS Chapter 18

Primer as recommended by manufacturer. Topcoat: Coating to match adjacent surfaces. Surface preparation and number of coats in accordance with manufacturer's instructions.

DIVISION 5: EXTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

STEEL / FERROUS SURFACES

A. New Steel that has been hand or power tool cleaned or per MLIT SS Chapter 18.

1. MLIT SS Chapter 18

B. New Steel that has been blast-cleaned:

2. MLIT SS Chapter 18

C. Existing steel that has been spot-blasted:

1. MLIT SS Chapter 18

2. [Surface previously coated with epoxy:
MLIT SS Chapter 18]

D. New [and existing] steel blast cleaned:

1. MLIT SS Chapter 18

2. [Pigmented Polyurethane
MLIT SS Chapter 18]

E. Metal floors (non-shop-primed surfaces or non-slip deck surfaces) with

non-skid additive (NSA), load at manufacturer's recommendations.:

1. MLIT SS Chapter 18

EXTERIOR GALVANIZED SURFACES

F. New Galvanized surfaces:

1. MLIT SS Chapter 18

2. [Waterborne Primer / Latex
MLIT SS Chapter 18]

3. [Waterborne Primer / Waterborne Light Industrial Coating
MLIT SS Chapter 18
System DFT: 112 microns]

4. [Epoxy Primer / Waterborne Light Industrial Coating
MLIT SS Chapter 18]

5. [Pigmented Polyurethane
MLIT SS Chapter 18]

G. Galvanized surfaces with slight coating deterioration; little or no rusting:

1. MLIT SS Chapter 18

2. [Pigmented Polyurethane
MLIT SS Chapter 18]

H. Galvanized surfaces with severely deteriorated coating or rusting:

1. MLIT SS Chapter 18

2. [Pigmented Polyurethane
MLIT SS Chapter 18]

EXTERIOR SURFACES, OTHER METALS (NON-FERROUS)

I. Aluminum, aluminum alloy and other miscellaneous non-ferrous metal items not otherwise specified except hot metal surfaces, roof surfaces, and new prefinished equipment. Match surrounding finish:

1. [Alkyd
MLIT SS Chapter 18]

2. [Waterborne Light Industrial Coating
MLIT SS Chapter 18]

J. Existing roof surfaces previously coated:

1. MLIT SS Chapter 18

2. [Aluminum Paint
MLIT SS Chapter 18]

K. Surfaces adjacent to painted surfaces; [Mechanical,] [Electrical,] [Fire extinguishing sprinkler systems including valves, conduit, hangers,

supports,][exposed copper piping,] [and miscellaneous metal items] not otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish:

1. [Alkyd
MLIT SS Chapter 18]

2. [Waterborne Light Industrial Coating
MLIT SS Chapter 18]

3.15.2 Interior Paint Tables

DIVISION 3: INTERIOR CONCRETE PAINT TABLE

A. [New and uncoated existing] [and Existing, previously painted] Concrete, vertical surfaces, not specified otherwise:

1. MLIT SS Chapter 18

2. [High Performance Architectural Latex
MLIT SS Chapter 18]

3. [Institutional Low Odor / Low VOC Latex
MLIT SS Chapter 18]

B. Concrete ceilings, uncoated:

1. [Latex Aggregate
MLIT SS Chapter 18]

Texture - [Fine] [Medium] [Coarse]. Surface preparation, number of coats, and primer in accordance with manufacturer's instructions. Topcoat: Coating to match adjacent surfaces.

C. [New and uncoated existing][and][Existing, previously painted] Concrete in [toilets,] [food-preparation,] [food-serving,] [restrooms,] [laundry areas,] [shower areas,] [areas requiring a high degree of sanitation,] [_____] [and other high-humidity areas] not otherwise specified except floors:

1. Coating shall conform to JIS K5670, 0.10 kg/sm for base coat and JIS K5670, 0.10 kg/sm for top coat.

DIVISION 4: INTERIOR CONCRETE MASONRY UNITS PAINT TABLE

A. New [and uncoated Existing] Concrete masonry:

1. [High Performance Architectural Latex
MLIT SS Chapter 18
Fill all holes in masonry surface]

2. [Institutional Low Odor / Low VOC Latex
MLIT SS Chapter 18]

B. Existing, previously painted Concrete masonry:

1. [High Performance Architectural Latex
MLIT SS Chapter 18]

2. [Institutional Low Odor / Low VOC Latex
MLIT SS Chapter 18]

C. New [and uncoated Existing] Concrete masonry units in [toilets,] [food-preparation,] [food-serving,] [restrooms,] [laundry areas,] [shower areas,] [areas requiring a high degree of sanitation,] [_____,] [and other high humidity areas] unless otherwise specified:

1. [Waterborne Light Industrial Coating
MLIT SS Chapter 18
Fill all holes in masonry surface]

2. [Alkyd
MLIT SS Chapter 18
Fill all holes in masonry surface]

3. [Epoxy
MLIT SS Chapter 18
Fill all holes in masonry surface]

D. Existing, previously painted, concrete masonry units in [toilets,] [food-preparation,] [food-serving,] [restrooms,] [laundry areas,] [shower areas,] [areas requiring a high degree of sanitation,] [_____,] [and other high humidity areas] unless otherwise specified:

1. [Waterborne Light Industrial Coating
MLIT SS Chapter 18]

2. [Alkyd
MLIT SS Chapter 18]

3. [Epoxy
MLIT SS Chapter 18]

DIVISION 5: INTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

INTERIOR STEEL / FERROUS SURFACES

A. Metal, [Mechanical,] [Electrical,] [Fire extinguishing sprinkler systems including valves, conduit, hangers, supports]. [Surfaces adjacent to painted surfaces (Match surrounding finish),] [exposed copper piping,] [and miscellaneous metal items] not otherwise specified except floors, hot metal surfaces, and new prefinished equipment:

1. [High Performance Architectural Latex
MLIT SS Chapter 18]

2. [Alkyd
MLIT SS Chapter 18]

B. Metal floors (non-shop-primed surfaces or non-slip deck surfaces) with non-skid additive (NSA), load at manufacturer's recommendations.:

1. [Alkyd Floor Paint
MLIT SS Chapter 18]

2. [Epoxy

MLIT SS Chapter 18]

C. Metal in [toilets,] [food-preparation,] [food-serving,] [restrooms,] [laundry areas,] [shower areas,] [areas requiring a high degree of sanitation,] [_____,] [and other high-humidity areas] not otherwise specified except floors, hot metal surfaces, and new prefinished equipment:

1. [Alkyd
MLIT SS Chapter 18]

2. [Alkyd
MLIT SS Chapter 18]

D. Miscellaneous non-ferrous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment. Match surrounding finish:

1. [High Performance Architectural Latex
MLIT SS Chapter 18]

2. [Alkyd
MLIT SS Chapter 18]

DIVISION 6: INTERIOR WOOD PAINT TABLE

A. New [and Existing, uncoated] Wood and plywood not otherwise specified:

1. [High Performance Architectural Latex
MLIT SS Chapter 18]

2. [Alkyd
MLIT SS Chapter 18]

3. [Institutional Low Odor / Low VOC Latex
New; MPI INT 6.3V-G2 (Flat)
MLIT SS Chapter 18]

B. Existing, previously painted Wood and plywood not otherwise specified:

1. [High Performance Architectural Latex
MLIT SS Chapter 18]

2. [Alkyd
MLIT SS Chapter 18]

3. [Institutional Low Odor / Low VOC Latex
MLIT SS Chapter 18]

C. New [and Existing, previously finished or stained] Wood and Plywood, except floors; natural finish or stained:

1. [Natural finish, oil-modified polyurethane
MLIT SS Chapter 18]

2. [Stained, oil-modified polyurethane
MLIT SS Chapter 18]

3. [Stained, Moisture Cured Urethane
   MLIT SS Chapter 18]

D. New [and Existing, previously finished or stained] Wood Floors; Natural finish or stained:

1. [Natural finish, oil-modified polyurethane
   MLIT SS Chapter 18]

2. [Natural finish, Moisture Cured Polyurethane
   MLIT SS Chapter 18]

3. [Stained, oil-modified polyurethane
   MLIT SS Chapter 18]

4. [Stained, Moisture Cured Polyurethane
   MLIT SS Chapter 18]

E. New [and Existing, previously coated] Wood floors; pigmented finish:

1. [Latex Floor Paint
   MLIT SS Chapter 18]

2. [Alkyd Floor Paint
   MLIT SS Chapter 18]

F. New [and Existing, uncoated] wood surfaces in [toilets,] [food-preparation,] [food-serving,] [restrooms,] [laundry areas,] [shower areas,] [areas requiring a high degree of sanitation,] [_____] [and other high humidity areas] not otherwise specified.:

1. [As specified in Section 09 96 59 HIGH-BUILD GLAZE COATINGS.]

2. [MLIT SS Chapter 18]

3. [Alkyd
   MLIT SS Chapter 18]

G. Existing, previously painted wood surfaces in [toilets,] [food-preparation,] [food-serving,] [restrooms,] [laundry areas,] [shower areas,] [areas requiring a high degree of sanitation,] [_____] [and other high humidity areas] not otherwise specified:

1. [As specified in Section 09 96 59 HIGH-BUILD GLAZE COATINGS.]

2. [MLIT SS Chapter 18]

3. [Alkyd
   MLIT SS Chapter 18]

H. New [and Existing, previously finished or stained] Wood Doors; Natural Finish or Stained:

1. [MLIT SS Chapter 18]
   Note: Sand between all coats per manufacturers recommendations.

2. [Stained, oil-modified polyurethane
   MLIT SS Chapter 18]
   Note: Sand between all coats per manufacturers recommendations.

3. [Stained, Moisture Cured Urethane
MLIT SS Chapter 18]
Note: Sand between all coats per manufacturers recommendations.

I. New [and Existing, uncoated] Wood Doors; Pigmented finish:

1. [Alkyd
MLIT SS Chapter 18]
Note: Sand between all coats per manufacturers recommendations.

2. [Pigmented Polyurethane
MLIT SS Chapter 18]
Note: Sand between all coats per manufacturers recommendations.

J. Existing, previously painted Wood Doors; Pigmented finish:

1. [Alkyd
MLIT SS Chapter 18]

Note: Sand between all coats per manufacturers recommendations.

DIVISION 9: INTERIOR PLASTER, GYPSUM BOARD, TEXTURED SURFACES PAINT TABLE

A. New [and Existing, previously painted] [Plaster] [and] [Wallboard] not otherwise specified:

1. [Latex
MLIT SS Chapter 18]

2. [High Performance Architectural Latex - High Traffic Areas
MLIT SS Chapter 18]

3. [Institutional Low Odor / Low VOC Latex
MLIT SS Chapter 18]

B. New [and Existing, previously painted] [Plaster] [and] [Wallboard] in [toilets,] [food-preparation,] [food-serving,] [restrooms,] [laundry areas,] [shower areas,] [areas requiring a high degree of sanitation,] [_____] [and other high humidity areas] not otherwise specified.:

1. [Waterborne Light Industrial Coating
MLIT SS Chapter 18]

2. [Alkyd
MLIT SS Chapter 18]

3. [Epoxy
MLIT SS Chapter 18]

-- End of Section --

SECTION 10 14 00.10

EXTERIOR SIGNAGE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS G 3101	(2017) Rolled Steels for General Structure (Amendment 1)
JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS G 3466	(2015) Carbon Steel Square and Rectangular Tubes for General Structure
JIS H 4000	(2017) Aluminium and Aluminium Alloy Sheets, Strips and Plates (Amendment 1)
JIS H 4040	(2015) Aluminum and Aluminum Alloy Bars and Wires
JIS H 5202	(2010) Aluminum Alloy Castings
JIS H 8602	(2010) Combined Coatings of Anodic Oxide and Organic Coatings on Aluminum and Aluminum Alloys
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS K 5906	(1998) Aluminum Pigments For Paints
JIS K 6735	(2014) Plastics - Polycarbonate sheets - Types, dimensions and characteristics
JIS R 3205	(2005) Laminated Glass
JIS Z 3001	(2013) Welding and Allied Processes - Vocabulary - Part 6: Resistance Welding
JIS Z 3410	(2013) Welding Coordination - Tasks and Responsibilities

JIS Z 3801	(2018) Standard Qualification Test and Acceptance Requirements for Manual Welding Technique
JIS Z 3841	(2018) Test Method and Criteria in Semi-Automatic Welding Technology Certification

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code

1.2 GENERAL REQUIREMENTS

All exterior signage must be provided by a single manufacturer. Exterior signage must be of the design, detail, sizes, types, and message content shown on the drawings, must conform to the requirements specified, and must be provided at the locations indicated. Submit exterior signage schedule in electronic media with spread sheet format. Spread sheet must include sign location, sign type, and message. Signs must be complete with lettering, framing as detailed, and related components for a complete installation. Each sample must consist of a complete sign panel with letters and symbols. Samples may be installed in the work, provided each sample is identified and location recorded. Submit [three] [_____] color samples for each material requiring color and 300 mm square sample of sign face color sample.

1.2.1 Wind Load Requirements

Exterior signage must be designed to withstand [_____] km/h windload. Submit design analysis and supporting calculations performed in support of specified signage.

1.2.2 Character Proportions and Heights

Letters and numbers on indicated signs for handicapped-accessible buildings must have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10. Characters and numbers on indicated signs must be sized according to the viewing distance from which they are to be read. The minimum height is measured using an upper case letter "X". Lower case characters are permitted.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings; G[, [_____]]

SD-10 Operation and Maintenance Data

Protection and Cleaning; G[, [_____]]

1.4 QUALIFICATIONS

Signs, plaques, and dimensional letters must be the standard product of a manufacturer regularly engaged in the manufacture of the products. Items of equipment must essentially duplicate equipment that has been in satisfactory use at least 2 years prior to bid opening.

1.5 DELIVERY AND STORAGE

Materials must be wrapped for shipment and storage, delivered to the jobsite in manufacturer's original packaging, and stored in a clean, dry area in accordance with manufacturer's instructions.

1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period must be provided.

1.7 EXTRA STOCK

Provide [_____] extra interchangeable message panels and extra stock of the following: [[_____] message bars of each color and size for sign types [_____].] [[_____] pressure-sensitive letters in each color and size for sign type [_____].] [[_____] changeable message strips for sign type [_____].]

PART 2 PRODUCTS

2.1 MODULAR EXTERIOR SIGNAGE SYSTEM

Exterior signage must consist of a system of coordinated directional, identification, and regulatory type signs located where shown. Dimensions, details, materials, message content, and design of signage must be as shown. Submit manufacturer's descriptive data and catalog cuts.

2.1.1 Free-Standing Base Mount Pylon/Monolith Type Signs

2.1.1.1 Framing

Interior framing must consist of [aluminum] [or] [galvanized steel] tube columns welded to companion plates. Perimeter framing must consist of [aluminum] [or] [steel] angle framing welded to the post and plate system as designed. Framing members must be designed to permit [access to electrical equipment] [and] [panel removal]. Mounting must be provided as shown. Framing members of steel must be finished with semi-gloss baked enamel or two-component acrylic polyurethane. Openings must be sealed from moisture and made tamper-proof.

2.1.1.2 Exterior Sheeting Panels

Modular panels must be provided in sizes shown on drawings. Panels must be fabricated a minimum of [3 mm thick [aluminum] [steel]] [3 mm thick

fiberglass reinforced plastic (FRP)]. [Panels must be heliarc welded to framing system [_____].] Top and end panels must be removable and must be secured by 5 mm socket head jack nuts. Finish for metal panels must be [semi-gloss baked enamel] [two-component acrylic polyurethane] [anodized conforming to JIS H 8602].

2.1.1.3 Mounting

Mount by securing to concrete foundation as indicated.

2.1.1.4 Finishes

Base finish must be [semi-gloss baked enamel] [or] [two-component acrylic polyurethane] [anodized conforming to JIS H 8602] [_____]. Metal panel system finish must be [baked enamel or two-component acrylic polyurethane] [anodized conforming to JIS H 8602 [_____], as shown].

2.1.2 Panel And Post/Panel Type Signs

2.1.2.1 Posts

One-piece [aluminum] [or] [galvanized steel] posts must be provided with minimum 3.2 mm wall thickness. Posts must be designed to accept panel framing system described. The post must be designed to permit attachment of panel framing system without exposed fasteners. Caps must be provided for each post.

2.1.2.2 Panel Framing System

Panel framing consisting of aluminum sections and interlocking track components must be designed to interlock with posts with concealed fasteners.

2.1.2.3 Panels

Modular message panels must be provided in sizes shown on drawings. Panels must be fabricated a minimum of [3 mm aluminum] [3 mm acrylic] [3 mm fiberglass reinforced plastic (FRP)]. [Panels must be designed to be interchangeable.] [Panels with metal return sheeting must have welded corners, ground smooth.] [Panels must be heliarc welded to framing system.] [Face panels must be removable to provide access to electrical components.]

2.1.2.4 Finishes

Post finish must be [semi-gloss baked enamel] [or] [two-component acrylic polyurethane] [anodized conforming to JIS H 8602] [_____]. Metal panel system finish must be [baked enamel or two-component acrylic polyurethane] [anodized conforming to JIS H 8602 [_____], as shown].

2.1.2.5 Mounting

[Provide permanent mounting by embedding posts in concrete foundation as indicated.] [Provide removable mounting by [[a steel] [an aluminum]] [[sleeve] [flange]] embedded in concrete as indicated.]

2.1.3 Changeable Letter Directories

2.1.3.1 Frame and Trim

Aluminum alloy finish must be [_____].

2.1.3.2 Header Plates

[Header plate must consist of background metal matching frame and having raised letters attached through the back.] [Header plate must consist of acrylic with raised acrylic letters.] [Header plate must consist of MP plastic with raised letters.]

2.1.3.3 Door Glazing

Door glazing must be [clear safety or tempered glass minimum 6 mm thick.] [clear acrylic sheet 5 mm thick.] [clear polycarbonate sheet [5] [6] mm thick.]

2.1.3.4 Door Construction

Door frame must be of same material and finish as surrounding frame. Corners must be mitered [, reinforced] [, welded], and assembled with concealed fasteners. Hinges must be standard with manufacturer, in finish to match frames and trim. Glazing must be set in frame with resilient glazing channels.

2.1.3.5 Door Locks

Door locks must be manufacturer's standard and must be keyed alike.

2.1.3.6 Fabrication

Frames and trim must be assembled with corners [reinforced] [welded] and mitered to hairline fit, with no exposed fasteners. Removable changeable directory panel must consist of [6 mm thick white acrylic with clear acrylic letter tracks] [exterior grade plywood] [aluminum] [rubber] back with [vinyl] [polycarbonate] [corkboard] covering backgrooved 6 mm on centers to receive letters.

2.1.3.7 Finishes

Post finish must be [semi-gloss baked enamel] [or] [two-component acrylic polyurethane] [anodized conforming to JIS H 8602] [_____]. Metal panel system finish must be [baked enamel or two-component acrylic polyurethane] [anodized conforming to JIS H 8602 [_____], as shown].

2.1.3.8 Mounting

Directories must be mounted to supporting structures with concealed fasteners in accordance with manufacturer's instructions.

2.1.3.9 Changeable Letters

Changeable letters must be upper-case or upper and lower-case [helvetica medium] [_____]. Tabbed vinyl letters and numbers must be furnished in accordance with the [drawings] [and] [schedule].

2.2 ILLUMINATION

Concealed lighting must be provided within panel framing members. Lighting must be controlled by a photocell device. [Top] [Back] lighting and electrical equipment must be provided by UL or FM listed and comply with NFPA 70. Illumination must be evenly distributed. A switch on the interior of the sign must be provided to turn off power in the sign. Switch must be readily accessible when sign is open.

2.3 GRAPHICS FOR EXTERIOR SIGNAGE SYSTEMS

2.3.1 Graphics

Signage graphics must conform to the following:

[a. [Cast] [Custom fabricated] [Plate] aluminum letters, [6] [13] [_____] mm thick must be provided and fastened to the message panel with concealed fasteners. Letters must project [_____] mm from face of panel.]

[b. Pressure sensitive precision cut vinyl letters [with reflecting surface] [_____] must be provided.]

[c. Message must be applied to panel using the silkscreen process. Silkscreened images must be executed with photo screens prepared from original art. Handcut screens will not be accepted. Original art must be defined as artwork that is a first generation pattern of the original specified art. Edges and corners must be clean. Rounded corners, cut or ragged edges, edge buildup, bleeding or surfaces pinholes will not be accepted.]

[d. Message letters must be cut out from panel. Panel cutouts must be backed with [2.0 mm FRP] [3.2 mm acrylic] where cutouts occur.]

[e. Message must be cut out from panel. Acrylic letters [3] [6] [13] mm thick must be projected through the cutout area and chemically welded to 3.2 mm thick acrylic backup sheet.]

[f. Message must be embedded in FRP sheet and completely covered with thermosetting polyester resin. Message must be embedded minimum 1 mm. Sheets must be processed in one piece, in one process, to prevent delamination.]

[g. Message must be applied using the frisket method. Photomechanically reproduced graphic masks must be applied to the sign face which has been coated with the graphics color. A background must then be applied to the exposed surfaces. Handcut masks will not be accepted. Edges that are nicked, cut, or ragged will not be acceptable. A protective overcoat containing UV-resistant additives must be applied.]

[h. Message must be engraved in non-corrosive, three-ply fiberglass laminate. Message must be core color or paint filled multiple colors.]

2.3.2 Messages

See [drawings] [and] [schedule] for message content. Typeface: [Helvetica medium] [_____]. Type size [_____] [as indicated].

2.4 METAL PLAQUES

Design and location of plaques must be as indicated.

2.4.1 Cast Metal Plaques

2.4.1.1 Fabrication

Cast metal plaques must have the logo, emblem and artwork cast in the [bas relief] [flat relief] [_____] technique. Plaques must be fabricated from [prime aluminum] [bronze] [yellow brass].

2.4.1.2 Size

Plaque size must be [_____] [as indicated].

2.4.1.3 Border

Border must be [flat band] [plain edge] [bevel] [custom ornamental as indicated] [_____].

2.4.1.4 Background

Background texture must be [leather] [fine pebble] [_____].

2.4.1.5 Mounting

Mounting must be [concealed] [rosettes and anchors] [rosettes and toggle bolts] [invisible] [_____].

2.4.1.6 Finish

Finishes must consist of [aluminum light colored sandblasted background. Letters must be satin polished and entire plaque must be sprayed with two coats of clear lacquer.] [aluminum with background sprayed dark gunmetal colored lacquer. Letters must be satin polished and entire plaque sprayed with two coats clear lacquer.] [bronze with dark finish oxidized background. Letters must be satin polished and entire plaque sprayed with two coats of clear lacquer.] [[aluminum] [bronze] with sprayed background. Letters must be satin polished.]

2.4.2 Chemically Etched Metal Plaques

2.4.2.1 Fabrication

Plaque must be chemically [single-] [double-] etched one-piece [brass] [bronze] [_____] mm thick.

2.4.2.2 Size

Plaque size must be [_____] [as shown].

2.4.2.3 Finish

[Single-etched raised areas must be in [gold-tone] [silver-tone] [bronze-tone] finish and recessed areas must be colorfilled.] [Double-etched raised areas must be [gold-tone] [silver-tone] and recessed textured areas must be [gold-tone] [silver-tone] colorfilled.]

2.4.3 Frost and Surface Oxidized Plaques

2.4.3.1 Fabrication

Plaque must be frosted and surface oxidized one - piece [anodized aluminum] [brass] [bronze] [stainless steel] [_____] mm thick.

2.4.3.2 Size

Plaque size must be [_____] [as shown].

2.4.3.3 Finish

[Material finish must be [satin] [polished].] [Frosted areas must be oxidized [black for aluminum or stainless steel] [or] [black or brown, for brass or bronze].]

2.5 DIMENSIONAL BUILDING LETTERS

2.5.1 Fabrication

Letters must be fabricated from [cast aluminum] [cast bronze] [2 mm aluminum sheet] [3 mm aluminum sheet] [extruded aluminum] [_____]. Letters must be cleaned by chemical etching or cleaned ultrasonically in a special degreasing bath. Letters must be packaged for protection until installation.

2.5.2 Typeface

Typeface must be [helvetica medium] [_____] [as indicated].

2.5.3 Size

Letter size must be [_____] [as indicated].

2.5.4 Finish

[Anodized aluminum] [Baked enamel or two-component acrylic polyurethane] [[Polished] [Oxidized] bronze with clear coat] finish must be provided.

2.5.5 Mounting

[Threaded studs] [Steel U-bracket, cap screws, and expansion bolts] of number and size as recommended by manufacturer, must be used for concealed anchorage. Letters which project from the building line must have stud spacer sleeves. Letters, studs, and sleeves must be of the same material. Supply templates for mounting.

2.6 ALUMINUM ALLOY PRODUCTS

Aluminum alloy products must conform to JIS H 4000 for sheet or plate, JIS H 4040 for extrusions and JIS H 5202 for castings. Aluminum extrusions must be provided at least 3 mm thick and aluminum plate or sheet at least 16 gauge thick. Welding for aluminum products must conform to JIS Z 3001.

2.7 ANODIC COATING

Anodized finish must conform to JIS H 8602 as follows:

[Clear (natural.]

[Integrated color anodized.]

[Electrolytically deposited color - anodized.]

2.8 ORGANIC COATING

Clean, prime and give surfaces a [semi-gloss baked enamel] [or] [two-component acrylic polyurethane] finish in accordance with JIS K 5906, AMP 505, with total dry film thickness not less than 0.030 mm.

2.9 STEEL PRODUCTS

Structural steel products must conform to JIS G 3466. Sheet and strip steel products must conform to JIS G 3101. Welding for steel products must conform to JIS Z 3801.

2.10 CAST BRONZE

Fabricate components with sharp corners, flat faces, and accurate profiles. Remove and polish burrs and rough spots. Finish faces to a uniform high luster.

2.11 VINYL SHEETING FOR GRAPHICS

Vinyl sheeting must be 5 to 7 year premium type and must be in accordance with the flammability requirements of ASTM E84 and must be a minimum 0.08 mm film thickness. Film must include a precoated pressure sensitive adhesive backing, Class 1, or positionable pressure sensitive adhesive backing, Class 3.

2.12 ACRYLIC SHEET

Acrylic sheet must be in accordance with the flammability requirements of ASTM E84 and must conform to JIS R 3205.

2.13 POLYCARBONATE SHEET

Polycarbonate sheet must conform to JIS K 6735.

2.14 ANCHORS AND FASTENERS

Exposed anchor and fastener materials must be compatible with metal to which applied and must match in color and finish and must be non-rusting, non-corroding, and non-staining. Exposed fasteners must be tamper-proof.

2.15 SHOP FABRICATION AND MANUFACTURE

2.15.1 Factory Workmanship

Work must be assembled in the shop, as far as practical, ready for installation at the site. Work that cannot be shop assembled must be given a trial fit in the shop to ensure proper field assembly. Holes for bolts and screws must be drilled or punched. Drilling and punching must produce clean, true lines and surfaces. Welding to or on structural steel must be in accordance with JIS Z 3801, JIS Z 3410 and JIS Z 3841. Welding must be continuous along the entire area of contact. Exposed welds must

be ground smooth. Exposed surfaces of work must have a smooth finish and exposed riveting must be flush. Fastenings must be concealed where practical. Items specified to be galvanized must be by hot-dip process after fabrication if practical. Galvanization must be in accordance with JIS G 3302 and JIS H 8641, as applicable. Other metallic coatings of steel sheet must be in accordance with JIS G 3302. Joints exposed to the weather must be formed to exclude water. Drainage and weep holes must be included as required to prevent condensation buildup.

2.15.2 Dissimilar Materials

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces must be protected with a coat of asphalt varnish or a coat of zinc-molybdate primer to prevent galvanic or corrosive action.

2.15.3 Shop Painting

Surfaces of miscellaneous metal work, except nonferrous metal, corrosion resisting steel, and zinc-coated work, must be given one coat of zinc-molybdate primer or an approved rust-resisting treatment and metallic primer in accordance with manufacturer's standard practice. Surfaces of items to be embedded in concrete must not be painted. Upon completion of work, damaged surfaces must be recoated.

2.16 COLOR, FINISH, AND CONTRAST

Color must be [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES.] [as indicated on the drawings.] [selected from manufacturers standard colors.] [[_____.] Color listed is not intended to limit the selection of equal colors from other manufacturers.] For buildings required to be handicapped-accessible, the characters and background of signs must be eggshell, matte, or other non-glare finish. Characters and symbols must contrast with their background - either light characters on a dark background or dark characters on a light background.

PART 3 EXECUTION

3.1 INSTALLATION

Signs, plaques, or dimensional letters must be installed in accordance with approved manufacturer's instructions at locations shown on the approved detail drawings; submit drawings showing elevations of each type of sign; dimensions, details, and methods of mounting or anchoring; shape and thickness of materials; and details of construction. A schedule showing the location, each sign type, and message must be included. Circuits installed underground must conform to the requirements of Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Steel conduits installed underground and illuminated signage mounted directly on buildings must be in conformance with the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Signs must be installed plumb and true at mounting heights indicated, and by method shown or specified. Signs mounted on other surfaces must not be installed until finishes on such surfaces have been completed. Submit manufacturer's installation instructions and cleaning instructions.

3.1.1 Anchorage

Anchorage and fastener materials must be in accordance with approved manufacturer's instructions for the indicated substrate. Anchorage not otherwise specified or indicated must include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood.

3.1.2 Protection and Cleaning

The work must be protected against damage during construction. Hardware and electrical equipment must be adjusted for proper operation. Glass, frames, and other sign surfaces must be cleaned in accordance with manufacturer's instructions. After signs are completed and inspected, cover all project identification, directional, and other signs which may mislead the public. Covering must be maintained until instructed to be removed by the Contracting Officer or until the facility is to be opened for business. Submit [six] [_____] copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. The instructions must include simplified diagrams for the equipment as installed. Signs must be cleaned, as required, at time of cover removal.

3.2 FIELD PAINTED FINISH

Miscellaneous metals and frames must be field painted in accordance with Section 09 90 00 PAINTS AND COATINGS. Anodized metals, masonry, and glass must be protected from paint. Finish must be free of scratches or other blemishes.

-- End of Section --

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SECTION 10 14 00.20

INTERIOR SIGNAGE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D635	(2018) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 COMM	(2017) Standard and Commentary Accessible and Usable Buildings and Facilities

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS H 4000	(2017) Aluminium and Aluminium Alloy Sheets, Strips and Plates (Amendment 1)
JIS H 4040	(2015) Aluminum and Aluminum Alloy Bars and Wires
JIS H 8602	(2010) Combined Coatings of Anodic Oxide and Organic Coatings on Aluminum and Aluminum Alloys
JIS K 5906	(1998) Aluminum Pigments For Paints
JIS R 3202	(2011) Float Glass and Polished Plate Glass
JIS Z 3410	(2013) Welding Coordination - Tasks and Responsibilities
JIS Z 3801	(2018) Standard Qualification Test and Acceptance Requirements for Manual Welding Technique
JIS Z 3841	(2018) Test Method and Criteria in Semi-Automatic Welding Technology Certification

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2018; TIA 18-1; TIA 18-2; TIA 18-3) Life Safety Code
NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;

TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17)
National Electrical Code

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191 — Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G[, [_____]]

SD-10 Operation and Maintenance Data

Approved Manufacturer's Instructions; G[, [_____]]

Protection and Cleaning; G[, [_____]]

1.3 EXTRA MATERIALS

Provide [_____] extra frames and extra stock of the following: [[_____] blank plates of each color and size for sign types [_____].] [[_____] changeable message strips for sign type [_____].] Provide [[_____] paper inserts and [one][_____] copy of the software for user produced signs and inserts after project completion] [and equipment necessary for removal of signage parts and pieces.]

1.4 QUALITY ASSURANCE

1.4.1 Samples

Submit interior signage samples of each of the following sign types showing typical quality, workmanship and color: Directional sign, Standard Room sign, Changeable message strip sign, [Facility Recognition Plaque] [_____]. The samples may be installed in the work, provided each sample is identified and location recorded.

1.4.2 Detail Drawings

Submit detail drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, mounting height, shape and thickness of materials, and details of construction. Include a schedule showing the location, each sign type, and message.

1.5 DELIVERY, STORAGE, AND HANDLING

Materials must be packaged to prevent damage and deterioration during shipment, handling, storage and installation. Product must be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area in accordance with manufacturer's instructions.

1.6 WARRANTY

Warrant the interior signage for a period of [2][ ] year[s] against defective workmanship and material. Warranties must be signed by the authorized representative of the manufacturer. Submit warranty accompanied by the document authenticating the signer as an authorized representative of the guarantor. Guarantee that the signage products and the installation are free from any defects in material and workmanship from the date of delivery.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Signs, plaques, directories, and dimensional letters must be the standard product of a manufacturer regularly engaged in the manufacture of such products that essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening. Obtain signage from a single manufacturer with edges and corners of finished letterforms and graphics true and clean.

2.2 ROOM IDENTIFICATION/DIRECTIONAL SIGNAGE SYSTEM

2.2.1 Standard Room Signs

Signs must consist of [acrylic plastic 2 mm thickness minimum conforming to] [laminated thermosetting Type MP plastic (three-ply melamine plastic laminate with phenolic core)] [6063-T5 extruded aluminum in accordance with] [_____] and must conform to the following:

a. Frames must be [[aluminum] [wood] [molded acrylic]], [[flat][radius]] [[3 mm] [6 mm] [_____] thick.]

b. End caps must be [aluminum] [wood] [molded acrylic] with [round] [square] [_____] style corners.

c. Units must be frameless. Corners of signs must be [squared] [rounded to [10] [13] [19] [_____] mm radius].

2.2.2 Changeable Message Strip Signs

Changeable message strip signs must be of same construction as standard room signs to include a clear sleeve that will accept a paper or plastic insert identifying changeable text. The insert must be prepared [die-cut vinyl letters applied to 0.38 mm rigid vinyl film] [typeset message mounted on paper card stock][typewritten message] [_____].[Provide[paper and] software for creating text and symbols for computers identified by owner for Owner production of paper inserts after project completion.][Furnish one [suction][_____] device to assist in removing face sheet.][Sliding inserts or slide knobs that slide horizontally exposing different graphic information must be provided as identified in

the signage placement schedule and [drawings][attachments.]]

2.2.3 Type of Mounting For Signs

Provide extruded aluminum brackets for hanging, projecting, and double-sided signs. Mounting for framed, hanging, and projecting signs must be by mechanical fasteners. Surface mounted signs must be mounted with [countersunk mounting holes in plaques and mounting screws][1.6 mm thick closed cell vinyl foam with adhesive backing. Adhesive must be transparent, long aging, high tech formulation on two sides of the vinyl foam.][magnetic tape [silicone adhesive]][[hook and loop tape consisting of hooked part on sign back and looped side on mounting surface] [pin mount] for textile surfaces] [_____] fabricated from materials that are not corrosive to sign material and mounting surface.

2.2.4 Graphics

Signage graphics for modular signs must conform to the following:

[2.2.4.1 Subsurface Copy

Copy is transferred to the back face of clear acrylic sheeting forming the panel face to produce precisely formed opaque image. This method bonds all sign elements (color, graphics, lettering, Braille and substrate) into a single unit.

][2.2.4.2 First Surface Copy Direct Print or Silkscreened (Non-Tactile)

Message may be applied to panel using the silkscreen process. Silkscreened images must be executed with photo screens prepared from original art. Handcut screens will not be accepted. Original art is defined as artwork that is a first generation reproduction of the specified art. Edges and corners must be clean.

][2.2.4.3 Surface Applied Photopolymer

Integral graphics and Braille achieved by photomechanical stratification processes. Photopolymer used for ADA compliant graphics must be of the type that has a minimum durometer reading of 90. Tactile graphics must be raised 0.8 mm from the first surface of plaque by photomechanical stratification process.

][2.2.4.4 Engraved Copy

Machine engrave letters, numbers, symbols, and other graphics into panel sign on face to produce precisely formed copy and sharp images, incised to uniform depth. Melamine plastic engraving stock used for ADA compliant graphic must be three-ply lamination contrasting color core meeting ASTM D635.

][2.2.4.5 Graphic Blast Raised Copy

Background is sandblasted to a uniform depth of 0.8 mm leaving raised text and Braille. Background must be painted with polyurethane paint.

][2.2.4.6 Embossed

Methods other than sandblasting such as vacuum formed to create ADA compliant projected graphics.

][2.2.4.7 [Cast] [Fabricated] [Solid] Aluminum Letters

Provide [3] [6] [_____] mm thick and fasten to the message panel with concealed fasteners.

]2.2.5 Character Proportions and Heights

Letters and numbers on signs conform to 36 CFR 1191.

2.2.6 Tactile Letters, Symbols and Braille

Raised letters and numbers on signs must conform to 36 CFR 1191.

2.3 STAIR SIGNAGE

Provide signs on stairs serving three or more stories with special signage within the enclosure at each floor landing conforming to NFPA 101. Indicate the floor level, the terminus of the top and bottom of the stair enclosure, and the identification of the stair enclosure. Also, state the floor level of, and the direction to, exit discharge. Locate the signage inside the enclosure in a position that is visible when the door is in the open or closed position and install in conformance with 36 CFR 1191. The floor level designation must also be tactile in accordance with ICC A117.1 COMM.

2.4 BUILDING DIRECTORIES

Building directories must be lobby directories or floor directories, and must be provided with a changeable directory listing consisting of the areas, offices and personnel located within the facility. Dimensions, details, and materials of sign and message content must be as shown on the [drawings][attachments][signage placement schedule].

2.4.1 Header Panel

Header panel must [have background metal to match frame] [be acrylic with raised acrylic letters][be ES/MP plastic with raised letters] [_____].

2.4.2 Doors

2.4.2.1 Door Glazing

Door glazing must be [in accordance with JIS R 3202, minimum 3 mm thick][clear acrylic sheet 5 mm thick conforming to [_____]][clear polycarbonate sheet 5 mm thick][_____].

2.4.2.2 Door Construction

Extruded aluminum door frame must be of same finish as surrounding frame. Corners must be mitered [, reinforced] [, welded], and assembled with concealed fasteners. Hinges must be standard with the manufacturer, in finish to match frames and trim. Glazing must be set in frame with resilient glazing channels.

2.4.2.3 Door Locks

Door locks must be manufacturer's standard, and must be keyed alike. Provide two sets of keys.

2.4.3 Fabrication

Extruded aluminum frames and trim must be assembled with corners [reinforced] [welded] and mitered to a hairline fit, with no exposed fasteners.

2.4.4 Illuminated Units

Illuminated directory units must have concealed internal [top] [back] lighting with [LED] [rapid start fluorescent tube lamp] [_____], internal wiring, and lead at wire for connection. Electrical work must comply with NFPA 70 and must be UL or FM listed. Directory must consist of backlit photo negative directory strips and a black background. Unit must have a tinted [tempered safety solar glass][_____] door.

2.4.4.1 Construction

The directory must be [50][100][150] mm deep frame constructed of an [aluminum with [[satin [black][painted][dark bronze][_____] anodized finish]][[red oak][walnut][_____] with [natural][stained] finish]]. Unit must be [[semi][fully] recessed][surface][_____] mounted. Unit must have a [75][_____] mm high header lettering as shown. Unit must have a [10][_____]mm face door frame with concealed hinges and locking system or other secure method. Door frame must [match directory material and finish][_____].

2.4.4.2 Message Strips

Message strips must be photo negative type updatable by user. Message strips must be [as shown on the drawings] [_____].

2.4.5 Non-Illuminated Unit

Directory must consist of a non-illuminated unit with [machine or laser engraved copy in interchangeable acrylic, metal, or high-pressure plastic laminate strips] [screen printed or vinyl copy applied to acrylic, metal, or high-pressure plastic laminate strips] [vinyl or screen printed lettering on plastic film held in interchangeable plastic carriers] [screen printed or vinyl copy laminated to magnetic tape]. Design of unit must be as shown in the drawings.

2.4.5.1 Construction

The directory must be constructed of an aluminum [50][100][150] mm deep frame with [satin [black][painted][dark bronze][_____] anodized finish][[red oak][walnut][ ] with [natural][stained] finish]. Unit must be [[semi][fully] recessed][surface][_____] mounted. Unit must have a [75][_____] mm high header lettering as shown. Unit must have a [9.3][ ] mm face door frame with concealed hinges and locking system or other secure method. Door frame must [match directory material and finish][_____].

2.4.5.2 Message Strips

[Message strips must be updatable by user.]Message strips must be [sized in accordance with manufacturer's standard] [_____]. Letters and numbers must be provided in accordance with the [drawings] [schedule].

2.4.6 Electronic Directory System

Provide [non-interactive][interactive] electronic directory. Electronic directory system must be a complete turnkey system consisting of digital display, hardware, software connected through the local area network (LAN) to a [server][cloud]. Electrical equipment must be UL listed and must comply with NFPA 70. Unit must be [free-standing][wall mounted].

2.5 METAL PLAQUES

2.5.1 Cast Metal Plaques

2.5.1.1 Fabrication

Cast metal plaques must have the logo, emblem and artwork cast in the [bas relief] [flat relief] [_____] technique. Plaques must be fabricated from [prime aluminum] [bronze] [brass] [_____].

2.5.1.2 Border

Border must be [flat band] [plain edge] [bevel] [custom ornamental] [_____].

2.5.1.3 Finish

Letter Finish	[satin] [polished]
Background Finish	[[light][dark] aluminum][[dark][ ] bronze]
Background Texture	[leather][pebble][smooth][ ]

2.5.1.4 Mounting

Mounting must be [concealed] [rosettes and anchors] [rosettes and toggle bolts] [_____].

2.5.2 Chemically Etched Metal Plaques

2.5.2.1 Fabrication

Plaque must be chemically etched one-piece or photochemically engraved metal sheet or plate [aluminum] [brass] [bronze] [zinc] [magnesium] [_____] [_____] mm thick.

2.5.2.2 Finish

[Single-etched raised areas must be in [gold-tone] [silver-tone] [bronze-tone] finish and recessed areas must be colorfilled.] [Double-etched raised areas must be [gold-tone] [silver-tone] and recessed textured areas must be [gold-tone] [silver-tone] colorfilled.]

2.6 DIMENSIONAL BUILDING LETTERS

2.6.1 Fabrication

Letters must be [cast][cutout][fabricated channel][molded plastic]. Letters must be [aluminum][bronze][brass][ ]. Package letters for protection until installation.

2.6.2 Size

Letter size must be [_____] [as indicated]. Provide letter thickness that is [manufacturer's standard for the size of letter][_____].

2.6.3 Finish

Provide [[mill][clear anodized][[light][medium][dark] anodized bronze]] [[polished] bronze with clear coat] [baked enamel] [powder coat][two-component acrylic polyurethane] finish.

2.6.4 Mounting

[Threaded studs] [Steel U-bracket, cap screws, and expansion bolts] of number and size recommended by manufacturer, must be supplied for concealed anchorage. Letters which project from the mounting surface must have [stud spacer sleeves] [_____]. Letters, studs, and sleeves must be of the same material. Templates for mounting must be supplied.

2.7 PRESSURE SENSITIVE LETTERS

2.7.1 Fabrication

Ensure that vinyl letter edges and corners of finished letterforms and graphics are true and clean. Do not use letterforms and graphics with rounded positive or negative corners, nicked, cut, or ragged edges.

2.7.2 Size

Letter size: [as indicated] [_____].

2.8 ALUMINUM ALLOY PRODUCTS

Aluminum extrusions must be at least 3 mm thick, and aluminum plate or sheet must be at least 1.3 mm thick. Extrusions must conform to JIS H 4040; plate and sheet must conform to JIS H 4000. Where anodic coatings are specified, alloy must conform to [_____]. Exposed anodized aluminum finishes must be as shown. Welding for aluminum products must conform to JIS Z 3801, JIS Z 3410, and JIS Z 3841.

2.9 ANODIC COATING

Anodized finish must conform to JIS H 8602 as follows:

a. [Clear (natural).]

b. [Integral color.]

c. [Electrolytically deposited color-anodized.]

2.10 ORGANIC COATING

Organic coating must conform to JIS K 5906, with total dry film thickness not less than 0.030 mm.

2.11 FABRICATION AND MANUFACTURE

2.11.1 Factory Workmanship

Holes for bolts and screws must be drilled or punched. Drilling and punching must produce clean, true lines and surfaces. Exposed surfaces of work must have a smooth finish and exposed riveting must be flush. Fastenings must be concealed where practicable.

2.11.2 Dissimilar Materials

Where dissimilar metals are in contact, the surfaces will be protected to prevent galvanic or corrosive action.

2.12 COLOR, FINISH, AND CONTRAST

Color must be [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] [as indicated] [_____]. Finish of all signs must be eggshell, matte, or other non-glare finish as required in handicapped-accessible buildings.

2.13 TYPEFACE

[ADA-ABA compliant font for Room Signs][Helvetica Regular][_____].

PART 3 EXECUTION

[3.1 PLACEMENT SCHEDULE

SIGNAGE PLACEMENT SCHEDULE				
Door/Room Number	Sign Type	Text	Insert(s)	Symbol/Remarks
[_____]	[_____]	[_____]	[_____]	[_____]

]3.2 INSTALLATION

Install signs plumb and true and in accordance with approved manufacturer's instructions at locations shown on the [detail drawings] [schedule below] [attachments]. Submit operating instructions outlining the step-by-step procedures required for system operation. The instructions include simplified diagrams for the system as installed, the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Provide each set permanently bound with a hard cover. The following identification must be inscribed on the covers: "OPERATING AND MAINTENANCE INSTRUCTIONS", name and location of the facility, name of the Contractor, and contract number. Submit in accordance with Section 01 78 23 OPERATING AND MAINTENANCE DATA. Mounting height and mounting location complies with 36 CFR 1191. Install required blocking. Do not install signs on doors or other surfaces until finishes on such surfaces have been installed. Signs installed on glass surfaces are installed with matching blank back-up plates in accordance with manufacturer's instructions. [Provide illuminated signage in conformance with the requirements of Section 26 51 00 INTERIOR LIGHTING.]

Do not install items that show visual evidence of biological growth.

3.2.1 Anchorage

Provide anchorage in accordance with approved manufacturer's instructions. In high humidity interior spaces (for example, bathrooms, locker rooms, pools, trainers) and unconditioned spaces, use corrosion-resistant anchors/fasteners or with approval by the manufacturer, waterproof silicone adhesive. Anchorage not otherwise specified or shown must include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood. Provide exposed anchor and fastener materials compatible with metal to which applied with matching color and finish.At interior applications in heavy traffic areas, firmly attach signage to structure walls with tamper-proof fasteners.

a. Signs mounted to painted gypsum board surfaces must be removable for painting maintenance.

b. Mount signs mounted to lay-in ceiling grids with clip connections to ceiling tees.

c. Install signs mounted on metal surfaces with magnetic tape.

d. Install signs mounted on fabric surfaces with hook and loop tape or pin mount.

e. Install signs to workstation panels with panel clips.

3.2.2 Protection and Cleaning

Protect the work against damage during construction. Adjust hardware and electrical equipment for proper operation. Clean glass, frames, and other sign surfaces at completion of signage installation in accordance with the manufacturer's written instructions.

-- End of Section --

SECTION 10 21 13

TOILET COMPARTMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 COMM	(2017) Standard and Commentary Accessible and Usable Buildings and Facilities

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1901	(2015) Determination of the Emission of Volatile Organic Compounds and Aldehydes by Building Products - Small Chamber Test Method
JIS G 3203	(1988) Alloy Steel Forgings for Pressure Vessels for High-Temperature Service
JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS G 4304	(2012) Hot-Rolled Stainless Steel Plate, Sheet and Strip
JIS H 3100	(2018) Copper and Copper Alloy Sheets, Plates and Strips
JIS H 4040	(2015) Aluminum and Aluminum Alloy Bars and Wires
JIS H 5301	(2018) Zinc Alloy Die Castings
JIS H 8601	(1999) Anodic Oxide Coatings on Aluminum and Aluminum Alloys
JIS H 8617	(1999) Electroplated Coatings of Nickel and Chromium
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS K 6899	(2015) Plastics-symbols and Abbreviations-Part 1: Basic Polymers and Their Properties

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191	Americans with Disabilities Act (ADA)

Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings

Installation Drawings; G[, [_____]]

SD-07 Certificates

Warranty

SD-10 Operation and Maintenance Data

Plastic Identification; G[, [_____]]

1.3 REGULATORY REQUIREMENTS

Conform to ICC A117.1 COMM code for access for the handicapped operation of toilet compartment door and hardware.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the manufacturer's original unopened packages with the brand, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated; free from dust, water, other contaminants, and damage during delivery, storage, and construction.

1.5 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials and workmanship for a period of [one year][____] [years] from date of final acceptance of the work.

PART 2 PRODUCTS

2.1 SYSTEM REQUIREMENTS

Provide a complete and usable toilet partition system, including toilet enclosures, room entrance screens, urinal screens, system of panels, hardware, and support components. Furnish the partition system from a single manufacturer, with a standard product as shown in the most recent catalog data. Submit Fabrication Drawings for metal toilet partitions and urinal screens consisting of fabrication and assembly details to be performed in the factory. Submit manufacturer's Cleaning and Maintenance

Instructions with Fabrication Drawings for review.

2.1.1 Plastic Identification

Verify that plastic products to be incorporated into the project are labeled in accordance with JIS K 6899. Where products are not labeled, provide product data indicating polymeric information in the Operation and Maintenance Manual.

Type 1	Polyethylene Terephthalate (PET, PETE)
Type 2	High Density Polyethylene (HDPE)
Type 3	Vinyl (Polyvinyl Chloride or PVC)
Type 4	Low Density Polyethylene (LDPE)
Type 5	Polypropylene (PP)
Type 6	Polystyrene (PS)
Type 7	Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

2.2 MATERIALS

2.2.1 Galvanized Steel Sheet

Provide galvanized steel sheet cold-rolled, stretcher-level, commercial quality material, conforming to JIS G 3302. Conform surface preparation of material for painting to JIS H 8617.

2.2.2 Sound-Deadening Cores

Provide sound deadening consisting of treated kraft paper honeycomb cores with a cell size of not more than 25 mm. Resin-material content must weigh not less than 11 percent of the finished core weight. Expanded cores must be faced on both sides with kraft paper.

2.2.3 Anchoring Devices and Fasteners

Provide steel anchoring devices and fasteners hot-dipped galvanized after fabrication, in conformance with JIS G 3302 and JIS H 8641. Conceal all galvanized anchoring devices.

2.2.4 Brackets

Wall brackets must be two-ear panel brackets, T-style, 25 mm stock. Provide stirrup style panel-to-pilaster brackets.

2.2.5 Hardware and Fittings

2.2.5.1 General Requirements

Conform hardware for the toilet partition system for the specified type and style of partitions. Provide hardware finish highly resistant to alkalis, urine, and other common toilet room acids. Comply latching

devices and hinges for handicap compartments with 36 CFR 1191; provide [chrome-plated steel] [or] [stainless steel] devices and hinges with door latches that operate without either tight grasping or twisting of the wrist of the operator. Submit three samples of each item, including anchoring devices and fasteners. Approved hardware samples may be installed in the work if properly identified.

Material	Conformance Standard
Cold-rolled sheet steel	JIS G 3203, commercial quality
Zinc-base alloy	JIS H 5301 ZDC-1
Brass	JIS H 3100, Alloy C26800
Aluminum	JIS H 4040
Corrosion-resistant steel	JIS G 4304, Type [SUS302][SUS304]

2.2.5.2 Finishes

[a. Chrome plating must conform to JIS H 8617.]

[b. Finish must conform to JIS H 8617, Class I (Corrosion Protective Plasting), Type [I, Bright] [II, Satin].]

[c. Aluminum must have a clear anodic coating conforming to JIS H 8601.]

[d. Corrosion-resistant steel must have a No. 4 finish.]

[e. Exposed fasteners must match the hardware and fittings.]

2.2.6 Door Hardware

2.2.6.1 Hinges

Hinges must be adjustable to hold in-swinging doors open at any angle up to 90 degrees and outswinging doors to 10 degrees. Provide self-lubricating hinges with the indicated swing. Hinges must [be the surface-mounted type.] [be the cutout-insert type.] [have the following type of return movement:

[a. Gravity return movement]

[b. Spring-action cam return movement]

[c. Torsion-rod return movement]]

2.2.6.2 Latch and Pull

Latch and pull must be a combination rubber-faced door strike and keeper equipped with emergency access.

2.2.6.3 Coat Hooks

Coat hooks must be combination units with hooks and rubber tipped pins.

2.3 PARTITION PANELS AND DOORS

Fabricate partition panels and doors not less than 25 mm thick with face sheets not less than 1.006 mm thick.

[Provide painted steel toilet partitions and screens with recycled content of 27 percent minimum. Provide data identifying percentage of recycled content for painted steel partitions and screens.][Provide stainless steel toilet partitions and screens with recycled content of 50 percent minimum. Provide data identifying percentage of recycled content for stainless steel partitions and screens.] [Provide plastic laminate toilet partitions and screens with recycled content of 45 percent minimum. Provide data identifying percentage of recycled content for plastic laminate partitions and screens.] [Provide solid polyethylene toilet partitions and screens with recycled content of 30 percent minimum. Provide data identifying percentage of recycled content for plastic, solid polyethylene partitions and screens.]

Provide laminated plastic and solid phenolic toilet partitions and urinal screens to meet the emissions requirements of JIS A 1901 (use the office or classroom requirements, regardless of space type). [Provide certification or validation of indoor air quality for laminated plastic partitions and screens.][Provide certification or validation of indoor air quality for solid phenolic, black core partitions and screens.]

2.3.1 Toilet Enclosures

Provide Style [A, floor supported] [B, ceiling hung] [C, overhead braced] [F, overhead braced-alcove]. Furnish width, length, and height of toilet enclosures as shown. [Provide a width of 25 mm.] Finish surface of panels must be [painted metal, Finish 1][stainless steel, Finish 2][laminated plastic, Finish 3][solid phenolic, black core Finish 4][solid phenolic, color through the core Finish 4A][solid polyethylene, Finish 5][_____]; water resistant; graffiti resistant; non-absorbent; [with plastic face sheets permanently fused to plastic core; 6 mm radius beveled edges]. Reinforce panels indicated to receive toilet paper holders or grab bars for mounting of the items required. Provide grab bars to withstand a bending stress, shear stress, shear force, and a tensile force induced by 1112 N. Grab bars must not rotate within their fittings.

2.3.2 Room Entrance Screens

Provide Style [A, floor anchored] [B, ceiling hung braced] [C, overhead braced] [D, wall hung] [_____]. Provide finish surface of screens to be [painted metal, Finish 1][stainless steel, Finish 2][laminated plastic, Finish 3][solid phenolic, black core Finish 4][solid phenolic, color through the core Finish 4A][solid polyethylene, Finish 5][_____]; water resistant; graffiti resistant; non-absorbent[; with plastic face sheets permanently fused to plastic core; 6 mm radius beveled edges]. Furnish length and height of screens as shown. [Provide thickness of 25 mm.] Fabricate screens from the same types of panels, pilasters, and fittings as the toilet partitions.

2.3.3 Urinal Screens

Provide and conform urinal screens Style [A, floor supported] [B, ceiling hung] [C, overhead braced] [D, floor to ceiling hung] [E, floor to ceiling post supported]. Provide finish for surface of screens as [painted metal, Finish 1][stainless steel, Finish 2][laminated plastic, Finish 3][solid

phenolic, black core Finish 4][solid phenolic, color through the core Finish 4A][solid polyethylene, Finish 5][_____]; water resistant; graffiti resistant; non-absorbent; [with plastic face sheets permanently fused to plastic core; 6 mm radius beveled edges]. Furnish width and height of urinal screens as shown. [Provide thickness of 25 mm.] Secure wall hung urinal screens with [a minimum of three wall stirrup brackets.] [1050 mm long, continuous flanges.] Fabricate screens from the same types of panels and pilasters as the toilet partitions. Use corrosion-resistant stainless steel fittings and fasteners.

2.4 CEILING-HUNG PARTITIONS

Pilasters must be not less than 31.75 mm thick with face sheets not less than 1.613 mm thick. Anchoring device at the top of the pilaster must be welded to the reinforced face sheets and must have not less than two 9.525 mm round threaded rods, lock washers, and leveling-adjustment nuts. Anchoring device must be designed to transmit the strain and loading on the pilaster directly to the structural support above without putting strain or loading on the finished ceiling. Trim piece at the top of the pilaster must be 76.2 mm high and fabricated from not less than 0.762 mm thick stainless steel.

2.5 FLOOR-ANCHORED PARTITIONS

Pilasters must be not less than 31.75 mm thick with face sheets not less than 1.613 mm thick. Provide anchoring device at the bottom of the pilaster consisting of a steel bar not less than 12.7 by 22.2 mm welded to the reinforced face sheets and having not less than two 9.5 mm round anchorage devices for securing to the floor slab. Provide anchorage devices complete with threaded rods, expansion shields, lock washers, and leveling-adjustment nuts. Trim piece at the floor must be 76.2 mm high and fabricated from not less than 0.76 mm thick corrosion-resistant stainless steel.

2.6 OVERHEAD-BRACED PARTITIONS

Pilasters must be not less than 31.75 mm thick with face sheets not less than 1.0 mm thick. Provide anchoring device at the bottom of the pilaster consisting of a channel-shaped floor stirrup fabricated from not less than 1.6 mm thick material and a leveling bolt. Secure the stirrup to the pilaster with not less than a 4.76 mm bolt and nut after the pilaster is leveled. Secure the stirrup to the floor with not less than two lead expansion shields and sheetmetal screws. Fabricate overhead brace from a continuous extruded aluminum tube not less than 25 mm wide by 38 mm high, 3.2 mm wall thickness. Finish must be clear anodized with a minimum 0.4 mils or thicker in accordance with JIS H 8601. Set and secure brace into the top of each pilaster. Fabricate 75 mm high trim piece at the floor from not less than 0.75 mm thick corrosion-resistant stainless steel.

2.7 PILASTER SHOES

Provide shoes at pilasters to conceal floor-mounted anchorage. Pilaster shoes must be [aluminum] [stainless steel] [one piece molded HDPE] [_____]. Height is a minimum 76 mm.

2.8 HARDWARE

Provide hardware for the toilet partition system for the specified type and style of partitions. [Provide hardware pre-drilled by manufacturer.]

Use a hardware finish that is highly resistant to alkalis, urine, and other common toilet room acids. [Hardware includes: chrome plated non ferrous cast pivot hinges, gravity type, adjustable for door close positioning; nylon bearings; [black anodized] [chrome plated] [_____] aluminum door latch; door strike and keeper with rubber bumper; and cast alloy chrome plated coat hook and bumper, [_____].] Provide latching devices and hinges for handicap compartments complying with 36 CFR 1191 and [chrome-plated steel] [or] [stainless steel] door latches that operate without either tight grasping or twisting of the wrist of the operator. Use stainless steel, tamper proof type screws and bolts. Wall mounting brackets must be continuous, full height, [aluminum] [stainless steel] [heavy duty plastic] [_____], in accordance with toilet compartment manufacturer's instructions. [Provide floor-mounted anchorage consisting of corrosion-resistant anchoring assemblies with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor.]

2.9 COLORS AND FINISHES

2.9.1 Colors

Provide manufacturer's standard color charts for color of finishes for toilet partition system components. [Color of pilaster shoes must match the core of solid plastic compartments and screens.] Submit three samples showing a finished edge on two adjacent sides and core construction, each not less than 304.8 mm square

2.9.2 Finishes No. 1 Through No. 3

Conform partitions, panels, screen, and door finishes finished with [Finish No. 1, baked enamel] [Finish No. 2, stainless steel] [Finish No. 3, laminated plastic].

2.9.3 Finishes No.4 and No. 5

Provide solid plastic fabricated of [solid phenolic core with melamine facing sheets] [or] [polymer resins (polyethylene)] formed under high pressure rendering a single component section not less than 25 mm thick. Colors must extend throughout the panel thickness. Provide exposed finish surfaces: smooth, waterproof, non-absorbent, and resistant to staining and marking with pens, pencils, or other writing devices. Solid plastic partitions must not show any sign of deterioration when immersed in the following chemicals and maintained at a temperature of 27 degrees C for a minimum of 30 days:

Acetic Acid (80 percent)	Hydrochloric Acid (40 percent)
Acetone	Hydrogen Peroxide (30 percent)
Ammonia (liquid)	Isopropyl Alcohol
Ammonia Phosphate	Lactic Acid (25 percent)
Bleach (12 percent)	Lime Sulfur

Borax	Nicotine
Brine	Potassium Bromide
Caustic Soda	Soaps
Chlorine Water	Sodium Bicarbonate
Citric Acid	Trisodium Phosphate
Copper Chloride	Urea; Urine
Core Oils	Vinegar

PART 3 EXECUTION

3.1 PREPARATION

Take field measurements prior to the preparation of drawing and fabrication to ensure proper fits. Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive work. Verify correct spacing of plumbing fixtures. Verify correct location of built in framing, anchorage, and bracing. Report in writing to Contracting Officer prevailing conditions that will adversely affect satisfactory execution of the work of this section. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 METAL PARTITION FABRICATION

a. Fabricate metal Partition Panels, doors, screens, and pilasters required for the project from galvanized-steel face sheets with formed edges. Face sheets must be pressure-laminated to the sound-deadening core with edges sealed with a continuous locking strip and corners mitered and welded. Ground all welds smooth. Provide concealed reinforcement for installation of hardware, fittings, and accessories. Surface of face sheets must be smooth and free from wave, warp, or buckle.

b. Before application of an enamel coating system, solvent-clean galvanized-steel surfaces to remove processing compounds, oils, and other contaminants harmful to coating-system adhesion. After cleaning, coat the surfaces with a metal-pretreatment phosphate coating. After pretreatment, finish exposed galvanized-steel surfaces with a baked-enamel coating system as specified.

c. Provide an enamel coating system consisting of a factory-applied baked acrylic enamel coating system. Coating system must be a durable, washable, stain-resistant, mar-resistant finish.

3.3 INSTALLATION

Do not install items that show visual evidence of biological growth. Install partitions rigid, straight, plumb, and level, with the panels centered between the fixtures. Provide a panel clearance of not more than 13 mm and secure the panels to walls and pilasters with not less than two wall brackets attached near the top and bottom of the panel. Locate wall brackets so that holes for wall bolts occur in masonry or tile joints.

Secure Panels to pilasters with brackets matching the wall brackets. Provide for adjustment due to minor floor variations. Locate head rail joints at pilaster center lines. Install adjacent components for consistency of line and plane. Equip each door with hinges, one door latch, and one coat hook and bumper. Align hardware to uniform clearance at vertical edges of doors.

a. Secure panels to hollow plastered walls with toggle bolts using not less than M6x1 screws of the length required for the wall thickness. Toggle bolts must have a load-carrying strength of not less than 2668.9 N per anchor.

b. Secure panels to ceramic tile on hollow plastered walls or hollow concrete-masonry walls with toggle bolts using not less than M6x1 screws of the length required for the wall thickness. Toggle bolts must have a load-carrying strength of not less than 2668.9 N per anchor.

c. Secure panels to solid masonry or concrete with lead or brass expansion shields designed for use with not less than M6x1 screws, with a shield length of not less than 38 mm. Expansion shields must have a load-carrying strength of not less than 2668.9 N per anchor.

d. Submit Installation Drawings for metal toilet partitions and urinal screens showing plans, elevations, details of construction, hardware, reinforcing and blocking, fittings, mountings and escutcheons. Indicate on drawings the type of partition, location, mounting height, cutouts, and reinforcement required for toilet-room accessories.

3.4 CEILING-HUNG PARTITIONS

Secure pilasters to the structural support above with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Level the bottoms of doors with bottoms of pilasters when doors are in a closed position.

3.5 FLOOR-ANCHORED PARTITIONS

Secure pilasters to the floor with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Level tops of doors with tops of pilasters when doors are in a closed position. Expansion shields must have a minimum 50 mm penetration into the concrete slab.

3.6 OVERHEAD-BRACED PARTITIONS

Secure pilasters to the floor with the anchorage device specified. Make all leveling devices readily accessible for leveling, plumbing, and tightening the installation. Secure overhead brace to the pilaster face with not less than two fasteners per face. Expansion shields must have a minimum 50 mm penetration into the concrete slab. Make tops of doors parallel with the overhead brace when doors are in a closed position.

3.7 FINAL ADJUSTMENT

After completion of the installation, make final adjustments to the pilaster-leveling devices, door hardware, and other working parts of the partition assembly. Doors must have a uniform vertical edge clearance of approximately 5 mm and must rest open at approximately 30 degrees when

unlatched.

3.8 CLEANING

Baked enamel finish must be touched up with the same color of paint that was used for the finish. Clean all surfaces of the work, and adjacent surfaces soiled as a result of the work, in an approved manner compliant with the manufacturer's recommended cleaning and protection from damage procedures until accepted. Remove all equipment, tools, surplus materials, and work debris from the site.

-- End of Section --

SECTION 10 26 00

WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

ASTM INTERNATIONAL (ASTM)

ASTM A240/A240M	(2018) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM B221	(2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM D256	(2010; R 2018) Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
ASTM D543	(2014) Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D635	(2018) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G21	(2015) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1901	(2015) Determination of the Emission of Volatile Organic Compounds and Aldehydes by Building Products - Small Chamber Test Method
JIS A 6909	(2014) Coating Materials for Textured

Finishes of Buildings

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 500 (2006) Metal Finishes Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (2016; TIA 16-1) Standard for Fire Doors and Other Opening Protectives

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1545 (2005; R 2014) Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Corner Guards; G[, [_____]]

Wall Guards (Bumper Guards); G[, [_____]]

Door Protectors; G[, [_____]]

Wall Covering/Panels; G[, [_____]]

SD-03 Product Data

Corner Guards; G[, [_____]]

Wall Guards (Bumper Guards); G[, [_____]]

Door Protectors; G[, [_____]]

Wall Covering/Panels; G[, [_____]]

[Recycled content for aluminum component of corner guards; S]

[Recycled content for steel component of corner guards; S]

[Recycled content for aluminum component of wall guards, Combination Handrail/Wall guard and handrails; S]

[Recycled content for aluminum component of wall guards/bed locators; S]

[Recycled content for aluminum component of combination

handrail/wall guards; S]

[Recycled content for aluminum component of handrails; S]

SD-04 Samples

Finish; G[, [_____]]

SD-06 Test Reports

Corner Guards

Wall Guards (Bumper Guards)

Door Protectors

Wall Covering/Panels

SD-07 Certificates

Corner Guards

Wall Guards (Bumper Guards)

Door Protectors

[Indoor air quality for wall covering/panels; S]

[Indoor air quality for adhesives; S]

1.3 CERTIFICATIONS

1.3.1 Indoor Air Quality

1.3.1.1 Wall Covering/Panels

Provide sheet and high impact resistant resilient materials certified to meet indoor air quality requirements of JIS A 1901 (use the office or classroom requirements, regardless of space type) and formaldehyde emission class F**** per JIS A 6909. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

1.3.1.2 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements of JIS A 1901 (use the office or classroom requirements, regardless of space type) and formaldehyde emission class F**** per JIS A 6909. Provide current product certification documentation from certification body When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein..

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and trademarks intact. Keep materials dry, protected from weather and damage, and stored under cover. Materials must be stored at approximately 21 degrees C for at least 48

hours prior to installation.

1.5 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

To the maximum extent possible, corner guards, door and door frame protectors, wall guards (bumper guards), wall panels and wall covering must be the standard products of a single manufacturer and must be furnished as detailed. Drawings show general configuration of products required, and items differing in minor details from those shown will be acceptable.

2.1.1 Resilient Material

Provide resilient material consisting of high impact resistant extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic conforming to the following:

2.1.1.1 Minimum Impact Resistance

Minimum impact resistance must be 960.8 N-m/m when tested in accordance with ASTM D256, (Izod impact, ft-lbs per sq inch notched).

2.1.1.2 Fire Rating

Fire rating must be Class 1 when tested in accordance with ASTM E84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less. Material must be rated self extinguishing when tested in accordance with ASTM D635. Material must be labeled and tested by an approved nationally known testing laboratory. Resilient material used for protection on fire rated doors and frames must be listed by the testing laboratory performing the tests. Resilient material installed on fire rated wood/steel door and frame assemblies must have been tested on similar type assemblies. Test results of material tested on any other combination of door/frame assembly will not be acceptable.

2.1.1.3 Integral Color

Colored components must have integral color and must be matched in accordance with SAE J1545 to within plus or minus 1.0 on the CIE-LCH scales.

2.1.1.4 Chemical and Stain Resistance

Materials must be resistant to chemicals and stains reagents in accordance with ASTM D543.

2.1.1.5 Fungal and Bacterial Resistance

Materials must be resistant to fungi and bacteria in accordance with ASTM G21, as applicable.

2.2 CORNER GUARDS

2.2.1 Resilient Corner Guards

Corner guard units must be [flush mounted] [surface mounted] type, radius formed to profile shown. Corner guards must [extend from floor to ceiling.] [be [_____] mm high.] Mounting hardware, cushions, and base plates must be furnished. Assembly must consist of a snap-on corner guard formed from high impact resistant resilient material, mounted on a continuous aluminum retainer. Extruded aluminum retainer must conform to ASTM B221, alloy 6063, temper T5 or T6. Provide aluminum components that contain a minimum of 35 percent recycled content. Provide data identifying percentage of recycled content for aluminum component of corner guards. Flush mounted type guards must act as a stop for adjacent wall finish material. Factory fabricated end closure caps must be furnished for top and bottom of surface mounted corner guards. Flush mounted corner guards installed in fire rated wall must maintain the rating of the wall. Insulating materials that are an integral part of the corner guard system must be provided by the manufacturer of the corner guard system. Exposed metal portions of fire rated assemblies must have a paintable surface.

2.2.2 Stainless Steel Corner Guards

Stainless steel corner guards must be fabricated of [1.3 mm][0.9 mm] thick material conforming to ASTM A240/A240M, type 302 or 304. Provide stainless steel base material that contains a minimum of 60 percent recycled content. Provide data identifying percentage of recycled content for steel component of corner guards. Corner guards must [extend from floor to ceiling.] [be [_____] mm high.] Corner guard must be formed to dimensions shown.

2.3 WALL GUARDS (BUMPER GUARDS)

2.3.1 Wall Guards, Combination Handrail/Wall Guards and Handrails

Wall guards, combination handrail/wall guards, and handrails must be provided with prefabricated end closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories standard with the manufacturer. Extruded aluminum retainers must conform to ASTM B221, alloy 6063, temper T5 or T6. Provide aluminum components that contain a minimum of 35 percent recycled content. Provide data identifying percentage of recycled content for aluminum component of wall guards, combination handrail/wall guard and handrails. End caps and corners must be field adjustable to assure close alignment with handrails and wall guards. [Wall guards] [Combination handrail/wall guards] must have profile [as shown] [as shown with [vinyl] [carpet] [_____] inserts].

2.3.2 Wall Guards/Bed Locators

Wall guards must consist of snap-on covers of high impact resistant resilient material, minimum 1.98 mm thick, mounted over [50] [_____] mm wide aluminum, minimum 1.57 mm thick retainer, anchored to wall at maximum 600 mm on center. Provide aluminum components that contain a minimum of 35 percent recycled content. Provide data identifying percentage of recycled content for aluminum component of wall guards/bed locators.

2.3.3 Combination Handrail/Wall Guards

Combination handrail/wall guards must consist of snap-on covers of high impact resistant resilient material, minimum 1.98 mm thick, on a continuous, extruded aluminum retainer, minimum 1.83 mm thick anchored to wall at maximum 800 mm on center. Provide aluminum components that contain a minimum of 35 percent recycled content. Provide data identifying percentage of recycled content for aluminum component of combination handrail/wall guards.

2.3.4 Handrails

Handrails must consist of snap-on covers of high impact resistant resilient material, minimum 1.98 mm thick on a continuous extruded aluminum retainer, minimum 1.83 mm thick anchored to wall at maximum 800 mm on center. Provide aluminum components that contain a minimum of 35 percent recycled content. Provide data identifying percentage of recycled content for aluminum component of handrails. Handrails must be provided with prefabricated end closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories standard with the manufacturer. End caps and corners must be field adjustable to assure close alignment with handrails.

2.4 DOOR PROTECTORS

[Door] [Door envelope] [Door knob] [and] [door frame] protection items must consist of high impact resistant acrylic vinyl or polyvinyl chloride resilient material, minimum [1.52 mm thick for doors] [and] [0.89 mm thick for door frames]. Coordinate door and door frame protection material requirements with door and frame suppliers to insure fit for all components and color matching with other resilient materials. Provide adhesive as recommended by resilient material manufacturer.

2.5 WALL COVERING/PANELS

Provide wall covering/panels consisting of high impact rigid acrylic vinyl or polyvinyl chloride resilient material. Panel sizes must be [600 mm x 1220 mm] [_____]. Submit fire rating and extinguishing test results for resilient material. Also submit statements attesting that the items comply with specified fire and safety code requirements. Provide wall covering material used on the interior of the building (defined as inside of the weatherproofing system) that meets either emissions requirements of CDPH SECTION 01350 (use the office or classroom requirements, regardless of space type) the VOC content requirements of JIS A 1901 (use the office or classroom requirements, regardless of space type) and formaldehyde emission class F**** per JIS A 6909. Provide certification or validation of indoor air quality for wall covering/panels.

2.5.1 Rigid Vinyl Acrylic Wall Covering

Wall covering thickness must be [0.56] [0.71] [1.02] [1.52] mm.

2.5.2 High Impact Wall Panels

Wall panel face and edge thickness must be [0.56] [0.71] mm. Panel face must be factory banded to a 9.53 mm thick fiberboard core. The backside of the panel must be laminated with a moisture resistant vapor barrier.

2.6 TRIM, FASTENERS AND ANCHORS

Provide vinyl trim, fasteners and anchors for each specific installation as shown.

2.7 FINISH

Submit [three] [_____] samples indicating color and texture of materials requiring color and finish.

2.7.1 Aluminum Finish

Finish for aluminum must be in accordance with AA DAF45. Exposed aluminum must be designation [[AA-C22A31] [_____] chemically etched medium matte, with clear anodic coating] [[AA-C22A32] [_____] chemically etched medium matte with integrally colored anodic coating] class II architectural coating 0.010 mm thick. Concealed aluminum shall be mill finish as fabricated, uniform in natural color and free from surface blemishes.

2.7.2 Stainless Steel Finish

Finish for stainless steel must be in accordance with [ASTM A240/A240M, Type 302 or 304] [NAAMM AMP 500], finish number 4.

2.7.3 Resilient Material Finish

Finish for resilient material must be [embossed [velour] [stipple] [_____]] [[fake woodgrain] [high gloss vinyl]] texture with colors in accordance with SAE J1545.

2.8 ADHESIVES

Adhesive for resilient material must be in accordance with manufacturers recommendations. Provide sealants and non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) that meet either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) the VOC content requirements of JIS A 1901 (use the office or classroom requirements, regardless of space type) and formaldehyde emission class F**** per JIS A 6909. Provide certification or validation of indoor air quality for adhesives.

2.9 COLOR

Color must be [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES.] [as indicated.] [selected from manufacturers standard colors.] [[_____.] Color listed is not intended to limit the selection of equal colors from other manufacturers.]

PART 3 EXECUTION

3.1 INSTALLATION

Do not install items that show visual evidence of biological growth.

3.1.1 Corner Guards and Wall Guards (Bumper Guards)

Material must be mounted at location indicated in accordance with

manufacturer's recommendations.

3.1.2 Door, Door Frame Protectors, and Wall Panels

Surfaces to receive protection must be clean, smooth, and free of obstructions. Protectors must be installed after frames are in place, but prior to hanging of doors, in accordance with manufacturer's specific instructions. Adhesives must be applied in controlled environment in accordance with manufacturer's recommendations. Protection for fire doors and frames must be installed in accordance with NFPA 80.

3.1.3 Stainless Steel Guards

a. Mount guards on external corners of interior walls, partitions and columns as [shown] [in accordance with manufacturer's recommendations].

b. Where corner guards are installed on walls, partitions or columns finished with plaster or ceramic tile, [anchor corner guards as indicated] [provide continuous 1.5 mm thick, perforated, galvanized z-shape steel anchors welded to back edges of corner guards and [wired to metal studs] [expansion bolted to concrete or masonry with four 10 mm diameter bolts, spaced 400 mm on centers]]. Coat back surfaces of corner guards, where shown, with a non-flammable, sound deadening material. Corner guards must overlap finish plaster surfaces.

c. Where corner guards are installed on exposed structural glazed facing tile units or masonry wall, partitions or columns, [anchor corner guards as indicated] [anchor corner guards to existing walls with 6 mm oval head stainless steel countersunk expansion or toggle bolts] [anchor corner guards with four nominal 1.3 mm thick, adjustable galvanized steel anchors, spaced as shown]. Grout spaces solid between guards and backing with portland cement and sand mortar.

d. Where corner guards are installed on gypsum board, clean surfaces and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from the guard edges and allow to cure undisturbed for 24 hours.

e. For wall guards, space brackets at no more than 900 mm on centers and anchor to the wall in accordance with the manufacturer's installation instructions.

-- End of Section --

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM F2285	(2004; R 2016; E 2016) Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 3864	(2011) Graphical Symbols - Safety Colours and Safety Signs
ISO 7010	(2019) Graphical Symbols - Safety Colours and Safey Signs - Registered Safety Signs

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS R 3220	(2011) Glass in Building - Silvered, Flat-Glass Mirror
JIS Z 2911	(2018) Methods of Test for Fungus Resistance
JIS Z 9103	(2018) Graphic Symbols - Safety Colors and Safety Signs - Range of Chromaticity Coordinates and Measurement Methods for Safety Colors

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-04 Samples

Finishes; G[, [_____]]

Accessory Items

SD-10 Operation and Maintenance Data

Electric Hand Dryer; G[, [_____]]

[1.3 CERTIFICATIONS

1.3.1 Baby Changing Stations

Provide certification that baby changing stations meet the performance criteria of ASTM F2285.

Provide certification that baby changing stations safety signage meet the requirements of JIS Z 9103, ISO 3864 or ISO 7010.

Provide certification that baby changing stations meet the testing requirements of JIS Z 2911.

]1.4 DELIVERY, STORAGE, AND HANDLING

Wrap toilet accessories for shipment and storage, then deliver to the jobsite in manufacturer's original packaging, and store in a clean, dry area protected from construction damage and vandalism.

1.5 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Provide toilet accessories where indicated in accordance with paragraph SCHEDULE. Porcelain type, tile-wall accessories are specified in Section 09 30 10 CEMENT TILING, QUARRY TILING, AND PAVER TILING. Provide each accessory item complete with the necessary mounting plates of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Provide anchors and fasteners capable of developing a restraining force commensurate with the strength of the accessory to be mounted and suited for use with the supporting construction. Provide [tamperproof design] [oval heads] exposed fasteners with finish to match the accessory.

2.1.2 Finishes

Except where noted otherwise, provide the following finishes on metal:

Metal	Finish
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

2.2 ACCESSORY ITEMS

Conform to the requirements for accessory items specified below. Submit fasteners proposed for use for each type of wall construction, mounting, operation, and cleaning instructions and one sample of each other accessory proposed for use. Incorporate approved samples into the finished work, provided they are identified and their locations noted. Submit certificate for each type of accessory specified, attesting that the items meet the specified requirements.

2.2.1 Facial Tissue Dispenser (FTD)

Provide [surface] [recessed] mounted facial tissue dispenser, Type 304 stainless steel face, [satin finish] [bright polished finish]. Secure face of recessed dispenser by friction with suitable spring steel clips. Provide a minimum capacity of [150] [200] [300] two-ply tissues for dispenser.

2.2.2 Grab Bar (GB)

Provide an 18 gauge, 32 mm grab bar OD Type 304 stainless steel. Provide form and length for grab bar as indicated. Provide [concealed] [exposed] mounting flange. Provide grab with [satin finish] [peened non-slip surface]. Furnish installed bars capable of withstanding a 2.225 kN vertical load without coming loose from the fastenings and without obvious permanent deformation. Allow 38 mm space between wall and grab bar.

2.2.3 Medicine Cabinet (MC)

Construct medicine cabinet with cold-rolled carbon steel sheet of minimum 0.76 mm thickness, formed from a single sheet of steel or mechanically formed and spot welded. Provide width, height and depth of cabinet in accordance with paragraph SCHEDULE.

2.2.3.1 Sliding Door Cabinet

Provide [surface mounted vanity] [recessed cabinet] sliding door cabinet assembly with design and lighting arrangement as indicated. Provide a minimum of 2 shelves per cabinet. Provide [a wide] [a narrow] [no] frame mirror.

2.2.3.2 Swinging Door Cabinet

Provide swinging door cabinet assembly, including the lighting arrangement, as indicated. Provide [surface] [recess] mounted assembly. Locate cabinet centrally behind the door with a minimum of two shelves. Provide stainless steel or carbon steel door hinges. Provide permanent type magnets used in door catches. Provide doors [with] [without] a mirror.

2.2.4 Mirrors, Glass (MG)

Provide clear glass for mirrors conforming to JIS R 3220. Coat glass on one surface with silver coating, copper protective coating, and mirror backing paint. Provide highly adhesive pure silver coating of a thickness which provides reflectivity of 83 percent or more of incident light when viewed through 6 mm thick glass, free of pinholes or other defects. Provide copper protective coating with pure bright reflective copper, homogeneous without sludge, pinholes or other defects, of proper thickness

to prevent "adhesion pull" by mirror backing paint. Provide mirror backing paint with two coats of special scratch and abrasion-resistant paint and baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

2.2.5 Mirror, Metal (MM)

Provide a brightly polished stainless steel metal mirror of 0.94 mm minimum thickness, edges turned back 6 mm and recess fitted with tempered hardboard backing, and theft-proof fasteners. Provide size in accordance with paragraph SCHEDULE.

2.2.6 Mirror, Tilt (MT)

Provide surface mounted tilt mirror with full visibility for persons in a wheelchair. Furnish [adjustable] [fixed] tilt mirror, extending at least 100 mm from the wall at the top and tapering to 25 mm at the bottom. Provide size in accordance with [paragraph SCHEDULE] [the drawings] [_____]. Conform to JIS R 3220 and paragraph Glass Mirrors.

2.2.7 Paper Towel Dispenser (PTD)

Provide [_____] paper towel dispenser constructed of a minimum [22 gauge carbon steel] [0.7 mm Type 304 stainless steel], [surface] [recessed] mounted. Provide a towel compartment and a [mirror door] [and] [liquid soap dispenser] for each dispenser. Furnish [tumbler key lock] [concealed tumbler key lock] locking mechanism.

2.2.8 Combination Paper Towel Dispenser/Waste Receptacle (PTDWR)

Provide [recessed] [semi-recessed] dispenser/receptacle with a capacity of [400] [600] [_____] sheets of C-fold, single-fold, or quarter-fold towel. Design waste receptacle to be locked in unit and removable for service. Provide tumbler key locking mechanism. Provide waste receptacle capacity of [45] [68] [_____] L. Fabricate a minimum 0.7 mm stainless steel welded construction unit with all exposed surfaces having a satin finish. Provide waste receptacle that accepts reusable liner standard for unit manufacturer.

2.2.9 Sanitary Napkin Disposer (SND)

Construct a Type 304 stainless steel sanitary napkin disposal with removable leak-proof receptacle for disposable liners. Provide [fifty] [_____] disposable liners of the type standard with the manufacturer. Retain receptacle in cabinet by tumbler lock. Provide disposer with a door for inserting disposed napkins, [recessed] [partition mounted, double access] [surface mounted].

2.2.10 Sanitary Napkin and Tampon Dispenser (SNTD)

Provide sanitary napkin and tampon dispenser [surface mounted] [recessed]. Dispenser, including door of Type 304 stainless steel that dispense both napkins and tampons with a minimum capacity of 20 each. Furnish dispensing mechanism for [complimentary] [coin] operation. Provide coin mechanisms with minimum denominations of [_____] [free]. Hang doors with a full-length corrosion-resistant steel piano hinge and secure with a tumbler lock. Provide keys for coin box different from the door keys.

2.2.11 Shower Curtain (SC)

Provide [_____] shower curtain, size to suit conditions. Provide anti-bacterial nylon/vinyl fabric curtain. Furnish [_____] color [as shown in Section 09 06 00 SCHEDULES FOR FINISHES].

2.2.12 Shower Curtain Rods (SCR)

Provide Type 304 stainless steel shower curtain rods 32 mm OD by 1.24 mm minimum [straight] [bent as required] to meet installation conditions.

2.2.13 Soap Dispenser (SD)

Provide soap dispenser [surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 1.2 L with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps.] [surface mounted, powder type constructed of stainless steel or chromium plated zinc die casting, containing a swap feed mechanism and an agitator designed to break up powdered soap, with a minimum capacity of 0.94 L.] [lavatory mounted, liquid type consisting of a polyethylene tank with a minimum 0.94 L holding capacity and a [100 mm] [150 mm] spout length.]

2.2.14 Soap Holder (SH)

Provide [surface mounted] [recessed] Type 304 stainless steel soap holder. Provide stainless steel separate supports.

2.2.15 Shelf, Metal, Heavy Duty (SMHD)

Furnish a minimum 18 gauge stainless steel heavy duty metal shelf with hemmed edges. Provide shelves over 750 mm with intermediate supports. Provide minimum of 16 gauge supports, welded to the shelf, and spaced no more than 750 mm apart.

2.2.16 Shelf, Metal, Light Duty (SMLD)

Support light duty metal shelf between brackets or on brackets. Purpose of brackets is to prevent lateral movement of the shelf. Furnish [450 mm] [600 mm] long shelf. Provide stainless steel shelf and brackets.

2.2.17 Soap and Grab Bar Combination, Recessed (SGR)

Provide recessed type, Type 304 stainless steel soap and grab bar combination [bright polished finish] [satin finish].

2.2.18 Hand Sanitizer Dispenser (HSD)

Provide hand sanitizer dispensers complete with mounting brackets, batteries as recommended by manufacturer, sanitizer solution, and one bottle of refill sanitizer solution for each dispenser installed. Dispenser properties and characteristics:

a. Wall mounted

b. Battery operated

c. Automatic, touchless type that dispenses sanitizer when a hand is placed in proximity of a sensor

d. Integral tray below the dispensing portal to catch wasted sanitizer

e. Operated using standard size batteries

2.2.19 Towel Bar (TB)

Provide stainless steel towel bar with a minimum thickness of 0.38 mm. Provide minimum 19 mm diameter bar, or 16 mm square. Provide [bright polish] [satin] finish.

2.2.20 Towel Pin (TP)

Provide towel pin with concealed wall fastenings, and a pin integral with or permanently fastened to wall flange with maximum projection of 100 mm. Provide [bright polish] [satin] finish.

2.2.21 Toilet Tissue Dispenser (TTD)

Furnish [surface mounted] [recess mounted] toilet tissue holder with two rolls of standard tissue [mounted horizontally] [stacked vertically]. Provide [carbon steel, bright chromium plated] [stainless steel, satin] finish cabinet.

2.2.22 Toilet Tissue Dispenser, Jumbo (TTDJ)

Provide surface mounted toilet tissue dispenser with 2 rolls of jumbo tissue. Fabricate cabinet of [Type 304, 18 gauge stainless steel with Type 304, 20 gauge stainless steel door] [high-impact plastic body and transparent plastic front cover]. Provide cover with key lock.

2.2.23 Toothbrush and Tumbler Holder (TTH)

Provide stainless steel, surface mounted toothbrush and tumbler holder. Furnish holder to hold a minimum of four toothbrushes in a vertical position. Provide 57 plus or minus 3 mm in diameter size of hole for securing tumbler.

2.2.24 Waste Receptacle (WR)

Provide Type 304 stainless steel waste receptacle, designed for [recessed] [surface] mounting. Provide reusable liner, of the type standard with the receptacle manufacturer. Provide a minimum [_____] cubic meters capacity. Provide receptacles with push doors and doors for access to the waste compartment with continuous hinges. Furnish [tumbler key lock] [_____] locking mechanism.

2.2.25 Toilet Seat Cover Dispenser (TSCD)

Provide Type 304 stainless steel with [recessed mounted] [surface mounted] toilet seat cover dispensers. Provide dispenser with a minimum capacity of 500 seat covers.

2.2.26 Toilet Seat Cover/Tissue Dispenser/Waste Receptacle (TSCTDWR)

Provide stainless steel and [partition mounted] [recessed mounted] [surface mounted] toilet seat cover, tissue dispenser, and waste receptacle combination. Provide a minimum of 500 [seat covers] [seat covers per side] and [2] [4 (2 per side)] standard tissue rolls for each

dispenser. Provide a waste receptacle of the reusable liner of type standard with the receptacle manufacturer. Provide receptacle with [_____] cubic meters capacity. Furnish [tumbler key lock] [_____] locking mechanism.

2.2.27 Electric Hand Dryer (EHD)

Provide wall mount and electric hand dryer designed to operate at [_____]phase alternating current with a heating element core rating of a maximum [_____]. Provide dryer housing of single piece construction and of [white porcelain enamel] [chrome plated steel] [baked electrostatically applied epoxy] [_____]. Submit [4] [_____] complete copies of maintenance instructions listing routine maintenance procedures and possible breakdowns. Include repair instructions for simplified wiring and control diagrams and other information necessary for unit maintenance.

2.2.28 Diaper Changing Station (DCS)

Provide [recess mount] [surface mounted] diaper changing station fabricated of high impact plastic with no sharp edges. Provide fold down platform concave to the child's shape, equipped with nylon and hook and loop safety straps and engineered to withstand a minimum static load of[155 kg] [113 kg]. Provide an integral dispenser for sanitary liners for each unit. Provide pictorial for universal use of safety graphics conforming to JIS Z 2911, ISO 3864 or ISO 7010. Provide stations that comply with these standards: ASTM F2285 Standard Safety Performance Specification for Diaper Changing tables for Diaper Changing Tables for Commercial Use. Furnish color [_____] [as shown in Section 09 06 00 SCHEDULES FOR FINISHES].

2.2.29 Folding Shower Seat (FSS)

Folding shower seat must have a frame constructed of type-304 satin finish stainless steel, 16-gauge, 32 mm square tubing, and 18-gauge, 25 mm diameter seamless tubing. Seat must be constructed of one-piece, 13 mm thick water-resistant, ivory colored solid phenolic with black edge. Clearance between back of shower seat and wall must be 38 mm to comply with ADA Accessibility Guidelines (ADAAG). Seat supports must not come into contact with the floor. Seat must be able to lock in upright position when not in use. Seat must be attached to wall by two 75 mm diameter mounting flanges constructed of type-304, 5 mm thick stainless steel with satin finish. Manufacturer's service and parts manual must be provided to building owner/manager upon completion of project.

2.2.30 Mop and Broom Holder (MH)

Stainless steel with grip jaw cam mechanism securing [3][4][5] mop or broom handles. [Also includes [hooks][and][storage shelf].]

PART 3 EXECUTION

3.1 INSTALLATION

Do not install items that show visual evidence of biological growth. Provide the same finish for the surfaces of fastening devices exposed after installation as the attached accessory. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the installation is accepted. After acceptance of accessories, remove and dispose of

strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. [Use sealants for brackets, plates, anchoring devices and similar items in showers (a silicone or polysulfide sealant) as they are set to provide a watertight installation.] After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

3.1.1 Recessed Accessories

Fasten accessories with wood screws to studs, blocking or rough frame in wood construction. Set anchors in mortar in masonry construction. Fasten to metal studs or framing with sheet metal screws in metal construction.

3.1.2 Surface Mounted Accessories

Mount on concealed backplates, unless specified otherwise. Conceal fasteners on accessories without backplates. Install accessories with sheet metal screws or wood screws in lead-lined braided jute, PTFE or neoprene sleeves, or lead expansion shields, or with toggle bolts or other approved fasteners as required by the construction. Install backplates in the same manner, or provide with lugs or anchors set in mortar, as required by the construction. Fasten accessories mounted on gypsum board and plaster walls without solid backing into the metal or wood studs or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.

3.2 CLEANING

Clean material in accordance with manufacturer's recommendations. Do not use alkaline or abrasive agents. Take precautions to avoid scratching or marring exposed surfaces.

3.3 SCHEDULE

Accessories Required						
Room or Space	MG	PTD	SMLD	SD	SH	TTD
[_____]	[_____]	[_____]	[_____]	[_____]	[_____]	[_____]

-- End of Section --

SECTION 12 21 00

WINDOW BLINDS

PART 1 GENERAL

1.1 SUMMARY

Provide window treatment, complete with necessary brackets, fittings, and hardware. Provide each window treatment type as a complete unit in accordance with paragraph WINDOW TREATMENT PLACEMENT SCHEDULE. Mount and operate equipment in accordance with manufacturer's instructions. Completely cover windows to receive a treatment.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1901	(2015) Determination of the Emission of Volatile Organic Compounds and Aldehydes by Building Products - Small Chamber Test Method

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.][information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES

SD-02 Shop Drawings

Installation

SD-10 Operation and Maintenance Data

Window Blinds; G[, [_____]]

[1.4 CERTIFICATIONS

1.4.1 Window Blinds

Provide products certified to meet indoor air quality requirements by JIS A 1901 or provide certification or validation by other third-party program that products meet the requirements of this Section. Provide current product certification documentation from certification body. When product does not have certification, provide validation that product meets the indoor air quality product requirements cited herein.

]1.5 DELIVERY, STORAGE, AND HANDLING

Deliver components to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated and free from dust, water, or other contaminants and has easy access for inspection and handling. Store materials flat in a clean dry area with temperature maintained above 1 0 degrees C. Do not open containers until needed for installation unless verification inspection is required.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 WINDOW BLINDS

Provide each blind, including hardware, accessory items, mounting brackets and fastenings, as a complete unit produced by one manufacturer. Unless otherwise indicated, all parts will be the same color and will match the color of the blind slat. Treat steel features for corrosion resistance. Submit product data and samples of each type and color of window treatment. Provide [slat][louver] samples 150 mm in length for each color.[Window blinds must meet emissions requirements of JIS A 1901 (use the office or classroom requirement, regardless of space type). Provide certification or validation of indoor air quality for window blinds.]

2.1.1 Horizontal Blinds

Provide horizontal blinds with[50 mm][25 mm] slats. Blind units must be capable of nominally 180 degree partial tilting operation and full-height raising. Blinds must be [inside][outside] mount. Provide tapes for 50 mm slats with longitudinal reinforced vinyl plastic in 1-piece turn ladder construction. Tapes for 25 mm slats must be braided polyester or nylon.

2.1.1.1 Head Channel and Slats

Provide head channel made of[steel or] aluminum with corrosion-resistant finish nominal[0.46 mm for 50 mm][0.61 mm for 25 mm] slats. Provide slats of aluminum, not less than [0.203][0.152][0.813] mm thick, and of sufficient strength to prevent sag or bow in the finished blind. Provide a sufficient amount of slats to assure proper control, uniform spacing, and adequate overlap. Enclose all hardware in the headrail.

2.1.1.2 Controls

A transparent tilting wand will be provided to tilt the slats, it will hang vertically by its own weight, and will swivel for easy operation. Provide a tilter control of enclosed construction. Provide moving parts and mechanical drive made of compatible materials which do not require lubrication during normal expected life. The tilter will tilt the slats to any desired angle and hold them at that angle so that any vibration or movement of ladders and slats will not drive the tilter and change the angle of slats. Include a mechanism to prevent over tightening. Provide a wand of sufficient length to reach to within 1500 mm of the floor.

[Provide cordless blinds or blinds with cords that are out of reach of children and strangle proof.]

2.1.1.3 Intermediate Brackets

Provide intermediate brackets for installation, as recommended by the manufacturer, of blinds over [1200][1500][2100] mm wide.

2.1.1.4 Bottom Rail

Provide bottom rail made of corrosion-resistant steel with factory applied finish. Provide closed oval shaped bottom rail with double-lock seam for maximum strength. Bottom rail and end caps to match slats in color.

2.1.1.5 Braided Ladders

Provide braided ladders of 100 percent polyester yarn, color to match the slat color. Space ladders 15.2 slats per 300 mm of drop in order to provide a uniform overlap of the slats in a closed position.

2.1.1.6 Hold-Down Brackets

Provide universal type hold-down brackets for sill or jamb mount where indicated on placement list.

2.1.2 Light Control and Privacy Blinds

In addition to requirements for horizontal blinds, provide each unit with a feature that offers hidden slat holes for maximum light control and privacy.

2.1.3 Vertical Blinds

Provide vertical blind units capable of nominal 180 degree partial tilting operation and full stackback. Provide blinds that are listed by the manufacturer as designed for heavy duty strength applications including heavy duty hardware. Provide [ceiling][wall] mounted vertical blinds with [outside][inside] brackets. Provide blinds that are [sill][floor] length. Outside mount type installation must provide adequate overlap to control light and privacy.

2.1.3.1 Louvers

Provide louvers [which are fire resistant solid vinyl, UV stable, and impact resistant.][which are flame retardant fabric having straight, flat, unfrayed edges and flat, without noticeable twists. Provide a weight at the bottom of the louver without the insert discoloring the fabric.] [which are groover extruded from solid vinyl with clear non-yellowing channel lips to accept fabric inserts. Provide fabric inserts that are flame retardant and colorfast.] Louvers that are[90 mm must overlap not less than 10 mm][50 mm must overlap not less than mm] and be dimensionally stable.

2.1.3.2 Carriers

Provide carriers to support each louver made of molded plastic to transverse on self-fabricated wheels for smooth, easy operation. The hook of the carrier must have an automatic latch to permit easy installation and removal of the louver, and to securely lock the louver for tilting and

traversing.

2.1.3.3 Headrail System

Provide headrail system not less than 1.19 mm thick and made of anodized aluminum alloy or 0.635 mm thick phosphate treated steel with a baked on ivory gloss enamel paint finish. Provide a headrail that extends the full width of the blind and can be closed with an end cap at each end. One cap will contain the traversing and tilting controls. The opposite cap will house the pulley for the traversing cord.

2.1.3.4 Valance

Attach the manufacturer's standard valance to the headrail by metal or plastic holders which grip the top and bottom edge of the valance and accept an insert of the same material as the slats. Provide sufficient clearance behind the valance to permit the louvers to tilt without interference. Extend the headrail cover the full width of the blind.[Provide returns].

2.1.3.5 Controls

Provide tilting and traversing controls that hang compactly at the side of the blinds and reach within 1500 mm of the floor. Provide [tilt/traverse control][bead chain tilting control] that tilts all vanes simultaneously to any desired angle and hold them at that angle. Provide louvers that traverse [one way to the right] [one way to the left] [two-way split].[The traversing control cord will be minimum 1.78 mm in diameter with a minimum breaking strength of 556 N. Anchor the cord to a lead carrier linked to all adjacent carriers.] Provide louvers that traverse along the headrail by pulling one side of the looped cord [fastened to a cord tension pulley][or][a fiberglass wand that tilts the louvers by turning the wand and traverses the louvers by using the wand as a control]. Sliding glass doors will have a one way draw with stackback occurring opposite door openings.

2.1.3.6 Connectors and Spacers

The connector must be flexible, smooth and flat to slide unhindered when carriers move independently of each other, and to nest compactly when carriers are stacking. Relate the length of the links to the louver width in order to equally space the traversing louvers, to maintain uniform and adequate overlap of louvers, and to fully cover the width of the opening.

2.1.3.7 Intermediate Brackets

Provide intermediate installation brackets for blinds over 1575 mm wide.

2.2 COLOR

Provide color, pattern and texture [in accordance with Section 09 06 00 SCHEDULES FOR FINISHES][as indicated][selected from manufacturer's standard colors][[_____]. Color listed is not intended to limit the selection of equal colors from other manufacturers.]

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 WINDOW TREATMENT PLACEMENT SCHEDULE

[All exterior windows include [_____].] [Provide window covering as follows:

Room Number/Name	Window Covering Type	Vertical Blind Draw Direction	Window Type	Quantity
[_____]	[_____]	[_____]	[_____]	[_____]

]

3.3 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Submit drawings showing fabrication and Installation details. Show layout and locations of track, direction of draw, mounting heights, and details. Provide Manufacturer's Instructions and Operation and Maintenance Data. Perform installation of window blinds in accordance with the approved detail drawings and manufacturer's installation instructions. Install units level, plumb, secure, and at proper height and location relative to window units. Provide and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Do not start installation until completion of room painting and finishing operations.

3.4 CLEAN-UP

Upon completion of the installation, inspect window treatments for soiling, damage or blemishes; and adjust them for form and appearance and proper operating condition. Repair or replace damaged units as directed by the Contracting Officer. Isolate metal parts from direct contact with concrete, mortar, or dissimilar metals. Ensure blinds installed in recessed pockets can be removable without disturbing the pocket. The entire blind, when retracted, must be contained behind the pocket. For blinds installed outside the jambs and mullions, overlap each jamb and mullion 20 mm or more when the jamb and mullion sizes permit. Include all hardware, brackets, anchors, fasteners, and accessories necessary for a complete, finished installation.

-- End of Section --

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SECTION 21 13 13

WET PIPE SPRINKLER SYSTEMS, FIRE PROTECTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(2015) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.3	(2016) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2016) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.21	(2016) Nonmetallic Flat Gaskets for Pipe Flanges

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1013	(2011) Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers - (ANSI approved 2010)
ASSE 1015	(2011) Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies - (ANSI approved 2010)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2016) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2017) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C203	(2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA M14	(2015) Manual: Recommended Practice for

	Backflow Prevention and Cross-Connection Control

ASTM INTERNATIONAL (ASTM)

ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A135/A135M	(2009; R2014) Standard Specification for Electric-Resistance-Welded Steel Pipe
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A183	(2014; R 2020) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INTELLIGENCE COMMUNITY STANDARD (ICS)

ICS 705-1	(2010) Physical and Technical Security Standard for Sensitive Compartmented Information Facilities

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-71	(2018) Gray Iron Swing Check Valves, Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13	(2019; ERTA 1 2018; TIA 18-1; TIA 18-2; ; ERTA 2-3 2019; TIA 19-3; TIA 19-4; TIA 19-5; TIA 19-6; ERTA 4 2019; ERTA 5 2020) Standard for the Installation of Sprinkler Systems
NFPA 13R	(2019) Standard for the Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height
NFPA 15	(2017; ERTA 1 2017; ERTA 2 2019) Standard for Water Spray Fixed Systems for Fire Protection

NFPA 24	(2019; TIA 19-1) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 101	(2018; ERTA 18-1; ERTA 18-2; ERTA 18-3; ERTA 18-4; TIA 18-1; TIA 18-2; TIA 18-3; TIA 18-4) Life Safety Code
NFPA 291	(2019) Recommended Practice for Fire Flow Testing and Marking of Hydrants
NFPA 1963	(2019) Standard for Fire Hose Connections

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	(2012) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL 193	(2016) UL Standard for Safety Alarm Valves for Fire-Protection Service
UL 199	(2020) UL Standard for Safety Automatic Sprinklers for Fire-Protection Service
UL 262	(2004; Reprint Oct 2011) Gate Valves for Fire-Protection Service
UL 312	(2010; Reprint Mar 2018) UL Standard for Safety Check Valves for Fire-Protection Service
UL 405	(2013; Bul. 2020) UL Standard for Safety Fire Department Connection Devices
UL 668	(2004; Reprint Jul 2016) UL Standard for Safety Hose Valves for Fire-Protection Service
UL 789	(2004; Reprint May 2017) UL Standard for Safety Indicator Posts for Fire-Protection Service
UL 1626	(2008; Bul. 2018) UL Standard for Safety Residential Sprinklers for Fire-Protection Service
UL 1767	(3013; Bul. 2015) UL Standard for Safety Early-Suppression Fast-Response Sprinklers
UL Fire Prot Dir	(2020) Fire Protection Equipment Directory

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 2301	(2013) Screwed Type Malleable Cast Iron Pipe Fittings
JIS B 2311	(2015) Steel Butt-Welding Pipe Fittings for Ordinary Use
JIS G 3454	(2019) Carbon Steel Pipes for Pressure Service (Amendment 1)

1.2 SYSTEM DESCRIPTION

Provide wet pipe [sprinkler][water spray] system(s) in [all areas of the building][areas indicated on the drawings] [_____]. Except as modified herein, the system must meet the requirements of NFPA 13[NFPA 13R][and][NFPA 15]. Pipe sizes which are not indicated on the Contract drawings must be determined by hydraulic calculations.

1.2.1 Hydraulic Design

1.2.1.1 Basis for Calculations

A waterflow test was performed on (DATE) at (LOCATION). The results are as indicated on the design drawings. Perform a fire hydrant flow test prior to shop drawing submittal in accordance with NFPA 291. Results must include hydrant elevations relative to the building and hydrant number/identifiers for the tested hydrants, including which were flowed, which had a gauge. This information must be presented in a tabular form if multiple hydrants were flowed. The results must be included with the hydraulic calculations. Hydraulic calculations must be based on flow test noted on the design drawing, unless verified by the USACE Designated Fire Protection Engineer (USACE DFPE) approved by Contracting Officer. Hydraulic calculations must be based upon the Hazen-Williams formula with a "C" value noted in NFPA 13 for piping, [and [_____] for existing underground piping].[Hydraulic calculations must be based on operation of the fire pump(s) provided in Section 21 30 00 FIRE PUMPS.] [The minimum residual pressure in a service lateral (lead-in) at the [design flow rate][150% of the fire pump rated flow] must be 138 kPa at [the inlet to the backflow preventer][the suction side of the fire pump]].

1.2.1.2 Hydraulic Calculations

a. Water supply curves and system requirements must be plotted on semi-logarithmic graph (N^1.85) paper so as to present a summary of the complete hydraulic calculation.

b. Provide a summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, minimum discharge pressures and minimum flows. Elevations of hydraulic reference points (nodes) must be indicated.

c. Documentation must identify each pipe individually and the nodes connected thereto. Indicate the diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient for each pipe.

d. Where the sprinkler system is supplied by interconnected risers, the

sprinkler system must be hydraulically calculated using the hydraulically most demanding single riser. The calculations must not assume the simultaneous use of more than one riser.

e. All calculations must include the backflow preventer manufacturer's stated friction loss at the design flow or [83 kPa for reduced pressure][55 kPa for double check] backflow preventer, whichever is greater.

f. All calculations must be performed back to the actual location of the flow test, taking into account the direction of flow in the service main at the test location.

g. For gridded systems, calculations must show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. A flow diagram indicating the quantity and direction of flows must be included.

1.2.1.3 Design Criteria

Hydraulically design the system to discharge a minimum density over the hydraulically most demanding floor areaas indicated on the drawings. Hydraulic calculations must be in accordance with the Area/Density Method of NFPA 13. Add an allowance for exterior hose streams shall be as indicated on design drawing at the point of connection to the existing water system.

1.2.2 Sprinkler Coverage

Sprinklers must be uniformly spaced on branch lines. Provide coverage throughout 100 percent of the [building][area noted on the Contract drawings]. This includes, but is not limited to, telephone rooms, electrical equipment rooms (regardless of the fire resistance rating of the enclosure), boiler rooms, switchgear rooms, transformer rooms, attached electrical vaults and other electrical and mechanical spaces. Coverage per sprinkler must be in accordance with NFPA 13. Provide sprinklers below all obstructions in accordance with NFPA 13. Exceptions are as follows:

a. Sprinklers may be omitted from small rooms which are exempted for specific occupancies in accordance with NFPA 101.

b. Facilities that are designed in accordance with NFPA 13R.

1.2.3 Qualified Fire Protection Engineer (QFPE)

An individual who is a licensed professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveying (NCEES) and has relevant fire protection engineering experience. Services of the QFPE must include:

a. Reviewing SD-02, SD-03, and SD-05 submittal packages for completeness and compliance with the provisions of this specification. Working (shop) drawings and calculations must be prepared by, or prepared under the immediate supervision of, the QFPE. The QFPE must affix their professional engineering stamp with signature to the shop drawings, calculations, and material data sheets, indicating approval prior to submitting the shop drawings to the DFPE.

b. Provide a letter documenting that the SD-02, SD-03, and SD-05 submittal package has been reviewed and noting all outstanding comments.

c. Performing in-progress construction surveillance prior to installation of ceilings (rough-in inspection).

d. Witnessing pre-Government [and final Government]functional performance testing and performing a final installation review.

e. Signing applicable certificates under SD-07.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval][information only]. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Partial submittals and submittals not fully complying with NFPA 13 and this specification section must be returned disapproved without review. SD-02, SD-03 and SD-05 must be submitted simultaneously.

Shop drawings (SD-02), product data (SD-03) and calculations (SD-05) must be prepared by the designer and combined and submitted as one complete package. The QFPE must review the SD-02/SD-03/SD-05 submittal package for completeness and compliance with the Contract provisions prior to submission to the Government. The QFPE must provide a Letter of Confirmation that they have reviewed the submittal package for compliance with the contract provisions. This letter must include their professional engineer stamp and signature. Partial submittals and submittals not reviewed by the QFPE must be returned disapproved without review.

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualified Fire Protection Engineer (QFPE); G[, [_____]]

Sprinkler System Designer; G[, [_____]]

Sprinkler System Installer; G[, [_____]]

SD-02 Shop Drawings

Shop Drawing; G[, [_____]]

SD-03 Product Data

Pipe; G[, [_____]]

Fittings; G[, [_____]]

Valves, including gate, check, butterfly, and globe; G[, [_____]]

Alarm Valves; G[, [_____]]

Relief Valves; G[, [_____]]

Sprinklers ; G[, [_____]]

Pipe Hangers and Supports ; G[, [_____]]

Sprinkler Alarm Switch; G[, [_____]]

Valve Supervisory (Tamper) Switch; G[, [_____]]

Fire Department Connection; G[, [_____]]

Backflow Prevention Assembly; G[, [_____]]

Air Vent; G[, [_____]]

Hose Valve; G[, [_____]]

[Seismic Bracing; G[, [_____]]

] Nameplates; G[, [_____]]

SD-05 Design Data

[Seismic Bracing; G[, [_____]]

Load calculations for sizing of seismic bracing

] Hydraulic Calculations; G[, [_____]]

SD-06 Test Reports

Test Procedures; G[, [_____]]

SD-07 Certificates

Verification of Compliant Installation; G[, [_____]]

Request for Government Final Test; G[, [_____]]

SD-10 Operation and Maintenance Data

Operating and Maintenance (O&M) Instructions; G[, [_____]]

Spare Parts Data; G[, [_____]]

SD-11 Closeout Submittals

As-built drawings

1.4 QUALITY ASSURANCE

1.4.1 Preconstruction Submittals

Within 36 days of contract award but no less than [14 days][_____] prior to commencing work on site, the prime Contractor must submit the following for review and approval. SD-02, SD-03 and SD-05 submittals received prior to the review and approval of the qualifications will be returned Disapproved Without Review.

1.4.1.1 Shop Drawing

[_____] copies of the shop drawings, no later than 28 days prior to the start of system installation. Working drawings conforming to the requirements prescribed in NFPA 13 and must be no smaller than [ISO A1][ANSI D][the Contract Drawings]. Each set of drawings must include the following:

1. A descriptive index with drawings listed in sequence by number. A legend sheet identifying device symbols, nomenclature, and conventions used in the package.

2. Floor plans drawn to a scale not less than 1:100 equals 1-foot clearly showing locations of devices, equipment, risers, and other details required to clearly describe the proposed arrangement.

3. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross mains and branch lines to finished floor and roof or ceiling. A detail must show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

4. Longitudinal and transverse building sections showing typical branch line and cross main pipe routing, elevation of each typical sprinkler above finished floor and elevation of "cloud" or false ceilings in relation to the building ceilings.

5. Plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance.

6. Riser layout drawings drawn to a scale of not less than 1:25 equals 1-foot to show details of each system component, clearances between each other and from other equipment and construction in the room.

7. Details of each type of riser assembly, pipe hanger, [sway bracing for earthquake protection,]and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring. The dimension from the edge of vertical piping to the nearest adjacent wall(s) must be indicated on the drawings when vertical piping is located in stairs or other portions of the means of egress.

8. Details of each type of pipe hanger[, seismic bracing/restraint] and related components.

[9. Include fire pump curve with shop drawings and hydraulic calculations.]

1.4.1.2 Product Data

[_____] copies of annotated catalog data to show the specific model, type, and size of each item. Catalog cuts must also indicate the NRTL listing. The data must be highlighted to show model, size, options, and other pertinent information, that are intended for consideration. Data must be adequate to demonstrate compliance with all contract requirements. Product data for all equipment must be combined into a single submittal.

1.4.1.3 Hydraulic Calculations

Calculations must be as outlined in NFPA 13 except that calculations must be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings.[Calculations must include isometric diagram indicating hydraulic nodes and pipe segments.][Include fire pump curve with submittal.]

1.4.1.4 Operating and Maintenance (O&M) Instructions

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA as supplemented and modified by this specification section.

Provide [six][_____] manuals[and one pdf version on electronic media]. The manuals must include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment.[Each service organization submitted must be capable of providing [4][_____]-hour on-site response to a service call on an emergency basis.]

Submit spare parts data for each different item of material and equipment specified. The data must include a complete list of parts and supplies, and a list of parts recommended by the manufacturer to be replaced after 1-year and 3 years of service. Include a list of special tools and test equipment required for maintenance and testing of the products supplied.

1.4.2 Qualifications

1.4.2.1 Sprinkler System Designer

The sprinkler system designer must be certified as a Level [III][IV] Technician by National Institute for Certification in Engineering Technologies (NICET) in the Water-Based Systems Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7.

1.4.2.2 Sprinkler System Installer

The sprinkler system installer must be regularly engaged in the installation of the type and complexity of system specified in the contract documents, and must have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.4.3 Regulatory Requirements

Equipment and material must be listed or approved. Listed or approved, as used in this Section, means listed, labeled or approved by a Nationally Recognized Testing Laboratory (NRTL) such as UL Fire Prot Dir or FM APP GUIDE. The omission of these terms under the description of an item or equipment described must not be construed as waiving this requirement. All listings or approvals by testing laboratories must be from an existing ANSI or UL published standard. The recommended practices stated in the manufacturer's literature or documentation are mandatory requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect all equipment delivered and placed in storage from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. All pipes must be either capped or plugged until installed.

1.6 EXTRA MATERIALS

Spare sprinklers and wrench(es) must be provided as spare parts in accordance with NFPA 13.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Standard Products

Provide materials, equipment, and devices listed for fire protection service when so required by NFPA 13 or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for a classification of material. Material and equipment must be standard products of a manufacturer regularly engaged in the manufacture of the products for at least [2][_____] years prior to bid.

2.1.2 Nameplates

Major components of equipment must have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new name plate permanently affixed to the item or equipment. Nameplates must be etched metal or plastic, permanently attached by screws to control units, panels or adjacent walls.

2.1.3 Identification and Marking

Pipe and fitting markings must include name or identifying symbol of manufacturer and nominal size. Pipe must be marked with ASTM designation. Valves and equipment markings must have name or identifying symbol of manufacturer, specific model number, nominal size, name of device, arrow indicating direction of flow, and position of installation (horizontal or vertical), except if valve can be installed in either position. Markings must be included on the body casting or on an etched or stamped metal nameplate permanently on the valve or cover plate.

2.1.4 Pressure Ratings

Valves, fittings, couplings, alarm switches, and similar devices must be rated for the maximum working pressures that can be experienced in the system, but in no case less than [1207][1724] kPa.

2.2 UNDERGROUND PIPING COMPONENTS

2.2.1 Pipe

Pipe must comply with NFPA 24. Minimum pipe size is [100 mm][150 mm]. Piping more than 1.50 meters outside the building walls must comply with Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING. A continuous section of welded stainless steel fire water service piping from a point outside the building perimeter to a flanged fitting at least 304 mm above the

finished floor within the building is acceptable.

2.2.2 Fittings and Gaskets

Fittings must be ductile-iron conforming to AWWA C110/A21.10 with cement mortar lining conforming to AWWA C104/A21.4. Gaskets must be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile-iron pipe joints must conform to AWWA C111/A21.11.

2.2.3 Gate Valve[and Indicator Posts]

Installation must comply with NFPA 24. Gate valves for use with indicator post must conform to UL 262.[Indicator posts must conform to UL 789. Provide each indicator post with one coat of primer and two coats of red enamel paint.]

[2.2.4 Valve Boxes

Except where indicator posts are provided, for each buried valve, provide a cast-iron, ductile-iron, or plastic valve box of a suitable size. Plastic boxes must be constructed of acrylonitrile-butadiene-styrene (ABS) or inorganic fiber-reinforced black polyolefin. Provide cast-iron, ductile-iron, or plastic cover for valve box with the word "WATER" cast on the cover. The minimum box shaft diameter must be 133 mm. Coat cast-iron and ductile-iron boxes with bituminous paint applied to a minimum dry-film thickness of 0.254 mm.

]2.2.5 Buried Utility Warning and Identification Tape

Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape must be detectable by an electronic detection instrument. Provide tape, 80 mm minimum width, color coded for the utility involved with warning and identification imprinted in bold block letters continuously and repeatedly over the entire tape length. Warning and identification must read "CAUTION BURIED WATER PIPING BELOW" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.3 ABOVEGROUND PIPING COMPONENTS

2.3.1 Steel Piping Components

2.3.1.1 Steel Pipe

Except as modified herein, steel pipe must be black as permitted by NFPA 13 and conform to the applicable provisions of ASTM A53/A53M, ASTM A135/A135M , ASTM A153/A153M, or JIS G 3454 - STPG370.

Steel pipe must be Schedule 40 only. Galvanized pipe is not permitted.

2.3.1.2 Fittings

Fittings must be welded, threaded, or grooved-end type. Threaded fittings must be cast-iron conforming to ASME B16.4, malleable-iron conforming to ASME B16.3 or JIS B 2301, ductile-iron conforming to ASTM A536, or steel butt-welded fittings to JIS B 2311. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe, steel press fittings and field welded fittings are not permitted.

Fittings, mechanical couplings, and rubber gaskets must be supplied by the same manufacturer. Threaded fittings must use Teflon tape or manufacturer's approved joint compound. Saddle tees using rubber gasketed fittings are permitted only when connecting to existing piping for additions or modifications. Saddle tees must use a connection method that completely wraps around the pipe. Reducing couplings are not permitted except as allowed by NFPA 13. Galvanized fittings are not permitted.

2.3.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings must be designed for not less than 1200 kPa service and the product of the same manufacturer. Field welded fittings must not be used. Fitting and coupling housing must be malleable-iron conforming to ASTM A47/A47M, Grade 32510; ductile-iron conforming to ASTM A536, Grade 65-45-12. Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 50 mm and larger. Gasket must be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts must be heat-treated steel conforming to ASTM A183 and must be cadmium-plated or zinc-electroplated.

2.3.1.4 Flanges

Flanges must conform to NFPA 13 and ASME B16.1. Gaskets must be non-asbestos compressed material in accordance with ASME B16.21, 1.6 mm thick, and full face or self-centering flat ring type.

2.3.2 Flexible Sprinkler Hose

The use of flexible hose is not permitted.

2.3.3 Pipe Hangers and Supports

Provide galvanized pipe hangers[, supports and seismic bracing][and supports] in accordance with NFPA 13.[Design and install seismic protection in accordance with the requirements of NFPA 13 section titled "Protection of Piping Against Damage Where Subject to Earthquakes for Seismic Design Category ["D"]["_____"]].

2.3.4 Valves

Provide valves of types approved for fire service. Valves must open by counterclockwise rotation.

2.3.4.1 Control Valve

Manually operated sprinkler control/gate valve must be [outside stem and yoke (OS&Y) type][or][butterfly type][as indicated on the drawings] and must be listed.

2.3.4.2 Check Valves

Check valves must comply with UL 312. Check valves 100 mm and larger must be of the swing type, have a clear waterway and meet the requirements of MSS SP-71, for Type 3 or 4. Inspection plate must be provided on valves larger than 150 mm.

2.3.4.3 Hose Valve

Valve must comply with UL 668.

2.3.5 [Alarm][Riser Check] Valves

[Provide riser check valve, pressure gauges and main drain.][Provide variable pressure type alarm check valve, standard trim piping, pressure gauges, bypass, retarding chamber, testing valves, and main drain, and other components as required for a fully operational system. Alarm valves must comply with UL 193.]

2.4 ALARM INITIATING AND SUPERVISORY DEVICES

2.4.1 Sprinkler Alarm Switch

Vane or pressure-type flow switch(es). [Connection of switch must be by the fire alarm installer]. [Vane type alarm actuating devices must have mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and must instantly recycle.][Flow switches for elevator power shunt must not have a retard feature.]

2.4.2 Valve Supervisory (Tamper) Switch

Switch must be integral to the control valve or suitable for mounting to the type of control valve to be supervised open. The switch must be tamper resistant and contain SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

[2.5 BACKFLOW PREVENTION ASSEMBLY

[Reduced-pressure principle][Double-check] valve assembly backflow preventer complying with ASSE 1013, ASSE 1015 and AWWA M14. Each check valve must have a drain. Backflow prevention assemblies must have current "Certificate of Approval from the Foundation for Cross-Connection Control and Hydraulic Research, FCCCHR List" and be listed for fire protection use. Listing of the specific make, model, design, and size in the FCCCHR List is acceptable as the required documentation.

2.5.1 Backflow Preventer Test Connection

Test connection must consist of a series of listed hose valves with 65-mm National Standard male hose threads with cap and chain.

]2.6 FIRE DEPARTMENT CONNECTION

Fire department connection must be [freestanding][projecting][flush] type with cast-brass body, matching [wall] escutcheon lettered "Auto Spkr" with a [polished-brass][chromium-plated] finish. [The connection must have individual self-closing clappers, caps with drip drains and chains.] Female inlets must have [65-mm][100 mm][125 mm][_____] diameter [American National Fire Hose Connection Screw Threads (NH) per NFPA 1963] [Storz][_____]. Comply with UL 405.

2.7 SPRINKLERS

Sprinklers must comply with UL 199 and NFPA 13. Sprinklers with internal O-rings are not acceptable. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters must have temperature classification in accordance with NFPA 13. Extended coverage sprinklers are permitted for loading docks, residential occupancies and high-piled

storage applications only.

2.7.1 Pendent Sprinkler

Pendent sprinkler must be[recessed][quick-response][dry pendent] type with nominal K-factor of [80][115][160][_____]. Pendent sprinklers must have a [polished chrome][stainless steel][white polyester][_____] finish. Assembly must include an integral escutcheon.

2.7.2 Upright Sprinkler

Upright sprinkler must be [brass][chrome-plated][stainless steel][white polyester] [quick-response type][_____] and have a nominal K-factor of [80][115][160][_____].

2.7.3 Sidewall Sprinkler

Sidewall sprinkler must be the [quick-response][standard-response] [recessed][dry sidewall] type. Sidewall sprinkler must have a nominal K-factor of [80][115][160][_____]. Sidewall sprinkler must have a [brass][polished-chrome][stainless steel][white polyester][_____] finish.

[2.7.4 Concealed Sprinkler

Concealed sprinkler must be [chrome-plated][stainless steel][white polyester] [quick-response type][_____] and have a nominal K-factor of [80][115][160][_____]. Coverplate must be [chrome][white][_____].

]2.7.5 Residential Sprinkler

Residential sprinkler must be [recessed pendent][pendent][sidewall] type with nominal K-factor of [60][80]. Residential sprinkler must have a [polished-chrome][white polyester][_____] finish. Sprinkler must comply with UL 1626.

[2.7.6 Corrosion-Resistant Sprinkler

Corrosion-resistant sprinkler must be the [upright][pendent] type installed in locations as indicated. Corrosion-resistant coatings must be factory-applied by the sprinkler manufacturer.

][2.7.7 Dry Sprinkler Assembly

Dry sprinkler assembly must be of the[pendent][sidewall][45-degree] type as indicated. Assembly must include an integral escutcheon. Maximum length must not exceed maximum indicated in its listing. Sprinkler must have a [polished chrome][polyester coating][white enamel] finish.

][2.7.8 Control Mode Specific Application Sprinkler

Control mode specific application sprinkler must be of the [pendent][upright][dry sidewall] type as indicated. Sprinkler must be specifically listed for high-piled storage only. Sprinkler must have a [polished chrome][rough brass] finish.

][2.7.9 ESFR Sprinkler

ESFR sprinkler must be [pendent][upright] and comply with UL 1767. Nominal K-factor must be [_____].

][2.7.10 Intermediate Level Rack Sprinkler

Intermediate level rack sprinkler must be of the [upright][pendent] type with nominal K-factor of [80][115]. The sprinkler must be equipped with a deflector plate to shield the fusible element from water discharged above it.

]2.8 ACCESSORIES

2.8.1 Sprinkler Cabinet

Provide spare sprinklers in accordance with NFPA 13 and must be placed in a suitable metal or plastic cabinet of sufficient size to accommodate all the spare sprinklers and wrenches in designated locations. Spare sprinklers must be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed as required by NFPA 13. At least one wrench of each type required must be provided.

2.8.2 Pendent Sprinkler Escutcheon

Escutcheon must be one-piece metallic type with a depth of less than 19 mm and suitable for installation on pendent sprinklers. The escutcheon must have a factory finish that matches the pendent sprinkler.

2.8.3 Pipe Escutcheon

Provide split hinge metal plates for piping entering walls, floors, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

2.8.4 Sprinkler Guard

Listed guard must be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards must be provided on sprinklers located [_____][within 2.1 meters of the floor][as indicated].

2.8.5 Relief Valve

Relief valves must be listed and installed at there riser in accordance with NFPA 13.

2.8.6 Air Vent

Air vents must be of the automatic type and piped to drain to the building exterior.

2.8.7 Identification Sign

Valve identification sign must be minimum 150 mm wide by 50 mm high with enamel baked finish on minimum 1.214-mm steel or 0.6-mm aluminum with red letters on a white background or white letters on red background. Wording of sign must include, but not be limited to "main drain", "auxiliary drain", "inspector's test", "alarm test", "alarm line", and similar wording as required to identify operational components. Where there is more than one sprinkler system, signage must include specific details as to the respective system.

PART 3 EXECUTION

3.1 VERIFYING ACTUAL FIELD CONDITIONS

Before commencing work, examine all adjoining work on which the contractor's work that is dependent for perfect workmanship according to the intent of this specification section, and report to the Contracting Officer's Representative a condition that prevents performance of first class work. No "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed before submittal of a proposal.

3.2 INSTALLATION

The installation must be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein.[Installation of in-rack sprinklers must comply with applicable provisions of NFPA 13.] Locate sprinklers in a consistent pattern with ceiling grid, lights, and air supply diffusers. Install sprinkler system over and under ducts, piping and platforms when such equipment can negatively affect or disrupt the sprinkler discharge pattern and coverage.

a. Piping offsets, fittings, and other accessories required must be furnished to provide a complete installation and to eliminate interference with other construction.

b. Wherever the contractor's work interconnects with work of other trades the Contractor must coordinate with other Contractors to insure all Contractors have the information necessary so that they may properly install all necessary connections and equipment. Identify all work items needing access (dampers and similar equipment) that are concealed above hung ceilings by permanent color coded pins/tabs in the ceiling directly below the item.

c. Provide required supports and hangers for piping, conduit, and equipment so that loading will not exceed allowable loadings of structure. Submittal of a bid must be a deemed representation that the contractor submitting such bid has ascertained allowable loadings and has included in his estimates the costs associated in furnishing required supports.

3.2.1 Waste Removal

At the conclusion of each day's work, clean up and stockpile on site all waste, debris, and trash which may have accumulated during the day as a result of work by the contractor and of his presence on the job. Sidewalks and streets adjoining the property must be kept broom clean and free of waste, debris, trash and obstructions caused by work of the contractor, which will affect the condition and safety of streets, walks, utilities, and property.

3.3 UNDERGROUND PIPING INSTALLATION

The fire protection water main must be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover must be [900][_____] mm or the frost line, whichever is deeper. The supply line must terminate inside the building with a flanged piece, the bottom of which must be set not less than 304 mm above the finished floor. A blind flange must be installed temporarily on top of the flanged piece to prevent the entrance

of foreign matter into the supply line. A concrete thrust block must be provided at the elbow where the pipe turns up toward the floor. In addition, joints must be anchored in accordance with NFPA 24. Buried steel components must be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 1500 mm outside the building walls must meet the requirements of Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING.

3.4 ABOVEGROUND PIPING INSTALLATION

The methods of fabrication and installation of the aboveground piping must fully comply with the requirements and recommended practices of NFPA 13 and this specification section.

3.4.1 Protection of Piping Against Earthquake Damage

Seismic restraint is [not]required.

3.4.2 Piping in Exposed Areas

Install exposed piping without diminishing exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, must be installed to provide maximum headroom.

3.4.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping must be concealed above ceilings. Piping must be inspected, hydrostatically tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas must be concealed.

3.4.4 Pendent Sprinklers

a. Drop nipples to pendent sprinklers must consist of minimum 25-mm pipe with a reducing coupling into which the sprinkler must be threaded.

b. Where sprinklers are installed below suspended or dropped ceilings, drop nipples must be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling must not extend below the underside of the ceiling.

c. Recessed pendent sprinklers must be installed such that the distance from the sprinkler deflector to the underside of the ceiling must not exceed the manufacturer's listed range and must be of uniform depth throughout the finished area.

d. Pendent sprinklers in suspended ceilings must be located in the center of the tile (+/- 2 inches).[

e. Dry pendent sprinkler assemblies must be such that sprinkler ceiling plates or escutcheons are of the uniform depth throughout the finished space.][

f. Dry pendent sprinklers must be of the required length to permit the sprinkler to be threaded directly into a branch line tee.][

g. Where the maximum static or flowing pressure, whichever is greater at

the sprinkler, applied other than through the fire department connection, exceeds 6.9 bar and a branch line above the ceiling supplies sprinklers in a pendent position below the ceiling, the cumulative horizontal length of an unsupported armover to a sprinkler or sprinkler drop must not exceed 300 mm for steel pipe.]

3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers must contain no fittings between the branch line tee and the reducing coupling at the sprinkler.

3.4.6 Pipe Joints

Pipe joints must conform to NFPA 13, except as modified herein. Not more than four threads must show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints must be provided where indicated or required by NFPA 13. Grooved pipe and fittings must be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools must be products of the same manufacturer. The diameter of grooves made in the field must be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe must be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances.

3.4.7 Reducers

Reductions in pipe sizes must be made with one-piece tapered reducing fittings. When standard fittings of the required size are not manufactured, single bushings of the face or hex type will be permitted. Where used, face bushings must be installed with the outer face flush with the face of the fitting opening being reduced. Bushings cannot be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 13 mm.

3.4.8 Pipe Penetrations

a. Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors must be core-drilled and provided with pipe sleeves. Each sleeve must be Schedule 40 galvanized steel, ductile-iron or cast-iron pipe and extend through its respective wall or floor and be cut flush with each wall surface. Sleeves must provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe must be firmly packed with mineral wool insulation.

b. Where pipes and sleeves penetrate fire walls, fire partitions, or floors, pipes/sleeves must be firestopped in accordance with Section 07 84 00 FIRESTOPPING.

c. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe must be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

d. All penetrations through the boundary of rooms/areas identified as secure space area must meet ICS 705-1.

3.4.9 Escutcheons

Escutcheons must be provided for pipe penetration in finished areas of ceilings, floors and walls. Escutcheons must be securely fastened to the pipe at surfaces through which piping passes.

3.4.10 Inspector's Test Connection

Unless otherwise indicated, the test connection must consist of 25-mm pipe connected [to the remote branch line][at the riser as a combination test and drain valve]; a test valve located approximately 2 meters above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test". All test connection piping must be inside of the building and penetrate the exterior wall at the location of the discharge orifice only. The discharge orifice must be located outside the building wall no more than 0.6 meters above finished grade, directed so as not to cause damage to adjacent construction or landscaping during full flow discharge, or to the sanitary sewer. Discharge to the exterior must not interfere with exiting from the facility. Water discharge or runoff must not cross the path of egress from the building. Do not discharge to the roof. Discharge to floor drains, janitor sinks or similar fixtures is not permitted.

Provide concrete splash blocks at all drain and inspector's test connection discharge locations if not discharging to a concrete surface. Splash blocks must be large enough to mitigate erosion and not become dislodged during a full flow of the drain. Ensure all discharged water drains away from the facility and does not cause property damage.

3.4.11 Backflow Preventer

Locate within the building or in a heated enclosure in locations subject to freezing. For heated enclosures, provide a low temperature supervisory alarm connected to the facility fire alarm system. Heat trace is not permitted to be used.

Install backflow preventers so that the bottom of the assembly is a minimum of 150 mm above the finished floor/grade. Install horizontal backflow preventers so that the bottom of the assembly is no greater than [_____]610 mm above the finished floor/grade. Install vertical backflow preventers so that the upper operating handwheel is no more than [_____] 1.8 meters above the finished floor/grade. Clearance around control valve handles must be minimum 150 mm above grade/finished floor and away from walls.

[3.4.11.1 Test Connection

Provide downstream of the backflow prevention assembly UL 668 hose valves with 65-mm National Standard male hose threads with cap and chain. Provide one valve for each 946 L/min of system demand or fraction thereof. Provide a permanent sign in accordance with paragraph entitled "Identification Signs" which reads, "Test Valve". Indicate location of test header. If an exterior connection, provide a control valve inside a heated mechanical room to prevent freezing.

]3.4.12 Drains

a. Main drain piping must be provided to discharge [at a safe point outside the building, no more than 0.6 meters above finished grade][at the location indicated][to the sanitary sewer]. Provide a concrete splash block at drain outlet. Discharge to the exterior must not interfere with exiting from the facility. Water discharge or runoff must not cross the path of egress from the building.

b. Auxiliary drains must be provided as required by NFPA 13. Auxiliary drains are permitted to discharge to a floor drain if the drain is sized to accommodate full flow (min 151 L/min). Discharge to service sinks or similar plumbing fixtures is not permitted.

3.4.13 Installation of Fire Department Connection

Connection must be mounted [on the exterior wall approximately 900 mm above finished grade][adjacent to and on the sprinkler system side of the backflow preventer]. The piping between the connection and the check valve must be provided with an automatic drip in accordance with NFPA 13 and piped to drain to the outside or a floor drain within the same room.

3.4.14 Identification Signs

Signs must be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Main drain test results must be etched into main drain identification sign. Hydraulic design data must be etched into the nameplates and permanently affixed to each sprinkler riser as specified in NFPA 13. Provide labeling on the surfaces of all feed and cross mains to show the pipe function (e.g., "Sprinkler System", "Fire Department Connection", "Standpipe") and normal valve position (e.g. "Normally Open", "Normally Closed"). For pipe sizes 100 mm and larger provide white painted stenciled letters and arrows, a minimum of 50 mm in height and visible from at least two sides when viewed from the floor. For pipe sizes less than 100 mm, provide white painted stenciled letters and arrows, a minimum of 18 mm in height and visible from the floor.[Provide properly lettered and approved metal sign to elevator flow switch stating the circuits' voltage, and identify the switch as an "Elevator Power Shunt Flow Switch".]

3.5 ELECTRICAL

Except as modified herein, electric equipment and wiring must be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.[Alarm signal wiring connected to the building fire alarm control system must be by the fire alarm installer.]

3.6 PAINTING

Color code mark piping [red][as specified in Section 09 90 00 PAINTS AND COATINGS].

3.7 FIELD QUALITY CONTROL

3.7.1 Test Procedures

Submit detailed test procedures, prepared and signed by the NICET Level

[III][or][IV] Fire Sprinkler Technician, and the representative of the installing company,[and reviewed by the QFPE] [60][_____] days prior to performing system tests. Detailed test procedures must list all components of the installed system. Test procedures must include sequence of testing, time estimate for each test, and sample test data forms. The test data forms must be in a check-off format (pass/fail with space to add applicable test data; similar to the forms in NFPA 13 .) The test procedures and accompanying test data forms must be used for the pre-Government testing and the Government final testing.

a. Provide space to identify the date and time of each test. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

3.7.2 Pre-Government Testing

3.7.2.1 Verification of Compliant Installation

Conduct inspections and tests to ensure that equipment is functioning properly. Tests must meet the requirements of paragraph entitled "Minimum System Tests" and "System Acceptance" as noted in NFPA 13. The Contractor [and QFPE] must be in attendance at the pre-Government testing to make necessary adjustments. After inspection and testing is complete, provide a signed Verification of Compliant Installation letter by the QFPE that the installation is complete, compliant with the specification and fully operable. The letter must include the names and titles of the witnesses to the pre-Government tests. Provide all completion documentation as required by NFPA 13 and the test reports noted below.

a. NFPA 13 Aboveground Material and Test Certificate

b. NFPA 13 Underground Material and Test Certificate

3.7.2.2 Request for Government Final Test

When the verification of compliant installation has been completed, submit a formal request for Government final test to the [_____][Designated Fire Protection Engineer (DFPE)][Contracting Officers Designated Representative (COR)]. Government final testing will not be scheduled until the DFPE has received copies of the request for Government final testing and Verification of Compliant Installation letter with all required reports. Government final testing will not be performed until after the connections to the [building fire alarm system][installation fire alarm reporting system] have been completed and tested to confirm communications are fully functional. Submit request for test at least [15][_____] calendar days prior to the requested test date.

3.7.3 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, perform corrective actions and repeat the tests. Tests must be conducted and repeated if necessary until the system has been demonstrated to comply with all contract requirements.

3.7.4 Government Final Tests

The tests must be performed in accordance with the approved test procedures in the presence of the DFPE. Furnish instruments and personnel required for the tests. The following must be provided at the job site

for Government Final Testing:

a. The manufacturer's technical representative.

[b. The contractor's Qualified Fire Protection Engineer (QFPE).]

c. Marked-up red line drawings of the system as actually installed.

Government Final Tests will be witnessed by the [_____], [Designated Fire Protection Engineer][Contracting Officer][, Qualified Fire Protection Engineer (QFPE)]. At this time, all required tests noted in the paragraph "Minimum System Tests" must be repeated at their discretion.

3.8 MINIMUM SYSTEM TESTS

The system, including the underground water mains, and the aboveground piping and system components, must be tested to ensure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure must be tested in accordance with NFPA 13 and NFPA 24.

3.8.1 Underground Piping

3.8.1.1 Flushing

Underground piping must be flushed at a minimum of 3 mps in accordance with NFPA 24.

3.8.1.2 Hydrostatic Test

New underground piping must be hydrostatically tested in accordance with NFPA 24.

3.8.2 Aboveground Piping

3.8.2.1 Hydrostatic Test

Aboveground piping must be hydrostatically tested in accordance with NFPA 13. There must be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure must be read from a gauge located at the low elevation point of the system or portion being tested.

3.8.2.2 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly must be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. The Contractor must provide all equipment and instruments necessary to conduct a complete forward flow test, including 65-mm diameter hoses, playpipe nozzles or flow diffusers, calibrated pressure gauges, and pitot tube gauge. The Contractor must provide all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction loss) across the assembly must be recorded. A metal placard must be provided on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate determined during the preliminary testing. The pressure drop must be compared to the manufacturer's data and the readings observed during the final inspections and tests.

3.8.3 Main Drain Flow Test

Following flushing of the underground piping, a main drain test must be made to verify the adequacy of the water supply. Static and residual pressures must be recorded on the certificate specified in paragraph SUBMITTALS.

3.9 SYSTEM ACCEPTANCE

Following acceptance of the system, as-built drawings and O&M manuals must be delivered to the Contracting Officer for review and acceptance. Submit six sets of detailed as-built drawings. The drawings must show the system as installed, including deviations from both the project drawings and the approved shop drawings. These drawings must be submitted within two weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings must be provided at the time of, or prior to the final acceptance test.

[a. Provide one set of full size paper as-built drawings and schematics. The drawings must be prepared electronically and sized no less than the contract drawings.] [Furnish one set of CDs or DVDs containing software back-up and CAD based drawings in latest version of [MicroStation][AutoCAD,]DXF and portable document formats of as-built drawings and schematics.]

b. Provide operating and maintenance (O&M) instructions.

3.10 ONSITE TRAINING

Conduct a training course for the responding fire department and operating and maintenance personnel as designated by the Contracting Officer. Training must be performed on two separate days (to accommodate different shifts of Fire Department personnel) for a period of [_____][4] hours of normal working time and must start after the system is functionally complete and after the final acceptance test. The on-site training must cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

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SECTION 21 30 00

FIRE PUMPS

PART 1 GENERAL

1.1 SUMMARY

Except as modified in this Section or on the drawings, install fire pumps in conformance with NFPA 20, NFPA 70, and NFPA 72. In the event of a conflict between specific provisions of this specification and applicable NFPA standards, this specification governs. Devices and equipment for fire protection service must be UL Fire Prot Dir listed or FM APP GUIDE approved. Interpret all reference to the authority having jurisdiction to mean the Contracting Officer.

1.2 SEQUENCING

1.2.1 Primary Fire Pump

Primary fire pump shall [automatically operate when the pressure drops to [758][_____] kPa] [automatically upon tripping of the [_____] sprinkler system][, [and][or] manually when the starter is operated]. [Pump[s] shall continue to run until shut down manually.] [Pump[s] shall automatically shut down after a running time of [_____] minutes unless manually shutdown.] The fire pump shall automatically stop operating when the system pressure reaches [862][_____] kPa and after the fire pump has operated for the minimum pump run time specified herein.

1.2.2 Secondary Fire Pump

Secondary fire pump shall operate at 69 kPa increments, set below the primary fire pump starting pressure. The fire pump shall automatically stop running at [862][_____] kPa and after the fire pump has operated for the minimum pump run time. Fire pumps shall be prevented from starting simultaneously and shall start sequentially at intervals of 5 to 10 seconds.

1.2.3 Pressure Maintenance Pump

Pressure maintenance pump shall operate when the system pressure drops to [793][_____] kPa. Pump shall automatically stop when the system pressure reaches [862][_____] kPa and after the pump has operated for the minimum pump run time specified herein.

1.3 FIRE PUMP INSTALLATION RELATED SUBMITTALS

[Perform work specified in this section under the supervision of and certified by the Fire Protection Specialist who is certified as a Level [III] [IV] Technician by National Institute for Certification in Engineering Technologies (NICET) in the [Automatic Sprinkler System] [Special Hazards Suppression System] Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7.]

[Perform work specified in this section under the supervision of or prepared by the by fire protection specialist who is the QFPE as stated in paragraph 1.7.1.]

The Fire Protection Specialist shall prepare a list of the submittals, from the Contract Submittal Register, that relate to the successful installation of the fire pump(s), no later than [7] [_____] days after the approval of the Fire Protection Specialist and the Manufacturer's Representative. The submittals identified on this list shall be accompanied by a letter of approval signed and dated by the Fire Protection Specialist when submitted to the Government.

1.4 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084	(2005) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(2010; Addenda 2011) Hypochlorites
AWWA B301	(2010) Liquid Chlorine
AWWA C104/A21.4	(2016) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2017) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C151/A21.51	(2017) Ductile-Iron Pipe, Centrifugally Cast
AWWA C500	(2009) Metal-Seated Gate Valves for Water Supply Service
AWWA C606	(2015) Grooved and Shouldered Joints

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.11	(2016) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(2018) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2016) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.26	(2013) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.3	(2016) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.39	(2014) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.5	(2017) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2018) Factory-Made Wrought Buttwelding Fittings
ASME B31.1	(2016; Errata 2016) Power Piping

ASTM INTERNATIONAL (ASTM)

ASTM A183	(2014) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A193/A193M	(2017) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2018) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A449	(2014) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A536	(1984; R 2014) Standard Specification for Ductile Iron Castings
ASTM A563M	(2007; R 2013) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM A795/A795M	(2013) Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B135M	(2010) Standard Specification for Seamless Brass Tube (Metric)

ASTM B42	(2015a) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B62	(2017) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B75/B75M	(2011) Standard Specification for Seamless Copper Tube
ASTM B88M	(2018) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C533	(2017) Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM D2000	(2012; R 2017) Standard Classification System for Rubber Products in Automotive Applications
ASTM D3308	(2012; R 2017) PStandard Specification for TFE Resin Skived Tape
ASTM F436M	(2011) Hardened Steel Washers (Metric)

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-80	(2013) Bronze Gate, Globe, Angle and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2016; SUPP 2016) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1963	(2014) Standard for Fire Hose Connections
NFPA 20	(2016; ERTA 2016) Standard for the Installation of Stationary Pumps for Fire Protection
NFPA 24	(2016; ERTA 2016) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 37	(2018) Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code
NFPA 72	(2019; TIA 19-1; ERTA 2019) National Fire Alarm and Signaling Code

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7	(2012) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL 1247	(2007; Reprint Apr 2014) Diesel Engines for Driving Stationary Fire Pumps
UL 142	(2006; Reprint Jul 2013) Steel Aboveground Tanks for Flammable and Combustible Liquids
UL 262	(2004; Reprint Oct 2011) Gate Valves for Fire-Protection Service
UL 448	(2007; Reprint Jan 2016) Centrifugal Stationary Pumps for Fire-Protection Service
UL 80	(2007; Reprint Jan 2014) Standard for Steel Tanks for Oil-Burner Fuels and Other Combustible Liquids
UL Fire Prot Dir	(2019) Fire Protection Equipment Directory

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 2301	(2013) Screwed Type Malleable Cast Iron Pipe Fittings
JIS B 2311	(2015) Steel Butt-Welding Pipe Fittings for Ordinary Use
JIS G 3452	(2016) Carbon Steel Pipes for Ordinary Piping (Amendment 1)

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.]

Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Fire Pump Installation Related Submittals

Fire Protection Specialist; G[, [_____]]

No later than [14] [_____] days after the Notice to Proceed and prior to the submittal of the fire pump installation drawings

SD-02 Shop Drawings

Installation Drawings; G[, [_____]]

[3] [_____] copies

As-Built Drawings; G[, [_____]]

Piping Layout; G[, [_____]]

Pump Room; G[, [_____]]

SD-03 Product Data

Catalog Data; G[, [_____]]

Spare Parts

Preliminary Tests

At least [14] [_____] days prior to the proposed date and time to begin Preliminary Tests

Field Tests; G[, [_____]]

At least 2 weeks before starting field tests

Manufacturer's Representative; G[, [_____]]

Field Training; G[, [_____]]

Final Acceptance Test

SD-06 Test Reports

Preliminary Tests

[3] [_____] copies of the completed Preliminary Tests Reports, no later that [7] [_____] days after the completion of the Preliminary Tests.

SD-07 Certificates

Fire Protection Specialist

No later than [14] [_____] days after the Notice to Proceed and prior to the submittal of the fire pump installation drawings

Qualifications of Welders

Qualifications of Installer

Preliminary Test Certification

Final Test Certification

SD-10 Operation and Maintenance Data

Operating and Maintenance Instructions; G[, [_____]]

At least [14] [_____] days prior to conducting field training

Flow Meter

Submit Data Package 2 for flow meter and controllers in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.6 EXTRA MATERIALS

Submit Spare Parts data for each different item of equipment and material specified. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of parts recommended by the manufacturer to be replaced after 1 year and 3 years of service. Include a list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor.

1.7 QUALITY ASSURANCE

1.7.1 Quality Control Fire Protection Engineer

A QFPE (Quality Control Fire Protection Engineer)shall be an inidividual who is a registered professional engineering who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveys (NCESES). The role of the QFPE shall be to review and approve the construction drawings, calculations, material data sheets and must monitor the installation of the fire protection systems and certify in writing that the fire protection systems have been constructed and operate as intended in the design plans and specifications.

[The QFPE must review the shop drawings, hydraulic calculations and material submittals. The shop drawings must bear the Review Stamp of the QFPE prior to submitting the fire extinguishing system shop drawings to the DFPE.][Construction (shop) drawings and calculations must be prepared by, or prepared under the immediate supervision of the QFPE. The QFPE must affix their professional engineering stamp with signature to the shop drawings, calculations and material data sheets, indicating approval prior to submitting the fire extinguishing system shop drawings to the DFPE.]

1.7.2 Fire Protection Specialist

Work specified in this section shall be performed under the supervision of and certified by the Fire Protection Specialist. Submit the name and documentation of certification of the proposed Fire Protection Specialists. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers or who is certified as a Level IV Technician by National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.7.3 Qualifications of Welders

Submit certificates of each welder's qualifications prior to site welding; certifications shall not be more than one year old.

1.7.4 Qualifications of Installer

Prior to installation, submit data for approval showing that the Contractor has successfully installed fire pumps and associated equipment of the same type and design as specified herein, or that he has a firm contractual agreement with a subcontractor having such required experience. The data shall include the names and locations of at least two installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months.

1.7.5 Preliminary Test Certification

When preliminary tests have been completed and corrections made, submit a signed and dated certificate with a request for a formal inspection and tests.

1.7.6 Final Test Certification

Concurrent with the Final Acceptance Test Report, submit certification by the Fire Protection Specialist that the fire pump installation is in accordance with the contract requirements, including signed approval of the Preliminary and Final Acceptance Test Reports.[Submit data for approval showing the name and certification of all involved individuals with such qualifications at or prior to submittal of drawings.]

1.7.7 Manufacturer's Representative

Work specified in this section shall be performed under the supervision of and certified by a representative of the fire pump manufacturer. Submit the name and documentation of certification of the proposed Manufacturer's Representative, concurrent with submittal of the Fire Protection Specialist Qualifications. The Manufacturer's Representative shall be regularly engaged in the installation of the type and complexity of fire pump(s) specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the

manner intended for a period of not less than 6 months.

1.8 DELIVERY, STORAGE, AND HANDLING

Protect all equipment delivered and placed in storage from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. Additionally, all pipes shall be either capped or plugged until installed.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

a. Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

b. Submit manufacturer's catalog data included with the Fire Pump Installation Drawings for each separate piece of equipment proposed for use in the system. Catalog data shall indicate the name of the manufacturer of each item of equipment, with data annotated to indicate model to be provided. In addition, a complete equipment list that includes equipment description, model number and quantity shall be provided. Catalog data for material and equipment shall include, but not be limited to, the following:

(1) Fire pumps, drivers and controllers including manufacturer's certified shop test characteristic curve for each pump. Shop test curve may be submitted after approval of catalog data but shall be submitted prior to the final tests.

(2) Pressure maintenance pump and controller.

(3) Piping components.

(4) Valves, including gate, check, globe and relief valves.

(5) Gauges.

(6) Hose valve manifold test header and hose valves.

(7) Flow meter.

(8) Restrictive orifice union.

(9) Associated devices and equipment.

c. All equipment shall have a nameplate that identifies the manufacturer's name, address, type or style, model or serial number, [contract number and accepted date; capacity or size; system in which installed and system which it controls] and catalog number. Pumps and motors shall have standard nameplates securely affixed in a conspicuous place and easy to read. Fire pump shall have nameplates and markings in accordance with UL 448. Diesel driver shall have nameplate and markings in accordance with UL 1247. Electric motor nameplates shall provide the minimum information required by NFPA 70, Section 430-7.

2.2 FIRE PUMP

Fire pump shall be [electric motor driven] [diesel engine driven]. Each pump capacity shall be rated at [_____] L/second with a rated net pressure of [_____] kPa. Fire pump shall furnish not less than 150 percent of rated flow capacity at not less than 65 percent of rated net pressure. Pump shall be centrifugal [horizontal split case][water lubricated, vertical shaft turbine][end-suction][in-line] fire pump. Horizontal pump shall be equipped with automatic air release devices. The maximum rated pump speed shall be 2100 rpm when driving the pump at rated capacity. Pump shall be [automatic start and manual stop][manual pushbutton start and stop][automatic start and automatic stop]. Pump shall conform to the requirements of UL 448. Fire pump discharge and suction gauges shall be oil-filled type.

2.3 REQUIREMENTS FOR FIRE PROTECTION SERVICE

2.3.1 General Requirements

Materials and Equipment shall have been tested by Underwriters Laboratories, Inc. and listed in UL Fire Prot Dir or approved by Factory Mutual and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, such shall mean listed in UL Fire Prot Dir or FM APP GUIDE.

2.3.2 Alarms

Provide audible and visual alarms as required by NFPA 20 on the controller. Provide remote supervision as required by NFPA 20, in accordance with NFPA 72 under Section [_____]. Provide remote alarm devices located [at [_____]][as indicated]. Alarm signal shall be activated upon the following conditions: [electric motor controller has operated into a pump running condition, loss of electrical power to electric motor starter, and phase reversal on line side of motor starter] [engine drive controller has operated into an engine running condition, engine drive controller main switch has been turned to OFF or to MANUAL position, trouble on engine driven controller or engine]. Exterior alarm devices shall be weatherproof type. Provide alarm silencing switch and red signal lamp, with signal lamp arranged to come on when switch is placed in OFF position.

2.4 UNDERGROUND PIPING COMPONENTS

2.4.1 Pipe and Fittings

Provide outside-coated, cement mortar-lined, ductile-iron pipe (with a rated working pressure of [1034][1207][_____] kPa) conforming to NFPA 24 for piping under the building and less than 1.50 m outside of the building walls. Anchor the joints in accordance with NFPA 24; provide concrete thrust block at the elbow where the pipe turns up toward the floor, and restrain the pipe riser with steel rods from the elbow to the flange above the floor. Minimum pipe size shall be 150 mm. Minimum depth of cover shall be as required by NFPA 24, but no less than 1 m. Piping more than 1.50 m outside of the building walls shall be [outside coated, AWWA C104/A21.4cement mortar-lined, AWWA C151/A21.51 ductile-iron pipe, and AWWA C110/A21.10 fittings conforming to NFPA 24][provided under Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING].

2.4.2 Fittings and Gaskets

Fittings shall be ductile iron conforming to AWWA C110/A21.10. Gaskets shall be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile iron pipe joints shall conform to AWWA C111/A21.11.

2.4.3 Valves and Valve Boxes

Valves shall be gate valves conforming to AWWA C500 or UL 262. Valves shall have cast-iron body and bronze trim. Valve shall open by counterclockwise rotation. Except for post indicator valves, all underground valves shall be provided with an adjustable cast-iron or ductile iron valve box of a size suitable for the valve on which the box is to be used, but not less than 133 mm in diameter. The box shall be coated with bituminous coating. A cast-iron or ductile-iron cover with the word "WATER" cast on the cover shall be provided for each box.

2.4.4 Gate Valve and Indicator Posts

Gate valves for underground installation shall be of the inside screw type with counterclockwise rotation to open. Where indicating type valves are shown or required, indicating valves shall be gate valves with an approved indicator post of a length to permit the top of the post to be located 900 mm above finished grade. Gate valves and indicator posts shall be provided with one coat of primer and two coats of red enamel paint and shall be listed in UL Fire Prot Dir or FM APP GUIDE.

2.4.5 Buried Utility Warning and Identification Tape

Detectable aluminum foil plastic-backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping shall be provided for all buried piping. Tape shall be detectable by an electronic detection instrument. Tape shall be provided in rolls, 80 mm minimum width, color-coded for the utility involved and imprinted in bold black letters continuously and repeatedly over the entire tape length. Warning and identification shall be "CAUTION BURIED WATER PIPING BELOW" or similar wording. Code and lettering shall be permanent and unaffected by moisture and other substances contained in the trench backfill material. Tape shall be buried at a depth of 300 mm below the top surface of earth or the top surface of the subgrade under pavement.

2.5 ABOVEGROUND PIPING COMPONENTS

2.5.1 Pipe Sizes 65 mm and Larger

2.5.1.1 Pipe

Piping shall be [ASTM A53/A53M][ASTM A795/A795M],JIS G 3452, Weight Class STD (Standard), Schedule 40 (except for Schedule 30 for pipe sizes 200 mm and greater in diameter), Type E or Type S, Grade A; black steel pipe. Steel pipe shall be joined by means of flanges welded to the pipe or mechanical grooved joints only. Piping shall not be jointed by welding or weld fittings. Suction piping shall be galvanized on the inside in accordance with NFPA 20.

2.5.1.2 Flanges

Flanges shall be ASME B16.5, Class 150 flanges. Flanges shall be provided

at valves, connections to equipment, and where indicated.

2.5.1.3 Gaskets

Gaskets shall be AWWA C111/A21.11, cloth inserted red rubber gaskets.

2.5.1.4 Bolts

Bolts shall be [ASTM A449, Type [1][2]][ASTM A193/A193M, Grade B7]. Bolts shall extend no less than three full threads beyond the nut with bolts tightened to the required torque.

2.5.1.5 Nuts

Nuts shall be [ASTM A194/A194M, Grade 7][ASTM A193/A193M, Grade 5][ASTM A563M, Grade [C3][DH3]].

2.5.1.6 Washers

Washers shall meet the requirements of ASTM F436M. Flat circular washers shall be provided under all bolt heads and nuts.

2.5.2 Grooved Mechanical Joints and Fittings

Joints and fittings shall be designed for not less than 1200 kPa service and shall be the product of the same manufacturer. Fitting and coupling houses shall be malleable iron conforming to ASTM A47/A47M, JIS B 2301, JIS B 2311, Grade 32510; ductile iron conforming to ASTM A536, Grade 65-45-12. Gasket shall be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts shall be heat-treated steel conforming to ASTM A183 and shall be cadmium plated or zinc electroplated.Mechanical tees shall not be permitted.

2.5.3 Piping Sizes 50 mm and Smaller

2.5.3.1 Steel Pipe

Steel piping shall be [ASTM A795/A795MJIS G 3452, Weight Class STD (Standard), Schedule 40, Type E or Type S, Grade A][ASTM A53/A53M, Weight Class XS (Extra Strong)], zinc-coated steel pipe with threaded end connections. Fittings shall be [ASME B16.3][ASME B16.39,JIS B 2301, JIS B 2311], Class 150, zinc-coated threaded fittings. Unions shall be ASME B16.39, Class 150, zinc-coated unions.

2.5.3.2 Copper Tubing

Copper tubing shall be ASTM B88M, Type L or K, soft annealed. Fittings shall be ASME B16.26, flared joint fittings. Pipe nipples shall be ASTM B42 copper pipe with threaded end connections.

2.5.4 Pipe Hangers and Supports

Pipe hangers and support shall be [MSS SP-58][UL listed UL Fire Prot Dir or FM approved FM APP GUIDE] and shall be the adjustable type. Finish of rods, nuts, washers, hangers, and supports shall be zinc-plated after fabrication.

2.5.5 Valves

Valves shall be UL listed UL Fire Prot Dir or FM approved FM APP GUIDE for fire protection service. Valves shall have flange or threaded end connections.

2.5.5.1 Gate Valves and Control Valves

Gate valves and control valves shall be outside screw and yoke (O.S.&Y.) type which open by counterclockwise rotation. Butterfly-type control valves are not permitted.

2.5.5.2 Tamper Switch

The suction control valves, the discharge control valves, valves to test header and flow meter, and the by-pass control valves shall be equipped with valve tamper switches for monitoring by the fire alarm system.

2.5.5.3 Check Valve

Check valve shall be clear open, swing type check valve with flange or threaded inspection plate.

2.5.5.4 Relief Valve

Relief valve shall be [pilot operated][or][spring operated] type conforming to NFPA 20. A means of detecting water motion in the relief lines shall be provided where the discharge is not visible within the pump house.

2.5.5.5 Circulating Relief Valve

An adjustable circulating relief valve shall be provided for each fire pump in accordance with NFPA 20.

2.5.5.6 Suction Pressure Regulating Valve

Suction pressure regulating valve shall be FM approved FM APP GUIDE. Suction pressure shall be monitored through a pressure line to the controlling mechanism of the regulating valve. Valve shall be arranged in accordance with the manufacturer's recommendations.

2.5.6 Hose Valve Manifold Test Header

Construct header of steel pipe. Provide ASME B16.5, Class 150 flanged inlet connection to hose valve manifold assembly. Provide approved bronze hose gate valve with 65 mm National Standard male hose threads with cap and chain; locate one meter above grade in the horizontal position for each test header outlet. Welding shall be metallic arc process in accordance with ASME B31.1.

2.5.7 Pipe Sleeves

A pipe sleeve shall be provided at each location where piping passes entirely through walls, ceilings, roofs, and floors, including pipe entering buildings from the exterior. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, and floors. Provide 25 mm minimum clearance between exterior of piping or pipe insulation, and

interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of the sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, a fire seal shall be provided between the pipe and the sleeve in accordance with Section 07 84 00 FIRESTOPPING.

a. Sleeves in Masonry and Concrete Walls, Ceilings, Roofs, and Floors: Provide hot-dip galvanized steel, ductile-iron, or cast-iron pipe sleeves. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves provided that cavities in the core-drilled hole be completely grouted smooth.

b. Sleeves in Other Than Masonry and Concrete Walls, Ceilings, Roofs, and Floors: Provide galvanized steel sheet pipe not less than 4.4 kg/square m.

2.5.8 Escutcheon Plates

Provide one-piece or split-hinge metal plates for piping entering floors, walls, and ceilings in exposed areas. Provide polished stainless steel or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on plates in unfinished spaces. Plates shall be secured in place.

2.6 DISINFECTING MATERIALS

2.6.1 Liquid Chlorine

Liquid chlorine shall conform to AWWA B301.

2.6.2 Hypochlorites

Calcium hypochlorite and sodium hypochlorite shall conform to AWWA B300.

2.7 ELECTRIC MOTOR DRIVER

Motors, controllers, contactors, and disconnects shall be provided with their respective pieces of equipment, as specified herein and shall have electrical connections provided under Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Controllers and contactors shall have a maximum of 120-volt control circuits, and auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section. Motor shall conform to NEMA MG 1 Design B type. Integral size motors shall be the premium efficiency type in accordance with NEMA MG 1. Motor wattage shall be of sufficient size so that the nameplate wattage rating will not be exceeded throughout the entire published pump characteristic curve. The motor and fire pump controller shall be fully compatible.

2.8 DIESEL ENGINE DRIVER

Diesel engine driver shall conform to the requirements of UL 1247 and shall be UL listed UL Fire Prot Dir or FM approved FM APP GUIDE for fire pump service. Driver shall be of the make recommended by the pump manufacturer. The engine shall be closed circuit, liquid-cooled [with raw water heat exchanger][with radiator and engine-driven fan]. Diesel engine shall be electric start type taking current from 2 battery units. Engine

shall be equipped with a fuel in-line filter-water separator. Engine conditions shall be monitored with engine instrumentation panel that has a tachometer, hour meter, fuel pressure gauge, lubricating oil pressure gauge, water temperature gauge, and ammeter gauge. Engine shall be connected to horizontal-shaft pump by flexible couplings. For connections to vertical-shaft fire pumps, right-angle gear drives and universal joints shall be used. An engine jacket water heater shall be provided to maintain a temperature of 49 degrees C in accordance with NFPA 20.

2.8.1 Engine Capacity

Engine shall have adequate wattage to drive the pump at all conditions of speed and load over the full range of the pump performance curve. The wattage rating of the engine driver shall be as recommended by the pump manufacturer and shall be derated for temperature and elevation in accordance with NFPA 20. Ambient temperature at the pump location shall be [_____] degrees C. Site elevation shall be [_____] meters above mean sea level (MSL).

2.8.2 Exhaust System External to Engine

Exhaust system shall comply with the requirements of NFPA 20 and NFPA 37. An exhaust muffler shall be provided for each diesel engine driver to reduce noise levels less than [85][95] dBA. A flexible connector with flange connections shall be provided at the engine. Flexible sections shall be stainless steel suitable for diesel-engines exhaust gas at 538 degrees C.

2.8.2.1 Steel Pipe and Fittings

ASTM A53/A53M, [Schedule 40][Weight Class XS (Extra Strong], black steel, welding end connections. ASME B16.9 or ASME B16.11 welding fittings shall be of the same material and weight as the piping.

2.8.2.2 Flanges

ASME B16.5, Class [300][150]. Flanges shall be provided at connections to diesel engines, exhaust mufflers, and flexible connections. Gaskets shall be ASME B16.21, composition ring, 1.5875 mm. ASTM A193/A193M, Grade [B8][B7] bolts and ASTM A194/A194M, Grade [8][7] nuts shall be provided.

2.8.2.3 Piping Insulation

Comply with EPA requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING. Products containing asbestos will not be permitted. Exhaust piping system including the muffler shall be insulated with ASTM C533 calcium silicate insulation, minimum of 75 mm. Insulation shall be secured with not less than 9.525 mm width fibrous glass reinforced waterproof tape or Type 304 stainless steel bands spaced not more than 200 mm on center. An aluminum jacket encasing the insulation shall be provided. The aluminum jacket shall have a minimum thickness of 0.406 mm, a factory-applied polyethylene and kraft paper moisture barrier on the inside surface. The jacket shall be secured with not less than 13 mm wide stainless steel bands, spaced not less than 200 mm on centers. Longitudinal and circumferential seams of the jacket shall be lapped not less than 75 mm. Jackets on horizontal line shall be installed so that the longitudinal seams are on the bottom side of the pipe. The seams of the jacket for the vertical lines shall be placed on the off-weather side of the pipe. On vertical lines, the circumferential seams of the jacket

shall overlap so the lower edge of each jacket overlaps the upper edge of the jacket below.

2.9 FIRE PUMP CONTROLLER

Controller shall be the automatic type and UL listed UL Fire Prot Dir or FM approved FM APP GUIDE for fire pump service. Pump shall be arranged for automatic start and stop, and manual push-button stop. Automatic stopping shall be accomplished only after all starting causes have returned to normal and after a minimum pump run time has elapsed. Controllers shall be completely terminally wired, ready for field connections, and mounted in a [NEMA Type 2 drip-proof][NEMA Type 4 watertight and dust tight] enclosure arranged so that controller current carrying parts will not be less than 300 mm above the floor. Controller shall be provided with voltage surge arresters installed in accordance with NFPA 20. Controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments, automatic starting relay actuated from normally closed contacts, visual alarm lamps and supervisory power light. Controller shall be equipped with a thermostat switch with adjustable setting to monitor the pump room temperature and to provide an alarm when temperatures falls below 5 degrees C [Controller shall be equipped with a sequential start timer/relay feature to start multiple fire pumps in sequence.][The controller shall be factory-equipped with a heater operated by thermostat to prevent moisture in the cabinet.]

2.9.1 Controller for Electric Motor Driven Fire Pump

Controller shall be [electronic soft start][across the line][auto-transformer][wye-delta, open circuit transition][wye-delta, closed circuit transition] starting type. Controller shall be designed [for [_____] kW at [_____] volts][as indicated]. Controller[and transfer switch] shall have a short circuit rating [of [_____] amps r.m.s. symmetrical at [_____] volts a.c.][as indicated].[An automatic transfer switch (ATS) shall be provided for each fire pump. The ATS shall comply with NFPA 20 and shall be specifically listed for fire pump service. The ATS shall transfer source of power to the alternate source upon loss of normal power.] Controller shall monitor pump running, loss of a phase or line power, phase reversal[, low reservoir] and pump room temperature. Alarms shall be individually displayed in front of panel by lighting of visual lamps. Each lamp shall be labeled with rigid etched plastic labels. Controller shall be equipped with terminals for remote monitoring of pump running, pump power supply trouble (loss of power or phase and phase reversal), and pump room trouble (pump room temperature [and low reservoir level]), and for remote start. Limited service fire pump controllers are not permitted, except for fire pumps driven by electric motors rated less than 11 kW. Controller shall be equipped with a 7-day electric pressure recorder with 24-hour spring wound back-up. The pressure recorder shall provide a readout of the system pressure from 0 to 207 Pa, time, and date. Controller shall require the pumps to run for ten minutes for pumps with driver motors under 149 kW and for 15 minutes for pumps with motors 149 kW and greater, prior to automatic shutdown. The controller shall be equipped with an externally operable isolating switch which manually operates the motor circuit. Means shall be provided in the controller for measuring current for all motor circuit conductors.

2.9.2 Controller for Diesel Engine Driven Fire Pump

Controller shall require the pump to run for 30 minutes prior to automatic

shutdown. Controller shall be equipped with two battery chargers; two ammeters; two voltmeters, one for each set of batteries. Controller shall automatically alternate the battery sets for starting the pumps. Controller shall be equipped with the following supervisory alarm functions:

a. Engine Trouble (individually monitored)

(1) Engine overspeed

(2) Low Oil Pressure

(3) High Water Temperature

(4) Engine Failure to Start

(5) Battery

(6) Battery Charger/AC Power Failure

b. Main Switch Mis-set

c. Pump Running

d. Pump Room Trouble (individually monitored)

(1) Low Fuel

(2) Low Pump Room Temperature

(3) Low Reservoir Level

Alarms shall be individually displayed in front of panel by lighting of visual lamps, except that individual lamps are not required for pump running and main switch mis-set. Controller shall be equipped with a 7-day electric pressure recorder with 24-hour back-up mounted inside the controller. The pressure recorder shall provide a readout of the system pressure from 0 to 207 Pa, time, and date. The controller shall be equipped with an audible alarm which will activate upon any engine trouble or pump room trouble alarm condition and alarm silence switch. Controller shall be equipped with terminals for field connection of a remote alarm for main switch mis-set, pump running, engine trouble and pump room trouble; and terminals for remote start. When engine emergency overspeed device operates, the controller shall cause the engine to shut down without time delay and lock out until manually reset.

2.10 BATTERIES

Batteries for diesel engine driver shall be sealed lead calcium batteries. Batteries shall be mounted in a steel rack with non-corrosive, non-conductive base, not less than 300 mm above the floor.

2.11 PRESSURE SENSING LINE

A completely separate pressure sensing line shall be provided for each fire pump and for the jockey pump. The sensing line shall be arranged in accordance with Figure A-7-5.2.1. of NFPA 20. The sensing line shall be 13 mmH58 brass tubing complying with ASTM B135M. The sensing line shall be equipped with two restrictive orifice unions each. Restricted orifice

unions shall be ground-face unions with brass restricted diaphragms drilled for a 2.4 mm. Restricted orifice unions shall be mounted in the horizontal position, not less than 1.5 m apart on the sensing line. Two test connections shall be provided for each sensing line. Test connections shall consist of two brass 13 mm globe valves and 8 mm gauge connection tee arranged in accordance with NFPA 20. One of the test connections shall be equipped with a 0 to 2100 kPa water oil-filled gauge. Sensing line shall be connected to the pump discharge piping between the discharge piping control valve and the check valve.

2.12 PRESSURE MAINTENANCE PUMP

2.12.1 General

Pressure maintenance pump shall be electric motor driven,[horizontal shaft][or][in-line vertical shaft,] centrifugal type with a rated discharge of [0.63][_____] L/second at [862][_____] kPa. Pump shall draft [from the suction supply side of the suction pipe gate valve of the fire pump][as indicated] and shall discharge into the system at the downstream side of the pump discharge gate valve. An approved indicating gate valve of the outside screw and yoke (O.S.&Y.) type shall be provided in the maintenance pump discharge and suction piping. Oil-filled water pressure gauge and approved check valve in the maintenance pump discharge piping shall be provided. Check valve shall be swing type with removable inspection plate.

2.12.2 Pressure Maintenance Pump Controller

Pressure maintenance pump controller shall be arranged for automatic and manual starting and stopping and equipped with a "manual-off-automatic" switch. The controller shall be completely prewired, ready for field connections, and wall-mounted in a NEMA Type 2 drip-proof enclosure. The controller shall be equipped with a bourdon tube pressure switch or a solid state pressure switch with independent high and low adjustments for automatic starting and stopping. A sensing line shall be provided connected to the pressure maintenance pump discharge piping between the control valve and the check valve. The sensing line shall conform to paragraph, PRESSURE SENSING LINE. The sensing line shall be completely separate from the fire pump sensing lines. An adjustable run timer shall be provided to prevent frequent starting and stopping of the pump motor. The run timer shall be set for [2][_____] minutes.

2.13 DIESEL FUEL SYSTEM EXTERNAL TO ENGINE

Fuel system shall be provided that meets all requirements of NFPA 20 and NFPA 37. The fuel tank vent piping shall be equipped with screened weatherproof vent cap. Vents shall be extended to the outside. Each tank shall be equipped with a fuel level gauge. Flexible bronze or stainless steel piping connectors with single braid shall be provided at each piping connection to the diesel engine. Supply, return, and fill piping shall be steel piping, except supply and return piping may be copper tubing. Fuel lines shall be protected against mechanical damage. Fill line shall be equipped with 16 mesh removable wire screen. Fill lines shall be extended to the exterior. A weatherproof tank gauge shall be mounted on the exterior wall near each fill line for each tank. The fill cap shall be able to be locked by padlock. The engine supply (suction) connection shall be located on the side of the fuel tank so that 5 percent of the tank volume provides a sump volume not useable by the engine. The elevation of the fuel tank shall be such that the inlet of the fuel supply line is located so that its opening is no lower than the level of the

engine fuel transfer pump. The bottom of the tank shall be pitched 21 mm/m to the side opposite the suction inlet connection, and to an accessible 25 mmplugged globe drain valve.

2.13.1 Fuel Piping

As specified in NFPA 20.

2.13.2 Diesel Fuel Tanks

UL 80 or UL 142 for aboveground tanks.

2.13.3 Valves

Provide an indicating and lockable ball valve in the supply line adjacent to the tank suction inlet connection. Provide a check valve in fuel return line. Valves mustl be suitable for oil service. Valves must have union end connections or threaded end connections.

2.13.3.1 Globe Valve

MSS SP-80 Class 125

2.13.3.2 Check Valve

MSS SP-80, Class 125, swing check

2.13.3.3 Ball Valve

Full port design, copper alloy body, 2-position lever handle

2.14 JOINTS AND FITTINGS FOR COPPER TUBE

Wrought copper and bronze solder-joint pressure fittings shall conform to ASME B16.22 and ASTM B75/B75M. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B62. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment. Extracted brazed tee joints produced with an acceptable tool and installed as recommended by the manufacturer may be used. Grooved mechanical joints and fittings shall be designed for not less than 862 kPa service and shall be the product of the same manufacturer. Grooved fitting and mechanical coupling housing shall be ductile iron conforming to ASTM A536. Gaskets for use in grooved joints shall be molded synthetic polymer of pressure responsive design and shall conform to ASTM D2000 for circulating medium up to 110 degrees C. Grooved joints shall conform to AWWA C606 Coupling nuts and bolts for use in grooved joints shall be steel and shall conform to ASTM A183.

2.15 PUMP BASE PLATE AND PAD

Provide a common base plate for each horizontal-shaft fire pump for mounting pump and driver unit. Construct the base plate of cast iron with raised lip tapped for drainage or welded steel shapes with suitable drainage. Provide each base plate for the horizontal fire pumps with a 25 mmgalvanized steel drain line piped to the nearest floor drain. For vertical shaft pumps, pump head shall be provided with a cast-iron base plate and shall serve as the sole plate for mounting the discharge head

assembly. Mount pump units and bases on a raised [100][150] mmreinforced concrete pad that is an integral part of the reinforced concrete floor.

2.16 HOSE VALVE MANIFOLD TEST HEADER

Hose valve test header shall be connected by ASME B16.5, Class 150 flange inlet connection. Hose valves shall be UL listed UL Fire Prot Dir or FM approved FM APP GUIDE bronze hose gate valves with 65 mm American National Fire Hose Connection Screw Standard Threads (NH) in accordance with NFPA 1963. The number of valves shall be in accordance with NFPA 20. Each hose valve shall be equipped with a cap and chain, and located no more than 900 mm and no less than 600 mm above grade.

2.17 FLOW METER

Meter shall be UL listed UL Fire Prot Dir or FM approved FM APP GUIDE as flow meters for fire pump installation with direct flow readout device. Flow meter shall be capable of metering any waterflow quantities between 50 percent and 150 percent of the rated flow of the pumps. Arrange piping to permit flow meter to discharge to pump suction and to discharge through test header. The meter throttle valve and the meter control valves shall be O.S.&Y. valves. Provide automatic air release if flow meter piping between pump discharge and pump suction forms an inverted "U". Meter shall be of the [venturi][annular probe][orifice plate][_____] type.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSPECTION BY FIRE PROTECTION SPECIALIST

The Fire Protection Specialist and QFPEshall periodically perform a thorough inspection of the fire pump installation, including visual observation of the pump while running, to assure that the installation conforms to the contract requirements. There shall be no excessive vibration, leaks (oil or water), unusual noises, overheating, or other potential problems. Inspection shall include piping and equipment clearance, access, supports, and guards. Any discrepancy shall be brought to the attention of the Contracting Officer in writing, no later than three working days after the discrepancy is discovered. The Fire Protection Specialist and QFPE shall witness the preliminary and final acceptance tests and, after completion of the inspections and a successful final acceptance test, shall sign test results and certify in writing that the installation the fire pump installation is in accordance with the contract requirements.

3.3 INSTALLATION

Equipment, materials, workmanship, fabrication, assembly, erection, installation, examination, inspection and testing shall be in accordance NFPA 20, except as modified herein. In addition, the fire pump and engine shall be installed in accordance with the written instructions of the manufacturer.

3.3.1 Installation Drawings

Submit Fire Pump Installation Drawings consisting of a detailed plan view, detailed elevations and sections of the pump room, equipment and piping, drawn to a scale of not less than 1:20. Drawings shall indicate equipment, piping, and associated pump equipment to scale. Indicate all clearance, such as those between piping and equipment; between equipment and walls, ceiling and floors; and for electrical working distance clearance around all electrical equipment. Include a legend identifying all symbols, nomenclatures, and abbreviations. Indicate a complete piping and equipment layout including elevations and/or section views of the following:

a. Fire pumps, controllers, piping, valves, and associated equipment.

b. Sensing line for each pump including the pressure maintenance pump.

c. Engine fuel system for diesel driven pumps.

d. Engine cooling system for diesel driven pumps.

e. Pipe hangers and sway bracing including support for diesel muffler and exhaust piping.

f. Restraint of underground water main at [entry-point][entry-and exit-points] to the building including details of pipe clamps, tie rods, mechanical retainer glands, and thrust blocks.

g. A one-line schematic diagram indicating layout and sizes of all piping, devices, valves and fittings.

h. A complete point-to-point connection drawing of the pump power, control and alarm systems, as well as interior wiring schematics of each controller.

3.3.2 Pump Room Configuration

Provide detail plan view of the pump room including elevations and sections showing the fire pumps, associated equipment, and piping. Submit working drawings on sheets not smaller than A1 594 by 841 mm; include data for the proper installation of each system. Show piping schematic of pumps, devices, valves, pipe, and fittings. [Provide an isometric drawing of the fire pump and all associated piping]. Show point to point electrical wiring diagrams. Show piping layout and sensing piping arrangement. Show engine fuel and cooling system. Include:

a. Pumps, drivers, and controllers

b. Hose valve manifold test header

c. Circuit diagrams for pumps

d. Wiring diagrams of each controller

3.3.3 Accessories

Tank supports, piping offsets, fittings, and any other accessories required shall be furnished as specified to provide a complete installation and to eliminate interference with other construction.

3.4 PIPE AND FITTINGS

Piping shall be inspected, tested and approved before burying, covering, or concealing. Fittings shall be provided for changes in direction of piping and for all connections. Changes in piping sizes shall be made using tapered reducing pipe fittings. Bushings shall not be used.[Photograph all piping prior to burying, covering, or concealing.]

3.4.1 Cleaning of Piping

Interior and ends of piping shall be clean and free of any water or foreign material. Piping shall be kept clean during installation by means of plugs or other approved methods. When work is not in progress, open ends of the piping shall be securely closed so that no water or foreign matter will enter the pipes or fittings. Piping shall be inspected before placing in position.

3.4.2 Threaded Connections

Jointing compound for pipe threads shall be [polytetrafluoroethylene (PTFE) pipe thread tape conforming to ASTM D3308][Teflon pipe thread paste] and shall be applied to male threads only. Exposed ferrous pipe threads shall be provided with one coat of zinc molybdate primer applied to a minimum of dry film thickness of 0.025 mm.

3.4.3 Pipe Hangers and Supports

Additional hangers and supports shall be provided for concentrated loads in aboveground piping, such as for valves and risers.

3.4.3.1 Vertical Piping

Piping shall be supported at each floor, at not more than 3 meters intervals.

3.4.3.2 Horizontal Piping

Horizontal piping supports shall be spaced as follows:

MAXIMUM SPACING (METERS)										
Nominal Pipe Size (mm)	25 and Under	32	40	50	65	80	90	100	125	150+
Copper Tube	1.8	2	2.4							
Steel Pipe	2	2.4	2.7	3	3.3	3.6	3.9	4.2	4.8	5.0

3.4.4 Underground Piping

Installation of underground piping and fittings shall conform to NFPA 24. Joints shall be anchored in accordance with NFPA 24. Concrete thrust block shall be provided at elbow where pipe turns up towards floor, and the pipe riser shall be restrained with steel rods from the elbow to the flange above the floor. After installation in accordance with NFPA 24, rods and nuts shall be thoroughly cleaned and coated with asphalt or other corrosion-retard material approved by the Contracting Officer. Minimum depth of cover shall be 900 mm.

3.4.5 Grooved Mechanical Joint

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.5 ELECTRICAL WORK

Electric motor and controls shall be in accordance with NFPA 20, NFPA 72 and NFPA 70, unless more stringent requirements are specified herein or are indicated on the drawings. Electrical wiring and associated equipment shall be provided in accordance with NFPA 20 and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide wiring in rigid metal conduit or intermediate metal conduit, except electrical metallic tubing conduit may be provided in dry locations not enclosed in concrete or where not subject to mechanical damage.

3.6 PIPE COLOR CODE MARKING

Color code marking of piping as specified in Section 09 90 00 PAINTS AND COATINGS.

3.7 FLUSHING

The fire pump suction and discharge piping shall be flushed at [120][150] percent of rated capacity of each pump. Where the pump installation consists of more than one pump, the flushing shall be the total quantity of water flowing when all pumps are discharging at [120][150] percent of their rated capacities. The new pumps may be used to attain the required flushing volume. No underground piping shall be flushed by using the fire pumps. Flushing operations shall continue until water is clear, but not less than 10 minutes. Submit a signed and dated flushing certificate before requesting field testing.

3.8 FIELD TESTS

Submit system diagrams that show the layout of equipment, piping, and storage units, and typed condensed sequence of operation, wiring and control diagrams, and operation manuals explaining preventative

maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system shall be framed under glass or laminated plastic. After approval, these items shall be posted where directed.

3.8.1 Hydrostatic Test

Piping shall be hydrostatically tested at 1551 kPafor a period of 2-hours, or at least 345 kPain excess of the maximum pressure, when the maximum pressure in the system is in excess of [1207][1379] kPa in accordance with NFPA 20.

3.8.2 Preliminary Tests

Submit proposed procedures for Preliminary Tests prior to the proposed date and time to begin Preliminary Tests. The Fire Protection Specialist and QFPE shall take all readings and measurements. The Manufacturer's Representative, a representative of the fire pump controller manufacturer, and a representative of the diesel engine manufacturer (when supplied) shall witness the complete operational testing of the fire pump and drivers. The fire pump controller manufacturer's representative and the diesel engine manufacturer's representative shall each be an experienced technician employed by the respective manufacturers and capable of demonstrating operation of all features of respective components including trouble alarms and operating features. Fire pumps, drivers and equipment shall be thoroughly inspected and tested to insure that the system is correct, complete, and ready for operation. Tests shall ensure that pumps are operating at rated capacity, pressure and speed. Tests shall include manual starting and running to ensure proper operation and to detect leakage or other abnormal conditions, flow testing, automatic start testing, testing of automatic settings, sequence of operation check, test of required accessories; test of pump alarms devices and supervisory signals, test of pump cooling, operational test of relief valves, and test of automatic power transfer, if provided. Pumps shall run without abnormal noise, vibration or heating. If any component or system was found to be defective, inoperative, or not in compliance with the contract requirements during the tests and inspection, the corrections shall be made and the entire preliminary test shall be repeated. Submit Preliminary Tests Reports, to include both the Contractor's Material and Test Certificate for Underground Piping and the Contractor's Material and Test Certificate for Aboveground Piping. All items in the Report shall be signed by the Fire Protection Specialist and the Manufacturer's Representative.

3.8.3 Final Acceptance Test

The Fire Protection Specialist and QFPE shall take all readings and measurements. The Manufacturer's Representative, the fire pump controller manufacturer's representative, and the diesel engine manufacturer's representative (when supplied) shall also witness for the final tests. Repair any damage caused by hose streams or other aspects of the test. Submit proposed date and time to begin Final Acceptance Test, with the Acceptance Procedures. Notification shall be provided at least [14] [_____] days prior to the proposed start of the test. Submit [3] [_____] copies of the completed Final Acceptance Test Reports, no later that [7] [_____] days after the completion of the tests. All items in the reports shall be signed by the Fire Protection Specialist, QFPE and the Manufacturer's Representative. Test reports in booklet form (each copy furnished in a properly labeled three ring binder) showing all field tests

and measurements taken during the preliminary and final testing, and documentation that proves compliance with the specified performance criteria, upon completion of the installation and final testing of the installed system. Each test report shall indicate the final position of the controls and pressure switches. The test reports shall include the description of the hydrostatic test conducted on the piping and flushing of the suction and discharge piping. A copy of the manufacturer's certified pump curve for each fire pump shall be included in the report. Notification shall include a copy of the Contractor's Material & Test Certificates. Include the following in the final acceptance test:

3.8.3.1 Flow Tests

Flow tests using the test header, hoses and playpipe nozzles shall be conducted. Flow tests shall be performed at churn (no flow), 75, 100, 125 and 150 percent capacity for each pump and at full capacity of the pump installation. Flow readings shall be taken from each nozzle by means of a calibrated pitot tube with gauge or other approved measuring equipment. Rpm, suction pressure and discharge pressure reading shall be taken as part of each flow test. Voltage and ampere readings shall taken on each phase as part of each flow test for electric-motor driven pumps.

3.8.3.2 Starting Tests

Pumps shall be tested for automatic starting and sequential starting. Setting of the pressure switches shall be tested when pumps are operated by pressure drop. Tests may be performed by operating the test connection on the pressure sensing lines. As a minimum, each pump shall be started automatically 10 times and manually 10 times, in accordance with NFPA 20. Tests of engine-driven pumps shall be divided equally between both set of batteries. The fire pumps shall be operated for a period of a least 10 minutes for each of the starts; except that electric motors over 149 kW shall be operated for at least 15 minutes and shall not be started more than 2 times in 10 hours. Pressure settings that include automatic starting and stopping of the fire pump(s) shall be indicated on an etched plastic placard, attached to the corresponding pump controller.

3.8.3.3 Battery Changeover

Diesel driven fire pumps shall be tested for automatic battery changeover in event of failure of initial battery units.

3.8.3.4 Alarms

All pump alarms, both local and remote, shall be tested. Supervisory alarms for diesel drivers shall be electrically tested for low oil pressure, high engine jacket coolant temperature, shutdown from overspeed, battery failure and battery charger failure.

3.8.3.5 Miscellaneous

Valve tamper switches shall be tested. Pressure recorder operation relief valve settings, valve operations, operation and accuracy of meters and gauges, and other accessory devices shall be verified.

3.8.3.6 Alternate Power Source

On installations with an alternate source of power and an automatic transfer switch, loss of primary power shall be simulated and transfer

shall occur while the pump is operating at peak load. Transfer from normal to emergency source and retransfer from emergency to normal source shall not cause opening of overcurrent devices in either line. At least half of the manual and automatic starting operations listed shall be performed with the fire pump connected to the alternate source.

3.8.3.7 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, perform corrective actions and repeat the tests. Tests shall be conducted and repeated if necessary until the system has been demonstrated to comply with all contract requirements.

3.8.3.8 Test Documentation

The Manufacturer's Representative shall supply a copy of the manufacturer's certified curve for each fire pump at the time of the test. The Fire Protection Specialist shall record all test results and plot curve of each pump performance during the test. Complete pump acceptance test data of each fire pump shall be recorded. The pump acceptance test data shall be on forms that give the detail pump information such as that which is indicated in Figure A-11-2.6.3(f) of NFPA 20. All test data records shall be submitted in a three ring binder.

3.8.4 Test Equipment

Provide all equipment and instruments necessary to conduct a complete final test, including 65 mm diameter hoses, playpipe nozzles, pitot tube gauges, portable digital tachometer, voltage and ampere meters, and calibrated oil-filled water pressure gauges. Provide all necessary supports to safely secure hoses and nozzles during the test. The [Government will][Contractor shall] furnish water for the tests.

3.9 DISINFECTION

After all system components are installed including pumps, piping, and other associated work, and all hydrostatic tests are successfully completed, thoroughly flush the pumps and all piping to be disinfected with potable water until there is no visible sign of dirt or other residue. and hydrostatic test are successfully completed, each portion of the piping specified in this Section system to be disinfected shall be thoroughly flushed with potable water until all entrained dirt and other foreign materials have been removed before introducing chlorinating material.

3.9.1 Chlorination

The chlorinating material shall be hypochlorites or liquid chlorine. The chlorinating material shall be fed into the sprinkler piping at a constant rate of 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or liquid chlorine injected into the system through a solution-fed chlorinator and booster pump shall be used. Chlorination application shall continue until the entire system if filled. The water shall remain in the system for a minimum of 24 hours. Each valve in the system shall be opened and closed several times to ensure its proper disinfection. Following the 24-hour period, no less than 25 ppm chlorine residual shall remain in the system.

3.9.2 Flushing

The system shall then be flushed with clean water until the residual chlorine is reduced to less than one part per million. Samples of water in disinfected containers for bacterial examination will be taken from several system locations which are approved by the Contracting Officer.

3.9.3 Sample Testing

Samples shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA 10084. The testing method shall be either the multiple-tube fermentation technique or the membrane-filter technique. The disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.10 SYSTEM STARTUP

Fully enclose or properly guard coupling, rotating parts, gears, projecting equipment, etc. so as to prevent possible injury to persons that come in close proximity of the equipment. Conduct testing of the fire pumps in a safe manner and ensure that all equipment is safely secured. Hoses and nozzles used to conduct flow tests shall be in excellent condition and shall be safely anchored and secured to prevent any misdirection of the hose streams.

Post operating instructions for pumps, drivers, controllers, and flow meters.

3.11 CLOSEOUT ACTIVITIES

3.11.1 Field Training

The Fire Protection Specialist and the Manufacturer's Representative shall conduct a training course for operating and maintenance personnel as designated by the Contracting Officer. Submit the proposed schedule for field training at least 14 days prior to the start of related training. Training shall be provided for a period of [2] [8] hours of normal working time and shall start after the fire pump installation is functionally complete and after the Final Acceptance Test. The field instruction shall cover all of the items contained in the approved Operating and Maintenance Instructions. Submit manuals listing step-by-step procedures required for system startup, operation, shutdown, and routine maintenance. The manuals shall include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Data Package 3 shall be submitted for fire pumps and drivers in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. [Each service organization submitted shall be capable of providing [4] [_____] hour onsite response to a service call on an emergency basis.]

3.11.2 As-Built Drawings

Submit As-Built Drawings, no later than [14][_____] days after completion of the Final Tests. Update he Fire Pump Installation Drawings to reflect

as-built conditions after all related work is completed and shall be on reproducible full-size mylar film.

3.12 PROTECTION

Carefully remove materials so as not to damage material which is to remain. Replace existing work damaged by the Contractor's operations with new work of the same construction.

-- End of Section --

SECTION 22 00 00

PLUMBING, GENERAL PURPOSE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(2013; R 2018) Pipe Threads, General Purpose (Inch)
ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.15	(2018) Cast Copper Alloy Threaded Fittings Classes 125 and 250
ASME B16.18	(2021) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22	(2021) Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
ASME B16.24	(2022) Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves Classes 150, 300, 600, 900, 1500, and 2500
ASME B16.39	(2020) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300

ASTM INTERNATIONAL (ASTM)

ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
ASTM A733	(2016) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B42	(2020) Standard Specification for Seamless Copper Pipe, Standard Sizes

ASTM B43	(2020) Standard Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B88	(2020) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2020) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM B584	(2014; R 2022) Standard Specification for Copper Alloy Sand Castings for General Applications
ASTM B828	(2016) Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM D1785	(2015; E 2018) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	(2015) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	(2017) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2672	(2014) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D3035	(2015) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D2239	(2012) Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D3261	(2016) Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D2683	(2020) Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D2737	(2012a) Polyethylene (PE) Plastic Tubing

ASTM D2846/D2846M	(2019) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM F441/F441M	(2020) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F442/F442M	(2020) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F437	(2021) Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F438	(2017) Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F439	(2019) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F877	(2020) Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
ASTM F2389	(2021) Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

PL 93-523	(1974; A 1999) Safe Drinking Water Act

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 COMM	(2017) Standard and Commentary Accessible and Usable Buildings and Facilities

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2018) Standard for the Installation of Air Conditioning and Ventilating Systems

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA Fire Man	(2016) Firestopping: Plastic Pipe in Fire Resistive Construction

JAPAN WATER WORKS ASSOCIATION (JWWA)

JWWA K 115	(2018) Tar Epoxy Resin Paint of Water Works and Painting Method

JWWA K 120	(2008) Water Works Sodium Hypochlorite
JWWA S 101	(2019) Polyethylene Pipe Fitting for Water Distribution

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 4420	(2018) Components for Kitchen Equipments
JIS A 4421	(1991) Drain With Traps for Equipment Units
JIS A 5207	(2014) Sanitary Wares
JIS A 5532	(2011) Bathtubs
JIS A 5758	(2016) Sealants for Sealing and Glazing in Buildings
JIS A 6005	(2005) Asphalt Roofing Felts
JIS B 0203	(1999) Taper Pipe Threads
JIS B 2003	(2013) General Rules for Inspection of Valves
JIS B 2004	(1994) General Rules for Marking on Valves
JIS B 2011	(2013) Bronze, Gate, Globe, Angle, and Check Valves (Amendment 2)
JIS B 2031	(2015) Gray Cast Iron Valves (Amendment 1)
JIS B 2061	(2017) Faucets, Ball Taps and Flush Valves
JIS B 2071	(2000) Steel Valves
JIS B 2220	(2012) Steel Pipe Flanges
JIS B 2240	(2006) Copper Alloy Pipe Flanges
JIS B 2301	(2013) Screwed Type Malleable Cast Iron Pipe Fittings
JIS B 2302	(2013) Screwed Type Steel Pipe Fittings
JIS B 2308	(2013) Stainless Steel Threaded Fittings
JIS B 2309	(2009) Butt-Welding Pipe Fittings for Light Gauge Stainless Steel Tubes for Ordinary Use
JIS B 2404	(2018) Dimensions of Gaskets for Use with Pipe Flanges
JIS B 7414	(2018) Glass Thermometers
JIS B 7505-1	(2017) Aneroid Pressure Gauges-Part 1: Bourdon Tube Pressure Gauges

JIS B 8225	(2012) Safety Valves-Measuring Methods for Coefficient of Discharge
JIS B 8285	(2010) Welding Procedure Qualification Test for Pressure Vessels
JIS B 8372-1	(2003) Pneumatic Fluid Power-Compressed Air Pressure Regulators and Filter-Regulators-Part 1: Main Characteristics to be Included in Literature from Suppliers and Product-Making Requirements
JIS B 8410	(2015) Pressure Reducing Valves for Water Works
JIS B 8414	(2011) Relief Valves for Hot Water Appliances (Amendment 3)
JIS B 8570-1	(2013) Meters for Cold Water and Hot Water - Part 1: General Specifications
JIS C 4212	(2010) Low-Voltage Three-Phase Squirrel-Cage High-Efficiency Induction Motors (Amendment 1)
JIS C 9219-1	(2005) Electric Storage Tank Water Heaters
JIS C 9335-2-35	(2019) Household and Similar Electrical Appliances-Safety-Part 2-35: Particular Requirements for Instantaneous Water Heaters
JIS C 9618	(1992) Drinking-Water Coolers
JIS G 3103	(2012) Carbon Steel and Molybdenum Alloy Steel Plates for Boilers and Pressure Vessels
JIS G 3118	(2017) Carbon Steel Plates for Pressure Vessels for Intermediate and Moderate Temperature Services
JIS G 3201	(2008) Carbon Steel Forgings for General Use (Amendment 1)
JIS G 3452	(2016) Carbon Steel Pipes for Ordinary Piping (Amendment 1)
JIS G 4051	(2018) Carbon Steels for Machine Structural Use (Amendment 1)
JIS G 4107	(2015) Alloy Steel Bolting Materials for High Temperature Service (Amendment 1)
JIS G 4303	(2012) Stainless Steel Bars
JIS G 5502	(2007) Spheroidal Graphite Iron Castings

JIS G 5526	(2014) Ductile Iron Pipes
JIS G 5705	(2018) Malleable Iron Castings
JIS H 3100	(2018) Copper and Copper Alloy Sheets, Plates and Strips
JIS H 3250	(2015) Copper and Copper Alloy Rods and Bars
JIS H 3300	(2018) Copper and Copper Alloy Seamless Pipes and Tubes
JIS H 3401	(2001) Pipe Fittings of Copper and Copper Alloys
JIS H 5120	(2016) Copper and Copper Alloy Castings
JIS K 5981	(2006) Thermoplastic and Thermosetting Powder Coated Films
JIS K 6353	(2011) Rubber Goods for Water Works
JIS K 6739	(2016) Unplasticized Poly (Vinyl Chloride) (PVC-U) Pipe Fittings for Drain
JIS K 6741	(2016) Unplasticized Poly (Vinyl Chloride) (PVC-U) Pipes
JIS K 6742	(2016) Unplasticized poly (vinyl chloride) (PVC-U) pipes for water supply
JIS K 6743	(2016) Unplasticized Poly (Vinyl Chloride) (PVC-U) Pipe Fittings for Water Supply
JIS K 7013	(2009)Fibre Reinforced Plastic Pipes (Amendment 1)
JIS K 7014	(1997) Fittings and Joints for Fibre Reinforced Plastic Pipes
JIS K 7128-3	(1998) Plastics-Film and Sheeting-Determination of Tear Resistance-Part 3 : Right Angled Tear Method
JIS K 7129-7	(2019) Plastics-Film and Sheeting-Determination of Water Vapour Transmission Rate- Part 7: Calcium Corrosion Method
JIS K 7139	(2009) Plastics-Test Specimens
JIS K 7350-3	(2008) Plastics Methods of Exposure to Laboratory Light Sources Part 3 : Fluorescent UV Lamps
JIS R 3644	(1998) Glass Tubes
JIS S 2109	(2019) Gas Burning Water Heaters for

	Domestic Use
JIS S 2116	(2013) Water Heaters Containing Water Under Atmospheric Pressure
JIS S 2120	(2019) Gas Valves
JIS S 2135	(2013) Quick Coupling Unit for Gas Appliances
JIS S 3021	(2017) Oil Burning Water Boilers
JIS S 3024	(2017) Oil Burning Water Heaters for Domestic Use
JIS S 3030	(2009) General Rules for Construction of Oil Burning Appliances
JIS S 3200-3	(1997) Equipment for Water Supply Service-Test Method of Water Hammer
JIS S 3200-5	(1997) Equipment for Water Supply Service-Test Methods of Destruction by Vacuum Pressure
JIS S 3200-7	(2010) Equipment for Water Supply Service-Test Methods of Effect to Water Quality (Amendment 2)
JIS S 3201	(2017) Testing Methods for Household Water Purifiers
JIS Z 0208	(1976) Testing Methods for Determination of the Water Vapour Transmission Rate of Moisture-Proof Packaging Materials (Dish Method)
JIS Z 2371	(2015) Methods of Salt Spray Testing
JIS Z 3284-1	(2014) Solder Paste-Part 1: Kinds and Quality Classification
JIS Z 3313	(2009) Flux Cored Wires for Gas Shielded and Self-Shielded Metal Arc Welding of Mild Steel, High Strength Steel and Low Temperature Service Steel
JIS Z 3621	(2014) Recommended Practice for Brazing
JIS Z 3801	(2018) Standard Qualification Test and Acceptance Requirements for Manual Welding Technique
JIS Z 9102	(1987) Identification Marking for Piping Systems

JAPAN VALVE MANUFACTURERS ASSOCIATION

JV-5	(2008) Pipe end Anticorrosion Screwed Valve

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 14024	Environmental Labels and Declarations-Type I Environmental Labelling-Principles and Procedures

JAPAN PIPE FITTINGS ASSOCIATION (JPFA)

JPF-MP-006	(2019) Rool Grooving Dimension Fitting
JPF-DP-001	(2010) Screwed Cast Iron Fitting

JAPAN CAST IRON COVER & WASTE FITTING ASSOCIATION (JCW)

JCW 203	(2012) Floor Clean Out

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-44	(2019) Steel Pipeline Flanges
MSS SP-83	(2014) Class 3000 Steel Pipe Unions Socket Welding and Threaded

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT-M	(2019) Public Building Construction Standard Specification

NSF INTERNATIONAL (NSF)

NSF 372	(2016) Drinking Water System Components - Lead Content
NSF/ANSI 14	(2021) Plastics Piping System Components and Related Materials
NSF/ANSI 61	(2019) Drinking Water System Components - Health Effects

INDUSTRIAL SAFETY AND HEALTH ACT

CCPV	(2016) Construction Code of Pressure Vessel

WATER SUPPLY LAW

PSCP	Performance Standard Compliant Product

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section

01 33 00 SUBMITTAL PROCEDURES:

[SD-02 Shop Drawings

Plumbing System; G[, [_____]]

Detail drawings consisting of schedules, performance charts, instructions, diagrams, and other information to illustrate the requirements and operations of systems that are not covered by the Plumbing Code. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

] SD-03 Product Data

Water Heaters

Pumps

Backflow Prevention Assemblies

Swimming Pool [and Spa]Suction Fittings; G[, [_____]]

SD-06 Test Reports

Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Test of Backflow Prevention Assemblies; G[, [_____]].

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor shall have the manufacturer's representative test the device, to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests.

SD-10 Operation and Maintenance Data

Plumbing System

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.3.1 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.3.2 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.3.3 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.3.4 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.3.4.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.3.4.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative

requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.4 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.5 PERFORMANCE REQUIREMENTS

1.5.1 Welding

[Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with JIS Z 3801. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by JIS B 8285. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record. Structural members shall be welded in accordance with Section 05 05 23.16 STRUCTURAL WELDING.] [Welding and nondestructive testing procedures are specified in Section 40 05 13.96 WELDING PROCESS PIPING.] Structural members shall be welded in accordance with Section 05 05 23.16 STRUCTURAL WELDING.

1.5.2 Cathodic Protection and Pipe Joint Bonding

Cathodic protection and pipe joint bonding systems shall be in accordance with [Section 26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)] [and] [Section 26 42 17.00 10 CATHODIC PROTECTION SYSTEM (IMPRESSED CURRENT)][Section 26 42 13.00 20 CATHODIC PROTECTION BY GALVANIC ANODES] [and] [Section 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT]Section 26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE) and Section 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT.

1.6 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with MLIT-M.

1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.8 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including

pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.

Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

1.9 ACCESSIBILITY OF EQUIPMENT

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF/ANSI 61, Annex G or NSF 372. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with or PL 93-523 and NSF/ANSI 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Section 9. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used underground. Solder containing lead shall not be used with copper pipe.

a. Coupling for Cast-Iron Pipe: for hub and spigot type JIS G 5526, JPF-MP-006. For hubless type: JIS G 5526.

b. Coupling for Steel Pipe: JPF-MP-006.

c. Couplings for Grooved Pipe: [Ductile Iron JIS G 5502] [Malleable Iron JIS G 5705].[Copper JIS G 5502].

d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with JIS B 2404. Gaskets shall be flat, 1.6 mm thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.

e. Brazing Material: Brazing material shall conform to JIS Z 3621.

f. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.

g. Solder Material: Solder metal shall conform to JIS Z 3284-1.

h. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to JIS Z 3313.

i. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe.

j. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): JIS K 6353.

k. Rubber Gaskets for Grooved Pipe: JIS B 2404.

l. Flexible Elastomeric Seals: JIS A 5758.

m. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, JIS G 4051.

n. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: JWWA S 101.

o. Plastic Solvent Cement for ABS Plastic Pipe: JWWA S 101.

p. Plastic Solvent Cement for PVC Plastic Pipe: JWWA S 101 and JWWA S 101.

q. Plastic Solvent Cement for CPVC Plastic Pipe: JWWA S 101.

r. Flanged fittings including, but not limited to, flanges, bolts, nuts and bolt patterns shall be in accordance with JIS B 2220 and shall have the manufacturer's trademark affixed in accordance with JIS B 2004 and JIS Z 9102. Flange material shall conform to JIS G 3201. Blind flange material shall conform to JIS G 3118 and JIS G 3118 cold service and JIS G 3103 and JIS G 3118 for hot service. Bolts shall be high strength or intermediate strength with material conforming to JIS G 4107 and JIS G 4303.

s. Plastic Solvent Cement for Styrene Rubber Plastic Pipe: JIS K 6743.

t. Press fittings for Copper Pipe and Tube: Copper press fittings shall conform to the material and sizing requirements of JIS H 3401. Sealing elements shall be factory installed or an alternative supplied fitting manufacturer. Sealing element shall be selected based on manufacturer's approved application guidelines.

u. Copper tubing shall conform toJIS H 3300, Type K, L or M.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Water Hammer Arrester: Performance standards of products conforming to the Japanese Water Supply Law.[Water hammer arrester shall be [diaphragm][or][piston] type.]

b. Copper, Sheet and Strip for Building Construction: JIS H 3100.

c. Asphalt Roof Cement: JIS A 6005.

d. Hose Clamps: MLIT-M.

e. Metallic Cleanouts: JCW 203.

f. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

g. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: JWWA K 115.

h. Hypochlorites: JWWA K 120.

i. Liquid Chlorine: JWWA K 120.

j. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: JIS B 7505-1.

k. Thermometers: JIS B 7414. Mercury shall not be used in thermometers.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MLIT-M.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 65 mm and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 80 mm and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	JPF-DP-001
Cast-Iron Gate Valves, Flanged and Threaded Ends	JIS B 2031
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	JIS B 2011
Ball Valves with Flanged Butt-Welding Ends for General Service	JV-5
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	JV-5
Bronze Gate, Globe, Angle, and Check Valves	JV-5
Steel Valves, Socket Welding and Threaded Ends	JIS B 2003
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	JIS B 2071
Backwater Valves	
Vacuum Relief Valves	JIS B 8372-1 and JIS B 8225
Water Pressure Reducing Valves	JIS B 8410
Water Heater Drain Valves	JIS B 2011
Trap Seal Primer Valves	JIS B 2061
Temperature and Pressure Relief Valves for Hot Water Supply Systems	JIS B 8414 and JIS B 2011
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	JIS B 8414

2.3.1 Backwater Valves

Backwater valves shall be either separate from the floor drain or a combination floor drain, P-trap, and backwater valve, as shown. Valves

shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

2.3.2 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 20 mm male inlet threads, hexagon shoulder, and 20 mm hose connection. Faucet handle shall be securely attached to stem.

2.3.3 Lawn Faucets

Lawn faucets shall be brass, with either straight or angle bodies, and shall be of the compression type. Body flange shall be provided with internal pipe thread to suit 20 mm pipe. Body shall be suitable for wrench grip. Faucet spout shall have 20 mm exposed hose threads. Faucet handle shall be securely attached to stem.

2.3.4 Yard Hydrants

Yard box or post hydrants shall have valve housings located below frost lines. Water from the casing shall be drained after valve is shut off. Hydrant shall be bronze with cast-iron box or casing guard. "T" handle key shall be provided.

2.3.5 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to JIS B 8225. Relief valves for systems where the maximum rate of heat input is less than 59 kW shall have 20 mm minimum inlets, and 20 mm outlets. Relief valves for systems where the maximum rate of heat input is greater than 59 kW shall have 25 mm minimum inlets, and 25 mm outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

2.3.6 Thermostatic Mixing Valves

Provide thermostatic mixing valve for lavatory faucets. Mixing valves, thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 2 degrees C of any setting.

2.4 FIXTURES

Water closet replacements in major renovations may have a flush valve of up to 6.1 LPF to accommodate existing plumbing capacity. [JIS B 2308 302 stainless steel] [Vitreous China], nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear [white][_____], acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush valves and flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains [may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years][shall be copper alloy with all visible surfaces chrome plated].[Plastic in contact with hot water shall be suitable for 82 degrees C water temperature.]

2.4.1 Lavatories

[Enameled cast-iron lavatories shall be provided with two cast-iron or steel brackets secured to the underside of the apron and drilled for bolting to the wall in a manner similar to the hanger plate. Exposed brackets shall be porcelain enameled.][Vitreous china lavatories shall be provided with two integral molded lugs on the back-underside of the fixture and drilled for bolting to the wall in a manner similar to the hanger plate.] Provide faucet with a maximum flow rate of 1.9 L/min at a flowing pressure of 414 kPa. Water volume must be limited to 1.0 L per metering cycle.

2.4.2 Automatic Controls

Provide automatic, sensor operated faucets and flush valves to comply with JIS A 5207 and lavatory faucets, urinals, and water closets. Flushing and faucet systems shall consist of solenoid-activated valves with light beam sensors. Flush valve for water closet shall include an override pushbutton. Flushing devices shall be provided as described in paragraph FIXTURES AND FIXTURE TRIMMINGS.

2.4.3 Flush Valve Water Closets

JIS A 5207, [white] [_____] vitreous china, [JIS B 2308 and JIS B 2309 302 Stainless Steel,] siphon jet, elongated bowl, [floor-mounted, floor outlet][wall mounted, wall outlet]. Top of toilet seat height above floor shall be 360 to 380 mm, except 435 to 480 mm for wheelchair water closets. Provide wax bowl ring including plastic sleeve. Provide [white] [_____] solid plastic elongated [open-front seat] [closed-front seat with cover].

Water flushing volume of the water closet and flush valve combination shall not exceed 4.85 liters per flush.[Provide a dual-flush water

closet and flush valve combination that will also provide a second flushing water volume not to exceed 4.8 liters per flush.]

Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components shall be chromium-plated or polished stainless steel. Flush valves shall be nonhold-open type. Mount flush valves not less than 280 mm above the fixture. Mounted height of flush valve shall not interfere with the hand rail in ADA stalls.[Provide solenoid-activated flush valves including electrical-operated light-beam-sensor to energize the solenoid.][Provide piston type, oil operated, flush valve and wall support for salt water service.]

2.4.4 Flush Valve Urinals

JIS A 5207, [white] [_____] vitreous china, [JIS B 2308 and JIS B 2309 302 stainless steel],wall-mounted, wall outlet, siphon jet, integral trap, and extended side shields. Provide urinal with the rim 430 mm above the floor. Provide urinal with the rim 610 mm above the floor. Water flushing volume of the urinal and flush valve combination shall not exceed 1.9 liters per flush. Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components shall be chromium-plated or polished stainless steel. Flush valves shall be nonhold-open type. Mount flush valves not less than 280 mm above the fixture.[Provide solenoid-activated flush valves including electrical-operated light-beam-sensor to energize the solenoid.] [Provide piston type, oil operated, flush valve and wall support for salt water service.]

2.4.5 Wheelchair Flush Valve Type Urinals

JIS A 5207 [white] [_____] vitreous china, [JIS B 2308 and JIS B 2309 302 stainless steel],wall-mounted, wall outlet, blowout action, integral trap, elongated projecting bowl, 510 mm long from wall to front of flare, and JIS B 2061 trim. Provide large diaphragm (not less than 65 mm upper chamber inside diameter at the point where the diaphragm is sealed between the upper and lower chambers), nonhold-open flush valve of chrome plated cast brass conforming to JIS B 2061, including vacuum breaker and angle (control-stop) valve with back check. The water flushing volume of the flush valve and urinal combination shall not exceed 1.9 liters per flush. Furnish urinal manufacturer's certification of conformance. Mount urinal with front rim a maximum of 430 mm above floor and flush valve handle a maximum of 1120 mm above floor for use by handicapped on wheelchair.[Provide solenoid-activated flush valves including electrical-operated light-beam-sensor to energize the solenoid.]

2.4.6 Flush Tank Water Closets

JIS A 5207 [white] [_____] vitreous china, [JIS B 2308 and JIS B 2309 302 stainless steel], siphon jet, round bowl, pressure assisted, floor-mounted, floor outlet. Top of toilet seat height above floor shall be 360 to 380 mm, except 435 to 480 mm for wheelchair water closets.[Nonfloat swing type flush tank valves are not acceptable.][Gravity tank type water closets are not permitted.] Provide wax bowl ring including plastic sleeve. Water flushing volume of the water closet shall not exceed 4.8 liters per flush.[Provide a dual-flush toilet with a second flushing option that shall not exceed 4.1 liters per flush.] Provide [white] [_____] solid plastic round closed-front seat with cover.[Provide solenoid-activated flush valves including electrical-operated

light-beam-sensor to energize the solenoid.]

2.4.7 Non-Flushing Toilets

[Provide composting toilets in accordance with manufacturer's recommendations.][Provide vacuum toilet systems in accordance with manufacturer's recommendations.]

2.4.8 Wall Hung Lavatories

JIS A 5207 [[white] [_____] vitreous china, JIS B 2308 and JIS B 2309 302 stainless steel],straight back type, minimum dimensions of 480 mm, wide by 430 mm front to rear, with supply openings for use with top mounted centerset faucets, and openings for concealed arm carrier installation.[Provide aerator with faucet.]Provide lavatory faucets and accessories meeting the flow rate and product requirements of the paragraph LAVATORIES. Provide concealed chair carriers with vertical steel pipe supports and concealed arms for the lavatory. Mount lavatory with the front rim 865 mm above floor and with 740 mm minimum clearance from bottom of the front rim to floor.[Provide top mounted washerless centerset lavatory faucets.][Provide top-mounted solenoid-activated lavatory faucets including electrical-operated light-beam-sensor to energize the solenoid.] [Provide filters for chlorine in supply piping to faucets.]

2.4.9 Countertop Lavatories

JIS A 5207 [white] [_____] vitreous china, [JIS B 2308 and JIS B 2309 302 stainless steel],self-rimming, minimum dimensions of 480mm wide by 430 mm front to rear, with supply openings for use with top mounted centerset faucets. Furnish template and mounting kit by lavatory manufacturer.[Provide aerator with faucet.]Provide lavatory faucets and accessories meeting the flow rate and product requirements of the paragraph LAVATORIES. Mount counter with the top surface 865 mm above floor and with 737 mm minimum clearance from bottom of the counter face to floor.[Provide top mounted washerless centerset lavatory faucets.][Provide top-mounted solenoid-activated lavatory faucets including electrical-operated light-beam-sensor to energize the solenoid.] [Provide filters for chlorine in supply piping to faucets.]

2.4.10 Kitchen Sinks

JIS B 2308 and JIS B 2309 20 gage stainless steel with integral mounting rim for flush installation, minimum dimensions of 840 mm wide by 535 mm front to rear, two compartments, with undersides fully sound deadened, with supply openings for use with top mounted washerless sink faucets with hose spray, and with 90 mm drain outlet.[Provide aerator with faucet.]Water flow rate shall not exceed 8.3 L per minute when measured at a flowing water pressure of 414 kPa. Provide stainless steel drain outlets and stainless steel cup strainers. Provide separate 38 mm P-trap and drain piping to vertical vent piping from each compartment. Provide top mounted washerless sink faucets with hose spray. [Provide filters for chlorine in supply piping to faucets.][Provide JIS A 4420 waste disposer in right compartment.][Provide pedal valve for foot-operated flow control.][Provide secondary kitchen sink that drains to graywater system.][Provide sink with disposal chute to compost bucket under sink.]

2.4.11 Service Sinks

JIS A 5207, [[white] [_____] vitreous china JIS B 2308 and JIS B 2309 302

stainless steel] with integral back and wall hanger supports, minimum dimensions of 560 mm wide by 510 mm front to rear, with two supply openings in 254 mm high back. Provide floor supported wall outlet cast iron P-trap and stainless steel rim guards as recommended by service sink manufacturer. Provide back mounted washerless service sink faucets with vacuum breaker and 19 mm external hose threads.

2.4.12 Drinking-Water Coolers

JIS C 9618 with more than a single thickness of metal between the potable water and the refrigerant in the heat exchanger, wall-hung, bubbler style, air-cooled condensing unit, 5 ml per second minimum capacity, stainless steel splash receptor and basin, [bottle filler] and stainless steel cabinet. Bubblers shall be controlled by push levers or push bars, front mounted or side mounted near the front edge of the cabinet. Bubbler spouts shall be mounted at maximum of 915 mm above floor and at front of unit basin. Spouts shall direct water flow at least 100 mm above unit basin and trajectory parallel or nearly parallel to the front of unit. [Provide filters for chlorine in supply piping to faucets.]Provide concealed steel pipe chair carriers.

2.4.13 Wheelchair Drinking Water cooler

JIS C 9618 wall-mounted bubbler style with concealed chair carrier, air-cooled condensing unit, 5 mL per second minimum capacity, stainless steel splash receptor, and all stainless steel cabinet, with 690 mm minimum knee clearance from front bottom of unit to floor and 915 mm maximum spout height above floor [and bottle filler]. Bubblers shall also be controlled by push levers, by push bars, or touch pads one on each side or one on front and both sides of the cabinet. [Provide filters for chlorine in supply piping to faucets.]

2.4.14 Plastic Bathtub/Shower Units

JIS A 5207 four piece [white] [_____] solid acrylic pressure molded fiberglass reinforced plastic bathtub/shower units. Units shall be scratch resistant, waterproof, and reinforced. Provide showerheads meeting the requirements of the paragraph BATHTUB AND SHOWER FAUCETS AND DRAIN FITTINGS.[Provide flow restrictor in handshower to flow 6.6 L/min.][Provide filters for chlorine in supply piping to faucets and showerheads.] Provide recessed type units approximately 1520 mm wide, 760 mm front to rear, 1830 mm high with 380 mm high rim for through-the-floor drain installation with unit bottom or feet firmly supported by a smooth level floor. Provide left or right drain outlet units as required. Units shall have built-in soap dish and minimum of 305 mm long stainless steel horizontal grab bar located on back wall for standing use. Units shall meet performance requirements of JIS A 5207. Install unit in accordance with the manufacturer's written instructions. Finish installation by covering unit attachment flanges with wall board in accordance with unit manufacturer's recommendation. Provide smooth 100 percent silicone rubber [white] [_____] bathtub caulk between the unit and the adjacent walls and floor surfaces.

2.4.15 Plastic Bathtubs

JIS A 5207 one piece [white] [_____] solid acrylic pressure molded fiberglass reinforced plastic bathtubs. Bathtubs shall be scratch resistant, waterproof, and reinforced. Provide recessed type bathtubs approximately 1520 mm wide, 760 mm front to rear, 380 mm high rim for

through-the-floor drain installation with bathtub bottom or feet firmly supported by a smooth level floor. Provide left or right drain outlet bathtub as required. [Provide filters for chlorine in supply piping to faucets.]Bathtubs shall meet performance requirements of JIS A 5207. Install bathtub in accordance with the manufacturer's written instructions. Finish installation by covering bathtub attachment flanges with dry-wall in accordance with bathtub manufacturer's recommendation. Provide smooth 100 percent silicone rubber [white] [_____] bathtub caulk between the bathtub and the adjacent walls and floor surfaces.

2.4.16 Plastic Shower Stalls

JIS A 5207 four piece [white] [_____] solid acrylic pressure molded fiberglass reinforced plastic shower stalls. Shower stalls shall be scratch resistant, waterproof, and reinforced. Provide showerheads meeting the requirements of the paragraph BATHTUB AND SHOWER FAUCETS AND DRAIN FITTINGS.[Provide flow restrictor in handshower to flow 6.6 L/min.] [Provide filters for chlorine in supply piping to showerheads.] Provide recessed type shower stalls approximately 915 mm wide, 915 mm front to rear, 1830 mm high, and 125 high mm high curb with shower stall bottom or feet firmly supported by a smooth level floor. Provide PVC shower floor drains and stainless steel strainers. Shower stalls shall meet performance requirements of JIS A 5207. Install shower stall in accordance with the manufacturer's written instructions. Finish installation by covering shower stall attachment flanges with dry-wall in accordance with shower stall manufacturer's recommendation. Provide smooth 100 percent silicone rubber [white] [_____] bathtub caulk between the top, sides, and bottom of shower stalls and bathroom walls and floors.

2.4.17 Plastic Bathtub Liners

JIS A 5532 one piece [white] [_____] plastic bathtub liners. Existing bathtubs shall be identified and measured to insure proper identification in order that each new bathtub liner shall be custom molded to fit the exact contours of the existing bathtubs. Provide left or right drain outlet bathtub liners as required. Bathtub liners shall be inserted over and into the existing bathtubs without disturbing the existing ceramic tile wainscot walls and existing floor material. Prepare the existing cast-iron bathtubs, ceramic tile wainscots, and floor to receive the new bathtub liners in accordance with the bathtub liner manufacturer's written instructions. Installation personnel shall be trained by the bathtub liner manufacturer. Seal the bathtub liner to existing bathtub with waterproof adhesive as required to keep moisture out from behind the bathtub liner. Provide smooth [white] [_____] waterproof bathtub sealant between bathtub drains, bathtub, and bathtub liners. Provide replacement chromium-plated overflow cover plates and push-pull bathtub drain stopper assembly. Provide smooth 100 percent silicone rubber [white] [_____] bathtub caulk between the bathtub liner and the adjacent walls and floor surfaces in accordance with the bathtub liners manufacturer's written instructions.

2.4.18 Plastic Bathtub Wall Surrounds

JIS A 5207 three piece [white] [_____] sectional pressure molded fiberglass plastic bathtub wall surrounds suitable for installation with existing bathtubs which are approximately 1520 mm wide by 760 mm front to rear. Wall surrounds shall have built-in soap dish and minimum of 305 mm long stainless steel horizontal grab bar located on back wall for standing use. Bathtub wall surrounds shall meet performance requirements of

JIS A 5207. for compliance. Install bathtub wall surrounds in accordance with the manufacturers written instructions. Finish installation by covering bathtub wall surround attachment flanges with dry-wall in accordance with bathtub wall surround manufacturer's recommendations. Provide smooth 100 percent silicone rubber [white] [_____] bathtub caulk between the bathtubs and the adjacent walls and floor surfaces.

2.4.19 Precast Terrazzo Shower Floors

Terrazzo shall be made of marble chips cast in white portland cement to produce 25 mPa minimum compressive strength 7 days after casting. Provide floor or wall outlet copper alloy body drain cast integral with terrazzo, with polished stainless steel strainers.

2.4.20 Precast Terrazzo Mop Sinks

Terrazzo shall be made of marble chips cast in white portland cement to produce 25 mPa minimum compressive strength 7 days after casting. Provide floor or wall outlet copper alloy body drain cast integral with terrazzo, with polished stainless steel strainers.

2.4.21 Bathtubs, Cast Iron

JIS A 5207 [white] [_____] enameled cast iron, recessed type, minimum dimensions of 1520 mm wide by 760 mm front to rear by 410 mm high with drain outlet for above-the-floor drain installation. Provide left or right drain outlet bathtub as indicated. [Provide filters for chlorine in supply piping to faucets.]

2.4.22 Bathtubs, Porcelain

JIS A 5207 [white] [_____] porcelain bonded to enameling grade metal, bonded to a structural composite, recessed type, minimum dimensions of 1520 mm wide by 760 mm front to rear by 410 mm high with drain outlet for above-the-floor drain installation. Provide left or right drain outlet bathtub as indicated. [Provide filters for chlorine in supply piping to faucets.]

2.4.23 Emergency Eyewash and Shower

Ministry of Labour Ordinance (Tokutei-Kagaku-bushitsu-Shogai-Yobou-Kisoku) Article 38, floor supported free standing unit. Provide deluge shower head, stay-open ball valve operated by pull rod and ring or triangular handle. Provide eyewash and stay-open ball valve operated by foot treadle or push handle.

2.4.24 Emergency Eye and Face Wash

Ministry of Labour Ordinance (Tokutei-Kagaku-bushitsu-Shogai-Yobou-Kisoku) Article 38, wall-mounted self-cleaning, nonclogging eye and face wash with quick opening, full-flow valves, stainless steel eye and face wash receptor. Unit shall deliver 0.19 L/s of aerated water at 207 kPa (gage) flow pressure, with eye and face wash nozzles 840 to 1140 mm above finished floor. Provide copper alloy control valves. Provide an air-gap with the lowest potable eye and face wash water outlet located above the overflow rim by not less than the International Plumbing Code minimum.[Provide a pressure-compensated tempering valve, with leaving water temperature setpoint adjustable throughout the range 15.5 to 35 degrees C.][Provide packaged, UL listed, alarm system; including an amber strobe lamp,

horn with externally adjustable loudness and horn silencing switch, mounting hardware, and waterflow service within enclosures[and for explosion proof service within enclosures].]

2.5 BACKFLOW PREVENTERS

Backflow preventers with intermediate atmospheric vent shall conform to JIS S 3200-5. Reduced pressure principle backflow preventers shall be approved product of quality certification center of JWWA. Hose connection vacuum breakers shall be approved product of quality certification center of JWWA. Pipe applied atmospheric type vacuum breakers shall be approved product of quality certification center of JWWA. Pressure vacuum breaker assembly shall be approved product of quality certification center of JWWA. Air gaps in plumbing systems shall conform to Ministry of Health Labor and Welfare Ordinance Article 123.

2.6 DRAINS

2.6.1 Floor and Shower Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded connection. Between the drain outlet and waste pipe, a neoprene rubber gasket may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to JCM 201.

2.6.1.1 Metallic Shower Pan Drains

Where metallic shower pan membrane is installed, polyethylene drain with corrosion-resistant screws securing the clamping device shall be provided. Polyethylene drains shall have fittings to adapt drain to waste piping. Polyethylene for floor drains shall conform to JIS K 7350-3. Drains shall have separate cast-iron "P" trap, circular body, seepage pan, and strainer, unless otherwise indicated.

2.6.1.2 Drains and Backwater Valves

Drains and backwater valves installed in connection with waterproofed floors or shower pans shall be equipped with bolted-type device to securely clamp flashing.

2.6.2 Bathtub and Shower Faucets and Drain Fittings

Provide single control pressure equalizing bathtub and shower faucets with body mounted from behind the wall with threaded connections. Provide ball joint self-cleaning shower heads. Provide tubing mounted from behind the wall between bathtub faucets and shower heads and bathtub diverter spouts. Provide separate globe valves or angle valves with union connections in each supply to faucet. Provide trip-lever pop-up drain fittings for above-the-floor drain installations. The top of drain

pop-ups, drain outlets, tub overflow outlet, and; control handle for pop-up drain shall be chromium-plated or polished stainless steel. Linkage between drain pop-up and pop-up control handle at bathtub overflow outlet shall be copper alloy or stainless steel. Provide 40 mm copper alloy adjustable tubing with slip nuts and gaskets between bathtub overflow and drain outlet; chromium-plated finish is not required.[Provide bathtub and shower valve with ball type control handle.]

2.6.3 Area Drains

Area drains shall be plain pattern with polished stainless steel perforated or slotted grate and bottom outlet. The drain shall be circular or square with a 300 mm nominal overall width or diameter and 250 mm nominal overall depth. Drains shall be cast iron with manufacturer's standard coating. Grate shall be easily lifted out for cleaning. Outlet shall be suitable for inside caulked connection to drain pipe. Drains shall conform to JIS A 5207.

2.6.4 Floor Sinks

Floor sinks shall be [circular] [square], with 300 mm nominal overall width or diameter and 250 mm nominal overall depth. Floor sink shall have an acid-resistant enamel interior finish with cast-iron body, [aluminum][ABS] sediment bucket, and perforated grate of cast iron in industrial areas and stainless steel in finished areas. The outlet pipe size shall be as indicated or of the same size as the connecting pipe.

2.6.5 Boiler Room Drains

Boiler room drains shall have combined drain and trap, hinged grate, removable bucket, and threaded brass cleanout with brass backwater valve. The removable galvanized cast-iron sediment bucket shall have rounded corners to eliminate fouling and shall be equipped with hand grips. Drain shall have a minimum water seal of 100 mm. The grate area shall be not less than 0.065 square meters.

2.6.6 Pit Drains

Pit drains shall consist of a body, integral seepage pan, and nontilting perforated or slotted grate. Drains shall be of double drainage pattern suitable for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drain pipe. Membrane or flashing clamping device shall be provided when required. Drains shall be cast iron with manufacturer's standard coating. Drains shall be circular and provided with bottom outlet suitable for inside caulked connection, unless otherwise indicated. Drains shall be provided with separate cast-iron "P" traps, unless otherwise indicated.

2.6.7 Sight Drains

Sight drains shall consist of body, integral seepage pan, and adjustable strainer with perforated or slotted grate and funnel extension. The strainer shall have a threaded collar to permit adjustment to floor thickness. Drains shall be of double drainage pattern suitable for embedding in the floor construction. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or membrane shall be provided for other than concrete construction. Drains shall have a galvanized heavy cast-iron body and seepage pan and chromium-plated bronze, nickel-bronze, or nickel-brass

strainer and funnel combination. Drains shall be provided with threaded connection and with a separate cast-iron "P" trap, unless otherwise indicated. Drains shall be circular, unless otherwise indicated. The funnel shall be securely mounted over an opening in the center of the strainer. Minimum dimensions shall be as follows:

Area of strainer and collar: 0.023 square meters

Height of funnel: 95 mm

Diameter of lower portion: 50 mm of funnel

Diameter of upper portion: 100 mm of funnel

2.6.8 Roof Drains and Expansion Joints

Roof drains shall conform to MLIT-M, with dome and integral flange, and shall have a device for making a watertight connection between roofing and flashing. The whole assembly shall be galvanized heavy pattern cast iron. For aggregate surface roofing, the drain shall be provided with a gravel stop. On roofs other than concrete construction, roof drains shall be complete with underdeck clamp, sump receiver, and an extension for the insulation thickness where applicable. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or membrane shall be provided when required to suit the building construction. Strainer openings shall have a combined area equal to twice that of the drain outlet. The outlet shall be equipped to make a proper connection to threaded pipe of the same size as the downspout. An expansion joint of proper size to receive the conductor pipe shall be provided. The expansion joint shall consist of a heavy cast-iron housing, brass or bronze sleeve, brass or bronze fastening bolts and nuts, and gaskets or packing. The sleeve shall have a nominal thickness of not less than 3.5 mm. Gaskets and packing shall be close-cell neoprene, O-ring packing shall be close-cell neoprene of 70 durometer. Packing shall be held in place by a packing gland secured with bolts.

2.6.9 Swimming Pool [and Spa]Suction Fittings

Pool water suction fittings in swimming pools [and spas]shall comply with Pool Safety Standard Guidelines. The compliance of the fitting shall include of the associated drain cover, sump, and hardware.

2.7 SHOWER PAN

Shower pan may be copper, or nonmetallic material.

2.7.1 Sheet Copper

Sheet copper shall be 4.9 kg per square meter weight.

2.7.2 Plasticized Polyvinyl Chloride Shower Pan Material

Material shall be sheet form. The material shall be 1.015 mm minimum thickness of plasticized polyvinyl chloride or chlorinated polyethylene and shall be in accordance with JIS K 5981.

2.7.3 Nonplasticized Polyvinyl Chloride (PVC) Shower Pan Material

Material shall consist of a plastic waterproofing membrane in sheet form.

The material shall be 1.015 mm minimum thickness of nonplasticized PVC and shall have the following minimum properties:

a. JIS K 7139

Ultimate Tensile Strength:	1.79 MPa
Ultimate Elongation:	398 percent
100 Percent Modulus:	3.07 MPa

b. JIS K 7128-3

Tear Strength:	53 kilonewtons per meter

c. JIS Z 0208 and JIS K 7129-7:

Permeance:	0.46 ng per Pa per second per sq meter

d. Other Properties:

Specific Gravity:	1.29
PVC Solvent:	Weldable
Cold Crack:	minus 47 degrees C
Dimensional stability	100 degrees C
Hardness, Shore A:	89

2.8 TRAPS

Unless otherwise specified, traps shall be [plastic per JIS K 6741 and JIS K 7014] [or] [copper-alloy adjustable tube type with slip joint inlet and swivel]. Traps shall be without a cleanout.[Provide traps with removable access panels for easy clean-out at sinks and lavatories.]Tubes shall be copper alloy with walls not less than 0.813 mm thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 50 mm. The interior diameter shall be not more than 3.2 mm over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.9 INTERCEPTORS

2.9.1 Grease Interceptor

Grease interceptor of the size indicated shall be of reinforced concrete, [or precast concrete construction] [or equivalent capacity commercially available steel grease interceptor] with removable three-section, 9.5 mm checker-plate cover, and shall be installed outside the building. Steel grease interceptor shall be installed in a concrete pit and shall be epoxy-coated to resist corrosion as recommended by the manufacturer. Concrete shall have 21 MPa minimum compressive strength at 28 days.

Provide flow control fitting.

2.9.2 Oil Interceptor

Cast iron or welded steel, coated inside and outside with white acid resistant epoxy, with internal air relief bypass, bronze cleanout plug, double wall trap seal, removable combination pressure equalizing and flow diffusing baffle and sediment bucket, horizontal baffle, adjustable oil draw-off and vent connections on either side, gas and watertight gasketed nonskid cover, and flow control fitting.

2.9.3 Sand Interceptors

Sand interceptor of the size indicated shall be of reinforced concrete, [or precast concrete construction] [or equivalent capacity commercially available steel sand interceptor] with manufacturer's standard checker-plate cover, and shall be installed [outside the building][top flush with the floor][floor mounted]. Steel sand interceptor shall be installed in accordance with manufacturer's recommendations and shall be coated to resist corrosion as recommended by the manufacturer.[Concrete shall have 21 MPa minimum compressive strength at 28 days.]

2.10 WATER HEATERS

Water heater types and capacities shall be as indicated. Each water heater shall have replaceable anodes. Each primary water heater shall have controls with an adjustable range that includes 32 to 71 degrees C. Each gas-fired water heater and booster water heater shall have controls with an adjustable range that includes 49 to 82 degrees C. Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and standby heat losses shall conform to TABLE III in PART 3 of this Section for each type of water heater specified. The only exception is that storage water heaters and hot water storage tanks having more than 2000 liters storage capacity need not meet the standard loss requirement if the tank surface area is insulated to R-12.5 and if a standing light is not used. Plastic materials polyetherimide (PEI) and polyethersulfone (PES) are forbidden to be used for vent piping of combustion gases. A factory pre-charged expansion tank shall be installed on the cold water supply to each water heater. Expansion tanks shall be specifically designed for use on potable water systems and shall be rated for 93 degrees C water temperature and 1034 kPa working pressure. The expansion tank size and acceptance volume shall be [_____] [as indicated].

2.10.1 Automatic Storage Type

Heaters shall be complete with [control system,] [control system, temperature gauge, and pressure gauge,] and shall have combination pressure and temperature relief valve.

2.10.1.1 Oil-Fired Type

Oil-fired type water heaters shall conform to JIS S 3024.

2.10.1.2 Gas-Fired Type

Gas-fired water heaters shall conform to JIS S 2109 when input is 70 KW per hour or less for simultaneous heater and 42 KW per hour or less for storage type or JIS S 2116 for heaters with input greater than 42 KW per

hour.

2.10.1.3 Electric Type

Electric type water heaters shall conform to JIS C 9219-1 with dual heating elements. Each element shall be 4.5 KW. The elements shall be wired so that only one element can operate at a time.

2.10.1.4 Indirect Heater Type

Steam and high temperature hot water (HTHW) heaters with storage system shall be the assembled product of one manufacturer, and shall be in accordance with MLIT-M. The storage tank shall be as specified in paragraph HOT-WATER STORAGE TANKS. The heat exchanger shall be [double wall] [single wall] type that separates the potable water from the heat transfer medium with a space vented to the atmosphere.

a. HTHW Energy Source: The heater element shall have a working pressure of 2758 kPa with water at a temperature of 204 degrees C. The heating surface shall be based on 0.093 square meter of heating surface to heat 76 L or more of water in 1 hour from 4 to 82 degrees C using hot water at a temperature of 178 degrees C. Carbon steel heads shall be used. Tubing shall conform to JIS H 3300. Heating elements shall withstand an internal hydrostatic pressure of 4137 kPa for not less than 15 seconds without leaking or any evidence of damage.

b. Steam Energy Source: The heater element shall have a working pressure of 1034 kPa per square metergauge (psig) with steam at a temperature of 185 degrees C. The heating surface shall be based on 0.093 square meter of heating surface to heat 76 L or more of water in 1 hour from 4 to 82 degrees C using steam at atmospheric pressure.[Cast iron] [bronze] heads shall be used. Tubing shall be light-drawn copper tubing conforming to JIS H 3300. Heating elements shall withstand an internal hydrostatic pressure of 1551 kPa for not less than 15 seconds without leaking or any evidence of damage.

2.10.2 Instantaneous Water Heater

Heater shall be crossflow design with service water in the coil and [steam] [hot water] in the shell. An integral internal controller shall be provided, anticipating a change in demand so that the final temperature can be maintained under all normal load conditions when used in conjunction with [pneumatic control system] [pilot-operated temperature control system]. Normal load conditions shall be as specified by the manufacturer for the heater. Unit shall be manufactured in accordance with MLIT-M, and shall be certified for 1.03 MPa working pressure in the shell and 1.03 MPa working pressure in the coils. Shell shall be carbon steel with copper lining. Heads shall be [cast iron] [bronze] [carbon steel plate with copper lining]. Coils shall be [copper] [copper-nickel]. Shell shall have metal sheathed fiberglass insulation, combination pressure and temperature relief valve, and thermometer. Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.10.3 Electric Instantaneous Water Heaters (Tankless)

JIS C 9335-2-35 flow switch activated, tankless electric instantaneous water heater for wall mounting below sink or lavatory.

2.10.4 Phenolic Resin Coatings for Heater Tubes

The phenolic resin coating system shall be applied at either the coil or coating manufacturer's factory in accordance with manufacturer's standard proven production process. The coating system shall be a product specifically intended for use on the material the water heating tubes/coils are made of and shall be acceptable for use in potable water systems.

[The entire exterior surface] [and] [the first 125 mm to 200 mm inside the tubes] of each coil shall be coated with phenolic resin coating system.

2.10.4.1 Standard Product

Provide a phenolic resin coating system that is a standard product of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship.

Standard products are defined as components and equipment that have been in satisfactory commercial or industrial use in similar applications of similar size for at least two years before bid opening.

Prior to this two year period, these standard products were sold on the commercial market using advertisements in manufacturers' catalogs or brochures. These manufacturers' catalogs, or brochures shall have been copyrighted documents or be identified with a manufacturer's document number.

2.11 HOT-WATER STORAGE TANKS

Hot-water storage tanks shall be constructed by one manufacturer, and nameplate shall indicate the working pressure. The tank shall be steel type in accordance with MLIT-M. Each tank shall be equipped with a thermometer, conforming to JIS B 7414, style and form as required for the installation, and with 175 mm scale. Thermometer shall have a separable socket suitable for a 20 mm tapped opening. Tanks shall be equipped with a pressure gauge 155 mm minimum diameter face. Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Storage tank capacity shall be as shown.

2.12 PUMPS

2.12.1 Sump Pumps

Sump pumps shall be of capacities indicated. The pumps shall be of the automatic, electric motor-driven, submerged type, complete with necessary control equipment and with a split or solid cast-iron or steel cover plate. The pumps shall be direct-connected by an approved flexible coupling to a vertical electric motor having a continuous oiling device or packed bearings sealed against dirt and moisture. Motors shall be totally enclosed, fan-cooled of sizes as indicated. The across-the-line magnetic controller shall be equipped with industrial use type enclosure. Integral size motors shall be the premium efficiency type in accordance with JIS C 4212. Each pump shall be fitted with a high-grade thrust bearing mounted above the floor. Each shaft shall have an alignment bearing at each end, and the suction inlet shall be between 75 and 150 mm above the sump bottom. The suction side of each pump shall have a strainer of ample capacity. A float switch assembly, with the switch completely enclosed in an industrial use type enclosure, shall start and stop each motor at

predetermined water levels. Duplex pumps shall be equipped with an automatic alternator to change the lead operation from one pump to the other, and for starting the second pump if the flow exceeds the capacity of the first pump. The discharge line from each pump shall be provided with a union or flange, a nonclog swing check valve, and a stop valve in an accessible location near the pump.

2.12.2 Circulating Pumps

Domestic hot water circulating pumps shall be electrically driven, single-stage, centrifugal, with mechanical seals, suitable for the intended service. Pump and motor shall be [integrally mounted on a cast-iron or steel subbase,] [close-coupled with an overhung impeller,] [or] [supported by the piping on which it is installed]. The shaft shall be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze.

Motor shall be totally enclosed, fan-cooled and shall have sufficient wattage for the service required. Each pump motor shall be equipped with an across-the-line magnetic controller in an industrial type enclosure with "START-STOP" switch in cover.

Integral size motors shall be premium efficiency type in accordance with JIS C 4212. Pump motors smaller than 746 W shall have integral thermal overload protection in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Guards shall shield exposed moving parts.

2.12.3 Booster Pumps

2.12.3.1 Centrifugal Pumps

Horizontal split-case centrifugal-type booster pumps shall be furnished. The capacities shall be as shown, and the speed shall not exceed 1800 rpm. Pumps shall have a casing of close-grained iron or steel with smooth water passages. A gasket shall be provided between the upper and lower halves of the casing. Suction and discharge connections shall be flanged. Impellers shall be nonoverloading, bronze, balanced to eliminate vibration, and shall be keyed to corrosion-resisting steel shafts. The casings shall be fitted with bronze wearing or sealing rings. Bearings shall be cartridge type, enabling the entire rotating element to be removed without disturbing alignment or exposing the bearings to dirt, water, and other foreign matter. Pumps shall be provided with mechanical seals. Seal boxes shall be machined in the pump casing and at both sides of the pump, and shall be of sufficient depth to include a conventional bronze seal ring and rows of shaft packing. Bedplates shall be close-grain cast iron or steel with ribs and lugs, complete with foundation bolts, and shall have a drip lip with drain hole. Each pump shall be tested at the manufacturer's plant for operating characteristics at the rated capacity and under specified operating conditions. Test curves shall be furnished showing capacity in liters per second, head in meters, efficiency, brake wattage, and operation in parallel with similar pumps. Multiple pump installations shall have pump characteristics compatible for operation in parallel with similar pumps. The electric motor shall be sized for non-overload when operating at any point along the characteristic curve of the pump. Guards shall shield exposed belts and moving parts.

2.12.3.2 Controls

Each pump motor shall be provided with enclosed across-the-line-type magnetic controller complete in an industrial use type enclosure with three position, "HAND-OFF-AUTOMATIC," selector switch in cover. Pumps shall be automatically started and stopped by float or pressure switches, as indicated. The pumps shall start and stop at the levels and pressures indicated. A multiposition sequence selector switch shall be provided so that any two pumps may be operated simultaneously keeping a third pump as a standby.

2.12.4 Flexible Connectors

Flexible connectors shall be provided at the suction and discharge of each pump that is 1 hp or larger. Connectors shall be constructed of neoprene, rubber, or braided bronze, with Class 150 standard flanges. Flexible connectors shall be line size and suitable for the pressure and temperature of the intended service.

2.12.5 Sewage Pumps

Provide single type duplex type with automatic controls to alternate the operation from one pump to the other pump and to start the second pump in the event the first pump cannot handle the incoming flow. Provide high water alarm and check valve.

2.13 WATER PRESSURE BOOSTER SYSTEM

2.13.1 Constant Speed Pumping System

Constant speed pumping system with pressure-regulating valves shall employ one lead pump for low flows, and one or more lag pumps for higher flows. Pressure-regulating valves shall be provided with nonslam check feature. The factory prepiped and prewired assembly shall be mounted on a steel frame, complete with pumps, motors, and automatic controls. The system capacity and capacity of individual pumps shall be as indicated. Current sensing relays shall provide staging of the pumps. The pumps shall be protected from thermal buildup, when running at no-flow, by a common thermal relief valve. Pressure gauges shall be mounted on the suction and discharge headers. The control panel shall be industrial use type enclosure. The control panel shall include the following: No-flow shutdown; 7-day time clock; audiovisual alarm; external resets; manual alternation; magnetic motor controllers; time delays; transformer; current relays; "HAND-OFF-AUTOMATIC" switches for each pump; minimum run timers; low suction pressure cutout; and indicating lights for power on, individual motor overload, and low suction pressure. The control circuit shall be interlocked so that the failure of any controller shall energize the succeeding controller.

2.13.2 Hydro-Pneumatic Water Pressure System

Hydro-pneumatic water tank shall be constructed in accordance with pressure vessel construction standard (atsuryoku-youki-kouzou-kisoku).

2.13.3 Variable Speed Pumping System

Variable speed pumping system shall provide system pressure by varying speed and number of operating pumps. The factory prepiped and prewired assembly shall be mounted on a steel frame complete with pumps, variable

speed drives, motors, and controls. The variable speed drives shall be the oil-filled type capable of power transmission throughout their complete speed range without vibration, noise, or shock loading. Each variable speed drive shall be run-tested by the manufacturer for rated performance, and the manufacturer shall furnish written performance certification. System shall have suppressors to prevent noise transmission over electric feed lines. Required electrical control circuitry and system function sensors shall be supplied by the variable speed drive manufacturer. The primary power controls and magnetic motor controllers shall be installed in [the controls supplied by the drive manufacturer] [the motor control center]. The sensors shall be located in the system to control drive speed as a function of [constant pump discharge pressure] [constant system pressure at location indicated]. Connection between the sensors and the variable speed drive controls shall be accomplished with [hydraulic sensing lines] [copper wiring] [telemetry]. Controls shall be in industrial use type enclosures.

2.14 COMPRESSED AIR SYSTEM

2.14.1 Air Compressors

Air compressor unit shall be a factory-packaged assembly, including [_____] phase, [_____] volt motor controls, switches, wiring, accessories, and motor controllers, in an industrial use type enclosure. Air compressors shall have manufacturer's name and address, together with trade name, and catalog number on a nameplate securely attached to the equipment. Each compressor shall [start and stop automatically at upper and lower pressure limits of the system] [regulate pressure by constant speed compressor loading and unloading] [have a manual-off-automatic switch that when in the manual position, the compressor loads and unloads to meet the demand and, in the automatic position, a time delay relay shall allow the compressor to operate for an adjustable length of time unloaded, then stop the unit]. Guards shall shield exposed moving parts. Each duplex compressor system shall be provided with [automatic] [manual] alternation system. Each compressor motor shall be provided with an across-the-line-type magnetic controller, complete with low-voltage release. An intake air filter and silencer shall be provided with each compressor. Aftercooler and moisture separator shall be installed between compressors and air receiver to remove moisture and oil condensate before the air enters the receiver. Aftercoolers shall be either air- or water-cooled, as indicated. The air shall pass through a sufficient number of tubes to affect cooling. Tubes shall be sized to give maximum heat transfer. Water to unit shall be controlled by a solenoid or pneumatic valve, which opens when the compressors start and closes when the compressors shut down. Cooling capacity of the aftercooler shall be sized for the total capacity of the compressors. Means shall be provided for draining condensed moisture from the receiver by an automatic float type trap. Capacities of air compressors and receivers shall be as indicated.

2.14.2 Lubricated Compressors

Compressors shall be two-stage, V-belt drive, capable of operating continuously against their designed discharge pressure, and shall operate at a speed not in excess of 1800 rpm. Compressors shall have the capacity and discharge pressure indicated. Compressors shall be assembled complete on a common subbase. The compressor main bearings shall be either roller or ball. The discharge passage of the high pressure air shall be piped to the air receiver with a copper pipe or tubing. A pressure gauge

calibrated to 1.03 MPa and equipped with a gauge cock and pulsation dampener shall be furnished for installation adjacent to pressure switches.

2.14.3 Air Receivers

Receivers shall be designed for 1.38 MPa working pressure. Receivers shall be factory air tested to 1-1/2 times the working pressure. Receivers shall be equipped with safety relief valves and accessories, including pressure gauges and automatic and manual drains. The outside of air receivers may be galvanized or supplied with commercial enamel finish. Receivers shall be designed and constructed in accordance with Contruction code for pressure vessel (CCPV) and shall have the design working pressures specified herein.

2.14.4 Intake Air Supply Filter

Dry type air filter shall be provided having a collection efficiency of 99 percent of particles larger than 10 microns. Filter body and media shall withstand a maximum 862 kPa, capacity as indicated.

2.14.5 Pressure Regulators

The air system shall be provided with the necessary regulator valves to maintain the desired pressure for the installed equipment. Regulators shall be designed for a maximum inlet pressure of 862 kPa and a maximum temperature of 93 degrees C. Regulators shall be single-seated, pilot-operated with valve plug, bronze body and trim or equal, and threaded connections. The regulator valve shall include a pressure gauge and shall be provided with an adjustment screw for adjusting the pressure differential from 0 kPa to 862 kPa. Regulator shall be sized as indicated.

2.15 DOMESTIC WATER SERVICE METER

[The requirements for metering and submetering are specified in Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING.

][Cold water meters 50 mm and smaller shall be positive displacement type conforming to JIS B 8570-1. Cold water meters 64 mm and larger shall be turbine type conforming to JIS B 8570-1. Meter register may be round or straight reading type, [indicating [_____]] [as provided by the local utility]. Meter shall be provided with a pulse generator, remote readout register and all necessary wiring and accessories.

Meters must be connected to the base wide energy and utility monitoring and control system (if this system exists) using the installation's advanced metering protocols.

]2.16 ELECTRICAL WORK

Provide electrical motor driven equipment specified complete with motors, motor starters, and controls as specified herein and in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide [high efficiency type,]single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, corresponding to the applications in accordance with JIS C 4212.[In addition to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, provide polyphase, squirrel-cage medium induction motors with continuous ratings, including motors that are part of a system, that meet the efficiency

ratings for premium efficiency motors in accordance with JIS C 4212.] Provide motors in accordance with JIS C 4212 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor.

Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.

Controllers and contactors shall have auxiliary contacts for use with the controls provided. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers, including the required monitors and timed restart.

Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.17 MISCELLANEOUS PIPING ITEMS

2.17.1 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated on copper alloy plates or polished stainless steel finish in finished spaces. Provide paint finish on plates in unfinished spaces.

2.17.2 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Sleeves are not required where [supply] drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade, except where penetrating a membrane waterproof floor.

2.17.2.1 Sleeves in Masonry and Concrete

Provide steel pipe sleeves or schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2.17.2.2 Sleeves Not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

2.17.3 Pipe Hangers (Supports)

Provide Pipe hangers and supports in accordance with MLIT-M.

2.17.4 Nameplates

Provide 3.2 mm thick melamine laminated plastic nameplates, black matte

finish with white center core, for equipment, gages, thermometers, and valves; valves in supplies to faucets will not require nameplates. Accurately align lettering and engrave minimum of 6.4 mm high normal block lettering into the white core. Minimum size of nameplates shall be 25 by 63 mm. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule.

2.17.5 Labels

Provide labels for sensor operators at flush valves and faucets. Include the following information on each label:

a. Identification of the sensor and its operation with [graphic] [written] [Braille] description.

b. Range of the sensor.

c. Battery replacement schedule.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA Fire Man. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 1.5 m outside the building, unless otherwise indicated. A [gate valve] [full port ball valve] [ball valve] and drain shall be installed on the water service line inside the building approximately 150 mm above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 300 mm below the [average local frost depth] [finish grade] or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 12 mm between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 100 mm and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 20 mm hose bibb with renewable seat and [gate] [full port ball] [ball] valve ahead of hose bibb. At other low points, 20 mm brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets and changes in direction where indicated and required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 15 m in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and

risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

3.1.1.7 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 100 mm in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 14 MPa after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.1.8 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise location and sizing to be in accordance with products conforming to the Performance Standards Compliant Product (PSCP) of the Water Supply Law. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to JIS S 3200-3. Vertical capped pipe columns will not be permitted.

3.1.2 Compressed Air Piping (Non-Oil Free)

Compressed air piping shall be installed as specified for water piping and suitable for 862 kPa working pressure. Compressed air piping shall have supply lines and discharge terminals legibly and permanently marked at both ends with the name of the system and the direction of flow.

3.1.3 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.3.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to JIS B 0203. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.3.2 Mechanical Couplings

Mechanical couplings may be used in conjunction with grooved pipe for aboveground, ferrous or non-ferrous, domestic hot and cold water systems, in lieu of unions, brazed, soldered, welded, flanged, or threaded joints.

Mechanical couplings are permitted in accessible locations including behind access plates. Flexible grooved joints will not be permitted, except as vibration isolators adjacent to mechanical equipment. Rigid grooved joints shall incorporate an angle bolt pad design which maintains metal-to-metal contact with equal amount of pad offset of housings upon installation to ensure positive rigid clamping of the pipe.

Designs which can only clamp on the bottom of the groove or which utilize gripping teeth or jaws, or which use misaligned housing bolt holes, or which require a torque wrench or torque specifications will not be permitted.

Grooved fittings and couplings, and grooving tools shall be provided from the same manufacturer. Segmentally welded elbows shall not be used. Grooves shall be prepared in accordance with the coupling manufacturer's latest published standards. Grooving shall be performed by qualified grooving operators having demonstrated proper grooving procedures in accordance with the tool manufacturer's recommendations.

The Contracting Officer shall be notified 24 hours in advance of test to demonstrate operator's capability, and the test shall be performed at the work site, if practical, or at a site agreed upon. The operator shall demonstrate the ability to properly adjust the grooving tool, groove the pipe, and to verify the groove dimensions in accordance with the coupling manufacturer's specifications.

3.1.3.3 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 65 mm and smaller; flanges shall be used on pipe sizes 80 mm and larger.

3.1.3.4 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

3.1.3.5 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.3.6 Copper Tube and Pipe

a. Brazed. Brazed joints shall be made in conformance with JIS Z 3621, JIS H 3300, and JIS H 3300 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.

b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 50 mm and smaller. Soldered joints shall conform to JIS H 3300 and JIS H 3300. Soldered joints shall not be used in compressed air piping between the air compressor and the receiver.

c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with MLIT-M.

d. Press connection. Copper press connections shall be made in **strict** accordance with the manufacturer's installation instructions for manufactured rated size. The joints shall be pressed using the tool(s) approved by the manufacturer **of that joint**. Minimum distance between fittings shall be in accordance with the manufacturer's requirements.

3.1.3.7 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

3.1.3.8 Glass Pipe

Joints for corrosive waste glass pipe and fittings shall be made with corrosion-resisting steel compression-type couplings with acrylonitrile rubber gaskets lined with polytetrafluoroethylene.

3.1.3.9 Corrosive Waste Plastic Pipe

Joints for polyolefin pipe and fittings shall be made by mechanical joint or electrical fusion coil method. Joints for filament-wound reinforced thermosetting resin pipe shall be made in accordance with manufacturer's instructions. Unions or flanges shall be used where required for disconnection and inspection.

3.1.3.10 Other Joint Methods

3.1.4 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric

flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.5 Corrosion Protection for Buried Pipe and Fittings

Ductile iron, cast iron, and steel pipe, fittings, and joints shall have a protective coating. Additionally, ductile iron, cast iron, and steel pressure pipe shall have a cathodic protection system and joint bonding. The cathodic protection system, protective coating system, and joint bonding for cathodically protected pipe shall be in accordance with [Section 26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)] [and] [Section 26 42 17.00 10 CATHODIC PROTECTION SYSTEM (IMPRESSED CURRENT)][Section 26 42 13.00 20 CATHODIC PROTECTION BY GALVANIC ANODES] [and] [Section 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT] [Section 26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)][Section 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT]. and as otherwise specified. The pipe shall be cleaned and the coating system applied prior to pipe tightness testing. Joints and fittings shall be cleaned and the coating system applied after pipe tightness testing. For tape coating systems, the tape shall conform to JWWA K 115 and shall be applied with a 50 percent overlap. Primer utilized with tape type coating systems shall be as recommended by the tape manufacturer.

3.1.6 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.6.1 Sleeve Requirements

Unless indicated otherwise, provide pipe sleeves meeting the following requirements:

Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors.

A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved.

Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 100 mm above the finished floor.

Unless otherwise indicated, sleeves shall be of a size to provide a minimum of[6 mm][25 mm] clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic.

Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to JIS A 5758 and with a primer, backstop material and surface preparation as specified in Section 07 92 00 JOINT SEALANTS. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated.

Sleeves through below-grade walls in contact with earth shall be recessed 12 mm from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and [concrete] [masonry] wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section 07 84 00 FIRESTOPPING.

3.1.6.2 Flashing Requirements

Pipes passing through roof shall be installed through a 4.9 kg per square meter copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 200 mm from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 250 mm. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 200 mm from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 250 mm in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.6.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 40 mm to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 40 mm; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 200 mm from the drainpipe and shall be lapped

between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 40 mm to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.6.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

a. A standard roof coupling for threaded pipe up to 150 mm in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

3.1.6.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs FLASHING REQUIREMENTS and WATERPROOFING, a groove 6 to 13 mm wide by 6 to 10 mm deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07 92 00 JOINT SEALANTS.

3.1.6.6 Pipe Penetrations

Provide sealants for all pipe penetrations. All pipe penetrations shall be sealed to prevent infiltration of air, insects, and vermin.

3.1.7 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07 84 00 FIRESTOPPING.

3.1.8 Supports

3.1.8.1 General

Hangers used to support piping 50 mm and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

3.1.8.2 Pipe Supports and Structural Bracing, Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads as specified in Section 13 48 00 [SEISMIC] BRACING FOR MISCELLANEOUS

EQUIPMENT and [Section 23 05 48.19 [SEISMIC] BRACING FOR HVAC][Section 22 05 48.00 20 MECHANICAL SOUND, VIBRATION, AND SEISMIC CONTROL] [as shown]. Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided. Material used for supports shall be as specified in[Section 05 12 00 STRUCTURAL STEEL][Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS][Section 05 51 33 METAL LADDERS][Section 05 52 00 METAL RAILINGS][Section 05 51 00 METAL STAIRS].

3.1.8.3 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MLIT-M except as modified herein.

a. Horizontal pipe supports shall be spaced as specified in MLIT-M and a support shall be installed not over 300 mm from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 49 degrees C for PVC and 82 degrees C for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.

b. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 4.5 m nor more than 2 m from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

3.1.8.4 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

3.1.9 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to JIS B 8285. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.10 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 100 mm will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy

cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 100 mm. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 450 mm of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be [cast iron] [or] [plastic].

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 150 mm above the top of the tank or water heater.

3.2.2 Installation of Gas- and Oil-Fired Water Heater

Installation shall conform to JIS S 2120, and JIS S 2135, for gas fired and JIS S 3024, JIS S 3021 and JIS S 3030 for oil fired. Storage water heaters that are not equipped with integral heat traps and having vertical pipe risers shall be installed with heat traps directly on both the inlet and outlet. Circulating systems need not have heat traps installed. An acceptable heat trap may be a piping arrangement such as elbows connected so that the inlet and outlet piping make vertically upward runs of not less than 600 mm just before turning downward or directly horizontal into the water heater's inlet and outlet fittings. Commercially available heat traps, specifically designed by the manufacturer for the purpose of effectively restricting the natural tendency of hot water to rise through vertical inlet and outlet piping during standby periods may also be approved.

3.2.3 Heat Traps

Piping to and from each water heater and hot water storage tank shall be routed horizontally and downward a minimum of 600 mm before turning in an upward direction.

3.2.4 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.2.5 Expansion Tank

A pre-charged expansion tank shall be installed on the cold water supply between the water heater inlet and the cold water supply shut-off valve. The Contractor shall adjust the expansion tank air pressure, as recommended by the tank manufacturer, to match incoming water pressure.

3.2.6 Direct Fired and Domestic Water Heaters

Notify the Contracting Officer when any direct fired domestic water heater over 117 kw is operational and ready to be inspected and certified.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket.[Flushometer valves for water closets shall be installed 1 m above the floor, except at water closets intended for use by the physically handicapped where flushometer valves shall be mounted at approximately 760 mm above the floor and arranged to avoid interference with grab bars. In addition, for water closets intended for handicap use, the flush valve handle shall be installed on the wide side of the enclosure.][Bumpers for water closet seats shall be installed on the [wall] [flushometer stop] [flushometer spud].]

3.3.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 775 mm above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim 1020 mm above floor. Wall-hung service sinks shall be mounted with rim 700 mm above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with ICC A117.1 COMM.

3.3.4 Shower Bath Outfits

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

3.3.5 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.5.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

3.3.5.2 Support for Concrete-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the concrete wall using through bolts and a back-up plate.

3.3.5.3 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.5.4 Support for Wood Stud Construction

Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs shall be fastened with not less than No. 10 wood screws, 6 mm thick minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

3.3.5.5 Wall-Mounted Water Closet Gaskets

Where wall-mounted water closets are provided, reinforced wax, treated felt, or neoprene gaskets shall be provided. The type of gasket furnished

shall be as recommended by the chair-carrier manufacturer.

3.3.6 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with MLIT-M at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.7 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in[Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS][Section 05 51 33 METAL LADDERS][Section 05 52 00 METAL RAILINGS][Section 05 51 00 METAL STAIRS].

3.3.8 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 50 mm above the flood rim of the funnel to provide an acceptable air gap.

3.3.9 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to JIS A 4421. Traps for acid-resisting waste shall be of the same material as the pipe.

3.3.10 Shower Pans

Before installing shower pan, subfloor shall be free of projections such as nail heads or rough edges of aggregate. Drain shall be a bolt-down, clamping-ring type with weepholes, installed so the lip of the subdrain is flush with subfloor.

3.3.10.1 General

The floor of each individual shower, the shower-area portion of combination shower and drying room, and the entire shower and drying room where the two are not separated by curb or partition, shall be made watertight with a shower pan fabricated in place. The shower pan material shall be cut to size and shape of the area indicated, in one piece to the maximum extent practicable, allowing a minimum of 150 mm for turnup on walls or partitions, and shall be folded over the curb with an approximate

return of 1/4 of curb height. The upstands shall be placed behind any wall or partition finish. Subflooring shall be smooth and clean, with nailheads driven flush with surface, and shall be sloped to drain. Shower pans shall be clamped to drains with the drain clamping ring.

3.3.10.2 Metal Shower Pans

When a shower pan of required size cannot be furnished in one piece, metal pieces shall be joined with a flintlock seam and soldered or burned. The corners shall be folded, not cut, and the corner seam shall be soldered or burned. Pans, including upstands, shall be coated on all surfaces with one brush coat of asphalt. Asphalt shall be applied evenly at not less than 1 liter per square meter. A layer of felt covered with building paper shall be placed between shower pans and wood floors. The joining surfaces of metal pan and drain shall be given a brush coat of asphalt after the pan is connected to the drain.

3.3.10.3 Plasticized Chlorinated Polyethylene Shower Pans

Corners of plasticized chlorinated polyethylene shower pans shall be folded against the upstand by making a pig-ear fold. Hot-air gun or heat lamp shall be used in making corner folds. Each pig-ear corner fold shall be nailed or stapled 12 mm from the upper edge to hold it in place. Nails shall be galvanized large-head roofing nails. On metal framing or studs, approved duct tape shall be used to secure pig-ear fold and membrane. Where no backing is provided between the studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding 12 mm from upper edge. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it will be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Surfaces to be solvent-welded shall be clean. Surfaces to be joined with xylene shall be initially sprayed and vigorously cleaned with a cotton cloth, followed by final coating of xylene and the joining of the surfaces by roller or equivalent means. If ambient or membrane temperatures are below 4 degrees C the membrane and the joint shall be heated prior to application of xylene. Heat may be applied with hot-air gun or heat lamp, taking precautions not to scorch the membrane. Adequate ventilation and wearing of gloves are required when working with xylene. Membrane shall be pressed into position on the drain body, and shall be cut and fit to match so that membrane can be properly clamped and an effective gasket-type seal provided. On wood subflooring, two layers of 0.73 kg per square meter dry felt shall be installed prior to installation of shower pan to ensure a smooth surface for installation.

3.3.10.4 Nonplasticized Polyvinyl Chloride (PVC) Shower Pans

Nonplasticized PVC shall be turned up behind walls or wall surfaces a distance of not less than 150 mm in room areas and 75 mm above curb level in curbed spaces with sufficient material to fold over and fasten to outside face of curb. Corners shall be pig-ear type and folded between pan and studs. Only top 25 mm of upstand shall be nailed to hold in place. Nails shall be galvanized large-head roofing type. Approved duct tape shall be used on metal framing or studs to secure pig-ear fold and membrane. Where no backing is provided between studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding at top inch of upstand. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it is to be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after

which the membrane shall be pressed into place. Trim for drain shall be exactly the size of drain opening. Bolt holes shall be pierced to accommodate bolts with a tight fit. Adhesive shall be used between pan and subdrain. Clamping ring shall be bolted firmly. A small amount of gravel or porous materials shall be placed at weepholes so that holes remain clear when setting bed is poured. Membrane shall be solvent welded with PVC solvent cement. Surfaces to be solvent welded shall be clean (free of grease and grime). Sheets shall be laid on a flat surface with an overlap of about 50 mm. Top edge shall be folded back and surface primed with a PVC primer. PVC cement shall be applied and surfaces immediately placed together, while still wet. Joint shall be lightly rolled with a paint roller, then as the joint sets shall be rolled firmly but not so hard as to distort the material. In long lengths, about 600 or 900 mm at a time shall be welded. On wood subflooring, two layers of 0.73 kg per square meter felt shall be installed prior to installation of shower pan to ensure a smooth surface installation.

3.4 VIBRATION-ABSORBING FEATURES

Mechanical equipment, including compressors and pumps, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors. Isolation unit installation shall limit vibration to [_____] percent of the lowest equipment rpm.

3.4.1 Tank- or Skid-Mounted Compressors

Floor attachment shall be as recommended by compressor manufacturer. Compressors shall be mounted to resist seismic loads as specified in Section 23 05 48.19 [SEISMIC] BRACING FOR HVAC.

3.4.2 Foundation-Mounted Compressors

[Foundation attachment shall be as recommended by the compressor manufacturer.][Foundation shall be as recommended by the compressor manufacturer, except the foundation shall weigh not less than three times the weight of the moving parts.] Compressors shall be mounted to resist seismic loads as specified in Section 23 05 48.19 [SEISMIC] BRACING FOR HVAC.

3.5 WATER METER REMOTE READOUT REGISTER

The remote readout register shall be mounted at the location indicated or as directed by the Contracting Officer.

3.6 IDENTIFICATION SYSTEMS

3.6.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 35 mm minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded

chain, or plastic straps designed for that purpose.

3.6.2 Pipe Color Code Marking

Color code marking of piping shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.6.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 12 mm in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 1 m width, 750 mm height, and 12 mm thickness. The board shall be made of wood fiberboard and framed under glass or 1.6 mm transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 20 mm in diameter and the related lettering in 12 mm high capital letters. The color code board shall be mounted and located in the mechanical or equipment room. The color code system shall be as indicated below:

Color	System	Item	Location
[_____]	[_____]	[_____]	[_____]

3.7 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.8 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09 90 00 PAINTS AND COATINGS.

3.8.1 Painting of New Equipment

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

3.8.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with JIS Z 2371 and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 3 mm on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 50 degrees C, the factory painting system shall be designed for the temperature service.

3.8.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 50 degrees C shall be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

a. Temperatures Less Than 50 Degrees C: Immediately after cleaning, the metal surfaces subject to temperatures less than 50 degrees C shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.0076 mm, one coat of primer applied to a minimum dry film thickness of 0.0255 mm; and two coats of enamel applied to a minimum dry film thickness of 0.0255 mm per coat.

b. Temperatures Between 50 and 205 Degrees C: Metal surfaces subject to temperatures between 50 and 205 degrees C shall receive two coats of 205 degrees C heat-resisting enamel applied to a total minimum thickness of 0.05 mm.

c. Temperatures Greater Than 205 Degrees C: Metal surfaces subject to temperatures greater than 205 degrees C shall receive two coats of 315 degrees C heat-resisting paint applied to a total minimum dry film thickness of 0.05 mm.

3.9 TESTS, FLUSHING AND DISINFECTION

3.9.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with MLIT-M, except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure and reasons for

choosing this option in lieu of the smoke test to the Contracting Officer for approval.

a. Drainage and Vent Systems Test. The final test shall include a smoke test.

b. Building Sewers Tests.

c. Water Supply Systems Tests.

3.9.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies.

Backflow prevention assembly test gauges shall be tested annually for accuracy in accordance with the requirements of State or local regulatory agencies. If there is no State or local regulatory agency requirements, gauges shall be tested annually for accuracy in accordance with the requirements of University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14), or any other approved testing laboratory having equivalent capabilities for both laboratory and field evaluation of backflow prevention assembly test gauges. Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	
Test Pressure Readings	Serial Number and Test Data of Gauges

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.9.1.2 Shower Pans

After installation of the pan and finished floor, the drain shall be temporarily plugged below the weep holes. The floor area shall be flooded with water to a minimum depth of 25 mm for a period of 24 hours. Any drop in the water level during test, except for evaporation, will be reason for rejection, repair, and retest.

3.9.1.3 Compressed Air Piping (Nonoil-Free)

Piping systems shall be filled with oil-free dry air or gaseous nitrogen to

1.03 MPa and hold this pressure for 2 hours with no drop in pressure.

3.9.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.9.3 System Flushing

3.9.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with [hot] potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 1.2 meters per second through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets and drinking water fountains, to include any device considered as an end point device by JIS S 3200-7, Section 9, shall be flushed a minimum of 1 L per 24 hour period, ten times over a 14 day period.

3.9.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Flow rates on fixtures must not exceed those stated in PART 2 of this Section. Unless more stringent local requirements exist, lead levels shall not exceed limits established by JIS S 3201. The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

3.9.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of

the system:

a. Time, date, and duration of test.

b. Water pressures at the most remote and the highest fixtures.

c. Operation of each fixture and fixture trim.

d. Operation of each valve, hydrant, and faucet.

e. Pump suction and discharge pressures.

f. Temperature of each domestic hot-water supply.

g. Operation of each floor and roof drain by flooding with water.

h. Operation of each vacuum breaker and backflow preventer.

i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.

j. Compressed air readings at each compressor and at each outlet. Each indicating instrument shall be read at 1/2 hour intervals. The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

3.9.5 Disinfection

After all system components are provided and operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. Before introducing disinfecting chlorination material, entire system shall be flushed with potable water until any entrained dirt and other foreign materials have been removed.

Water chlorination procedure shall be in accordance with Japanese Water Supply Law, Article 20 as modified and supplemented by this specification. The chlorinating material shall be hypochlorites or liquid chlorine. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per
million (ppm). Feed a properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or inject liquid chlorine into the system through a solution-feed chlorinator and booster pump until the entire system is completely filled.

Test the chlorine residual level in the water at 6 hour intervals for a continuous period of 24 hours. If at the end of a 6 hour interval, the chlorine residual has dropped to less than 25 ppm, flush the piping including tanks with potable water, and repeat the above chlorination procedures. During the chlorination period, each valve and faucet shall be opened and closed several times.

After the second 24 hour period, verify that no less than 25 ppm chlorine residual remains in the treated system. The 24 hour chlorination procedure must be repeated until no less than 25 ppm chlorine residual remains in the treated system.

Upon the specified verification, the system including tanks shall then

be flushed with potable water until the residual chlorine level is reduced to less than one part per million. During the flushing period, each valve and faucet shall be opened and closed several times.

Take additional samples of water in disinfected containers, for bacterial examination, at locations specified by the Contracting Officer
Test these samples for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with MLIT-M. The testing method used shall be EPA approved for drinking water systems and shall comply with applicable local and state requirements.

Disinfection shall be repeated until bacterial tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.10 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.11 PERFORMANCE OF WATER HEATING EQUIPMENT

Standard rating condition terms are as follows:

EF = Energy factor, minimum overall efficiency.

ET = Minimum thermal efficiency with 21 degrees C delta T.

SL = Standby loss is maximum (Btu/h) based on a 38.9 degree C temperature difference between stored water and ambient requirements.

V = Rated volume in gallons

Q = Nameplate input rate in kW (Btu/h)

3.11.1 Storage Water Heaters

3.11.1.1 Electric

a. Storage capacity of 227 liters shall have a minimum energy factor (EF) of 0.93 or higher per FEMP requirements.

b. Storage capacity of 227 liters or more shall have a minimum energy factor (EF) of 0.91 or higher per FEMP requirements.

3.11.1.2 Gas

a. Storage capacity of 189 liters or less shall have a minimum energy factor (EF) of 0.67 or higher per FEMP requirements.

b. Storage capacity of 75.7 liters - or more and input rating of 23 KW W or less:

c. Rating of less than 22980 W: (75,000 Btu/h) ET shall be 80 percent; maximum SL shall be (Q/800+110x(V^^1/2)), per JIS S 2109

3.11.1.3 Oil

a. Storage capacity of 75.7 liters or more and input rating of 31 KW W or less:

b. Rating of less than 309.75 W/L or input rating more than 31 KW: ET shall be 78 percent; maximum SL shall be (Q/800+100x(V^^1/2)), per JIS S 2109.

3.11.2 Unfired Hot Water Storage

All volumes and inputs: shall meet or exceed R-12.5.

3.11.3 Instantaneous Water Heater

3.11.3.1 Gas

a. Rating of 309.75 W/L and greater and less than 7.57 L with an input greater than 14.66 kW and less than 58.62 kW

b. Rating of 309.75 W/L and greater and less than 37.85 L with an input of 58.62 kW and greater shall have a minimum thermal efficiency (ET) of 80 percent per JIS S 2109

c. Rating of 309.75 W/L and greater and 37.85 L and greater with an input of 58.62 kW and greater shall have a minimum thermal efficiency (ET) of 80 percent and the maximum SL shall be Q/800+110x(V^^1/2)) per JIS S 2109

3.11.3.2 Oil

a. Rating of 309.75 W/L and greater and less than 7.57 L with an input of 61.55 kW and less

b. Rating of 309.75 W/Ll and greater and less than 37.85 L with an input greater than 61.55 kW shall have a minimum thermal efficiency (ET) of 80 percent per JIS S 2109

c. Rating of 309.75 W/L and 37.85 L and greater with an input of greater than 61.55 kW shall have a minimum thermal efficiency (ET) of 78 percent and the
maximum SL shall be Q/800+110x(V^^1/2)) per JIS S 2109

3.11.4 Pool Heaters

a. Gas/oil fuel, capacities and inputs: ET shall be 78 percent.

b. Heat Pump, All capacities and inputs shall meet a COP of 4.0.

3.12 TABLES

TABLE I

PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, VENT AND CONDENSATE DRAIN PIPING SYSTEMS

It #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F	SERVICE G
1	Cast iron soil pipe and fittings, hub and spigot, JIS G 5526 with compression gaskets. Pipe and fittings shall be marked with the CISPI trademark.	X	X	X	X	X		
2	Cast iron soil pipe and fittings hubless, JIS G 5526 and JIS B 2302 and JIS B 2301. Pipe and fittings shall be marked with the CISPI trademark.		X	X	X	X		
3	Cast iron drainage fittings, threaded, JIS B 2302 and JIS B 2301 for use with Item 10	X		X	X			
4	Cast iron screwed fittings (threaded) JIS B 2302 and JIS B 2301 for use with Item 10				X	X		
5	Grooved pipe couplings, ferrous and non-ferrous pipe JIS G 5502 And JIS G 5705	X	X		X	X		

TABLE I

PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, VENT AND CONDENSATE DRAIN PIPING SYSTEMS

It #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F	SERVICE G
6	Ductile iron grooved joint fittings for ferrous pipe JIS G 5502 and JIS G 5705 for use with Item 5	X	X		X	X		
7	Bronze sand casting grooved joint pressure fittings for non-ferrous pipe JIS H 5120, for use with Item 5	X	X		X	X		
8	Wrought copper grooved joint pressure fittings for non-ferrous pipe JIS H 3250, Copper Rand Bores JIS H 3401 JIS H 3401 for use with Item 5	X	X					
9	Malleable-iron threaded fittings, galvanized JIS B 2301 for use with Item 10				X	X		
10	Steel pipe, seamless galvanized, JIS G 3452 Type S, Grade B	X			X	X		

TABLE I

PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, VENT AND CONDENSATE DRAIN PIPING SYSTEMS

It #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F	SERVICE G
11	Seamless red brass pipe, JIS H 3300				X	X		X
12	Bronzed flanged fittings, JIS B 2240 for use with Items 11 and 14				X	X		X
13	Cast copper alloy solder joint pressure fittings, JIS H 3401 for use with Item 14				X	X		X
14	Seamless copper pipe, JIS H 3300						X	X
15	Cast bronze threaded fittings, JIS H 3401				X	X		
16	Copper drainage tube, (DWV), JIS H 3300	X*	X	X*	X	X		X
17	Wrought copper and wrought alloy solder-joint drainage fittings. JIS H 3401	X	X	X	X	X		X
18	Cast copper alloy solder joint drainage fittings, DWV, JIS H 3401	X	X	X	X	X		X

TABLE I

PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, VENT AND CONDENSATE DRAIN PIPING SYSTEMS

It #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F	SERVICE G
19	Acrylonitrile-Butadier (ABS) plastic drain, waste, and vent pipe and fittings JIS H 3401	X	X	X	X	X	X	
20	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, JIS K 6739 JIS K 6742, (Sch 40) JIS K 6742	X	X	X	X	X	X	X
21	Process glass pipe and fittings, JIS R 3644						X	
22	High-silicon content cast iron pipe and fittings (hub and spigot, and mechanical joint), JPF-DP-001		X			X	X	
23	Filament-wound reinforced thermosetting resin (RTRP) pipe, JIS K 7013						X	

TABLE I

PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, VENT AND CONDENSATE DRAIN PIPING SYSTEMS

It #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F	SERVICE G

SERVICE:

A - Underground Building Soil, Waste and Storm Drain
B - Aboveground Soil, Waste, Drain In Buildings
C - Underground Vent
D - Aboveground Vent
E - Interior Rainwater Conductors Aboveground
F - Corrosive Waste And Vent Above And Belowground
G - Condensate Drain Aboveground

* - Hard Temper

TABLE II

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
1	Malleable-iron threaded fittings:				
	a. Galvanized, ASME B16.3 for use with Item 4a	X	X	X	X
	b. Same as "a" but not galvanized for use with Item 4b			X	
2	Grooved pipe couplings, ferrous pipe ASTM A536 and ASTM A47/A47M, non-ferrous pipe, ASTM A536 and ASTM A47/A47M	X	X	X	
3	Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M, for use with Item 2	X	X	X	

TABLE II

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
4	Steel pipe:				
	a. Seamless, galvanized, ASTM A53/A53M, Type S, Grade B	X	X	X	X
	b. Seamless, black, ASTM A53/A53M, Type S, Grade B			X	
5	Seamless red brass pipe, ASTM B43	X	X		X
6	Bronze flanged fittings, ASME B16.24 for use with Items 5 and 7	X	X		X
7	Seamless copper pipe, ASTM B42	X	X		X
8	Seamless copper water tube, ASTM B88, ASTM B88M	X**	X**	X**	X***
9	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7	X	X		X
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5, 7 and 8	X	X	X	X
11	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Item 8	X	X	X	X
12	Bronze and sand castings groovedjoint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 2	X	X	X	
13	Polyethylene (PE) plastic pipe, Schedules 40 and 80, based on outside diameter	X			X

TABLE II

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
14	Polyethylene (PE) plastic pipe (SDR-PR), based on controlled outside diameter, ASTM D3035	X			X
15	Polyethylene (PE) plastic pipe (SIDR-PR), based on controlled inside diameter, ASTM D2239	X			X
16	Butt fusion polyethylene (PE) plastic pipe fittings, ASTM D3261 for use with Items 14, 15, and 16	X			X
17	Socket-type polyethylene fittings for outside diameter-controlled polyethylene pipe, ASTM D2683 for use with Item 15	X			X
18	Polyethylene (PE) plastic tubing, ASTM D2737	X			X
19	Chlorinated polyvinyl chloride (CPVC) plastic hot and cold water distribution system, ASTM D2846/D2846M	X	X		X
20	Chlorinated polyvinyl chloride (CPVC) plastic pipe, Schedule 40 and 80, ASTM F441/F441M	X	X		X
21	Chlorinated polyvinyl chloride (CPVC) plastic pipe (SDR-PR) ASTM F442/F442M	X	X		X
22	Threaded chlorinated polyvinyl chloride (chloride CPVC) plastic pipe fittings, Schedule 80, ASTM F437 for use with Items 20, and 21	X	X		X

TABLE II

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
23	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F438 for use with Items 20, 21, and 22	X	X		X
24	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F439 for use with Items 20, 21, and 22	X	X		X
25	Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80, and 120, ASTM D1785	X			X
26	Polyvinyl chloride (PVC) pressure-rated pipe (SDR Series), ASTM D2241	X			X
27	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D2466	X			X
28	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2467 for use with Items 26 and 27	X			X
29	Threaded polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2464	X			X
30	Joints for IPS PVC pipe using solvent cement, ASTM D2672	X			X
31	Polypropylene (PP) plastic pipe and fittings; ASTM F2389	X	X		X
32	Steel pipeline flanges, MSS SP-44	X	X		

TABLE II

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
33	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B828	X	X		
34	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X	X	
35	Malleable-iron threaded pipe unions ASME B16.39	X	X		
36	Nipples, pipe threaded ASTM A733	X	X	X	
37	Crosslinked Polyethylene (PEX) Plastic Pipe ASTM F877	X	X		X
38	Press Fittings	X	X		
	SERVICE: A - Cold Water Service Aboveground B - Hot and Cold Water Distribution 82 degrees C Maximum Aboveground C - Compressed Air Lubricated D - Cold Water Service Belowground Indicated types are minimum wall thicknesses. ** - Type L - Hard *** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors **** - In or under slab floors only brazed joints				

TABLE III

STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT

FUEL	STORAGE CAPACITY LITERS	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE
A. STORAGE WATER HEATERS				
Elect.	227 max		ISO 14024	EF = 0.93

TABLE III

STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT

FUEL	STORAGE CAPACITY LITERS	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE
Elect.	227 min		ISO 14024	EF = 0.91
Elect.	75.7 min.	12 kW max.	ISO 14024	EF = 0.93-0.00132V minimum
Elect.	75.7 min. OR	12 kW min.	JIS S 2109	SL = 20+35x(V^^1/2) maximum
Elect. Heat Pump		24 Amps or less and 250 Volts or less	ISO 14024	EF = 0.93-0.00132V
Gas	189 max		ISO 14024	EF = 0.67-0.0019V min
Gas	75.7 min.	22 kW max.	ISO 14024	EF = 0.80-0.0019V minimum
Gas	309.75 W/L max.	22 kW max.	JIS S 2109	ET= 80 percent; SL = 1.3+38/V max.
Oil	75.7 min.	30.8 kW max.	ISO 14024	EF = 0.59-0.0019V min
Oil	309.75 W/L max	30.8 kW	JIS S 2109	ET = 78 percent; SL = (Q/800+110x(V^^1/2)) maximum
B. Unfired Hot Water Storage, R = 2.2 minimum				
C. Instantaneous Water Heater				
Gas	309.75 W/L min.	14.66 kW min.	ISO 14024	EF = 0.62-0.0019V and 7.57 L max 58.62 kW max.
Gas	309.75 W/L min.	58.62 kW min.	JIS S 2109	ET = 80 percent and 37.85 L max 58.62 kW max.
Gas	309.75 W/L min.	58.62 kW min.	JIS S 2109	ET = 80 percent and 37.85 L min. SL + (Q/800+110x(V^^1/2)

TABLE III

STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT

FUEL	STORAGE CAPACITY LITERS	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE
Oil	309.75 W/L min.	61.552 kW max.	ISO 14024	EF = 0.59-0.0019V and 37.85 L max.
Oil	309.75 W/L min.	61.552 kW max.	JIS S 2109	ET = 80 percent and 37.85 L min. SL + (Q/800+110x(V^^1/2)
Oil	309.75 W/L min.	61.552 kW max.	JIS S 2109	ET = 78 percent and 37.85 L max SL = (Q800+110x(V^^1/2))
D. Pool Heater				
Gas or Oil	All	All		ET = 78 percent
Heat Pump All	All	All		COP = 4.0

TERMS:

EF = Energy factor, minimum overall efficiency.
ET = Minimum thermal efficiency with 21 degrees C delta T.
SL = Standby loss is maximum Watts based on a 38.9 degrees C temperature difference between stored water and ambient requirements.
V = Rated storage volume in gallons
Q = Nameplate input rate in Watts

-- End of Section --

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SECTION 23 05 15

COMMON PIPING FOR HVAC

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 0203	(2014) Concrete Terminology
JIS A 1108	(2018) Method of Test for Compressive Strength of Concrete
JIS A 1110	(2006) Methods of Test for Density and Water Absorption of Coarse Aggregates
JIS A 5758	(2016) Sealants for Sealing and Glazing in Buildings
JIS A 9504	(2017) Man Made Mineral Fibre Thermal Insulation Materials
JIS B 0209-1	(2001) ISO General Purpose Metric Screw Threads-Tolerances-Part 1 : Principles and Basic Data
JIS B 1112	(1995) Cross Recessed Head Wood Screws
JIS B 1181	(2014) Hexagon Nuts and Hexagon Thin Nuts
JIS B 1220	(2015) Set of Anchor Bolt for Structures
JIS B 2011	(2013) Bronze, Gate, Globe, Angle, and Check Valves (Amendment 2)
JIS B 2031	(2015) Gray Cast Iron Valves (Amendment 1)
JIS B 2032	(2013) Wafer Type Rubber-Seated Butterfly Valves
JIS B 2061	(2017) Faucets, Ball Taps and Flush Valves
JIS B 2220	(2012) Steel Pipe Flanges
JIS B 2239	(2013) Cast Iron Pipe Flanges
JIS B 2240	(2006) Copper Alloy Pipe Flanges
JIS B 2301	(2013) Screwed Type Malleable Cast Iron Pipe Fittings

JIS B 2311	(2015) Steel Butt-Welding Pipe Fittings for Ordinary Use
JIS B 2312	(2015) Steel Butt-Welding Pipe Fittings
JIS B 7410	(1997) Liquid-In-Glass Thermometers for Testing of Petroleum Product
JIS B 7505-1	(2017) Aneroid Pressure Gauges-Part 1: Bourdon Tube Pressure Gauges
JIS B 8267	(2015) Construction of Pressure Vessel
JIS B 8285	(2010) Welding Procedure Qualification Test for Pressure Vessels
JIS C 3605	(R2002) 600 V Polyethylene Insulated Cables, Type CV
JIS F 0602	(1995) Shipbuilding-Non-Asbestos Gaskets to Cargo Piping System-Application Standard
JIS G 3138	(2005) Rolled Steel Bars for Building Structure
JIS G 3201	(2008) Carbon Steel Forgings for General Use (Amendment 1)
JIS G 3202	(2008) Carbon Steel Forgings for Pressure Vessels (Amendment 1)
JIS G 3454	(2019) Carbon Steel Pipes for Pressure Service (Amendment 1)
JIS G 3455	(2016) Carbon Steel Pipes for High Pressure Service
JIS G 3456	(2019) Carbon Steel Pipes for High Temperature Service
JIS G 3459	(2017) Stainless Steel Pipes (Amendment 1)
JIS G 4051	(2018) Carbon Steels for Machine Structural Use (Amendment 1)
JIS G 4053	(2018) Low-Alloyed Steels for Machine Structural Use (Amendment 1)
JIS G 4107	(2015) Alloy Steel Bolting Materials for High Temperature Service (Amendment 1)
JIS G 4303	(2012) Stainless Steel Bars
JIS G 4305	(2015) Cold-Rolled Stainless Steel Plate, Sheet and Strip (Amendment 1)
JIS G 5151	(1991) Steel Castings for High Temperature and High Pressure Service

JIS G 5501	(1995) Grey Iron Castings
JIS H 3100	(2018) Copper and Copper Alloy Sheets, Plates and Strips
JIS H 3300	(2018) Copper and Copper Alloy Seamless Pipes and Tubes
JIS H 3401	(2001) Pipe Fittings of Copper and Copper Alloys
JIS K 7311	(1995) Testing Methods for Thermoplastic Polyurethane Elastomers
JIS HB 40-1	(2019) Ferrous Materials & Metallurgy I
JIS HB 40-2	(2019) Ferrous Materials & Metallurgy II

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 834-1	(1999) Fire-Resistance Tests-Elements of Building Construction-Part 1: General Requirements

MLIT MECHANICAL STANDARD SPECIFICATION

MLIT-M	(2019) Public Building Construction Standard Specification

1.2 GENERAL REQUIREMENTS

[Section 23 30 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section]

[Section 40 17 30.00 40 WELDING GENERAL PIPING applies to work specified in this section.

] Submit Material, Equipment, and Fixture Lists for pipes, valves and specialties including manufacturer's style or catalog numbers, specification and drawing reference numbers, and warranty information.

Submit Record Drawings for pipes, valves and accessories providing current factual information including deviations and amendments to the drawings, and concealed and visible changes in the work.

Submit Coordination Drawings for pipes, valves and specialties showing coordination of work between different trades and with the structural and architectural elements of work. Detail all drawings sufficiently to show overall dimensions of related items, clearances, and relative locations of work in allotted spaces. Indicate on drawings where conflicts or clearance problems exist between various trades.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion

in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture Lists[G]

SD-02 Shop Drawings

Record Drawings[; G[, [_____]]]

Coordination Drawings[G]

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals[ ]

1.4 QUALITY ASSURANCE

1.4.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Provide standard products in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use includes applications of equipment and materials under similar circumstances and of similar size. Ensure the product has been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.4.2 Alternative Qualifications

Products having less than a two-year field service record are acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.4.3 Service Support

Ensure the equipment items are supported by service organizations located in Japan. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. Select service organizations that are reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.4.4 Manufacturer's Nameplate

Provide a nameplate on each item of equipment bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent is not acceptable.

1.4.5 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been

substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer.

1.4.5.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions are considered mandatory, the word "should" is interpreted as "shall." Reference to the "code official" is interpreted to mean the "Contracting Officer." For Navy owned property, interpret references to the "owner" to mean the "Contracting Officer." For leased facilities, references to the "owner" is interpreted to mean the "lessor." References to the "permit holder" are interpreted to mean the "Contractor."

1.4.5.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, are applied as appropriate by the Contracting Officer and as authorized by his administrative cognizance and the FAR.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Provide instructors thoroughly familiar with all parts of the installation and trained in operating theory as well as practical operation and maintenance work.

Give instruction during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished is as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

1.7 ACCESSIBILITY

Install all work so that parts requiring periodic inspection, operation,

maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 ELECTRICAL HEAT TRACING

Provide heat trace systems for pipes, valves, and fittings. System include all necessary components, including heaters and controls to prevent freezing.

Provide self-regulating heaters consisting of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature along its length. Ensure heater is able to be crossed over itself without overheating. Obtain approval before used directly on plastic pipe. Cover heater with a radiation cross-linked modified polyolefin dielectric jacket in accordance with JIS C 3605.

Provide heater with self-regulating factor of at least [90] percent, in order to provide energy conservation and to prevent overheating.

Operate heater on line voltages of [120] [208] volts without the use of transformers.

Size Heater according to the following table:

Pipe Size (DN)

(Millimeter Diameter)	Minus 23 degrees C	Minus 29 degrees C
80 or less	16 watts per meter (wpm)	16 watts per meter (wpm)
100	16 wpm	26 wpm
150	26 wpm	26 wpm
200	2 strips/16 wpm	2 strips/26 wpm
300 to 356	2 strips/26 wpm	2 strips/26 wpm

Control systems by an ambient sensing thermostat set at 4 degrees C either directly or through an appropriate contactor.

2.2 PIPE AND FITTINGS

Submit equipment and performance data for pipe and fittings consisting of corrosion resistance, life expectancy, gage tolerances, and grade line analysis. Submit design analysis and calculations consisting of surface resistance, rates of flow, head losses, inlet and outlet design, required radius of bend, and pressure calculations. Also include in data pipe size, shape, and dimensions, as well as temperature ratings, vibration and thrust limitations minimum burst pressures, shut-off and non-shock pressures and weld characteristics.

2.2.1 Type BCS, Black Carbon Steel

Ensure pipe DN6 through DN300 is Schedule 40 black carbon steel, conforming to JIS G 3454.

Ensure pipe DN6 through DN250 is Schedule 40 seamless or electric-resistance welded black carbon steel, conforming to JIS G 3454.

Ensure pipe DN300 through DN610 is 9.52 millimeter wall seamless black carbon steel, conforming to JIS G 3454.

Ensure fittings DN50 and under are 1034 kilopascal working steam pressure (wsp) banded black malleable iron screwed, conforming to JIS G 3454 and JIS B 2301.

Ensure unions DN50 and under are 1724 kilopascal female, screwed, black malleable iron with brass-to-iron seat, and ground joint, conforming to JIS B 2301.

Ensure fittings DN65 and over are Steel butt weld, conforming to JIS B 2312 to match pipe wall thickness.

Ensure flanges DN65 and over are 1034 kilopascal forged-steel conforming to JIS B 2220, welding neck to match pipe wall thickness.

2.2.2 Type BCS-125, 862 kilopascal Service

Ensure pipe DN6 through DN40 is Schedule 40 steam, Schedule 80 condensate, furnace butt weld, black carbon steel, conforming to JIS G 3456.

Ensure pipe DN50 through DN250 is Schedule 40 steam, Schedule 80 condensate, seamless or electric-resistance welded black carbon steel, conforming to [Grade B (electric-resistance welded)] or [Type S (seamless)] and JIS G 3456.

Ensure pipe DN300 through DN610 is 9.52 millimeter wall, [seamless] or [electric-resistance] welded black carbon steel, conforming to JIS G 3454.

Ensure fittings DN50 and under are 862 kilopascal wsp, cast iron, screwed end, conforming to JIS G 5501 and JIS G 3454 and JIS B 2301.

Ensure fittings DN50 and under are 1034 kilopascal wsp banded black malleable iron screwed, conforming to JIS G 3455 and JIS B 2301.

Ensure fittings DN25 through DN50 are 14 or 21 megapascal water, oil, or gas (wog) to match pipe wall, forged carbon steel socket weld, conforming to JIS G 3455 and JIS B 2301.

Ensure fittings DN50 and under are 862 kilopascal wsp, cast iron, screwed end, conforming to JIS G 3454 and JIS B 2301.

Ensure fittings DN65 and over are wall thickness to match pipe, long radius butt weld, black carbon steel, conforming to JIS G 4051 and JIS B 2311.

Ensure couplings DN50 and under are commercial standard weight for Schedule 40 pipe and commercial extra heavy weight for Schedule 80 pipe, black carbon steel where threaded, and 14 or 21 megapascal wog forged carbon steel, conforming to JIS G 3455 and JIS B 2301, where welded.

Ensure flanges DN65 and over are 1035 kilopascal, forged carbon-steel welding neck, with raised face or flat face and concentric serrated finish, conforming to JIS G 3455 and JIS B 2301.

Conform grooved pipe couplings and fittings in accordance with paragraph GROOVED PIPE COUPLINGS AND FITTINGS.

2.2.3 Type CPR, Copper

2.2.3.1 Type CPR-A, Copper Above Ground

Ensure tubing DN50 and under is seamless copper tubing, conforming to JIS H 3300, Type L (hard-drawn for all horizontal and all exposed vertical lines, annealed for concealed vertical lines).

Ensure fittings DN50 and under are 1034 kilopascal wsp wrought-copper solder joint fittings conforming to JIS H 3401.

Ensure unions DN50 and under are 1034 kilopascal wsp wrought-copper solder joint, conforming to JIS H 3401.

2.3 PIPING SPECIALTIES

Submit equipment and performance data for piping specialties consisting of corrosion resistance, life expectancy, gage tolerances, and grade line analysis. Submit design analysis and calculations consisting of surface resistance, rates of flow, head losses, inlet and outlet design, required radius of bend, and pressure calculations. Also include in data pipe size, shape, and dimensions, as well as temperature ratings, vibration and thrust limitations minimum burst pressures, shut-off and non-shock pressures and weld characteristics.

2.3.1 Air Separator

Air separated from converter discharge water is ejected by a reduced-velocity device vented to the compression tank.

Provide a commercially constructed separator, designed and certified to separate not less than 80 percent of entrained air on the first passage of water and not less than 80 percent of residual on each successive pass. Provide shop drawings detailing all piping connections proposed for this work.

Ensure the air separator is carbon steel, designed, fabricated, tested, and stamped in conformance with JIS B 8267 for service pressures not less than 862 kilopascal.

2.3.2 Air Vents

Provide manual air vents using 10 millimeter globe valves.

Provide automatic air vents on pumps, mains, and where indicated using ball-float construction. Ensure the vent inlet is not less than DN20 and the outlet not less than 8 millimeter. Orifice size is 3 millimeter. Provide corrosion-resistant steel trim conforming to [JIS G 4303] JIS G 4305. Fit vent with try-cock. Ensure vent discharges air at any pressure up to 1034 kilopascal . Ensure outlet is copper tube routed.

2.3.3 Dielectric Connections

Electrically insulate dissimlar pipe metals from each other by couplings, unions, or flanges commercially manufactured for that purpose and rated for the service pressure and temperature.

2.3.4 Expansion Vibration Isolation Joints

Construct single or multiple arch-flanged expansion vibration isolation joints of steel-ring reinforced chloroprene-impregnated cloth materials. Design joint to absorb the movement of the pipe sections in which installed with no detrimental effect on the pipe or connected equipment. Back flanges with ferrous-metal backing rings. Provide control rod assemblies to restrict joint movement. Coat all nonmetallic exterior surfaces of the joint with chlorosulphinated polyethylene. Provide grommets in limit bolt hole to absorb noise transmitted through the bolts.

Ensure joints are suitable for continuous-duty working temperature of at least 121 degrees C.

Fill arches with soft chloroprene.

Ensure joint, single-arch, movement limitations and size-related, pressure characteristics conform to MLIT-M.

2.3.5 Flexible Pipe

Construct flexible pipe vibration and pipe-noise eliminators of wire-reinforced, rubber-impregnated cloth and cord materials and be flanged. Back the flanges with ferrous-metal backing rings. Ensure service pressure-rating is a minimum 1.5 times actual service, with surge pressure at 82 degrees C.

Construct flexible pipe vibration and pipe noise eliminators of wire-reinforced chloroprene-impregnated cloth and cord materials. Ensure the pipe is flanged. Provide all flanges backed with ferrous-metal backing rings. Coat nonmetallic exterior surfaces of the flexible pipe with an acid- and oxidation-resistant chlorosulphinated polyethylene. Rate the flexible pipe for continuous duty at 896 kilopascal and 121 degrees C.

Ensure unit pipe lengths, face-to-face, are not less than the following:

INSIDE DIAMETER (DN)	UNIT PIPE LENGTH
To 65, inclusive	305 millimeter
80 to 100, inclusive	450 millimeter
125 to 300, inclusive	600 millimeter
To 80, inclusive	450 millimeter
110 to 250, inclusive	600 millimeter
300 and larger	914 millimeter

2.3.6 Flexible Metallic Pipe

Ensure flexible pipe is the bellows-type with wire braid cover and designed, constructed, and rated in accordance with the applicable requirements of MLIT-M.

Minimum working pressure rating is [345] [690] kilopascal at 149 degrees C.

Ensure minimum burst pressure is four times working pressure at 149 degrees C. Bellows material is JIS G 3459 corrosion-resistant steel. Ensure braid is JIS G 4053 corrosion-resistant steel wire.

Ensure welded end connections are Schedule 80 carbon steel pipe, conforming to JIS G 3456.

Provide threaded end connections; hex-collared Schedule 40, JIS G 3459 corrosion-resistant steel, conforming to JIS G 3459.

Ensure flanged end connection rating and materials conform to specifications for system primary-pressure rating.

2.3.7 Flexible Metal Steam Hose

Provide a bellows type hose with wire braid cover and designed, constructed, and rated in accordance with the applicable requirements of MLIT-M.

Ensure the working steam pressure rating is 862 kilopascal at 260 degrees C .

Ensure minimum burst pressure is nine times working steam pressure at 149 degrees C.

Ensure bellows material is JIS G 3459 corrosion-resistant steel. Braid is JIS G 4053 corrosion-resistant steel wire.

Provide welded end connections; Schedule 80 carbon steel pressure tube, conforming to JIS G 3456.

Provide threaded end connections; hex-collared Schedule 40, JIS G 3459 corrosion-resistant steel, conforming to JIS G 3459.

Ensure flanged end connection rating and materials conform to specifications for system primary-pressure rating.

2.3.8 Metallic Expansion Joints

Provide metallic-bellows expansion joints conforming to MLIT-M.

2.3.9 Hose Faucets

Construct hose faucets with 15 millimeter male inlet threads, hexagon shoulder, and 20 millimeter hose connection, conforming to MLIT-M. Ensure hose-coupling screw threads conform to JIS B 0209-1.

Provide vandal proof, atmospheric-type vacuum breaker on the discharge of all potable water lines.

2.3.10 Pressure Gages

Ensure pressure gages conform to JIS B 7505-1 and to requirements specified herein. Pressure-gage size is 90 millimeter nominal diameter. Ensure case is corrosion-resistant steel, conforming to any of JIS G 4053 series of JIS G 3138. Equip gages with adjustable red marking pointer and damper-screw adjustment in inlet connection. Align service-pressure reading at midpoint of gage range.

Fit steam gages with black steel syphons and steam service pressure-rated gage cocks or valves.

2.3.11 Sight-Flow Indicators

Construct sight-flow indicators for pressure service on 80 millimeter and smaller of bronze with specially treated single- or double-glass sight windows and have a bronze, nylon, or tetrafluoroethylene rotating flow indicator mounted on SUS 304, or SUS 316 corrosion-resistant steel shaft. Body may have screwed or flanged end. Provide pressure- and temperature-rated assembly for the applied service. Flapper flow-type indicators are not acceptable.

2.3.12 Sleeve Couplings

Sleeve couplings for plain-end pipe consist of one steel middle ring, two steel followers, two chloroprene or Buna-N elastomer gaskets, and the necessary steel bolts and nuts.

2.3.13 Thermometers

Ensure thermometers conform to JIS B 7410, except for being filled with a red organic liquid. Provide an industrial pattern armored glass thermometer, (well-threaded and seal-welded). Ensure thermometers installed 1800 millimeter or higher above the floor have an adjustable angle body. Ensure scale is not less than 180 millimeter long and the case face is manufactured from manufacturer's standard polished aluminum JIS G 4053 series polished corrosion-resistant steel. Provide thermometers with nonferrous separable wells. Provide lagging extension to accommodate insulation thickness.

2.3.14 Pump Suction Strainers

Provide a cast iron strainer body, rated for not less than 172 kilopascal at 38 degrees C, with flanges conforming to JIS B 2239. Strainer construction is such that there is a machined surface joint between body and basket that is normal to the centerline of the basket.

Ensure minimum ratio of open area of each basket to pipe area is 3 to 1. Provide a basket with JIS G 4053 series corrosion-resistant steel wire mesh with perforated backing.

Ensure mesh is capable of retaining all particles larger than 1,000 micrometer, with a pressure drop across the strainer body of not more than 5 kilopascal when the basket is two-thirds dirty at maximum system flow rate. Provide reducing fittings from strainer-flange size to pipe size.

Provide a [differential-pressure gage] fitted with a two-way brass cock across the strainer.

Provide manual air vent cocks in cap of each strainer.

2.3.15 Line Strainers, Water Service

Install Y-type strainers with removable basket. Ensure strainers in sizes DN50 and smaller have screwed ends; in sizes DN65 and larger, strainers have flanged ends. Ensure body working-pressure rating exceeds maximum service pressure of installed system by at least 50 percent. Ensure body has cast-in arrows to indicate direction of flow. Ensure all strainer bodies fitted with screwed screen retainers have straight threads and gasketed with nonferrous metal. For strainer bodies DN65 and larger, fitted with bolted-on screen retainers, provide offset blowdown holes. Fit all strainers larger than DN65 with manufacturer's standard ball-type blowdown valve. Ensure body material is [cast bronze conforming to MLIT-M] [cast iron conforming to Class 30]. Where system material is nonferrous, use nonferrous metal for the metal strainer body material.

Ensure minimum free-hole area of strainer element is equal to not less than 3.4 times the internal area of connecting piping. Strainer screens perforation size is not to exceed 1.14 millimeter. Ensure strainer screens have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material is [SUS 304, or SUS 316 corrosion-resistant steel] [Monel metal].

2.3.16 Line Strainers, Steam Service

Install Type Y strainers with removable strainer element.

Use flanged body end connections for all valves larger than DN50, unless butt weld ends are specified. Use [screwed] [socket] weld for sizes DN50 and under to suit specified piping system end connection and maintenance requirements [or be welded].

For strainers located in tunnels, trenches, manholes, and valve pits,use welded end connections.

Body working steam pressure rating is the same as the primary valve rating for system in which strainer is installed, except where welded end materials requirements result in higher pressure ratings. Ensure body has integral cast or forged arrows to indicate direction of flow. Provide strainer bodies with blowdown valves that have discharge end plugged with a solid metal plug. Make closure assembly with tetrafluoroethylene tape. Ensure bodies fitted with bolted-on screen retainers have offset blowdown holes.

Body materials are [cast steel conforming to JIS G 5151, Grade WCB] [forged carbon steel conforming to JIS G 3202 or JIS G 3201] [manufacturer's standard metallurgical equivalents for service pressures of 1035 kilopascal wsp and greater, and for lower pressure ratings where welding is required] [cast iron conforming to JIS B 2031, Class B, for service pressures 862 kilopascal wsp and less].

Ensure minimum free-hole area of strainer element is equal to not less than 3.4 times the internal area of connecting piping. Strainer screens perforation size is not to exceed 0.51 millimeter or equivalent wire mesh. Strainer screens have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material is SUS 304, or SUS 316 corrosion-resistant steel and fitted with backup screens where necessary to prevent collapse.

2.4 VALVES

Submit equipment and performance data for valves consisting of corrosion resistance and life expectancy. Submit design analysis and calculations consisting of rates of flow, head losses, inlet and outlet design, and pressure calculations. Also include in data, pipe dimensions, as well as temperature ratings, vibration and thrust limitations, minimum burst pressures, shut-off and non-shock pressures and weld characteristics.

2.4.1 Ball and Butterfly Valves

Ensure ball valves conform to JIS B 2061. For valve bodies in sizes DN50 and smaller, use screwed-end connection-type constructed of copper alloy. For valve bodies in sizes DN50 DN65 and larger, use flanged-end connection type, constructed of material. Balls and stems of valves DN50 and smaller are manufacturer's standard with hard chrome plating finish. Balls and stems of valves DN65 and larger are manufacturer's standard corrosion-resistant steel alloy with hard chrome plating. Balls of valves DN150 and larger may be Brinell hard chrome plating. Ensure valves are suitable for flow from either direction and seal equally tight in either direction. Valves with ball seals held in place by spring washers are not acceptable. Ensure all valves have adjustable packing glands. Seats and seals are fabricated from tetrafluoroethylene.

Ensure butterfly valves conform to JIS B 2032 and are the wafer type for mounting between specified flanges. Ensure valves are rated for 1034 kilopascal shutoff and nonshock working pressure. Select bodies of cast ferrous metal conforming to JIS B 2239 for body wall thickness. Seats and seals are fabricated from resilient elastomer designed for field removal and replacement.

2.4.2 Drain, Vent, and Gage Cocks

Provide [T-head] [lever handle] drain, vent, and gage cocks, ground key type, with washer and screw, constructed of polished JIS B 2240 and rated 862 kilopascal wsp. Ensure end connections are rated for specified service pressure.

Ensure pump vent cocks, and where spray control is required, constructed of manufacturer's standard polished brass. Ensure cocks are 15 millimeter male, end threaded, and rated at not less than 862 kilopascal at 107 degrees C.

2.4.3 Gate Valves (GAV)

Ensure gate valves DN50 and smaller conform to JIS B 2011. For valves located in tunnels, equipment rooms, factory-assembled equipment, and where indicated use union-ring bonnet, screwed-end type. Make packing of non-asbestos type materials. Use rising stem type valves.

Ensure gate valves DN65 and larger, are Type I, (solid wedge disc, tapered seats, steam rated); Class 125 (862 kilopascal steam-working pressure at 178 degrees C saturation); and 1379 kilopascal, wog (nonshock), conforming to JIS B 2031 and to requirements specified herein. Select flanged valves, with bronze trim and outside screw and yoke (OS&Y) construction. Make packing of non-asbestos type materials.

2.4.4 Globe and Angle Valves (GLV-ANV)

Ensure globe and angle valves DN50 and smaller, are 862 kilopascal conforming to JIS B 2011 and to requirements specified herein. For valves located in tunnels, equipment rooms, factory-assembled equipment, and where indicated, use union-ring bonnet, screwed-end type. Ensure disc is free to swivel on the stem in all valve sizes. Composition seating-surface disc construction may be substituted for all metal-disc construction. Make packing of non-asbestos type materials. Ensure disk and packing are suitable for pipe service installed.

Ensure globe and angle valves, DN65 and larger, are cast iron with bronze trim. Ensure valve bodies are cast iron conforming to JIS B 2011. Select flanged valves in conformance with JIS B 2239. Valve construction is outside screw and yoke (OS&Y) type. Make packing of non-asbestos type materials.

2.4.5 Standard Check Valves (SCV)

Ensure standard check valves in sizes DN50 and smaller are 862 kilopascal swing check valves except as otherwise specified. Provide lift checks where indicated. Ensure swing-check pins are nonferrous and suitably hard for the service. Select composition type discs. Ensure the swing-check angle of closure is manufacturer's standard unless a specific angle is needed.

Use cast iron, bronze trim, swing type check valves in sizes DN65 and larger. Ensure valve bodies are cast iron, conforming to JIS B 2031 and valve ends are flanged in conformance with JIS B 2239. Swing-check pin is approved equal corrosion-resistant steel. Angle of closure is manufacturer's standard unless a specific angle is needed. Ensure valves have bolted and gasketed covers.

2.4.6 Nonslam Check Valves (NSV)

Provide check valves at pump discharges in sizes DN50 and larger with nonslam or silent-check operation conforming to JIS B 2031. Select a valve disc or plate that closes before line flow can reverse to eliminate slam and water-hammer due to check-valve closure. Ensure valve is Class 125 rated for 1379 kilopascal maximum, nonshock pressure at 66 degrees C in sizes to DN300. Use valves that are [wafer type to fit between flanges conforming to JIS B 2239]. Valve body may be cast iron, or equivalent strength ductile iron. Select disks using manufacturer's standard bronze, aluminum bronze, or corrosion-resistant steel. Ensure pins, springs, and miscellaneous trim are manufacturer's standard corrosion-resistant steel.

2.5 MISCELLANEOUS MATERIALS

Submit equipment and performance data for miscellaneous materials consisting of corrosion resistance, life expectancy, gage tolerances, and grade line analysis.

2.5.1 Bituminous Coating

Ensure the bituminous coating is a solvent cutback, heavy-bodied material to produce not less than a 0.30 millimeter dry-film thickness in one coat, and is recommended by the manufacturer to be compatible with factory-applied coating and rubber joints.

For previously coal-tar coated and uncoated ferrous surfaces underground, use bituminous coating solvent cutback coal-tar type.

2.5.2 Bolting

Ensure flange and general purpose bolting is hex-head and conforms to JIS G 4107, above (bolts, for flanged joints in piping systems where one or both flanges are cast iron). Heavy hex-nuts conform to JIS B 1181. Square-head bolts and nuts are not acceptable. Ensure threads are coarse-thread series.

2.5.3 Elastomer Caulk

Use two-component polysulfide- or polyurethane-base elastomer caulking material, conforming to JIS K 7311.

2.5.4 Escutcheons

Manufacture escutcheons from nonferrous metals and chrome-plated except when JIS G 4053 series corrosion-resistant steel is provided. Ensure metals and finish conforms to Japanese standard.

Use one-piece escutcheons where mounted on chrome-plated pipe or tubing, and one-piece of split-pattern type elsewhere. Ensure all escutcheons have provisions consisting of internal spring-tension devices or setscrews for maintaining a fixed position against a surface.

2.5.5 Flashing

Ensure sheetlead conforms to Japanese standard

Ensure sheet copper conforms to JIS H 3100 and be not less than 4.88 kilogram per square meter weight.

2.5.6 Flange Gaskets

Provide compressed non-asbestos sheets, conforming to JIS F 0602, coated on both sides with graphite or similar lubricant, with nitrile composition, binder rated to 399 degrees C.

2.5.7 Grout

Provide shrink-resistant grout as a premixed and packaged metallic-aggregate, mortar-grouting compound conforming to JIS A 0203.

Ensure shrink-resistant grout is a combination of pre-measured and packaged epoxy polyamide or amine resins and selected aggregate mortar grouting compound conforming to the following requirements:

Tensile strength		13.100 Megapascal, minimum
Compressive strength	96.527 Megapascal, minimum	
	JIS A 1108	
Shrinkage, linear		0.003 mm per millimeter, maximum
Water absorption	0.1 percent, maximum	
	JIS A 1110	
Bond strength to		6.895 Megapascal, minimum steel in shear minimum

2.5.8 Pipe Thread Compounds

Use polytetrafluoroethylene tape not less than 0.05 to 0.08 millimeter thick in potable and process water and in chemical systems for pipe sizes to and including DN25. Use polytetrafluoroethylene dispersions and other suitable compounds for all other applications upon approval by the Contracting Officer; however, do not use lead-containing compounds in potable water systems.

2.6 SUPPORTING ELEMENTS

Submit equipment and performance data for the supporting elements consisting of corrosion resistance, life expectancy, gage tolerances, and grade line analysis.

Provide all necessary piping systems and equipment supporting elements, including but not limited to: building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; guides; and spring-cushion, variable, or constant supports. Ensure supporting elements are suitable for stresses imposed by systems pressures and temperatures and natural and other external forces normal to this facility without damage to supporting element system or to work being supported.

Ensure supporting elements conform to requirements of MLIT-M, except as noted.

Ensure attachments welded to pipe are made of materials identical to that of pipe or materials accepted as permissible raw materials by referenced code or standard specification.

Ensure supporting elements exposed to weather are hot-dip galvanized or stainless steel. Select materials of such a nature that their apparent and latent-strength characteristics are not reduced due to galvanizing process. Electroplate supporting elements in contact with copper tubing with copper.

Ensure masonry anchor group-, type-, and style-combination designations are in accordance with JIS A 5758 and JIS B 1112. Provide support elements, except for supplementary steel, that are cataloged, load rated, commercially manufactured products.

2.6.1 Building Structure Attachments

2.6.1.1 Anchor Devices, Concrete and Masonry

Ensure anchor devices conform to JIS A 5758 and JIS B 1220.

For cast-in, floor mounted, equipment anchor devices, provide adjustable positions.

2.6.1.2 Beam Clamps

Ensure beam clamps are center-loading conforming to MLIT-M.

When it is not possible to use center-loading beam clamps,

eccentric-loading beam clamps, conforming to MLIT-M may be used for piping sizes DN50 and less and for piping sizes DN50 through DN250 provided two counterbalancing clamps are used per point of pipe support. Where more than one rod is used per point of pipe support, determine rod diameter in accordance with referenced standards.

2.6.1.3 C-Clamps

Do not use C-clamps.

2.6.1.4 Inserts, Concrete

Use concrete conforming to MLIT-M inserts. When applied to piping in sizes DN50 and larger and where otherwise required by imposed loads, insert and wire a 305 millimeter length of 13 millimeter reinforcing rod through wing slots. Submit proprietary-type continuous inserts for approval.

2.6.2 Horizontal Pipe Attachments

2.6.2.1 Single Pipes

Support piping in sizes to and including DN50 by conforming to MLIT-M solid malleable iron pipe rings, except that, use split-band-type rings in sizes up to DN25.

Support piping in sizes through DN200 inclusive by conforming to MLIT-M.

Use MLIT-M assemblies on vapor-sealed insulated piping and have an inside diameter larger than pipe being supported to provide adequate clearance during pipe movement.

Where thermal movement of a point in a piping system DN100 and larger would cause a hanger rod to deflect more than 4 degrees from the vertical or where a horizontal point movement exceeds 13 millimeter, use conforming to MLIT-M.

Support piping in sizes larger than DN200 with conforming to MLIT-M.

Use conforming to MLIT-M shields on all insulated piping. Ensure area of the supporting surface is such that compression deformation of insulated surfaces does not occur. Roll away longitudinal and transverse shield edges from the insulation.

Provide insulated piping without vapor barrier on roll supports with conforming to MLIT-M saddles.

Provide spring supports as indicated.

2.6.2.2 Parallel Pipes

Use trapeze hangers fabricated from structural steel shapes, with U-bolts, in congested areas and where multiple pipe runs occur. Ensure structural steel shapes [conform to supplementary steel requirements] [be of commercially available, proprietary design, rolled steel].

2.6.3 Vertical Pipe Attachments

Ensure vertical pipe attachments are conforming to MLIT-M.

Include complete fabrication and attachment details of any spring supports in shop drawings.

2.6.4 Hanger Rods and Fixtures

Use only circular cross section rod hangers to connect building structure attachments to pipe support devices. Use pipe, straps, or bars of equivalent strength for hangers only where approved by the Contracting Officer.

Provide turnbuckles, swing eyes, and clevises as required by support system to accommodate temperature change, pipe accessibility, and adjustment for load and pitch. Rod couplings are not acceptable.

2.6.5 Supplementary Steel

Where it is necessary to frame structural members between existing members or where structural members are used in lieu of commercially rated supports, design and fabricate such supplementary steel in accordance with MLIT-M.

PART 3 EXECUTION

3.1 PIPE INSTALLATION

Submit certificates for pipes, valves and specialties showing conformance with test requirements as contained in the reference standards contained in this section. Provide certificates verifying Surface Resistance, Shear and Tensile Strengths, Temperature Ratings, Bending Tests, Flattening Tests and Transverse Guided Weld Bend Tests.

Fabricate and install piping systems in accordance with JIS HB 40-1 and JIS HB 40-2.

Ensure connections between steel piping and copper piping are electrically isolated from each other with [dielectric couplings (or unions)] [flanged with gaskets] rated for the service.

Make final connections to equipment with [unions] [flanges] provided every 30480 millimeter of straight run. Provide unions in the line downstream of screwed- and welded-end valves.

Ream all pipe ends before joint connections are made.

Make screwed joints with specified joint compound with not more than three threads showing after joint is made up.

Apply joint compounds to the male thread only and exercise care to prevent compound from reaching the unthreaded interior of the pipe.

Provide screwed unions, welded unions, or bolted flanges wherever required to permit convenient removal of equipment, valves, and piping accessories from the piping system for maintenance.

Securely support piping systems with due allowance for thrust forces, thermal expansion and contraction. Do not subject the system to mechanical, chemical, vibrational or other damage as specified in MLIT-M.

Ensure field welded joints conform to the requirements of the JIS HB 40-1

and JIS HB 40-2 and JIS B 8285.

[Accomplish preheat and postheat treatment of welds in accordance with JIS B 8285.

][Take all necessary precautions during installation of flexible pipe and hose including flushing and purging with water, steam, and compressed air to preclude bellows failure due to pipe line debris lodged in bellows. Ensure installation conforms to manufacturer's instructions.

]3.2 VALVES

Provide valves in piping mains and all branches and at equipment where indicated and as specified.

Provide valves to permit isolation of branch piping and each equipment item from the balance of the system.

Provide riser and downcomer drains above piping shutoff valves in piping DN65 and larger. Tap and fit shutoff valve body with a DN15 plugged globe valve.

Provide valves unavoidably located in furred or other normally inaccessible places with access panels adequately sized for the location and located so that concealed items may be serviced, maintained, or replaced.

3.3 SUPPORTING ELEMENTS INSTALLATION

Provide supporting elements in accordance with the referenced codes and standards.

Support piping from building structure. Do not support piping from roof deck or from other pipe.

Run piping parallel with the lines of the building. Space and install piping and components so that a threaded pipe fitting may be removed between adjacent pipes and so that there is no less than DN15 of clear space between the finished surface and other work and between the finished surface of parallel adjacent piping. Arrange hangars on different adjacent service lines running parallel with each other in line with each other and parallel to the lines of the building.

Install piping support elements at intervals specified hereinafter, at locations not more than 900 millimeter from the ends of each runout, and not over 300 millimeter from each change in direction of piping.

Base load rating for all pipe-hanger supports on insulated weight of lines filled with water and forces imposed. Deflection per span is not exceed slope gradient of pipe. Ensure supports are in accordance with the following minimum rod size and maximum allowable hanger spacing for specified pipe. For concentrated loads such as valves, reduce the allowable span proportionately:

PIPE SIZE (DN) MILLIMETER	ROD SIZE MILLIMETER	STEEL PIPE MILLIMETER	COPPER PIPE MILLIMETER
25 and smaller	10	2500	1850

PIPE SIZE (DN) MILLIMETER	ROD SIZE MILLIMETER	STEEL PIPE MILLIMETER	COPPER PIPE MILLIMETER
32 to 40	10	3050	2500
50	10	3050	3050
65 to 90	13	3700	3700
100 to 125	16	5000	4300
150	20	5000	5000
200 to 300	22	6100	6100
356 to 457	25	6100	6100
508 and over	32	6100	6100

Provide vibration isolation supports where needed. Refer to Section 23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT where A/C equipment and piping is installed.

Support vertical risers independently of connected horizontal piping, whenever practicable, with fixed or spring supports at the base and at intervals to accommodate system range of thermal conditions. Ensure risers have guides for lateral stability. For risers subject to expansion, provide only one rigid support at a point approximately one-third down from the top. Place clamps under fittings unless otherwise specified. Support carbon-steel pipe at each floor and at not more than 4572 millimeter intervals for pipe DN50 and smaller and at not more than 6096 millimeter intervals for pipe DN65 and larger.

3.4 PENETRATIONS

Provide effective sound stopping and adequate operating clearance to prevent structure contact where piping penetrates walls, floors, or ceilings into occupied spaces adjacent to equipment rooms; where similar penetrations occur between occupied spaces; and where penetrations occur from pipe chases into occupied spaces. Occupied spaces include space above ceilings where no special acoustic treatment of ceiling is provided. Finish penetrations to be compatible with surface being penetrated.

[Accomplish sound stopping and vapor-barrier sealing of pipe shafts and large floor and wall openings by packing to high density with properly supported fibrous-glass insulation or, where ambient or surface temperatures do not exceed 49 degrees C, by foaming-in-place with self-extinguishing, 0.9 kilogram density polyurethane foam to a depth not less than 152 millimeter. Finish foam with a rasp. Ensure vapor barrier is not less than 3 millimeter thick vinyl coating applied to visible and accessible surfaces. Where high temperatures and fire stopping are a consideration, use only mineral wool with openings covered by 1.6 millimeter sheet metal.

]3.5 SLEEVES

Provide sleeves where piping passes through roofs, masonry, concrete walls and floors.

Continuously [weld] [braze] sleeves passing through steel decks to the deck.

Ensure sleeves that extend through floors, roofs, load bearing walls, and fire barriers are continuous and fabricated from Schedule 40 steel pipe, with welded anchor lugs. Form all other sleeves by molded linear polyethylene liners or similar materials that are removable. Ensure diameter of sleeves is large enough to accommodate pipe, insulation, and jacketing without touching the sleeve and provides a minimum 10 millimeter clearance. Install a sleeve size to accommodate mechanical and thermal motion of pipe precluding transmission of vibration to walls and the generation of noise.

Pack the space between a pipe, bare or insulated, and the inside of a pipe sleeve or a construction surface penetration solid with a mineral fiber conforming to JIS A 9504. Provide this packing wherever the piping passes through firewalls, equipment room walls, floors, and ceilings connected to occupied spaces, and other locations where sleeves or construction-surface penetrations occur between occupied spaces. Where sleeves or construction surface penetrations occur between conditioned and unconditioned spaces, fill the space between a pipe, bare or insulated, and the inside of a pipe sleeve or construction surface penetration with an elastomer caulk to a depth of 13 millimeter. Ensure all caulked surfaces are oil- and grease-free.

Ensure through-penetration fire stop materials and methods are in accordance with ISO 834-1.

Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed metal components.

Ensure sleeve height above roof surface is a minimum of 305 and a maximum of 457 millimeter.

3.6 ESCUTCHEONS

Provide escutcheons at all penetrations of piping into finished areas. Where finished areas are separated by partitions through which piping passes, provide escutcheons on both sides of the partition. Where suspended ceilings are installed, provide plates at the underside only of such ceilings. For insulated pipes, select plates large enough to fit around the insulation. Use chrome-plated escutcheons in all occupied spaces and of size sufficient to effectively conceal openings in building construction. Firmly attach escutcheons with setscrews.

3.7 FLASHINGS

[Provide flashings at penetrations of building boundaries by mechanical systems and related work.

]3.8 UNDERGROUND PIPING INSTALLATION

Prior to being lowered into a trench, clean all piping, visually inspected for apparent defects, and tapped with a hammer to audibly detect hidden defects.

Further inspect suspect cast-ferrous piping by painting with kerosene on external surfaces to reveal cracks.

Distinctly mark defective materials found using a road-traffic quality yellow paint; promptly remove defective material from the site.

After conduit has been inspected, and not less than 48 hours prior to being lowered into a trench, coat all external surfaces of cast ferrous conduit with a compatible bituminous coating for protection against brackish ground water. Apply a single coat, in accordance with the manufacturer's instructions, to result in a dry-film thickness of not less than 0.30 millimeter.

Ensure excavations are dry and clear of extraneous materials when pipe is being laid.

Use wheel cutters for cutting of piping or other machines designed specifically for that purpose. Electric-arc and oxyacetylene cutting is not permitted.

Begin laying of pipe at the low point of a system. When in final acceptance position, ensure it is true to the grades and alignment indicated, with unbroken continuity of invert. Blocking and wedging is not permitted.

[Point bell or grooved ends of piping upstream.]

Make changes in direction with long sweep fittings.

Provide necessary socket clamping, piers, bases, anchors, and thrust blocking. Protect rods, clamps, and bolting with a coating of bitumen.

Support underground piping below supported or suspended slabs from the slab with a minimum of two supports per length of pipe. Protect supports with a coating of bitumen.

On excavations that occur near and below building footings, provide backfilling material consisting of 13800 kilopascal cured compressive-strength concrete poured or pressure-grouted up to the level of the footing.

Properly support vertical downspouts; soil, waste, and vent stacks; water risers; and similar work on approved piers at the base and provided with approved structural supports attached to building construction.

[Provide cleanout, flushing, and observation risers.]

3.9 HEAT TRACE CABLE INSTALLATION

Field apply heater tape and cut to fit as necessary, linearly along the length of pipe after piping has been pressure tested and approved by the Contracting Officer. Secure the heater to piping with [cable ties] [fiberglass tape]. Label thermal insulation on the outside, "Electrical Heat Trace."

Install power connection, end seals, splice kits and tee kit components provide a complete workable system. Terminate connection to the thermostat and ends of the heat tape in a junction box. Ensure cable and conduit connections are raintight.

3.10 DISINFECTION

[Disinfect water piping, including all valves, fittings, and other devices, with a solution of chlorine and water. Ensure the solution contains not less than 50 parts per million (ppm) of available chlorine. Hold solution for a period of not less than 8 hours, after which the solution contains not less than 10 ppm of available chlorine or redisinfect the piping. After successful sterilization, thoroughly flush the piping before placing into service. Flushing is complete when the flush water contains less than 0.5 ppm of available chlorine. Water for disinfected will be furnished by the Government. Approve disposal of contaminated flush water in accordance with written instructions received from the Environmental authority having jurisdiction through the Contracting Officer and all local, State and Federal Regulations.]

[Flush piping with potable water until visible grease, dirt and other contaminants are removed (visual inspection).]

3.11 OPERATION AND MAINTENANCE

Provide Operation and Maintenance Manuals consistent with manufacturer's standard brochures, schematics, printed instructions, general operating procedures and safety precautions. Submit test data that is clear and readily legible.

3.12 PAINTING OF NEW EQUIPMENT

Factory or shop apply new equipment painting, as specified herein, and provided under each individual section.

3.12.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied withstands 125 hours in a salt-spray fog test, except that equipment located outdoors withstand 500 hours in a salt-spray fog test. Conduct salt-spray fog test is in accordance with Japanese Industry Standards, and for that test the acceptance criteria is as follows: immediately after completion of the test, the inspected paint shows no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shows no signs of rust creepage beyond 3 mm on either side of the scratch mark.

Ensure the film thickness of the factory painting system applied on the equipment is not less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 50 degrees C, design the factory painting system for the temperature service.

3.12.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except clean to bare metal, surfaces subject to temperatures in excess of 50 degrees C.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Selected color of finish

coat is aluminum or light gray.

a. Temperatures Less Than 50 Degrees C: Immediately after cleaning, the metal surfaces subject to temperatures less than 50 degrees C receives one coat of pretreatment primer applied to a minimum dry film thickness of 0.0076 mm, one coat of primer applied to a minimum dry film thickness of 0.0255 mm; and two coats of enamel applied to a minimum dry film thickness of 0.0255 mm per coat.

b. Temperatures Between 50 and 205 Degrees C: Metal surfaces subject to temperatures between 50 and 205 degrees C Receives two coats of 205 degrees C heat-resisting enamel applied to a total minimum thickness of 0.05 mm .

c. Temperatures Greater Than 205 Degrees C: Metal surfaces subject to temperatures greater than 205 degrees C receives two coats of 315 degrees C heat-resisting paint applied to a total minimum dry film thickness of 0.05 mm.

-- End of Section --

SECTION 23 05 48.19

[SEISMIC] BRACING FOR HVAC

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 355.2	(2007) Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary
ACI 355.4	(2011) Qualification of Post-Installed Adhesive Anchors in Concrete (ACI 355.4) and Commentary

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325	(2017) Steel Construction Manual

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16	(2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C105/A21.5	(2018) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C116/A21.16	(2015) Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray Iron Fittings
AWWA C153/A21.53	(2019) Ductile-Iron Compact Fittings for Water Service
AWWA C213	(2015) Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A490	(2014a) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A500/A500M	(2021) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A603	(2019) Standard Specification for Zinc-Coated Steel Structural Wire Rope
ASTM D1785	(2015; E 2018) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2665	(2014) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM E488/E488M	(2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
ASTM F891	(2016) Standard Specification for Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core
ASTM F1554	(2020) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

FEMA P-414	(January 2004) Installing Seismic Restraints for Duct and Pipe

ICC EVALUATION SERVICE, INC. (ICC-ES)

ICC ES AC156	(2012) Acceptable Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components
ICC ES AC193	(2012) Acceptance Criteria for Mechanical Anchors in Concrete Elements

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2021) International Building Code

JAPANESE STANDARDS ASSOCIATION (JSA)

JIS B 1186	(2013) Sets of High Strength Hexagon Bolt, Hexagon Nut and Plain Washers for Friction Grip Joints
JIS G 3101	(2020) Rolled Steels for General Structure
JIS G 3106	(2020) Rolled Steels for Welded Structure
JIS G 3114	(2022) Hot-Rolled Atmospheric Corrosion Resisting Steels for Welded Structure
JIS G 3136	(2022) Rolled Steels for Building Structure
JIS G 3444	(2021) Carbon Steel Tubes for General Structure
JIS G 3466	(2021) Carbon Steel Square and Rectangular Tubes for General Structure
JIS G 3475	(2021) Carbon Steel Tubes for Building Structure

METAL FRAMING MANUFACTURERS ASSOCIATION (MFMA)

MFMA-4	(2004) Metal Framing Standards Publication

NSF INTERNATIONAL (NSF)

NSF/ANSI 61	(2020) Drinking Water System Components - Health Effects

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1981	(2008) Seismic Restraint Manual Guidelines for Mechanical Systems, 3rd Edition

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2019) Structural Engineering
UFC 3-301-02	(2020) Design of Risk Category V Structures, National Strategic Military Assets
UFC 4-010-01	(2018;with Change 1, 2020) DoD Minimum Antiterrorism Standards for Buildings

VIBRATION ISOLATION AND SEISMIC CONTROL MANUFACTURERS ASSOCIATION (VISCMA)

VISCMA 412	(2014) Installing Seismic Restraints for

Mechanical Equipment

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

Apply the requirements for seismic protection measures described in this section and on the drawings to the mechanical equipment and mechanical systems both inside and outside of the building along with exterior utilities and systems listed below. Where there is a conflict between the specifications and the drawings, the specifications will take precedence. Accomplish resistance to lateral forces induced by earthquakes without consideration of friction resulting from gravity loads.

1.2.2 Mechanical Equipment

Mechanical equipment to be seismically protected must include the following items to the extent required on the drawings or in other sections of these specifications:

[Equipment/Components with Ip = 1.0]

Boilers and furnaces	Storage Tanks for Oil and Water
Water Heaters	
Expansion Air Separator Tanks	Valves and Fittings for Piping
Heat Exchangers	Steam-fed Kitchen Appliances
Water Chiller Units	Thermal Storage Units
Cooling Towers, Evaporative Coolers, and Fluid Coolers	Air and Refrigerant Compressors
Computer Room Air Conditioners	Air Handling Units
Pumps with Motors	Lab Scrubbers
Large Commercial Dryers	Pollution Control Equipment
Gas Dryers	Split System DX Units
Flash Tanks	Unit Heaters
Accumulator Tank	Exhaust, Return and Misc. Fans
Gas Cylinders	Solar Heating and Hot Water Units
Bridge Cranes and Monorails	Pumps
Air Terminal Units	Unitary HVAC Systems

Humidifiers	Fan Coil Units
Stacks	Instrumentation and Control for HVAC
Duct Mounted Coils	Duct Silencers

[Equipment/Components with Ip = 1.5 (Designated Seismic Systems)
Insert edited list here similar to one above for Ip = 1.0]
[Non-Mission Critical (NMC) Equipment/Components in Risk Category V
Insert edited list here similar to one above for Ip = 1.0]
[Mission Critical Level 1 (MC-1) Equipment/Components in Risk Category V
Insert edited list here similar to one above for Ip = 1.0]
[Mission Critical Level 2 (MC-2) Equipment/Components in Risk Category V
Insert edited list here similar to one above for Ip = 1.0]

1.2.3 Mechanical Systems

Mechanical systems to be seismically protected must include the following items to the extent required on the drawings or in this or other sections of these specifications:

[Mechanical systems with Ip = 1.0]

a. All Piping and Ducts Inside the Building Except as Specifically Stated Below Under "Items Not Covered By This Section".

b. Chilled Water Distribution Systems Outside of Buildings.

c. Steam, Water, Oil, Gas and Fuel Piping Outside of Buildings.

d. All Water Supply Systems Outside of Buildings.

e. Storm and Sanitary Sewer Systems Outside of Buildings.

f. All Process Piping Outside of Buildings.

g. Heat Distribution Systems (Supply, Return, and Condensate Return) Outside of Buildings.

h. Condenser Water and Refrigerant Piping Outside the Building.

i. Pneumatic Tube Distribution System Outside of Buildings.

j. Cold Storage Refrigeration Systems Outside of Buildings.

k. Fuel Storage Tanks Outside of Buildings.

l. Water Storage Tanks Outside of Buildings.

m. Ductwork Outside of Buildings.

n. Stacks.

o. [_____]

[Mechanical systems with Ip = 1.5 (Designated Seismic Systems)
Insert edited list here similar to one above for Ip = 1.0]
[Non-Mission Critical (NMC) Mechanical Systems in Risk Category V

Insert edited list here similar to one above for Ip = 1.0]
[Mission Critical Level 1 (MC-1) Mechanical Systems in Risk Category V
Insert edited list here similar to one above for Ip = 1.0]
[Mission Critical Level 2 (MC-2) Mechanical Systems in Risk Category V
Insert edited list here similar to one above for Ip = 1.0]

1.2.4 Contractor Designed Bracing

Submit copies of the design calculations with the drawings. Calculations must be approved, certified, stamped and signed by a registered Professional Structural Engineer. Calculations must verify the capability of structural members to which bracing is attached for carrying the load from the brace. Design the bracing in accordance with UFC 3-301-01, [UFC 3-301-02], UFC 4-010-01 and additional data furnished by the Contracting Officer. Resistance to lateral forces induced by earthquakes must be accomplished without consideration of friction resulting from gravity loads. UFC 3-301-01 uses parameters for the building, not for the equipment in the building; therefore, corresponding adjustments to the formulas must be required. Loadings determined using UFC 3-301-01 are based on strength design; therefore, AISC 325 Specifications must be used for the design. The bracing for the mechanical equipment designated in paragraph 1.2.2 and systems designated in paragraph 1.2.3 must be developed by the Contractor.

[Provide documentation of an independent design review for mission critical (MC) equipment bracing design. Documentation must be signed by the independent reviewer who must also be a registered structural engineer.]

1.2.5 Items Not Covered By This Section

1.2.5.1 Fire Protection Systems

Install seismic protection of piping for fire protection systems as specified in Sections 21 30 00 FIRE PUMPS, 21 13 13 WET PIPE SPRINKLER SYSTEMS, FIRE PROTECTION, 21 13 16 DRY PIPE SPRINKLER SYSTEMS, FIRE PROTECTION, 21 13 18 PREACTION SPRINKLER SYSTEMS, FIRE PROTECTION, and 21 13 24.00 10 AQUEOUS FILM-FORMING FOAM (AFFF) FIRE PROTECTION SYSTEM.

1.2.5.2 Items Requiring No Seismic Restraints

Seismic restraints are not required for the following items:

a. Gas piping less than 25 mm nominal pipe size.

b. Piping in boiler and mechanical equipment rooms less than 32 mm nominal pipe size.

c. All other piping equal to or less than nominal pipe size.

d. Rectangular air handling ducts less than 0.56 square meters in cross sectional area.

e. Round air handling ducts less than 711 mm in diameter.

f. Piping suspended by individual hangers 300 mm or less in length from the top of pipe to the bottom of the supporting structural member where the hanger is attached, except as noted below.

g. Ducts suspended by hangers 300 mm or less in length from the top of the duct to the bottom of the supporting structural member, except as noted below.

In exemptions f. and g. all hangers must meet the length requirements. If the length requirement is exceeded by one hanger in the run, brace the entire run. Seismically protect interior piping and ducts not listed above in accordance with the provisions of this specification.

Non-critical items may require seismic restraints if adjacent to critical equipment or systems that must remain operational after an earthquake and could be compromised by impact with non-critical adjacent components.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Coupling and Bracing

Flexible Couplings or Joints

Equipment Restraint

Contractor Designed Bracing; G[, [_____]]

SD-03 Product Data

Coupling and Bracing; G[, [_____]]

Flexible Couplings Or Joints; G[, [_____]]

Equipment Restraint; G[, [_____]]

Contractor Designed Bracing; G[, [_____]]

Snubbers

Anchor Bolts

Vibration Isolators

SD-05 Design Data

Design Calculations

SD-06 Test Reports

Anchor Bolts; G[, [_____]]

PART 2 PRODUCTS

2.1 GENERAL DESIGN REQUIREMENTS

Submit detailed seismic restraint drawings for mechanical equipment, duct systems, piping systems and any other mechanical systems along with calculations, catalog cuts, templates, and erection and installation details, as appropriate, for the items listed below. Indicate thickness, type, grade, class of metal, and dimensions; and show construction details, reinforcement, anchorage, and installation with relation to the building construction. Calculations must be stamped, by a registered structural engineer, and verify the capability of structural members to which bracing is attached for carrying the load from the brace. Include drawing for Mission Critical Equipment indicating the equipment location in the facility sufficient to be used for the installation. Design must be based on actual equipment and system layout. Design must include calculated dead loads, static seismic loads and capacity of materials utilized for the connection of the equipment or system to the structure. Analysis must detail anchoring methods.

2.2 EQUIPMENT RESTRAINT

Equipment must be rigidly or flexibly mounted as indicated in the specifications and/or drawings depending on vibration isolation requirements as follows below.

Roof mounted equipment such as cooling towers and condensers, both vibration isolated and nonisolated, must have support members designed and anchored to building structural steel or concrete as required for seismic restraint and wind loads.

2.2.1 Rigidly (Base and Suspended) Mounted Equipment

HVAC equipment furnished under this contract must be [rigidly mounted] [rigidly mounted using cast-in-place anchor bolts or post-installed anchors] that are qualified for earthquake loading in accordance with ACI 355.2 and ACI 355.4. Anchor bolts must conform to ASTM F1554 or JIS B 1186. For any rigid equipment which is rigidly anchored, provide flexible joints for piping, ductwork, electrical conduit, etc., that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions. Suspended equipment bracing attachments should be located just above the center of gravity to minimize swinging. Use the ratio of the overturning moment from seismic forces to the resisting moment due to gravity loads to determine if overturning forces need to be considered in the sizing of anchor bolts. Provide calculations to verify the adequacy of the anchor bolts for combined shear and overturning.

Roof mounted HVAC equipment roof curbs, framing and attachment to equipment and structure must be designed and braced to withstand seismic loads. [Mission critical base mounted and suspended equipment for Risk Category (RC) V,] Designated Seismic Systems (DSS) assigned to Seismic Design Category (SDC) C, D, E, or F and Risk Category IV components needed for continued operation after an earthquake must have two nuts provided on each anchor bolt.

2.2.2 Nonrigid or Flexibly-Mounted Equipment

Select vibration isolation devices so that the maximum movement of equipment from the static deflection point is 6 mm. Equipment flexibly mounted on vibration isolators must have a bumper restraint or snubber in each horizontal direction and vertical restraints must be provided where required to resist overturning. Isolator housing and restraints must be constructed of ductile materials. A viscoelastic pad or similar material of appropriate thickness must be used between the bumper and components to limit the impact load. Restraints must be designed to resist the calculated horizontal lateral and vertical forces.

Spring vibration isolators must be seismically rated, restrained isolators for equipment subject to load variations and large external forces. The seismically rated housing must be sized to meet or exceed the force requirements applicable to the project and meet the required isolation criteria. Spring vibration isolator manufacturer's will be a member of VISCMA. Design force, Fp, must be doubled for vibration isolators with an air gap greater than 0.25 inches as specified in ASCE 7-16, Chapter 13. Housed springs must not be used for seismic restraint applications because they cannot resist uplift.

2.3 BOLTS AND NUTS

Hex head bolts, and heavy hexagon nuts must be ASTM A325 or JIS B 1186, or ASTM A490 or JIS B 1186 bolts and ASTM A563 or JIS B 1186 nuts. Provide bolts and nuts galvanized in accordance with ASTM A153/A153M when used underground or exposed to weather.

2.4 FLEXIBLE JOINTS

Flexible joints must have same pressure and temperature ratings as adjoining pipe. Braided hoses must not be used where there is torsional or axial movement unless manufacturer allows it.

2.4.1 Braided Hose Expansion Joint

Braided hose expansion joint(s) must be installed in the locations indicated on the drawings and as required to accommodate any thermal expansion, contraction or seismic movement of the piping system. Joints must consist of two parallel sections of corrugated metal hose, compatible braid, and 180 degree return bend with inlet and outlet connections. Field fabricated loops are not acceptable. Braided hose expansion joint(s) must be installed in the locations indicated on the drawings and as required to accommodate any thermal expansion, contraction or seismic movement of the piping system. Joints must consist of two parallel sections of corrugated metal hose, compatible braid, and 180 degree return bend with inlet and outlet connections. Field fabricated loops must not be acceptable. Braided hose in a 60 degree flexible V loop arrangement must be used for small diameter pipe connections to coils in variable-air-volume (VAV)terminal units and fan coil units installed in suspended ductwork whether braced or unbraced.

All braided hose expansion joints must be manufactured in accordance with the documented manufacturers weld procedure specifications. The procedure qualification record must be used to document the execution of this procedure and must follow the general "guidelines" of ASME Section IX. Each individual welder must conform to the in-house procedure qualification record and be qualified prior to each production lot. The

testing of each individual welder must be documented in a welding procedure qualification record.

2.4.1.1 Corrugated Hose

Corrugated hose must be [Type [304] [321] [316] stainless steel] [bronze]. Braid must be [Type 304 stainless steel for any series 300 stainless steel hose] [bronze for any bronze hose]. Fittings materials of construction and end fitting type must be consistent with pipe material and equipment/ pipe connection fittings. Copper fittings must not be attached to stainless steel hose.

2.4.1.2 Flexible Hose Expansion Loops

Flexible hose expansion loops must have a factory supplied, hanger / support lug located at the bottom of the 180deg return. [Flexible hose expansion loop(s) must be furnished with a plugged FPT to be used for a drain or air release vent.] Flexible hose expansion loop(s) must be rated with an operating pressure which is the same as the adjoining pipe. The operating pressure must be based on burst pressure with a 4 to 1 safety factor. [For steam service, the operating pressure must be based on burst pressure with a 8 to 1 safety factor.]

2.4.2 Double Ball Flexible Expansion Joint

Install flexible expansion joints manufactured of ductile iron conforming to the material requirements of ASTM A536 and AWWA C153/A21.53 in the locations indicated on the drawings. Provide foundry certification of material upon request. Each flexible expansion joint must be pressure tested prior to shipment against its own restraint to a minimum of 350 psi (250 psi for flexible expansion joints 2 inch and 30 inches diameter and larger.) A minimum 2:1 safety factor, determined from the published pressure rating, must apply. Factory Mutual Approval for the 3 inch through 12 inch sizes is required. Each flexible expansion joint must consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum per ball deflection of: 20°, 2" - 12"; 15°, 14" - 36"; 12°, 42"-48" and 4-inches minimum expansion. Additional expansion sleeves must be available and easily added or removed at the factory or in the field. Both standardized mechanical joint and flange end connections must be available.

2.4.2.1 Internal Surfaces

Line all internal surfaces (wetted parts) with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C213. Sealing gaskets must be constructed of EPDM. The coating must meet NSF/ANSI 61.

2.4.2.2 Exterior Surfaces

Coat exterior surfaces with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C116/A21.16. Include appropriately sized polyethylene sleeves, meeting AWWA C105/A21.5, for direct buried applications.

2.4.3 Double Ball Flexible Expansion Joint Gravity Drain (Non-Pressurized)

Flexible expansion joints gravity drain must be installed in the locations indicated on the drawings and must be manufactured of pvc. All connections

whether solvent weld or mechanical must be restrained to allow movement to be transferred to expansion joint. Each ball must allow up to 15 degrees deflection.

End connection outside diameters must be compatible with ASTM D1785, ASTM D2665 and ASTM F891 PVC pipe and are to be solvent welded.

2.5 SWAY BRACING MATERIALS

Material used for members listed [in this section] [and] [on the drawings], must be structural steel conforming with the following:

a. Plates, rods, and rolled shapes, ASTM A36/A36M or JIS G 3101, JIS G 3106, JIS G 3114, JIS G 3136.

b. Wire rope, ASTM A603 pre-stretched. [Class B galv coating][Class C galv coating] Ferrule clamps must be qualified by testing for use in seismic applications per VISCMA 412. A minimum of two clamps are required on each end of wire rope.

c. Tubes, ASTM A500/A500M, Grade B. or JIS G 3444, JIS G 3475

d. Pipes, ASTM A53/A53M, Grade B or JIS G 3444, JIS G 3466.

e. Angles, ASTM A36/A36M or JIS G 3101, JIS G 3106, JIS G 3114, JIS G 3136.

f. Channels (Struts) with in-turned lips and associated hardware for fastening to channels at random points conforming to MFMA-4

2.6 MULTIDIRECTIONAL SEISMIC SNUBBERS

Install multidirectional seismic snubbers employing elastomeric pads on [floor- or slab-mounted equipment] [and] [large piping] as detailed on drawings. These snubbers must provide 6 mm free vertical and horizontal movement from the static deflection point. Snubber medium must consist of multiple pads of cotton duct and neoprene or other suitable materials arranged around a flanged steel trunnion so both horizontal and vertical forces are resisted by the snubber medium.

PART 3 EXECUTION

3.1 COUPLING AND BRACING

a. Submit detail drawings, as specified here and throughout this specification, along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals must be complete in detail; must indicate thickness, type, grade, class of metal, and dimensions; and must show construction details, reinforcement, anchorage, and installation with relation to the building construction.

b. Provide coupling installation conforming to the details shown on the drawings. Provisions of this paragraph apply to all piping within a 1.5 m line around outside of building unless buried in the ground. Piping grouped for support on trapeze-type hangers must be braced at the most frequent interval as determined by applying the requirements of this specification to each piping run on the common support.

c. Size bracing components as required for the total load carried by the

common supports. Bracing rigidly attached to pipe flanges, or similar, must not be used where it would interfere with thermal expansion of piping.

d. Adjust isolators and restraints after piping systems has been filled and equipment is at its operating weight, following the manufacturer's written instructions.

e. Install cables at a 45-degree slope. Where interference is present, the slope may be minimum of 30 degrees or a maximum of 60 degrees per VISCMA 412.

3.2 BUILDING DRIFT

Provide joints capable of accommodating seismic displacements for vertical piping between floors of the building, where pipes pass through a building seismic or expansion joint, or where rigidly supported pipes connect to equipment with vibration isolators. Provide horizontal piping across expansion joints to accommodate the resultant of the drifts of each building unit in each orthogonal direction. For threaded piping, provide swing joints made of the same piping material. For piping with manufactured ball joints the seismic drift must be [0.015] [_____] meters per meter of height above the base where the seismic separation occurs; this drift value must be used in place of the expansion given in the manufacturer's selection table.

3.3 FLEXIBLE COUPLINGS OR JOINTS

3.3.1 Building Piping

Provide flexible couplings or joints in building piping at bottom of all pipe risers for pipe larger than 90 mm in diameter. Laterally brace flexible couplings or joints without interfering with the action of the flexible coupling or joint. Cast iron waste and vent piping need only comply with these provisions when caulked joints are used. Flexible bell and spigot pipe joints using rubber gaskets may be used at each branch adjacent to tees and elbows for underground waste piping inside of building to satisfy these requirements.

3.3.2 Underground Piping

Install flexible coupling in underground piping and 100 mm or larger conduit, except heat distribution system, where the piping enters the building. Provide couplings that accommodate [_____] mm of relative movement between the pipe and the building in any direction. Provide additional flexible couplings where shown on the drawings.

3.4 PIPE SLEEVES

Size pipe sleeves in interior non-fire rated walls as indicated on the drawings to provide clearances that will permit differential movement of piping without the piping striking the pipe sleeve. Pipe sleeves in fire rated walls must conform to the requirements in Section 07 84 00 FIRESTOPPING.

3.5 SPREADERS

Provide spreaders between adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than

[100][_____] mm apart. Apply spreaders at same interval as sway braces at an equal distance between the sway braces. If rack type hangers are used where the pipes are restrained from contact by mounting to the rack, spreaders are not required for pipes mounted in the rack. Apply spreaders to surface of bare pipe and over insulation on insulated pipes utilizing high-density inserts and pipe protection shields in accordance with the requirements of Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.6 SWAY BRACES FOR PIPING

Provide sway braces to prevent movement of the pipes under seismic loading. Provide braces in both the longitudinal and transverse directions, relative to the axis of the pipe. Provide sufficient braces for equipment to resist a horizontal force as specified in UFC 3-301-01[UFC 3-301-02] without exceeding safe working stress of bracing components. Provide bracing that does not interfere with thermal expansion requirements for the pipes as described in other sections of these specifications. For seismic analysis of horizontal pipes, the equivalent static force should be considered to act concurrently with the full dead load of the pipe, including contents.

3.6.1 Transverse Sway Bracing

Provide transverse sway bracing for steel and copper pipe at intervals not to exceed those shown on the drawings. All runs (length of pipe between end joints) must have a minimum of transverse bracing at each end. Provide transverse sway bracing for pipes of materials other than steel and copper at intervals not to exceed the hanger spacing as specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.6.2 Longitudinal Sway Bracing

Provide longitudinal sway bracing at 12 m intervals unless otherwise indicated. All runs (length of pipe between end joints) must have one longitudinal brace minimum. Construct sway braces in accordance with the drawings. Do not use branch lines, walls, or floors as sway braces.

3.6.3 Vertical Runs

Run is defined as length of pipe between end joints. Do not brace vertical runs of piping no more than 3 m vertical intervals. Braces for vertical runs must be above the center of gravity of the segment being braced. Flexible couplings should be provided at the bottoms of risers for pipes larger than 3.5 in. (89 mm) in diameter. Flexible couplings and expansion joints should be braced laterally and longitudinally unless such bracing would interfere with the action of the couplings or joints. When pipes enter buildings, flexible couplings should be provided to allow for relative movement between the soil and building. Construct all sway braces in accordance with the drawings. Attach sway braces to the structural system. Do not connect to branch lines, walls, or floors.

3.6.4 Clamps and Hangers

Apply clamps or hangers on uninsulated pipes directly to pipe. Insulated piping must have clamps or hangers applied over insulation in accordance with Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

Hanger rod stiffener angle or strut bracing must be securely attached by a series of attachment clamps manufactured from a one piece metal stamping

and must include all require attachment hardware and locking nuts. Attachment clamps made from aluminum or cast iron must not be used in seismic applications. Do not weld vertical braces to hanger rods.

3.7 SWAY BRACES FOR DUCTS

3.7.1 Braced Ducts

Provide bracing details and spacing for rectangular and round ducts in accordance with SMACNA 1981. However, the design seismic loadings for these items must not be less than loadings obtained using the procedures in UFC 3-301-01[UFC 3-301-02]. Bracing must not attach to duct joints. Use shortest screws possible when penetrating ductwork to minimize airflow noise inside duct.

3.7.2 Unbraced Ducts

Attach hangers for unbraced ducts to the duct within 50 mm of the top of the duct with a minimum of two #10 sheet metal screws in accordance with FEMA P-414. Use shortest screws possible when penetrating ductwork to minimize airflow noise inside duct. Install unbraced ducts with a 150 mm minimum clearance to vertical ceiling hanger wires.

3.8 EQUIPMENT

3.8.1 General

Ensure housekeeping pads have adequate space to mount equipment and seismic restraint devices allowing adequate edge distance and embedment depth for restraint anchor bolts. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength. Install neoprene grommet washers or till the gap with epoxy on equipment anchor bolts where clearance between anchor and equipment support hole exceeds 0.125 inches.

3.8.2 Controls

Ensure that controls for critical equipment that must remain operational after an earthquake are certified per paragraph 3.11 SPECIAL TESTING FOR SEISMIC-RESISTING EQUIPMENT and are served by emergency power as required.

3.9 ANCHOR BOLTS

3.9.1 Cast-in-Place Anchor Bolts

Use templates to locate cast-in-place bolts accurately and securely in formwork. Anchor bolts must have an embedded straight length equal to at least 12 times nominal diameter of the bolt. Anchor bolts that exceed the normal depth of equipment foundation piers or pads must either extend into concrete floor or the foundation or be increased in depth to accommodate bolt lengths.

3.9.2 Drilled-In Anchor Bolts

Drill holes with rotary impact hammer drills Drill bits must be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes must be drilled perpendicular to the concrete surface. Where anchors are permitted to be installed in cored holes, use

core bits with matched tolerances as specified by the manufacturer. Properly clean cored hole per manufacturer's instructions. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the COR if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines. Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength. Perform anchor installation in accordance with manufacturer instructions.

3.9.2.1 Wedge Anchors, Heavy-Duty Sleeve Anchors, and Undercut Anchors

Protect threads from damage during anchor installation. Heavy-duty sleeve anchors must be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque must be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor must be removed and replaced unless otherwise directed by the Engineer.

3.9.2.2 Cartridge Injection Adhesive Anchors

Where approved for seismic application, clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive must be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

3.9.2.3 Capsule Anchors

Where approved for seismic application, perform drilling and setting operations in accordance with manufacturer instructions. Clean all holes to remove loose material and drilling dust prior to installation of adhesive. Remove water from drilled holes in such a manner as to achieve a surface dry condition. Capsule anchors must be installed with equipment conforming to manufacturer recommendations. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.

3.10 ANCHOR BOLT TESTING

Test in place expansion and chemically bonded anchors not more than [24][_____] hours after installation of the anchor, conducted by an independent testing agency; testing must be performed on random anchor bolts as described below.

3.10.1 Torque Wrench Testing

Perform torque wrench testing on not less than [50] [_____] percent of the total installed applied torque expansion anchors and at least [one anchor] [[_____] anchors] for every piece of equipment containing more than [two] [_____] anchors. The test torque must equal the minimum required installation torque as required by the bolt manufacturer. Calibrate torque wrenches at the beginning of each day the torque tests are performed. Recalibrate torque wrenches for each bolt diameter whenever tests are run on bolts of various diameters. Apply torque between 20 and 100 percent of wrench capacity. Reach the test torque within one half turn of the nut, except for 9 mm sleeve anchors which must reach their torque by one quarter turn of the nut. If any anchor fails the test, test similar anchors not previously tested until [20] [_____] consecutive anchors pass. Failed anchors must be retightened and retested to the specified torque; if the anchor still fails the test it must be replaced.

3.10.2 Pullout Testing

Test expansion and chemically bonded anchors by applying a pullout load using a hydraulic ram attached to the anchor bolt. Testing must be in accordance with ASTM E488/E488M or ICC ES AC193. At least [10] [_____] percent of each type and size of anchors, but not less than [3] [_____] per day must be tested. Apply the load to the anchor without removing the nut; when that is not possible, the nut must be removed and a threaded coupler must be installed of the same tightness as the original nut. Check the test setup to verify that the anchor is not restrained from withdrawing by the baseplate, the test fixture, or any other fixtures. The support for the testing apparatus must be at least 1.5 times the embedment length away from the bolt being tested. Load each tested anchor to [1] [_____] times the design tension value for the anchor. The anchor must have no observable movement at the test load. If any anchor fails the test, similar type and size anchors not previously tested must be tested until [10] [_____] percent of those type consecutive anchors pass. Remove and replace failed anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout.

3.11 SPECIAL TESTING FOR SEISMIC-RESISTING EQUIPMENT

Equipment and components (including controls) designated as [MC-1 (Mission Critical Level 1] Designated Seismic Systems required to remain operational after an earthquake will be seismic qualified by shake table testing conforming to ICC ES AC156 procedures. The manufacturer is to provide a certification by a fully qualified testing agency for the specific equipment and/or components. Prequalified certifications are acceptable unless noted otherwise.[Seismic component qualification documentation for each piece of equipment must contain the information required in UFC 3-301-02, Section 2-17.2.5 Component Qualification Documentation.]

Mechanical components that are required to be certified must bear permanent marking or nameplates constructed of a durable heat and water resistant material. Nameplates must be mechanically attached to such nonstructural components and placed on each component for clear identification. The nameplate must not be less than 5 inches x 7 inches with red letters 1 inch in height on a white background stating "Certified Equipment." The following statement must be on the nameplate: "This equipment/component is certified. No modifications are allowed unless authorized in advance and documented in the Equipment Certification

Documentation file." The nameplate must also contain the component identification number in accordance with the drawings/specifications and the O&M manuals.

3.12 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS AND EQUIPMENT

Perform special inspections for seismic-resisting mechanical systems, equipment and components [for structures assigned to Risk Category V;] designated mechanical seismic systems and equipment per ICC IBC 1705.12.4; and plumbing and mechanical components per ICC IBC 1705.12.6. Periodic special inspections will be conducted on mechanical equipment as required by Section 1705.12 of the International Building Code and paragraph 2-5.4 of UFC 3-301-01. Provide a Statement of Special Inspections and Final Report in accordance with paragraph 2-2.4.3 of UFC 3-301-01.

-- End of Section --

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SECTION 23 07 00

THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

ASTM INTERNATIONAL (ASTM)

ASTM C547	(2017) Standard Specification for Mineral Fiber Pipe Insulation
ASTM C592	(2016) Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
ASTM C612	(2014) Mineral Fiber Block and Board Thermal Insulation
ASTM C647	(2008; R 2013) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C921	(2010) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM C1136	(2017a) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM D882	(2012) Tensile Properties of Thin Plastic Sheeting
ASTM D5590	(2000; R 2010; E 2012) Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials

ASTM E2231	(2018) Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 2758	(2014) Paper - Determination of Bursting Strength

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2018) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	(2018) Standard for the Installation of Warm Air Heating and Air Conditioning Systems
NFPA 96	(2017; TIA 17-1) Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY (TAPPI)

TAPPI T403 OM	(2015) Bursting Strength of Paper

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-24179	(1969; Rev A; Am 2 1980; Notice 1 1987) Adhesive, Flexible Unicellular-Plastic Thermal Insulation
MIL-A-3316	(1987; Rev C; Am 2 1990) Adhesives, Fire-Resistant, Thermal Insulation
MIL-PRF-19565	(1988; Rev C) Coating Compounds, Thermal Insulation, Fire- and Water-Resistant, Vapor-Barrier

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5538	(2003) Adhesives for Wall and Ceiling Boards
JIS A 9504	(2017) Man Made Mineral Fibre Thermal Insulation Materials
JIS G 4304	(2012) Hot-Rolled Stainless Steel Plate, Sheet and Strip
JIS H 4000	(2017) Aluminium and Aluminium Alloy Sheets, Strips and Plates (Amendment 1)

MLIT MECHANICAL STANDARD SPECIFICATION

MLIT-M	(2019) Public Building Construction Standard Specification

UNDERWRITERS LABORATORIES (UL)

UL 723	(2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials

1.2 SYSTEM DESCRIPTION

1.2.1 General

Provide field-applied insulation and accessories on mechanical systems as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated. Insulation of heat distribution systems and chilled water systems outside of buildings shall be as specified in Section 33 61 13 PRE-ENGINEERED UNDERGROUND HEAT DISTRIBUTION SYSTEM, Section 33 63 13.19 CONCRETE TRENCH HYDRONIC AND STEAM ENERGY DISTRIBUTION, Section 33 60 02 ABOVEGROUND HEAT DISTRIBUTION SYSTEM, and Section 33 61 13.13 PREFABRICATED UNDERGROUND HYDRONIC ENERGY DISTRIBUTION. Field applied insulation materials required for use on Government-furnished items as listed in the SPECIAL CONTRACT REQUIREMENTS shall be furnished and installed by the Contractor.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Submit the three SD types, SD-02 Shop Drawings, SD-03 Product Data, and SD-08 Manufacturer's Instructions at the same time for each system.

SD-02 Shop Drawings

Pipe Insulation Systems and Associated Accessories

Duct Insulation Systems and Associated Accessories

Equipment Insulation Systems and Associated Accessories

1.4 CERTIFICATIONS

1.4.1 Adhesives and Sealants

Provide products certified to meet indoor air quality requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of SCAQMD Rule 1168, GS-36, or F 4-Star.

1.5 QUALITY ASSURANCE

1.5.1 Installer Qualification

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.6 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means. Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material, date codes, and approximate shelf life (if applicable). Insulation packages and containers shall be asbestos free.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Submit a complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories including adhesives, sealants and jackets for each mechanical system requiring insulation shall be included. The product data must be copyrighted, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation. Materials furnished under this section shall be submitted together in a booklet.

2.1.1 Insulation System

Provide insulation systems in accordance with MLIT-M. Provide field-applied insulation for heating, ventilating, and cooling (HVAC) air distribution systems and piping systems that are located within, on, under, and adjacent to buildings; and for plumbing systems.

2.1.2 Surface Burning Characteristics

Unless otherwise specified, insulation must have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flame spread, and smoke developed indexes,shall be determined by ASTM E84 or UL 723. Test insulation in the same density and installed thickness as the material to be used in the actual construction. Prepare and mount test specimens according to ASTM E2231.

2.2 MATERIALS

Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either

wet or dry state.

2.2.1 Adhesives

2.2.1.1 Acoustical Lining Insulation Adhesive

Adhesive shall be a nonflammable, fire-resistant adhesive conforming to JIS A 5538.

2.2.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with JIS A 9504.

2.2.1.3 Lagging Adhesive

Lagging is the material used for thermal insulation, especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. [To resist mold/mildew, lagging adhesive shall meet ASTM D5590 with 0 growth rating.]Lagging adhesives shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Adhesive shall be MIL-A-3316, Class 1, pigmented [white] [red] and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or Class 2 for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations for pipe and duct insulation.

2.2.1.4 Contact Adhesive

Adhesives may be any of, but not limited to, the neoprene based, rubber based, or elastomeric type that have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 100 degrees C. The dried adhesive shall be nonflammable and fire resistant. Flexible Elastomeric Adhesive: Comply with MIL-A-24179, Type II, Class I. Provide product listed in FM APP GUIDE.

2.2.2 Caulking

Caulking shall be in accordance with MLIT-M.

2.2.3 Corner Angles

Nominal 0.406 mm aluminum 25 by 25 mm with factory applied kraft backing. Aluminum shall beJIS H 4000.

2.2.4 Finishing Cement

MLIT-M: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must comply with MLIT-M.

2.2.5 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth, with 20X20 maximum mesh size, and glass tape shall be have maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Tape shall be 100 mm wide rolls. Class 3 tape shall be 0.15 kg/square m. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing an anti-microbial additive.

2.2.6 Staples

Outward clinching type [monel] [JIS G 4304, Type 304 or 316 stainless steel].

2.2.7 Jackets

2.2.7.1 Aluminum Jackets

Aluminum jackets shall be in accordance with MLIT-M, Table 2.3.1 and 2.3.2.

2.2.7.2 Vapor Barrier/Weatherproofing Jacket

Vapor barrier/weatherproofing jacket shall be in accordance with MLIT-M, Table 2.3.1 and 2.3.2.

2.2.8 Vapor Retarder Required

ASTM C921, Type I, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 6.1 N/mm width. ASTM C921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 3.5 N/mm width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing. Based on the application, insulation materials that require manufacturer or fabricator applied pipe insulation jackets are cellular glass, when all joints are sealed with a vapor barrier mastic, and mineral fiber. All non-metallic jackets shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flexible elastomerics require (in addition to vapor barrier skin) vapor retarder jacketing for high relative humidity and below ambient temperature applications.

2.2.8.1 Vapor Retarder/Vapor Barrier Mastic Coatings

2.2.8.1.1 Vapor Barrier

The vapor barrier shall be self adhesive (minimum 0.05 mm adhesive, 0.075 mm embossed) greater than 3 plies standard grade, silver, white, black and embossed white jacket for use on hot/cold pipes. Permeability shall be less than 0.02 when tested in accordance with ASTM E96/E96M. Products shall meet UL 723 or ASTM E84. Flame and smoke requirements and shall be UV resistant.

2.2.8.1.2 Vapor Retarder

The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall be 0.013 perms or less at 1 mm dry film thickness as determined according to procedure B of ASTM E96/E96M or utilizing apparatus described in ASTM E96/E96M. The coating shall be nonflammable, fire resistant type. [To resist mold/mildew, coating shall meet ASTM D5590 with 0 growth rating.]Coating shall meet MIL-PRF-19565 Type II (if selected for indoor service) and be Qualified Products Database listed. All other application and service properties shall be in accordance with ASTM C647.

2.2.8.2 Laminated Film Vapor Retarder

ASTM C1136, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork; where Type II, maximum moisture vapor transmission 0.02 perms, a minimum puncture resistance of 25 Beach units is acceptable. Vapor retarder shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84. Flexible Elastomeric exterior foam with factory applied UV Jacket. Construction of laminate designed to provide UV resistance, high puncture, tear resistance and an excellent WVT rate.

2.2.8.3 Polyvinylidene Chloride (PVDC) Film Vapor Retarder

The PVDC film vapor retarder shall have a maximum moisture vapor transmission of 0.02 perms, minimum puncture resistance of 150 Beach units, a minimum tensile strength in any direction of 5.3 kN/m when tested in accordance with ASTM D882, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.2.8.4 Vapor Barrier/Weather Barrier

The vapor barrier shall be greater than 3 ply self adhesive laminate -white vapor barrier jacket- superior performance (less than 0.0000 permeability when tested in accordance with ASTM E96/E96M). Vapor barrier shall meet UL 723 or ASTM E84. 25 flame and 50 smoke requirements; and UV resistant. Minimum burst strength 1.3 MPa in accordance with [TAPPI T403 OM] [ISO 2758]. Tensile strength 0.12 kg/m width (PSTC-1000). Tape shall be as specified for laminated film vapor barrier above.

2.2.9 Vapor Retarder Not Required

ASTM C921, Type II, Class D, minimum puncture resistance 50 Beach units on all surfaces except ductwork, where maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable. Jacket shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.2.10 Wire

Wire shall be in accordance with MLIT-M.

2.2.11 Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants

shall have a maximum permeance of 0.02 perms based on Procedure B for ASTM E96/E96M, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E84.

2.3 PIPE INSULATION SYSTEMS

Conform insulation materials to Table 1 and minimum insulation thickness as listed in Table 2 and meet. Limit pipe insulation materials to those listed herein and meeting the following requirements:

2.3.1 Aboveground Cold Pipeline (-34 to 16 deg. C)

Insulation for outdoor, indoor, exposed or concealed applications, shall be as follows:

2.3.1.1 Mineral Fiber Insulation with Integral Wicking Material (MFIWM)

JIS A 9504. Install in accordance with manufacturer's instructions. Do not use in applications exposed to outdoor ambient conditions in climatic zones 1 through 4.

2.3.2 Aboveground Hot Pipeline (Above 16 deg. C)

Insulation for outdoor, indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

2.3.2.1 Mineral Fiber

JIS A 9504, supply the insulation with manufacturer's recommended factory-applied jacket.

2.3.3 Aboveground Dual Temperature Pipeline

Selection of insulation for use over a dual temperature pipeline system (Outdoor, Indoor - Exposed or Concealed) shall be in accordance with the most limiting/restrictive case. Find an allowable material from paragraph PIPE INSULATION MATERIALS and determine the required thickness from the most restrictive case. Use the thickness listed in paragraphs INSULATION THICKNESS for cold & hot pipe applications.

2.4 DUCT INSULATION SYSTEMS

2.4.1 Factory Applied Insulation

Provide factory-applied insulation for insulation with insulation manufacturer's standard reinforced fire-retardant vapor barrier[, with identification of installed thermal resistance (R) value and out-of-package R value].

2.4.2 Kitchen Exhaust Ductwork Insulation

Insulation thickness shall be a minimum of 50 mm, blocks or boards, either mineral fiber conforming to JIS A 9504. The enclosure materials and the grease duct enclosure systems shall meet testing requirements for noncombustibility, fire resistance, durability, internal fire, and fire-engulfment with a through-penetration fire stop.

2.4.3 Acoustical Duct Lining

2.4.3.1 General

For ductwork indicated or specified in Section 23 30 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM to be acoustically lined, provide external insulation in accordance with this specification section and in addition to the acoustical duct lining. Do not use acoustical lining in place of duct wrap or rigid board insulation (insulation on the exterior of the duct).

2.4.4 Duct Insulation Jackets

2.4.4.1 All-Purpose Jacket

Provide insulation with insulation manufacturer's standard reinforced fire-retardant jacket with or without integral vapor barrier as required by the service. In exposed locations, provide jacket with a white surface suitable for field painting.

2.4.4.2 Metal Jackets

2.4.4.2.1 Aluminum Jackets

JIS H 4000, with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide smooth surface jackets for jacket outside dimension 200 mm and larger. Provide corrugated surface jackets for jacket outside dimension 200 mm and larger. Provide stainless steel bands, minimum width of 13 mm.

2.4.4.2.2 Stainless Steel Jackets

JIS G 4304; Type 304, smooth surface with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide stainless steel bands, minimum width of 13 mm.

2.5 EQUIPMENT INSULATION SYSTEMS

Insulate equipment and accessories as specified in accordance with MLIT-M, Chapter 3.

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and equipment. Flexible elastomeric cellular insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc. The insulation shall not pull apart after a one hour period; any insulation found to pull apart after one hour, shall be replaced.

3.1.1 Display Samples

Submit and display, after approval of materials, actual sections of installed systems, properly insulated in accordance with the specification requirements. Such actual sections must remain accessible to inspection throughout the job and will be reviewed from time to time for controlling the quality of the work throughout the construction site. Each material used shall be identified, by indicating on an attached sheet the

specification requirement for the material and the material by each manufacturer intended to meet the requirement. The Contracting Officer will inspect display sample sections at the jobsite. Approved display sample sections shall remain on display at the jobsite during the construction period. Upon completion of construction, the display sample sections will be closed and sealed.

3.1.1.1 Pipe Insulation Display Sections

Display sample sections shall include as a minimum an elbow or tee, a valve, dielectric waterways and flanges, a hanger with protection shield and insulation insert, or dowel as required, at support point, method of fastening and sealing insulation at longitudinal lap, circumferential lap, butt joints at fittings and on pipe runs, and terminating points for each type of pipe insulation used on the job, and for hot pipelines and cold pipelines, both interior and exterior, even when the same type of insulation is used for these services.

3.1.1.2 Duct Insulation Display Sections

Display sample sections for rigid and flexible duct insulation used on the job. Use a temporary covering to enclose and protect display sections for duct insulation exposed to weather

3.1.2 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until [tests] [tests and heat tracing] specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with plates except where modified herein or on the drawings.

3.1.3 Firestopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials as specified in Section 07 84 00 FIRESTOPPING. The protection of ducts at point of passage through firewalls must be in accordance with NFPA 90A and/or NFPA 90B. All other penetrations, such as piping, conduit, and wiring, through firewalls must be protected with a material or system of the same hourly rating that is listed by MLIT-M.

3.1.4 Painting and Finishing

Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.1.5 Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.6 Pipes/Ducts/Equipment That Require Insulation

Insulation is required on all pipes, ducts, or equipment, except for omitted items as specified.

3.2 PIPE INSULATION SYSTEMS INSTALLATION

Install pipe insulation systems in accordance with the approved plates as supplemented by the manufacturer's published installation instructions.

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder/barrier, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

a. Pipe used solely for fire protection.

b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.

c. Sanitary drain lines.

d. Air chambers.

e. Adjacent insulation.

f. Access plates of fan housings.

g. Cleanouts or handholes.

3.2.1.2 Pipe Insulation Material and Thickness

Pipe insulation materials must be as listed in Table 1.

TABLE 1

Insulation Material for Piping

Service					
	Material	Specification	Type	Class	VR/VB Req'd
Chilled Water (Supply & Return, Dual Temperature Piping, 4.44 C nominal)					

TABLE 1

Insulation Material for Piping

	Material	Specification	Type	Class	VR/VB Req'd
Service					
	[Mineral Fiber with Wicking Material][Do not use in applications exposed to outdoor ambient conditions in climatic zones 1 through 4.]	[]JIS A 9504	[I]		[Yes]
Heating Hot Water Supply & Return, Heated Oil (Max 121 C)					
	Mineral Fiber	JIS A 9504			
Cold Domestic Water Piping, Makeup Water & Drinking Fountain Drain Piping					
	Mineral Fiber	JIS A 9504			
Hot Domestic Water Supply & Recirculating Piping (Max 93 C)					
	Mineral Fiber	JIS A 9504			
Refrigerant Suction Piping (1.67 degrees C nominal)					
	Shall be pre-insulated by manufacturer				
Compressed Air Discharge, Steam and Condensate Return (94 to 121 Degrees C					
	Mineral Fiber	JIS A 9504			
Exposed Lavatory Drains, Exposed Domestic Water Piping & Drains to Areas for Handicapped Personnel					
	Mineral Fiber	JIS A 9504			
Horizontal Roof Drain Leaders (Including Underside of Roof Drain Fittings)					
	Mineral Fiber	JIS A 9504			
Condensate Drain Located Inside Building					
	Mineral Fiber	JIS A 9504			
Medium Temperature Hot Water, Steam and Condensate (122 to 176 Degrees C)					
	Mineral Fiber	JIS A 9504			
High Temperature Hot Water & Steam (177 to 371 Degrees C)					
	Mineral Fiber	JIS A 9504			
Brine Systems Cryogenics (-34 to -18 Degrees C)					
	Mineral Fiber	JIS A 9504			
Brine Systems Cryogenics (-18 to 1.11 Degrees C)					

TABLE 1

Insulation Material for Piping

Service					
	Material	Specification	Type	Class	VR/VB Req'd
	Mineral Fiber	JIS A 9504			

Note: VR/VB = Vapor Retarder/Vapor Barrier

TABLE 2

Piping Insulation Thickness (mm)
For flexible cellular foam the thickness should be 13mm instead of 15mm. Economic thickness or prevention of condensation is the basis of these tables. If prevention of condensation is the criterion, the ambient temperature and relative humidity must be stated. Do not use integral wicking material in Chilled water applications exposed to outdoor ambient conditions in climatic zones 1 through 4.

Service						
	Material	Tube And Pipe Size (mm)				
		<25	25-<40	40-<100	100-<200	> or = 200
[Chilled Water (Supply & Return, Dual Temperature Piping, 4.44 Degrees C nominal)]						
	Mineral Fiber with Wicking Material	25	40	40	50	50
[Chilled Water (Supply & Return, Dual Temperature Piping, 4.44 Degrees C nominal)]						
	Mineral Fiber with Wicking Material	25	40	40	50	50
Heating Hot Water Supply & Return, Heated Oil (Max 121 C)						
	Mineral Fiber	40	40	50	50	50
Cold Domestic Water Piping, Makeup Water & Drinking Fountain Drain Piping						
	Mineral Fiber	40	40	50	50	50
	Flexible Elastomeric Cellular	25	25	25	N/A	N/A
Hot Domestic Water Supply & Recirculating Piping (Max 93 C)						
	Mineral Fiber	25	25	25	40	40
Refrigerant Suction Piping (1.67 degrees C nominal)						

TABLE 2

Piping Insulation Thickness (mm)
For flexible cellular foam the thickness should be 13mm instead of 15mm. Economic thickness or prevention of condensation is the basis of these tables. If prevention of condensation is the criterion, the ambient temperature and relative humidity must be stated. Do not use integral wicking material in Chilled water applications exposed to outdoor ambient conditions in climatic zones 1 through 4.

Service						
	Material	Tube And Pipe Size (mm)				
		<25	25-<40	40-<100	100-<200	> or = 200
	Shall be pre-insulated by manufacturer					
Compressed Air Discharge, Steam and Condensate Return (94 to 121 Degrees C						
	Mineral Fiber	40	40	50	50	50
		40*	50*	65*	80*	90*
Exposed Lavatory Drains, Exposed Domestic Water Piping & Drains to Areas for Handicapped Personnel						
	Mineral Fiber	40	40	50	50	50
Horizontal Roof Drain Leaders (Including Underside of Roof Drain Fittings)						
	Mineral Fiber	40	40	50	50	50
Condensate Drain Located Inside Building						
	Mineral Fiber	40	40	50	50	50
Medium Temperature Hot Water, Steam and Condensate (122 to 176 Degrees C)						
	Mineral Fiber	40	80	80	100	100
		65*	80*	90*		
High Temperature Hot Water & Steam (177 to 371 Degrees C)						
	Mineral Fiber	65	80	80	100	100
Brine Systems Cryogenics (-34 to -18 Degrees C)						
	Mineral Fiber	40	40	50	50	50
Brine Systems Cryogenics (-18 to 1.11 Degrees C)						
	Mineral Fiber	40	40	50	50	50

3.2.2 Aboveground Cold Pipelines

The following cold pipelines for minus 34 to plus 16 degrees C, shall be insulated in accordance with Table 2 except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted. This includes but is not limited to the following:

a. Make-up water.

b. Horizontal and vertical portions of interior roof drains.

c. Refrigerant suction lines.

d. Chilled water.

e. Dual temperature water, i.e. HVAC hot/chilled water.

f. Air conditioner condensate drains.

g. Brine system cryogenics

h. Exposed lavatory drains and domestic water lines serving plumbing fixtures for handicap persons.

i. Domestic cold and chilled drinking water.

3.2.2.1 Insulation Material and Thickness

Insulation thickness for cold pipelines shall be determined using Table 2.

3.2.3 Aboveground Hot Pipelines

3.2.3.1 General Requirements

All hot pipe lines above 16 degrees C, except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted, shall be insulated in accordance with Table 2. This includes but is not limited to the following:

a. Domestic hot water supply & re-circulating system.

b. Steam.

c. Condensate & compressed air discharge.

d. Hot water heating.

e. Heated oil.

f. Water defrost lines in refrigerated rooms.

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type I jacket or field applied aluminum where required or seal welded PVC.

3.2.4 Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed in accordance

with MLIT-M.

3.3 DUCT INSULATION SYSTEMS INSTALLATION

Install duct insulation systems in accordance with the approved plates as supplemented by the manufacturer's published installation instructions. Duct insulation minimum thickness and insulation level must be as listed in Table 3.

3.3.1 Duct Insulation Minimum Thickness

Duct insulation minimum thickness in accordance with Table 4.

Table 4 - Minimum Duct Insulation (mm)

Cold Air Ducts	50
Relief Ducts	40
Fresh Air Intake Ducts	40
Warm Air Ducts	50
Relief Ducts	40
Fresh Air Intake Ducts	40

3.3.2 Insulation and Vapor Retarder/Vapor Barrier for Cold Air Duct

Insulation and vapor retarder/vapor barrier shall be provided for the following cold air ducts and associated equipment.

a. Supply ducts.

b. Return air ducts.

c. Relief ducts.

d. Flexible run-outs (field-insulated).

e. Plenums.

f. Duct-mounted coil casings.

g. Coil headers and return bends.

h. Coil casings.

i. Fresh air intake ducts.

j. Filter boxes.

k. Mixing boxes (field-insulated).

l. Supply fans (field-insulated).

m. Site-erected air conditioner casings.

n. Ducts exposed to weather.

o. Combustion air intake ducts.

3.3.3 Insulation for Warm Air Duct

Insulation and vapor barrier shall be provided for the following warm air ducts and associated equipment:.

a. Supply ducts.

b. Return air ducts.

c. Relief air ducts

d. Flexible run-outs (field insulated).

e. Plenums.

f. Duct-mounted coil casings.

g. Coil-headers and return bends.

h. Coil casings.

i. Fresh air intake ducts.

j. Filter boxes.

k. Mixing boxes.

l. Supply fans.

m. Site-erected air conditioner casings.

n. Ducts exposed to weather.

3.3.4 Ducts Handling Air for Dual Purpose

For air handling ducts for dual purpose below and above 16 degrees C, ducts shall be insulated as specified for cold air duct.

3.3.5 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

3.3.6 Duct Exposed to Weather

3.3.6.1 Installation

Ducts exposed to weather shall be insulated and finished as specified in accordance with MLIT-M.

3.3.7 Kitchen Exhaust Duct Insulation

NFPA 96 for [ovens,] [griddles,] [deep fat fryers,] [steam kettles,]

[vegetable steamers,] [high pressure cookers,] [and] [mobile serving units]. Provide insulation with 19 mm wide, minimum 4 mm thick galvanized steel bands spaced not over 305 mm o.c.; or 16 gauge galvanized steel wire with corner clips under the wire; or with heavy welded pins spaced not over 305 mm apart each way. Do not use adhesives.

3.4 EQUIPMENT INSULATION SYSTEMS INSTALLATION

Install equipment insulation systems in accordance with MLIT-M.

3.4.1 Insulation for Cold Equipment

Cold equipment below 16 degrees C: Insulation shall be furnished on equipment handling media below 16 degrees C including the following:

a. Pumps.

b. Refrigeration equipment parts that are not factory insulated.

c. Drip pans under chilled equipment.

d. Cold water storage tanks.

e. Water softeners.

f. Duct mounted coils.

g. Cold and chilled water pumps.

h. Pneumatic water tanks.

i. Roof drain bodies.

j. Air handling equipment parts that are not factory insulated.

k. Expansion and air separation tanks.

3.4.1.1 Insulation Type

Insulation shall be suitable for the temperature encountered. Material and thicknesses shall be as shown in Table 5:

TABLE 5

Insulation Thickness for Cold Equipment (mm)

Equipment handling media at indicated temperature		
	Material	Thickness (mm)
	Mineral Fiber	MLIT-M

3.4.2 Insulation for Hot Equipment

Insulation shall be furnished on equipment handling media above 16 degrees C including the following:

a. Converters.

b. Heat exchangers.

c. Hot water generators.

d. Water heaters.

e. Pumps handling media above 54 degrees C.

f. Fuel oil heaters.

g. Hot water storage tanks.

h. Air separation tanks.

i. Surge tanks.

j. Flash tanks.

k. Feed-water heaters.

l. Unjacketed boilers or parts of boilers.

m. Boiler flue gas connection from boiler to stack (if inside).

n. Induced draft fans.

o. Fly ash and soot collectors.

p. Condensate receivers.

3.4.2.1 Insulation

Insulation shall be suitable for the temperature encountered. Shell and tube-type heat exchangers shall be insulated for the temperature of the shell medium.

Insulation thickness for hot equipment shall be determined using Table 6:

TABLE 6

Insulation Thickness for Hot Equipment (mm)

Equipment handling steam or media at indicated pressure or temperature limit		
	Material	Thickness (mm)
103 kPa or 121 degrees C		
	Rigid Mineral Fiber	50
	Flexible Mineral Fiber	50
1380 kPa or 204 degree C		
	Rigid Mineral Fiber	75
	Flexible Mineral Fiber	75

TABLE 6		
Insulation Thickness for Hot Equipment (mm)		
Equipment handling steam or media at indicated pressure or temperature limit		
	Material	Thickness (mm)
316 degrees C		
	Rigid Mineral Fiber	125
	Flexible Mineral Fiber	150
316 degrees C: Thickness necessary to limit the external temperature of the insulation to 50 C. Heat transfer calculations shall be submitted to substantiate insulation and thickness selection.		

3.4.2.2 Insulation of Boiler Stack and Diesel Engine Exhaust Pipe

Insulation type and thickness shall be in accordance with the following Table 7.

TABLE 7						
Insulation and Thickness for Boiler Stack and Diesel Engine Exhaust Pipe						
Service & Surface Temperature Range (Degrees C)						
	Material	Outside Diameter (mm)				
		6 - 32	25 - 80	90-125	150 - 250	> or = 280 - 900
Boiler Stack (Up to 204 degrees C)						
	Mineral Fiber JIS A 9504	N/A	N/A	75	90	100
Boiler Stack (205 to 315 degrees C)						
	Mineral Fiber JIS A 9504 ASTM C547 Class 2, ASTM C592 Class 1, or ASTM C612 Class 3	N/A	N/A	100	100	125
	Mineral Fiber/Cellular Glass Composite:					

TABLE 7

Insulation and Thickness for
Boiler Stack and Diesel Engine Exhaust Pipe

	Material	Outside Diameter (mm)				
		6 - 32	25 - 80	90-125	150 - 250	> or = 280 - 900
	Mineral Fiber JIS A 9504 ASTM C547 Class 2, ASTM C592 Class 1, or ASTM C612 Class 3	25	25	25	25	50
Boiler Stack (316 to 427 degrees C)						
	Mineral Fiber JIS A 9504 ASTM C547 Class 3, ASTM C592 Class 1, or ASTM C612 Class 3 JIS A 9504	N/A	N/A	100	100	150
	Mineral Fiber/Cellular Glass Composite:					
	Mineral Fiber JIS A 9504 ASTM C547 Class 2, ASTM C592 Class 1, or ASTM C612 Class 3 JIS A 9504	50	50	50	80	80
Diesel Engine Exhaust (Up to 371 degrees C)						
	Mineral Fiber JIS A 9504 ASTM C547 Class 2, ASTM C592 Class 1, or ASTM C612 Class 3 JIS A 9504	50	50	50	80	80

3.4.3 Equipment Handling Dual Temperature Media

Below and above 16 degrees C: equipment handling dual temperature media shall be insulated as specified for cold equipment.

3.4.4 Equipment Exposed to Weather

3.4.4.1 Installation

Equipment exposed to weather shall be insulated and finished in accordance with the requirements for ducts exposed to weather in paragraph DUCT INSULATION INSTALLATION.

-- End of Section --

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 1180	(2014) Hexagon Head Bolts and Hexagon Head Screws
JIS B 2220	(2012) Steel Pipe Flanges
JIS B 2301	(2013) Screwed Type Malleable Cast Iron Pipe Fittings
JIS B 2312	(2015) Steel Butt-Welding Pipe Fittings
JIS B 2316	(2017) Steel Socket-Welding Pipe Fittings
JIS B 2404	(2018) Dimensions of Gaskets for Use with Pipe Flanges
JIS B 8225	(2012) Safety Valves-Measuring Methods for Coefficient of Discharge
JIS B 8471	(2004) Water Pipe Line-Solenoid Valves
JIS B 8605	(2002) Stop Valves for Refrigerants
JIS B 8619	(2018) Thermostatic Refrigerant Expansion Valves-Methods of Testing for Performance
JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS G 3454	(2019) Carbon Steel Pipes for Pressure Service (Amendment 1)
JIS H 3300	(2018) Copper and Copper Alloy Seamless Pipes and Tubes
JIS H 3401	(2001) Pipe Fittings of Copper and Copper Alloys

JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS K 7137-2	(2001)Plastics-Polytetrafluoroethylene (PTFE) Semi-Finished Products- Part 2 : Preparation of Test Specimens and Determination of Properties
JIS Z 2371	(2015) Methods of Salt Spray Testing
JIS Z 3197	(2012) Test Methods for Soldering Fluxes
JIS Z 3202	(2007) Copper and Copper Alloy Gas Welding Rods
JIS Z 3284-1	(2014) Solder Paste-Part 1: Kinds and Quality Classification
JIS Z 3801	(2018) Standard Qualification Test and Acceptance Requirements for Manual Welding Technique
JIS Z 3821	(2018) Standard Qualification Test and Acceptance Requirements for Welding Technique of Stainless Steel

JAPAN WELDING ENGINEERING SOCIETY (JWES)

JWES	Japan Welding Engineering Society

MLIT MECHANICAL STANDARD SPECIFICATION

MLIT-M	(2019) Public Building Construction Standard Specification

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Refrigerant Piping System; G[, [_____]]

SD-06 Test Reports

Refrigerant Piping Tests

SD-10 Operation and Maintenance Data

Maintenance
Operation and Maintenance Manuals
Demonstrations

1.3 QUALITY ASSURANCE

1.3.1 Qualifications

Submit [_____] copies of qualified procedures, and list of names and identification symbols of qualified welders and welding operators, prior to non-factory welding operations.[Piping shall be welded in accordance with the qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with JIS Z 3801. Notify the Contracting Officer 24 hours in advance of tests to be performed at the work site, if practical. The welder or welding operator shall apply the personally assigned symbol near each weld made, as a permanent record. Structural members shall be welded in accordance with Section [05 12 00 STRUCTURAL STEEL].] [Welding and nondestructive testing procedures are specified in Section [40 05 13.96 WELDING PROCESS PIPING] .]

1.3.2 Contract Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

1.4 DELIVERY, STORAGE, AND HANDLING

Protect stored items from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation is the Contractor's responsibility. Replace any materials found to be damaged at the Contractor's expense. During installation, cap piping and similar openings to keep out dirt and other foreign matter.

1.5 MAINTENANCE

1.5.1 General

Submit Data Package 2 plus operation and maintenance data complying with the requirements of Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein.

1.5.2 Extra Materials

Submit spare parts data for each different item of equipment specified, after approval of detail drawings and not later than [_____] months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

a. Provide materials and equipment which are standard products of a manufacturer regularly engaged in the manufacturing of such products, that are of a similar material, design and workmanship and that have

been in satisfactory commercial or industrial use for 2 years prior to bid opening.

b. The 2 year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products having less than a 2 year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown.

c. Products shall be supported by a service organization location in Japan. System components shall be environmentally suitable for the indicated locations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. The service organizations shall be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

d. Exposed equipment moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Install safety devices so that proper operation of equipment is not impaired. Welding and cutting safety requirements shall be in accordance with MLIT-M and JIS Z 3801.

e. Manufacturer's standard catalog data, at least [5 weeks] [_____] prior to the purchase or installation of a particular component, highlighted to show material, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Include in the data manufacturer's recommended installation instructions and procedures. Provide data for the following components as a minimum:

(1) Piping and Fittings
(2) Valves
(3) Piping Accessories
(4) Pipe Hangers, Inserts, and Supports

2.2 ELECTRICAL WORK

[Electrical equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Field wiring shall be in accordance with manufacturer's instructions.] [Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided.]

2.3 REFRIGERANT PIPING SYSTEM

Refrigerant piping, valves, fittings, and accessories shall be in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku) for Japanese Standard., except as specified herein. Refrigerant piping, valves, fittings, and accessories shall be compatible with the fluids used and capable of withstanding the pressures and temperatures of the service. Refrigerant piping, valves, and

accessories used for refrigerant service shall be cleaned, dehydrated, and sealed (capped or plugged) prior to shipment from the manufacturer's plant. Submit drawings, at least [5] [_____] weeks prior to beginning construction, provided in adequate detail to demonstrate compliance with contract requirements. Drawings shall consist of:

a. Piping layouts which identify all valves and fittings.

b. Plans and elevations which identify clearances required for maintenance and operation.

2.4 PIPE, FITTINGS AND END CONNECTIONS (JOINTS)

2.4.1 Steel Pipe

Steel pipe for refrigerant service shall conform to JIS G 3454 & JIS B 2301, Schedule 40.

2.4.1.1 Welded Fittings and Connections

Butt-welded fittings shall conform to JIS B 2312. Socket-welded fittings shall conform to JIS B 2316. Welded fittings shall be identified with the appropriate grade and marking symbol. Welded valves and pipe connections (both butt-welds and socket-welds types) shall conform to JIS B 2312 or JIS B 2316.

2.4.1.2 Threaded Fittings and Connections

Threaded fitting shall conform to JIS B 2301. Threaded valves and pipe connections shall conform to JIS B 2301.

2.4.1.3 Flanged Fittings and Connections

Flanges shall conform to JIS B 2220. Gaskets shall be non asbestos compressed material in accordance with JIS B 2404, 1.59 mm thickness, full face or self-centering flat ring type. This gaskets shall contain aramid fibers bonded with styrene butadeine rubber (SBR) or nitrile butadeine rubber (NBR). Bolts, nuts, and bolt patterns shall conform to JIS B 2220. Bolts shall be high or intermediate strength material conforming to JIS B 1180.

2.4.2 Copper Tubing

Copper tubing shall conform to JIS H 3300 and JIS H 3401, annealed or hard drawn as required. Copper tubing shall be soft annealed where bending is required and hard drawn where no bending is required. Soft annealed copper tubing shall not be used in sizes larger than 35 mm. Joints shall be brazed except that joints on lines 22 mmand smaller may be flared. Cast copper alloy fittings for flared copper tube shall conform to JIS H 3401. Wrought copper and bronze solder-joint pressure fittings shall conform to JIS H 3401. Joints and fittings for brazed joint shall be wrought-copper or forged-brass sweat fittings. Cast sweat-type joints and fittings shall not be allowed for brazed joints. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment.

2.4.3 Solder

Solder shall conform to JIS Z 3284-1, tin-antimony alloy for service

pressures up to 1034 kPa. Solder flux shall be liquid or paste form, non-corrosive and conform to JIS Z 3197.

2.4.4 Brazing Filler Metal

Filler metal shall conform to JIS Z 3202.

2.5 VALVES

Valves shall be designed, manufactured, and tested specifically for refrigerant service. Valve bodies shall be of brass, bronze, steel, or ductile iron construction. Valves 25 mm and smaller shall have brazed or socket welded connections. Valves larger than 25 mm shall have [tongue-and-groove flanged] [butt welded] end connections. Threaded end connections shall not be used, except in pilot pressure or gauge lines where maintenance disassembly is required and welded flanges cannot be used. Internal parts shall be removable for inspection or replacement without applying heat or breaking pipe connections. Valve stems exposed to the atmosphere shall be stainless steel or corrosion resistant metal plated carbon steel. Direction of flow shall be legibly and permanently indicated on the valve body. Control valve inlets shall be fitted with integral or adapted strainer or filter where recommended or required by the manufacturer. Purge, charge and receiver valves shall be of manufacturer's standard configuration.

2.5.1 Refrigerant Stop Valves

Valve shall be the globe or full-port ball type with a back-seating stem especially packed for refrigerant service. Valve packing shall be replaceable under line pressure. Valve shall be provided with a [handwheel] [or] [wrench] operator and a seal cap. Valve shall be the straight or angle pattern design as indicated.

2.5.2 Check Valves

Valve shall be the swing or lift type as required to provide positive shutoff at the differential pressure indicated. Valve shall be provide with resilient seat.

2.5.3 Liquid Solenoid Valves

Valves shall comply with JIS B 8471 and be suitable for continuous duty with applied voltages 15 percent under and 5 percent over nominal rated voltage at maximum and minimum encountered pressure and temperature service conditions. Valves shall be direct-acting or pilot-operating type, packless, except that packed stem, seal capped, manual lifting provisions shall be furnished. Solenoid coils shall be moisture-proof, UL approved, totally encapsulated or encapsulated and metal jacketed as required. Valves shall have safe working pressure of 2760 kPa and a maximum operating pressure differential of at least 1375 kPa at 85 percent rated voltage. Valves shall have an operating pressure differential suitable for the refrigerant used.

2.5.4 Expansion Valves

Valve shall conform to JIS B 8619. Valve shall be the diaphragm and spring-loaded type with internal or external equalizers, and bulb and capillary tubing. Valve shall be provided with an external superheat adjustment along with a seal cap. Internal equalizers may be utilized

where flowing refrigerant pressure drop between outlet of the valve and inlet to the evaporator coil is negligible and pressure drop across the evaporator is less than the pressure difference corresponding to 1 degree C of saturated suction temperature at evaporator conditions. Bulb charge shall be determined by the manufacturer for the application and such that liquid will remain in the bulb at all operating conditions. Gas limited liquid charged valves and other valve devices for limiting evaporator pressure shall not be used without a distributor or discharge tube or effective means to prevent loss of control when bulb becomes warmer than valve body. Pilot-operated valves shall have a characterized plug to provide required modulating control. A de-energized solenoid valve may be used in the pilot line to close the main valve in lieu of a solenoid valve in the main liquid line. An isolatable pressure gauge shall be provided in the pilot line, at the main valve. Automatic pressure reducing or constant pressure regulating expansion valves may be used only where indicted or for constant evaporator loads.

2.5.5 Safety Relief Valves

Valve shall be the two-way type, unless indicated otherwise. Valve shall conform to JIS B 8225. Valve capacity shall be certified by the National Board of Boiler and Pressure Vessel Inspectors or Japan Boiler Association. Valve shall be of an automatically reseating design after activation.

2.5.6 Evaporator Pressure Regulators, Direct-Acting

Valve shall include a diaphragm/spring assembly, external pressure adjustment with seal cap, and pressure gauge port. Valve shall maintain a constant inlet pressure by balancing inlet pressure on diaphragm against an adjustable spring load. Pressure drop at system design load shall not exceed the pressure difference corresponding to a 1 degree C change in saturated refrigerant temperature at evaporator operating suction temperature. Spring shall be selected for indicated maximum allowable suction pressure range.

2.5.7 Refrigerant Access Valves

Refrigerant access valves and hose connections shall be in accordance with JIS B 8605.

2.6 PIPING ACCESSORIES

2.6.1 Filter Driers

Sizes 15 mm and larger shall be the full flow, replaceable core type. Sizes 13 mm and smaller shall be the sealed type. Cores shall be of suitable desiccant that will not plug, cake, dust, channel, or break down, and shall remove water, acid, and foreign material from the refrigerant. Filter driers shall be constructed so that none of the desiccant will pass into the refrigerant lines. Minimum bursting pressure shall be 10.3 MPa.

2.6.2 Sight Glass and Liquid Level Indicator

2.6.2.1 Assembly and Components

Assembly shall be pressure- and temperature-rated and constructed of materials suitable for the service. Glass shall be borosilicate type. Ferrous components subject to condensation shall be electro-galvanized.

2.6.2.2 Gauge Glass

Gauge glass shall include top and bottom isolation valves fitted with automatic checks, and packing followers; red-line or green-line gauge glass; elastomer or polymer packing to suit the service; and gauge glass guard.

2.6.2.3 Bull's-Eye and Inline Sight Glass Reflex Lens

Bull's-eye and inline sight glass reflex lens shall be provided for dead-end liquid service. For pipe line mounting, two plain lenses in one body suitable for backlighted viewing shall be provided.

2.6.2.4 Moisture Indicator

Indicator shall be a self-reversible action, moisture reactive, color changing media. Indicator shall be furnished with full-color-printing tag containing color, moisture and temperature criteria. Unless otherwise indicated, the moisture indicator shall be an integral part of each corresponding sight glass.

2.6.3 Vibration Dampeners

Dampeners shall be of the all-metallic bellows and woven-wire type.

2.6.4 Flexible Pipe Connectors

Connector shall be a composite of interior corrugated phosphor bronze or stainless steel, as required for fluid service, with exterior reinforcement of bronze, stainless steel or monel wire braid. Assembly shall be constructed with a safety factor of not less than 4 at 150 degrees C. Unless otherwise indicated, the length of a flexible connector shall be as recommended by the manufacturer for the service intended.

2.6.5 Strainers

Strainers used in refrigerant service shall have brass or cast iron body, Y-or angle-pattern, cleanable, not less than 60-mesh noncorroding screen of an area to provide net free area not less than ten times the pipe diameter with pressure rating compatible with the refrigerant service. Screens shall be stainless steel or monel and reinforced spring-loaded where necessary for bypass-proof construction.

2.6.6 Pressure and Vacuum Gauges

Gauges shall conform to MLIT-M and shall be provided with throttling type needle valve or a pulsation dampener and shut-off valve. Gauge shall be a minimum of 85 mm in diameter with a range from 0 kPa to approximately 1.5 times the maximum system working pressure. Each gauge range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range.

2.6.7 Temperature Gauges

Temperature gauges shall be the industrial duty type and be provided for the required temperature range. Gauges shall have Celsius scale in 1 degree graduations scale (black numbers) on a white face. The pointer shall be adjustable. Rigid stem type temperature gauges shall be provided

in thermal wells located within 1.5 m of the finished floor. Universal adjustable angle type or remote element type temperature gauges shall be provided in thermal wells located 1.5 to 2.1 m above the finished floor. Remote element type temperature gauges shall be provided in thermal wells located 2.1 m above the finished floor.

2.6.7.1 Stem Cased-Glass

Stem cased-glass case shall be polished stainless steel or cast aluminum, 229 mm long, with clear acrylic lens, and non-mercury filled glass tube with indicating-fluid column.

2.6.7.2 Bimetallic Dial

Bimetallic dial type case shall be not less than 89 mm, stainless steel, and shall be hermetically sealed with clear acrylic lens. Bimetallic element shall be silicone dampened and unit fitted with external calibrator adjustment. Accuracy shall be one percent of dial range.

2.6.7.3 Liquid-, Solid-, and Vapor-Filled Dial

Liquid-, solid-, and vapor-filled dial type cases shall be not less than 89 mm, stainless steel or cast aluminum with clear acrylic lens. Fill shall be nonmercury, suitable for encountered cross-ambients, and connecting capillary tubing shall be double-braided bronze.

2.6.7.4 Thermal Well

Thermal well shall be identical size, 13 or 19 mm NPT connection, brass or stainless steel. Where test wells are indicated, provide captive plug-fitted type 13 mm NPT connection suitable for use with either engraved stem or standard separable socket thermometer or thermostat. Mercury shall not be used in thermometers. Extended neck thermal wells shall be of sufficient length to clear insulation thickness by 25 mm.

2.6.8 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, guides, and supports shall conform to MLIT-M.

2.6.9 Escutcheons

Escutcheons shall be chromium-plated iron or chromium-plated brass, either one piece or split pattern, held in place by internal spring tension or set screws.

2.7 FABRICATION

2.7.1 Factory Coating

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand [125] [500] hours exposure to the salt spray test specified in JIS Z 2371 using a 5 percent sodium chloride solution. Immediately after completion of the test, the specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 3 mm on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to

JIS H 8641.

2.7.2 Factory Applied Insulation

[Refrigerant suction lines between the cooler and each compressor [and cold gas inlet connections to gas cooled motors]] [Refrigerant pumps and exposed chilled water lines on absorption chillers] shall be insulated with not less than 19 mm thick unicellular plastic foam. Factory insulated items installed outdoors are not required to be fire-rated. As a minimum, factory insulated items installed indoors shall have a flamespread index no higher than 75 and a smoke developed index no higher than 150. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket shall be tested as a composite material. Jackets, facings, and adhesives shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, perform a verification of dimensions in the field. Submit a letter, at least [2] [_____] weeks prior to beginning construction, including the date the site was visited, conformation of existing conditions, and any discrepancies found before performing any work.

3.2 INSTALLATION

Pipe and fitting installation shall conform to the requirements of MLIT-M. Cut pipe accurately to measurements established at the jobsite, and work into place without springing or forcing, completely clearing all windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation are not permitted without written approval. Cut pipe or tubing square, removeremoved by reaming, and permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers.

3.2.1 Directional Changes

Make changes in direction with fittings, except that bending of pipe 100 mm and smalleris permitted, provided a pipe bender is used and wide weep bends are formed. Mitering or notching pipe or other similar construction to form elbows or tees is not permitted. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be accepted.

3.2.2 Functional Requirements

Piping shall be installed 4 mm/m of pipe in the direction of flow to ensure adequate oil drainage. Open ends of refrigerant lines or equipment shall be properly capped or plugged during installation to keep moisture, dirt, or other foreign material out of the system. Piping shall remain capped until installation. Equipment piping shall be in accordance with the equipment manufacturer's recommendations and the contract drawings. Equipment and piping arrangements shall fit into space allotted and allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance.

3.2.3 Fittings and End Connections

3.2.3.1 Threaded Connections

Make threaded connections with tapered threads and make tight with tape complying with JIS K 7137-2 thread-joint compound applied to the male threads only.

3.2.3.2 Brazed Connections

Perform brazing in accordance with MLIT-M, except as modified herein. During brazing, fill the pipe and fittings with a pressure regulated inert gas, such as nitrogen, to prevent the formation of scale. Before brazing copper joints, clean both the outside of the tube and the inside of the fitting with a wire fitting brush until the entire joint surface is bright and clean. Do not use brazing flux. Remove surplus brazing material at all joints. Make steel tubing joints in accordance with the manufacturer's recommendations. Paint joints in steel tubing with the same material as the baked-on coating within 8 hours after joints are made. Protect tubing against oxidation during brazing by continuous purging of the inside of the piping using nitrogen. Support piping prior to brazing and do not spring or force.

3.2.3.3 Welded Connections

Welded joints in steel refrigerant piping shall be fusion-welded. Branch connections shall be made with welding tees or forged welding branch outlets. Pipe shall be thoroughly cleaned of all scale and foreign matter before the piping is assembled. During welding the pipe and fittings shall be filled with an inert gas, such as nitrogen, to prevent the formation of scale. Beveling, alignment, heat treatment, and inspection of weld shall conform to JIS Z 3821. Weld defects shall be removed and rewelded at no additional cost to the Government. Electrodes shall be stored and dried in accordance with JWES-Welding Technology Education Sheet or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.2.3.4 Flared Connections

When flared connections are used, a suitable lubricant shall be used between the back of the flare and the nut in order to avoid tearing the flare while tightening the nut.

3.2.3.5 Flanged Connections

When steel refrigerant piping is used, union or flange joints shall be provided in each line immediately preceding the connection to each piece of equipment requiring maintenance, such as compressors, coils, chillers, control valves, and other similar items. Flanged joints shall be assembled square end tight with matched flanges, gaskets, and bolts. Gaskets shall be suitable for use with the refrigerants to be handled.

3.2.4 Valves

3.2.4.1 General

Refrigerant stop valves shall be installed on each side of each piece of equipment such as compressors condensers, evaporators, receivers, and

other similar items in multiple-unit installation, to provide partial system isolation as required for maintenance or repair. Stop valves shall be installed with stems horizontal unless otherwise indicated. Ball valves shall be installed with stems positioned to facilitate operation and maintenance. Isolating valves for pressure gauges and switches shall be external to thermal insulation. Safety switches shall not be fitted with isolation valves. Filter dryers having access ports may be considered a point of isolation. Purge valves shall be provided at all points of systems where accumulated noncondensable gases would prevent proper system operation. Valves shall be furnished to match line size, unless otherwise indicated or approved.

3.2.4.2 Expansion Valves

Expansion valves shall be installed with the thermostatic expansion valve bulb located on top of the suction line when the suction line is less than 54 mm in diameter and at the 4 o'clock or 8 o'clock position on lines larger than 54 mm. The bulb shall be securely fastened with two clamps. The bulb shall be insulated. The bulb shall installed in a horizontal portion of the suction line, if possible, with the pigtail on the bottom. If the bulb must be installed in a vertical line, the bulb tubing shall be facing up.

3.2.4.3 Valve Identification

Each system valve, including those which are part of a factory assembly, shall be tagged. Tags shall be in alphanumeric sequence, progressing in direction of fluid flow. Tags shall be embossed, engraved, or stamped plastic or nonferrous metal of various shapes, sized approximately 40 mm diameter, substantially attached to a component or immediately adjacent thereto. Tags shall be attached with nonferrous, heavy duty, bead or link chain, 14 gauge annealed wire, nylon cable bands or as approved. Tag numbers shall be referenced in Operation and Maintenance Manuals and system diagrams.

3.2.5 Vibration Dampers

Vibration damper shall be provided in the suction and discharge lines on spring mounted compressors. Vibration dampers shall be installed parallel with the shaft of the compressor and shall be anchored firmly at the upstream end on the suction line and the downstream end in the discharge line.

3.2.6 Strainers

Strainers shall be provided immediately ahead of solenoid valves and expansion devices. Strainers may be an integral part of an expansion valve.

3.2.7 Filter Dryer

A liquid line filter dryer shall be provided on each refrigerant circuit located such that all liquid refrigerant passes through a filter dryer. Dryers shall be sized in accordance with the manufacturer's recommendations for the system in which it is installed. Dryers shall be installed such that it can be isolated from the system, the isolated portion of the system evacuated, and the filter dryer replaced. Dryers shall be installed in the horizontal position except replaceable core filter dryers may be installed in the vertical position with the access

flange on the bottom.

3.2.8 Sight Glass

A moisture indicating sight glass shall be installed in all refrigerant circuits down stream of all filter dryers and where indicated. Site glasses shall be full line size.

3.2.9 Discharge Line Oil Separator

Discharge line oil separator shall be provided in the discharge line from each compressor. Oil return line shall be connected to the compressor as recommended by the compressor manufacturer.

3.2.10 Accumulator

Accumulators shall be provided in the suction line to each compressor.

3.2.11 Flexible Pipe Connectors

Connectors shall be installed perpendicular to line of motion being isolated. Piping for equipment with bidirectional motion shall be fitted with two flexible connectors, in perpendicular planes. Reinforced elastomer flexible connectors shall be installed in accordance with manufacturer's instructions. Piping guides and restraints related to flexible connectors shall be provided as required.

3.2.12 Temperature Gauges

Temperature gauges shall be located specifically on, but not limited to the following: [the sensing element of each automatic temperature control device where a thermometer is not an integral part thereof] [the liquid line leaving a receiver] [and] [the suction line at each evaporator or liquid cooler]. Thermal wells for insertion thermometers and thermostats shall extend beyond thermal insulation surface not less than 25 mm.

3.2.13 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MLIT-M, except as modified herein. Hangers used to support piping 50 mm and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Piping subjected to vertical movement, when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers.

3.2.13.1 Horizontal Pipe Supports

Horizontal pipe supports shall be spaced as specified in MLIT-M and a support shall be installed not over 300 mm from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m apart at valves. [Pipe hanger loads suspended from steel joist with hanger loads between panel points in excess of 23 kg shall have the excess hanger loads suspended from panel points.]

3.2.13.2 Vertical Pipe Supports

Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 4.5 m not more than 2.4 m from end of risers, and at vent terminations.

3.2.13.3 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.2.13.4 Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads as specified under Building equipment seismic design & construction guidelines 2014 Edition.

3.2.13.5 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Masonry anchors for overhead applications shall be constructed of ferrous materials only. Structural steel brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section.

3.2.14 Pipe Alignment Guides

Pipe alignment guides shall be provided where indicated for expansion loops, offsets, and bends and as recommended by the manufacturer for expansion joints, not to exceed 1.5 m on each side of each expansion joint, and in lines 100 mm or smaller not more than 600 mm on each side of the joint.

3.2.15 Pipe Anchors

Anchors shall be provided wherever necessary or indicated to localize expansion or to prevent undue strain on piping. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results using turnbuckles where required. Supports, anchors, or stays shall not be attached where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline. Where pipe and conduit penetrations of vapor barrier sealed surfaces occur, these items shall be anchored immediately adjacent to each penetrated surface, to provide essentially zero movement within penetration seal. Detailed drawings of pipe anchors shall be submitted for approval before installation.

3.2.16 Building Surface Penetrations

Sleeves shall not be installed in structural members except where indicated or approved. Sleeves in nonload bearing surfaces shall be galvanized sheet metal, conforming to JIS G 3302, 1.0 mm (20 gauge). Sleeves in load bearing surfaces shall be uncoated carbon steel pipe, conforming to JIS G 3454, [Schedule 30] [Schedule 20] [Standard weight]. Sealants shall be applied to moisture and oil-free surfaces and elastomers to not less than 13 mm depth. Sleeves shall not be installed in structural members.

3.2.16.1 Refrigerated Space

Refrigerated space building surface penetrations shall be fitted with sleeves fabricated from hand-lay-up or helically wound, fibrous glass reinforced polyester or epoxy resin with a minimum thickness equal to equivalent size Schedule 40 steel pipe. Sleeves shall be constructed with integral collar or cold side shall be fitted with a bonded slip-on flange or extended collar. In the case of masonry penetrations where sleeve is not cast-in, voids shall be filled with latex mixed mortar cast to shape of sleeve and flange/external collar type sleeve shall be assembled with butyl elastomer vapor barrier sealant through penetration to cold side surface vapor barrier overlap and fastened to surface with masonry anchors. Integral cast-in collar type sleeve shall be flashed [with not less than 100 mm of cold side vapor barrier overlap of sleeve surface.] Normally noninsulated penetrating round surfaces shall be sealed to sleeve bore with mechanically expandable seals in vapor tight manner and remaining warm and cold side sleeve depth shall be insulated with not less than [100] [_____] mm of foamed-in-place rigid polyurethane or foamed-in-place silicone elastomer. Vapor barrier sealant shall be applied to finish warm side insulation surface. Warm side of penetrating surface shall be insulated beyond vapor barrier sealed sleeve insulation for a distance which prevents condensation. Wires in refrigerated space surface penetrating conduit shall be sealed with vapor barrier plugs or compound to prevent moisture migration through conduit and condensation therein.

3.2.16.2 General Service Areas

Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Pipes passing through concrete or masonry wall or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall be of such size as to provide a minimum of 6 mm all-around clearance between bare pipe and sleeves or between jacketed-insulation and sleeves. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over-insulation and sleeve shall be sealed in accordance with Section 07 92 00 JOINT SEALANTS.

3.2.16.3 Waterproof Penetrations

Pipes passing through roof or floor waterproofing membrane shall be installed through a 5.17 kg/sq. m copper sleeve, or a 0.81 mm thick aluminum sleeve, each within an integral skirt or flange. Flashing sleeve shall be suitably formed, and skirt or flange shall extend not less than 200 mm from the pipe and be set over the roof or floor membrane in a troweled coating of bituminous cement. The flashing sleeve shall extend up the pipe a minimum of 50 mm above the roof or floor penetration. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. Penetrations shall be sealed by either one of the following methods.

3.2.16.3.1 Waterproofing Clamping Flange

Pipes up to and including 250 mm in diameter passing through roof or floor waterproofing membrane may be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.

3.2.16.3.2 Modular Mechanical Type Sealing Assembly

In lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve or conduit and sleeve, a modular mechanical type sealing assembly may be installed. Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal rubber sealing elements to expand and provide a watertight seal between the pipe/conduit seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals shall provide sleeves of the proper diameters.

3.2.16.4 Fire-Rated Penetrations

Penetration of fire-rated walls, partitions, and floors shall be sealed as specified in Section 07 84 00 FIRESTOPPING.

3.2.16.5 Escutcheons

Finished surfaces where exposed piping, bare or insulated, pass through floors, walls, or ceilings, except in boiler, utility, or equipment rooms, shall be provided with escutcheons. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheon shall be secured to pipe or pipe covering.

3.2.17 Access Panels

Access panels shall be provided for all concealed valves, vents, controls, and items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS.

3.2.18 Field Applied Insulation

Field installed insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS, except as defined differently herein.

3.2.19 Field Painting

Painting required for surfaces not otherwise specified, and finish painting of items only primed at the factory are specified in Section 09 90 00 PAINTS AND COATINGS.

3.2.19.1 Color Coding

Color coding for piping identification is specified in Section 09 90 00 PAINTS AND COATINGS.

3.2.19.2 Color Coding Scheme

A color coding scheme for locating hidden piping shall be in accordance with [Section 22 00 00 PLUMBING, GENERAL PURPOSE][Section 22 00 70 PLUMBING, HEALTHCARE FACILITIES].

3.2.20 Identification Tags

Provide identification tags made of brass, engraved laminated plastic or engraved anodized aluminum indicating service and item number on all valves and dampers. Tags shall be 35 mm minimum diameter and marking shall be stamped or engraved. Indentations shall be black for reading clarity. Tags shall be attached to valves with No. 12 AWG copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

3.3 CLEANING AND ADJUSTING

Clean uncontaminated system(s) by evacuation and purging procedures currently recommended by refrigerant and refrigerant equipment manufacturers, and as specified herein, to remove small amounts of air and moisture. Systems containing moderate amounts of air, moisture, contaminated refrigerant, or any foreign matter shall be considered contaminated systems. Restoring contaminated systems to clean condition including disassembly, component replacement, evacuation, flushing, purging, and re-charging, shall be performed using currently approved refrigerant and refrigeration manufacturer's procedures. Restoring contaminated systems shall be at no additional cost to the Government as determined by the Contracting Officer. Water shall not be used in any procedure or test.

3.4 TRAINING COURSE

a. Submit a schedule, at least [2] [_____] weeks prior to the date of the proposed training course, which identifies the date, time, and location for the training. Conduct a training course for [_____] members of the operating staff as designated by the Contracting Officer. The training period shall consist of a total [_____] hours of normal working time and start after the system is functionally completed but prior to final acceptance tests.

b. The field posted instructions shall cover all of the items contained in the approved operation and maintenance manuals as well as demonstrations of routine maintenance operations.

c. Submit [6] [_____] complete copies of an operation manual in bound 216 by 279 booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least [4] [_____] weeks prior to the first training course. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.

d. Submit [6] [_____] complete copies of maintenance manual in bound 216 by 279 booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping layouts and simplified wiring and control diagrams of the system as installed.

3.5 REFRIGERANT PIPING TESTS

After all components of the refrigerant system have been installed and connected, subject the entire refrigeration system to pneumatic, evacuation, and startup tests as described herein. Submit a schedule, at least [2] [_____] weeks prior to the start of related testing, for each test. Identify the proposed date, time, and location for each test. Conduct tests in the presence of the Contracting Officer. Water and electricity required for the tests will be furnished by the Government. Provide all material, equipment, instruments, and personnel required for the test. Provide the services of a qualified technician, as required, to perform all tests and procedures indicated herein. Field tests shall be coordinated with Section 23 05 93 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS. Submit [6] [_____] copies of the tests report in bound 216 by 279 mm booklets documenting all phases of the tests performed. The report shall include initial test summaries, all repairs/adjustments made, and the final test results.

3.5.1 Preliminary Procedures

Prior to pneumatic testing, equipment which has been factory tested and refrigerant charged as well as equipment which could be damaged or cause personnel injury by imposed test pressure, positive or negative, shall be isolated from the test pressure or removed from the system. Safety relief valves and rupture discs, where not part of factory sealed systems, shall be removed and openings capped or plugged.

3.5.2 Pneumatic Test

Pressure control and excess pressure protection shall be provided at the source of test pressure. Valves shall be wide open, except those leading to the atmosphere. Test gas shall be dry nitrogen, with minus 55 degrees C dewpoint and less than 5 ppm oil. Test pressure shall be applied in two stages before any refrigerant pipe is insulated or covered. First stage test shall be at 69 kPa with every joint being tested with a thick soap or color indicating solution. Second stage tests shall raise the system to the minimum refrigerant leakage test pressure, with a maximum test pressure 25 percent greater. Pressure above 690 KPa shall be raised in 10 percent increments with a pressure acclimatizing period between increments. The initial test pressure shall be recorded along with the ambient temperature to which the system is exposed. Final test pressures of the second stage shall be maintained on the system for a minimum of 24 hours. At the end of the 24 hour period, the system pressure will be recorded along with the ambient temperature to which the system is exposed. A correction factor of 2 kPa will be allowed for each degree C change between test space initial and final ambient temperature, plus for increase and minus for a decrease. If the corrected system pressure is not exactly equal to the initial system test pressure, then the system shall be investigated for leaking joints. To repair leaks, the joint shall be taken apart, thoroughly cleaned, and reconstructed as a new joint. Joints repaired by caulking, remelting, or back-welding/brazing shall not be acceptable. Following repair, the entire system shall be retested using the pneumatic tests described above. The entire system shall be reassembled once the pneumatic tests are satisfactorily completed.

3.5.3 Evacuation Test

Following satisfactory completion of the pneumatic tests, the pressure shall be relieved and the entire system shall be evacuated to an absolute

pressure of 300 micrometers. During evacuation of the system, the ambient temperature shall be higher than 2 degrees C. No more than one system shall be evacuated at one time by one vacuum pump. Once the desired vacuum has been reached, the vacuum line shall be closed and the system shall stand for 1 hour. If the pressure rises over 500 micrometers after the 1 hour period, then the system shall be evacuated again down to 300 micrometers and let set for another 1 hour period. The system shall not be charged until a vacuum of at least 500 micrometers is maintained for a period of 1 hour without the assistance of a vacuum line. If during the testing the pressure continues to rise, check the system for leaks, repair as required, and repeat the evacuation procedure. During evacuation, pressures shall be recorded by a thermocouple-type, electronic-type, or a calibrated-micrometer type gauge.

3.5.4 System Charging and Startup Test

Following satisfactory completion of the evacuation tests, the system shall be charged with the required amount of refrigerant by raising pressure to normal operating pressure and in accordance with manufacturer's procedures. Following charging, the system shall operate with high-side and low-side pressures and corresponding refrigerant temperatures, at design or improved values. The entire system shall be tested for leaks. Fluorocarbon systems shall be tested with halide torch or electronic leak detectors.

3.5.5 Refrigerant Leakage

If a refrigerant leak is discovered after the system has been charged, the leaking portion of the system shall immediately be isolated from the remainder of the system and the refrigerant pumped into the system receiver or other suitable container. Under no circumstances shall the refrigerant be discharged into the atmosphere.

3.5.6 Contractor's Responsibility

At all times during the installation and testing of the refrigeration system, take steps to prevent the release of refrigerants into the atmosphere. The steps shall include, but not be limited to, procedures which will minimize the release of refrigerants to the atmosphere and the use of refrigerant recovery devices to remove refrigerant from the system and store the refrigerant for reuse or reclaim. At no time shall more than 85 g of refrigerant be released to the atmosphere in any one occurrence. Any system leaks within the first year shall be repaired in accordance with the requirements herein at no cost to the Government including material, labor, and refrigerant if the leak is the result of defective equipment, material, or installation.

-- End of Section --

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SECTION 23 30 00

HVAC AIR DISTRIBUTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 52.2	(2012) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

ASTM INTERNATIONAL (ASTM)

ASTM C916	(2014) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2018) Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 96	(2017; TIA 17-1) Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1819	(2002) Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, 5th Edition

UNDERWRITERS LABORATORIES (UL)

UL 555	(2006; Reprint Aug 2016) UL Standard for Safety Fire Dampers
UL 555S	(2014; Reprint Aug 2016) UL Standard for Safety Smoke Dampers
UL 705	(2017; Reprint Oct 2018) UL Standard for Safety Power Ventilators

UL 723	(2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials
UL Electrical Construction	(2012) Electrical Construction Equipment Directory
UL Fire Resistance	(2014) Fire Resistance Directory

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1400	(2007) Radiators, Convectors and Similar Appliances-Methods of Performance Test
JIS A 4009	(2017) Components of Air Duct
JIS A 9504	(2017) Man Made Mineral Fibre Thermal Insulation Materials
JIS A 9511	(2017)Preformed Cellular Plastics Thermal Insulation Materials
JIS B 1518	(2013) Rolling Bearings-Dynamic Load Ratings and Rating Life
JIS B 1521	(2012) Rolling Bearings-Deep Groove Ball Bearings
JIS B 1534	(2013) Rolling Bearings-Tapered Roller Bearings
JIS B 8330	(2000) Testing Methods for Turbo-Fans
JIS B 8616	(2015) Package Air Conditioners
JIS B 8628	(2017) Air to Air Heat and Energy Exchanger and Ventilators
JIS B 9908-1	(2019) Test Method of Air Filter Units for Ventilation and Electric Air Cleaners for Ventilation-Part 1: Technical Specifications, Requirements and Classification System Based Upon Particulate Matter Efficiency
JIS B 9927	(1999) Cleanroom-Air Filters-Test Methods
JIS C 4203	(2010) Single Phase Induction Motors for General Purpose (Amendment 1)
JIS C 4212	(2010) Low-Voltage Three-Phase Squirrel-Cage High-Efficiency Induction Motors (Amendment 1)
JIS C 9603	(1988) Ventilating Fans
JIS C 9803	(1999) Household Electric Direct-Acting Room Heaters-Methods for Measuring Perofrmance

JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS G 3452	(2016) Carbon Steel Pipes for Ordinary Piping (Amendment 1)
JIS G 3553	(2011) Crimped Wire Cloth (Amendment 1)
JIS G 4305	(2015) Cold-Rolled Stainless Steel Plate, Sheet and Strip (Amendment 1)
JIS H 3100	(2018) Copper and Copper Alloy Sheets, Plates and Strips
JIS H 3300	(2018) Copper and Copper Alloy Seamless Pipes and Tubes
JIS H 4000	(2017) Aluminium and Aluminium Alloy Sheets, Strips and Plates (Amendment 1)
JIS H 8610	(1999) Electroplated-Coatings of Zinc on Iron or Steel
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS HB 71	(2019) Electrical Safety
JIS K 5600-5-5	(1999) Testing Methods for Paints- Part 5 : Mechanical Property of Film Section 5 : Scratch Hardness (Stylus Method)
JIS K 5600-5-6	(1999) Testing Methods for Paints - Part 5 : Mechanical Property of Film-Section 6 : Adhesion Test (Cross-Cut Test)
JIS K 5600-7-9	(2006) Testing Methods for Paints Part 7 : Determination Of Resistance to Cyclic Corrosion Conditions Section 9 : Salt Fog/Dry/Humidity
JIS K 6741	(2016) Unplasticized Poly (Vinyl Chloride) (PVC-U) Pipes
JIS Z 2330	(2012) Non-Destructive Testing-Selection of Leak Testing Method
JIS Z 2371	(2015) Methods of Salt Spray Testing
JIS Z 4812	(1995) HEPA Filters for Radioactive Aerosols
JIS Z 8734	(2000) Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure-Precision Methods for Reverberation Rooms

THE JAPAN REFRIGERATION AND AIR CONDITIONING INDUSTRY ASSOCIATION (JRAIA)

JRA 4036	(2014) Air Handling Unit

MLIT MECHANICAL STANDARD SPECIFICATION

MLIT-M	(2019) Public Building Construction Standard Specification
JBE-S	(2014) Japanese Building Equipment Seismic Standard Design

1.2 SYSTEM DESCRIPTION

Furnish ductwork, piping offsets, fittings, and accessories as required to provide a complete installation. Coordinate the work of the different trades to avoid interference between piping, equipment, structural, and electrical work. Provide complete, in place, all necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work as indicated and specified.

1.2.1 Mechanical Equipment Identification

The number of charts and diagrams must be equal to or greater than the number of mechanical equipment rooms. Where more than one chart or diagram per space is required, mount these in edge pivoted, swinging leaf, extruded aluminum frame holders which open to 170 degrees.

1.2.1.1 Charts

Provide chart listing of equipment by designation numbers and capacities such as flow rates, pressure and temperature differences, heating and cooling capacities, horsepower, pipe sizes, and voltage and current characteristics.

1.2.1.2 Diagrams

Submit proposed diagrams, at least 2 weeks prior to start of related testing. provide neat mechanical drawings provided with extruded aluminum frame under 3 mm glass or laminated plastic, system diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system. After approval, post these items where directed.

1.2.2 Service Labeling

Label equipment, including fans, air handlers, terminal units, etc. with labels made of self-sticking, plastic film designed for permanent installation. Provide labels in accordance with the typical examples below:

SERVICE	LABEL AND TAG DESIGNATION
Air handling unit Number	AHU - [_____]
Control and instrument air	CONTROL AND INSTR.
Exhaust Fan Number	EF - [_____]
VAV Box Number	VAV - [_____]
Fan Coil Unit Number	FC - [_____]
Terminal Box Number	TB - [_____]
Unit Ventilator Number	UV - [_____]

Identify similar services with different temperatures or pressures. Where pressures could exceed 860 kilopascal, include the maximum system pressure in the label. Label and arrow piping in accordance with the following:

a. Each point of entry and exit of pipe passing through walls.

b. Each change in direction, i.e., elbows, tees.

c. In congested or hidden areas and at all access panels at each point required to clarify service or indicated hazard.

d. In long straight runs, locate labels at distances within eyesight of each other not to exceed 22 meter. All labels must be visible and legible from the primary service and operating area.

For Bare or Insulated Pipes	
for Outside Diameters of	Lettering
13 thru [_____] mm	13 mm
40 thru [_____] mm	[_____] mm
65 mm and larger	[_____] mm

1.2.3 Color Coding

Color coding of all piping systems must be in accordance with MLIT-M or the base standard.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings; G[, [_____]]

SD-03 Product Data

Fire Dampers

Automatic Smoke-Fire Dampers

Automatic Smoke Dampers

Air Handling Units; G[, [_____]]

Room Fan-Coil Units; G[, [_____]]

Coil Induction Units; G[, [_____]]

Constant Volume, Single Duct Terminal Units; G[, [_____]]

Variable Volume, Single Duct Terminal Units; G[, [_____]]

Variable Volume, Single Duct, Fan-Powered Terminal Units; G[, [_____]]

Dual Duct Terminal Units; G[, [_____]]

Reheat Units; G[, [_____]]

Energy Recovery Devices; G[, [_____]]

Test ProceduresDiagrams; G[, [_____]]

SD-06 Test Reports

Performance Tests

Damper Acceptance Test; G[, [_____]]

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

Fire Dampers

Manual Balancing Dampers

Automatic Smoke-Fire Dampers

Automatic Smoke Dampers

Centrifugal Fans

In-Line Centrifugal Fans

Axial Flow Fans

Centrifugal Type Power Wall Ventilators

Centrifugal Type Power Roof Ventilators

Propeller Type Power Roof Ventilators

Air-Curtain Fans

Ceiling Exhaust Fans

Air Handling Units

Room Fan-Coil Units

Coil Induction Units

Constant Volume, Single Duct Terminal Units

Variable Volume, Single Duct Terminal Units

Variable Volume, Single Duct, Fan-Powered Terminal Units

Dual Duct Terminal Units

Reheat Units

Unit Ventilators

Energy Recovery Devices

Hydronic Modular Panels

Prefabricated Radiant-Heating Electric Panels

1.4 QUALITY ASSURANCE

Except as otherwise specified, approval of materials and equipment is based on manufacturer's published data.

a. Submit a written certificate from any recognized testing agency, adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the specified requirements. Outline methods of testing used by the specified agencies.

b. Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the JIS a manufacturer's certificate of compliance of each item is acceptable as proof of compliance.

c. Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.

1.4.1 Prevention of Corrosion

Protect metallic materials against corrosion. Provide rust-inhibiting treatment and standard finish for the equipment enclosures. Do not use aluminum in contact with earth, and where connected to dissimilar metal. Protect aluminum by approved fittings, barrier material, or treatment. Provide hot-dip galvanized ferrous parts such as anchors, bolts, braces,

boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials in accordance with JIS H 8641 for exterior locations and cadmium-plated in conformance with JIS H 8610 for interior locations.[Provide written certification from the bolt manufacturer that the bolts furnished comply with the requirements of this specification. Include illustrations of product markings, and the number of each type of bolt to be furnished in the certification.]

1.4.2 Asbestos Prohibition

Do not use asbestos and asbestos-containing products.

1.4.3 Ozone Depleting Substances Technician Certification

All technicians working on equipment that contain ozone depleting refrigerants must be Refrigerant Handling Technician (Reibai-Furontou-Toriatsukai-Gijutsusha). Provide copies of technician certifications to the Contracting Officer at least 14 calendar days prior to work on any equipment containing these refrigerants.

1.4.4 Detail Drawings

Submit detail drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and static pressure and seal classifications. Include any information required to demonstrate that the system has been coordinated and functions properly as a unit on the drawings and show equipment relationship to other parts of the work, including clearances required for operation and maintenance. Submit drawings showing bolt-setting information, and foundation bolts prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Submit function designation of the equipment and any other requirements specified throughout this Section with the shop drawings.

1.4.5 Test Procedures

Submit proposed test procedures and test schedules for the [ductwork leak test, and] performance tests of systems, at least 2 weeks prior to the start of related testing.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect stored equipment at the jobsite from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, cap or plug all pipes until installed.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide components and equipment that are "standard products" of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. "Standard products" is defined as being in satisfactory commercial or industrial use for 2 years before bid opening, including applications of components and equipment under similar circumstances and of similar size, satisfactorily completed

by a product that is sold on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record are acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. Provide equipment items that are supported by a service organization located in Japan.

2.2 STANDARD PRODUCTS

Except for the fabricated duct, plenums and casings specified in paragraphs "Metal Ductwork" and "Plenums and Casings for Field-Fabricated Units",
provide components and equipment that are standard products of manufacturers regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. This requirement applies to all equipment, including diffusers, registers, fire dampers, and balancing dampers.

a. Standard products are defined as components and equipment that have been in satisfactory commercial or industrial use in similar applications of similar size for at least two years before bid opening.

b. Prior to this two year period, these standard products must have been sold on the commercial market using advertisements in manufacturers' catalogs or brochures. These manufacturers' catalogs, or brochures must have been copyrighted documents or have been identified with a manufacturer's document number.

c. Provide equipment items that are supported by a service organization.

2.3 IDENTIFICATION PLATES

In addition to standard manufacturer's identification plates, provide engraved laminated phenolic identification plates for each piece of mechanical equipment. Identification plates are to designate the function of the equipment. Submit designation with the shop drawings. Provide identification plates that are layers, black-white-black, engraved to show white letters on black background. Letters must be upper case. Identification plates 40 mm that are high and smaller must be 1.6 mm thick, with engraved lettering 3 mm high; identification plates larger than 40 mm high must be 3 mm thick, with engraved lettering of suitable height. Identification plates 40 mm high and larger must have beveled edges. Install identification plates using a compatible adhesive.

2.4 EQUIPMENT GUARDS AND ACCESS

Fully enclose or guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact according to OSHA requirements. Properly guard or cover with insulation of a type specified, high temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard. The requirements for [catwalks,] [operating platforms,] [ladders,] [and] [guardrails] are specified in Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS.

2.5 ELECTRICAL WORK

a. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers

indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00INTERIOR DISTRIBUTION SYSTEM. Provide manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown. For packaged equipment, include manufacturer provided controllers with the required monitors and timed restart.

b. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with JIS C 4203.

c. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system , and that meet the efficiency ratings for premium efficiency motors in accordance with JIS C 4212.

d. Provide motors in accordance with JIS C 4212 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Provide motors rated for continuous duty with the enclosure specified. Provide motor duty that allows for maximum frequency start-stop operation and minimum encountered interval between start and stop. Provide motor torque capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Fit motor bearings with grease supply fittings and grease relief to outside of the enclosure.

e. [Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers are allowed to accomplish the same function. Use solid-state variable-speed controllers for motors rated 7.45 kW or less and adjustable frequency drives for larger motors.] [Provide variable frequency drives for motors as specified in Section 26 29 23 VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS.]

2.6 ANCHOR BOLTS

Provide anchor bolts for equipment placed on concrete equipment pads or on concrete slabs. Bolts to be of the size and number recommended by the equipment manufacturer and located by means of suitable templates. Installation of anchor bolts must not degrade the surrounding concrete.

2.7 SEISMIC ANCHORAGE

Anchor equipment in accordance with applicable seismic criteria for the area and as defined in JBE-S

2.8 PAINTING

Paint equipment units in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouch only if approved. Otherwise, return equipment to the factory for refinishing.

2.9 DUCT SYSTEMS

2.9.1 Metal Ductwork

Provide metal ductwork construction, including all fittings and components, that complies with MLIT-M.

2.9.1.1 Metallic Flexible Duct

a. Provide duct that conforms to MLIT-M with factory-applied insulation, vapor barrier, and end connections. Provide ducts designed for working pressures of 497 Pa and 373 Pa. Provide flexible round duct length that does not exceed 1525 mm. Secure connections by applying adhesive for 51 mm over rigid duct, apply flexible duct 51 mm over rigid duct, apply metal clamp, and provide minimum of three No. 8 sheet metal screws through clamp and rigid duct.

b. Inner duct core: Provide interlocking spiral or helically corrugated flexible core constructed of zinc-coated steel, aluminum, or stainless steel; or constructed of inner liner of continuous galvanized spring steel wire helix fused to continuous, fire-retardant, flexible vapor barrier film, inner duct core.

c. Insulation: Provide inner duct core that is insulated with mineral fiber blanket type flexible insulation, minimum of 25 mm thick. Provide insulation covered on exterior with manufacturer's standard fire retardant vapor barrier jacket for flexible round duct.

2.9.1.2 Insulated Nonmetallic Flexible Duct Runouts

Use flexible duct runouts only where indicated. Runout length is indicated on the drawings, and is not to exceed 1.5 m. Provide runouts that are preinsulated, factory fabricated. Provide either field or factory applied vapor barrier. Provide not less than 0.60 L glass fabric duct connectors coated on both sides with neoprene. Where coil induction or high velocity units are supplied with vertical air inlets, use a streamlined, vaned and mitered elbow transition piece for connection to the flexible duct or hose. Provide a die-stamped elbow and not a flexible connector as the last elbow to these units other than the vertical air inlet type. Insulated flexible connectors are allowed as runouts. Provide insulated material and vapor barrier that conform to the requirements of Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Do not expose the insulation material surface to the air stream.

2.9.1.3 General Service Duct Connectors

Provide a flexible duct connector approximately 150 mm in width where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, secure the flexible material by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, install the flexible material locked to metal collars using normal duct construction methods.

2.9.1.4 High Temperature Service Duct Connections

Provide material that is approximately 2.38 mm thick, 1.2 to 1.36 kg per square meter weight, plain weave fibrous glass cloth with, nickel/chrome wire reinforcement for service in excess of 650 degrees C.

2.9.1.5 Aluminum Ducts

JIS H 4000, alloy 3003-H14 for aluminum sheet and alloy 6061-T6 or equivalent strength for aluminum connectors and bar stock.

2.9.1.6 Copper Sheets

JIS H 3100, light cold rolled temper.

2.9.1.7 Corrosion Resisting (Stainless) Steel Sheets

JIS G 4305

2.9.2 Duct Access Doors

Provide hinged access doors conforming to MLIT-M in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system. Provide access doors upstream and downstream of air flow measuring primaries and heating and cooling coils. Provide doors that are a minimum 375 by 450 mm, unless otherwise shown. Where duct size does not accommodate this size door, make the doors as large as practicable. Equip doors 600 by 600 mm or larger with fasteners operable from inside and outside the duct. Use insulated type doors in insulated ducts.

2.9.3 Fire Dampers

Use 1.5 hour rated fire dampers unless otherwise indicated. Provide fire dampers that conform to the requirements of NFPA 90A and UL 555. Perform the fire damper test as outlined in NFPA 90A. Provide a pressure relief door upstream of the fire damper. If the ductwork connected to the fire damper is to be insulated then provide a factory installed pressure relief damper. Provide automatic operating fire dampers with a dynamic rating suitable for the maximum air velocity and pressure differential to which it is subjected. Provide fire dampers approved for the specific application, and install according to their listing. Equip fire dampers with a steel sleeve or adequately sized frame installed in such a manner that disruption of the attached ductwork, if any, does not impair the operation of the damper. Equip sleeves or frames with perimeter mounting angles attached on both sides of the wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce the ceiling of the assemblies in conformance with UL Fire Resistance. Provide [curtain type with damper blades] [in the air stream] [out of the air stream][or][single blade type][or][multi-blade type] fire dampers. Install dampers that do not reduce the duct or the air transfer opening cross-sectional area. Install dampers so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness. Unless otherwise indicated, comply with the installation details given in SMACNA 1819 and in manufacturer's instructions for fire dampers. Perform acceptance testing of fire dampers according to paragraph Fire Damper Acceptance Test and NFPA 90A.

2.9.4 Manual Balancing Dampers

Furnish manual balancing dampers with accessible operating mechanisms. Use chromium plated operators (with all exposed edges rounded) in finished portions of the building. Provide manual volume control dampers that are

operated by locking-type quadrant operators. Install dampers that are 2 gauges heavier than the duct in which installed. Unless otherwise indicated, provide opposed blade type multileaf dampers with maximum blade width of 300 mm. Provide access doors or panels for all concealed damper operators and locking setscrews. Provide stand-off mounting brackets, bases, or adapters not less than the thickness of the insulation when the locking-type quadrant operators for dampers are installed on ducts to be thermally insulated, to provide clearance between the duct surface and the operator. Provide stand-off mounting items that are integral with the operator or standard accessory of the damper manufacturer.

2.9.5 Manual Balancing Dampers

a. Furnish manual balancing dampers with accessible operating mechanisms. Use chromium plated operators (with all exposed edges rounded) in finished portions of the building. Provide manual volume control dampers that are operated by locking-type quadrant operators.

b. Unless otherwise indicated, provide opposed blade type multileaf dampers with maximum blade width of 300 mm. Provide access doors or panels for all concealed damper operators and locking setscrews. Provide access doors or panels in hard ceilings, partitions and walls for access to all concealed damper operators and damper locking setscrews. Coordinate location of doors or panels with other affected contractors.

c. Provide stand-off mounting brackets, bases, or adapters not less than the thickness of the insulation when the locking-type quadrant operators for dampers are installed on ducts to be thermally insulated, to provide clearance between the duct surface and the operator. Provide stand-off mounting items that are integral with the operator or standard accessory of the damper manufacturer.

2.9.5.1 Square or Rectangular Dampers

2.9.5.1.1 Duct Height 300 mm and Less

2.9.5.1.1.1 Frames

Width	Height	Galvanized Steel Thickness	Length
Maximum 483 mm	Maximum 300 mm	Minimum 0.91 mm	Minimum 75 mm
More than 483 mm	Maximum 300 mm	Minimum 1.6 mm	Minimum 75 mm

2.9.5.1.1.2 Single Leaf Blades

Width	Height	Galvanized Steel Thickness	Length
Maximum 483 mm	Maximum 300 mm	Minimum 0.91 mm	Minimum 75 mm

Width	Height	Galvanized Steel Thickness	Length
More than 483 mm	Maximum 300 mm	Minimum 1.6 mm	Minimum 75 mm

2.9.5.1.1.3 Blade Axles

To support the blades of round dampers, provide galvanized steel shafts supporting the blade the entire duct diameter frame-to-frame. Provide axle shafts that extend through standoff bracket and hand quadrant.

Width	Height	Material	Square Shaft
Maximum 483 mm	Maximum 300 mm	Galvanized Steel	Minimum 10 mm
More than 483 mm	Maximum 300 mm	Galvanized Steel	Minimum 13 mm

2.9.5.1.1.4 Axle Bearings

Support the shaft on each end at the frames with shaft bearings. Press fit shaft bearings configuration to provide a tight joint between blade shaft and damper frame.

Width	Height	Material
Maximum 483 mm	Maximum 300 mm	solid nylon, or equivalent solid plastic, or oil-impregnated bronze
More than 483 mm	Maximum 300 mm	oil-impregnated bronze

2.9.5.1.1.5 Control Shaft/Hand Quadrant

Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Provide a minimum stand-off distance of 50 mm off the metal duct surface. Provide stand-off mounting items that are integral with the operator or standard accessory of the damper manufacturer.

2.9.5.1.1.6 Finish

Mill Galvanized

2.9.5.1.2 Duct Height Greater than 300 mm

2.9.5.1.2.1 Dampers

Provide dampers with multi-leaf opposed-type blades.

2.9.5.1.2.2 Frames

Maximum 1200 mm in height; maximum 1200 mm in width; minimum of 1.6 mm galvanized steel,
minimum of 127 mm long.

2.9.5.1.2.3 Blades

Minimum of 1.6 mm galvanized steel; 150 mm nominal width.

2.9.5.1.2.4 Blade Axles

To support the blades of round dampers, provide galvanized square steel shafts supporting the blade the entire duct diameter frame-to-frame. Provide axle shafts that extend through standoff bracket and hand quadrant.

2.9.5.1.2.5 Axle Bearings

Support the shaft on each end at the frames with shaft bearings constructed of oil-impregnated bronze, or solid nylon, or a solid plastic equivalent to nylon. Press fit shaft bearings configuration to provide a tight joint between blade shaft and damper frame.

2.9.5.1.2.6 Blade Actuator

Minimum 50 mm diameter galvanized steel.

2.9.5.1.2.7 Blade Actuator Linkage

Mill Galvanized steel bar and crank plate with stainless steel pivots.

2.9.5.1.2.8 Control Shaft/Hand Quadrant

Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Provide a minimum stand-off distance of 50 mm off the metal duct surface. Provide stand-off mounting items that are integral with the operator or standard accessory of the damper manufacturer.

2.9.5.1.2.9 Finish

Mill Galvanized

2.9.5.2 Round Dampers

2.9.5.2.1 Frames

Size	Galvanized Steel Thickness	Length
100 to 500 mm	Minimum 0.91 mm	Minimum 152 mm
550 to 750 mm	Minimum 0.91 mm	Minimum 250 mm
775 to 1000 mm	Minimum 1.6 mm	Minimum 250 mm

2.9.5.2.2 Blades

Size	Galvanized Steel Thickness
100 to 500 mm	Minimum 0.91 mm
550 to 750 mm	Minimum 1.6 mm
775 to 1000 mm	Minimum 3.5 mm

2.9.5.2.3 Blade Axles

To support the blades of round dampers, provide galvanized steel shafts supporting the blade the entire duct diameter frame-to-frame. Provide axle shafts that extend through standoff bracket and hand quadrant.

Size	Shaft Size and Shape
100 to 500 mm	Minimum 10 mm square
550 to 750 mm	Minimum 13 mm square
775 to 1000 mm	Minimum 19 mm square

2.9.5.2.4 Axle Bearings

Support the shaft on each end at the frames with shaft bearings constructed of oil-impregnated bronze, or solid nylon, or a solid plastic equivalent to nylon. Press fit shaft bearings configuration to provide a tight joint between blade shaft and damper frame.

Size	Material
100 to 500 mm	solid nylon, or equivalent solid plastic, or oil-impregnated bronze
550 to 750 mm	solid nylon, or equivalent solid plastic, or oil-impregnated bronze
775 to 1000 mm	oil-impregnated bronze, or stainless steel sleeve bearing

2.9.5.2.5 Control Shaft/Hand Quadrant

Provide dampers with accessible locking-type control shaft/hand quadrant operators.

Provide stand-off mounting brackets, bases, or adapters for the locking-type quadrant operators on dampers installed on ducts to be thermally insulated. Provide a minimum stand-off distance of 50 mm off the metal duct surface. Provide stand-off mounting items that are integral with the operator or standard accessory of the damper manufacturer.

2.9.5.2.6 Finish

Mill Galvanized

2.9.6 Automatic Balancing Dampers

Provide dampers as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS.

2.9.7 Automatic Smoke-Fire Dampers

Multiple blade type, 82 degrees C fusible fire damper link; smoke damper assembly to include [pneumatically powered][electric] damper operator. UL 555 as a 1.5 hour rated fire damper; further qualified under UL 555S as a leakage rated damper. Provide a leakage rating under UL 555S that is no higher than Class [II][or][III] at an elevated temperature Category B (121 degrees C for 30 minutes). Ensure that pressure drop in the damper open position does not exceed 25 Pa with average duct velocities of 13 m/second.

2.9.8 Automatic Smoke Dampers

UL listed multiple blade type, supplied by smoke damper manufacturer, with [pneumatic][electric] damper operator as part of assembly. Qualified under UL 555S with a leakage rating no higher than Class [II][or][III] at an elevated temperature Category B (121 degrees C for 30 minutes). Ensure that pressure drop in the damper open position does not exceed 25 Pa with average duct velocities of 13 m/second.

2.9.9 Air Supply And Exhaust Air Dampers

Provide outdoor air supply and exhaust air dampers that have a maximum leakage rate when tested in accordance with JIS A 4009 as required by MLIT-M, including maximum Damper Leakage for:

a. Climate Zones 1,2,6,7,8 the maximum damper leakage at 250 Pa for

motorized dampers is 20 L/s per square m of damper area and non-motorized dampers are not allowed.

b. All other Climate Zones the maximum damper leakage at 250 Pa is 50 L/s per square m and for non-motorized dampers is 100 L/s per square m of damper area.

Dampers smaller than 600 mm in either direction may have leakage of 200 L/s per square m.

2.9.10 Air Deflectors (Volume Extractors) and Branch Connections

Provide air deflectors (volume extractors) at all duct mounted supply outlets, at takeoff or extension collars to supply outlets, at duct branch takeoff connections, and at 90 degree elbows, as well as at locations as indicated on the drawings or otherwise specified. Conical branch connections or 45 degree entry connections are allowed in lieu of deflectors for branch connections. Furnish all air deflectors (volume extractors), except those installed in 90 degree elbows, with an approved means of adjustment. Provide easily accessible means for adjustment inside the duct or from an adjustment with sturdy lock on the face of the duct. When installed on ducts to be thermally insulated, provide external adjustments with stand-off mounting brackets, integral with the adjustment device, to provide clearance between the duct surface and the adjustment device not less than the thickness of the thermal insulation. Provide factory-fabricated air deflectors consisting of curved turning vanes or louver blades designed to provide uniform air distribution and change of direction with minimum turbulence or pressure loss. Provide factory or field assembled air deflectors (volume extractors). Make adjustment from the face of the diffuser or by position adjustment and lock external to the duct. Provide stand-off brackets on insulated ducts as described herein. Provide fixed air deflectors (volume extractors), also called turning vanes, in 90 degree elbows.

2.9.11 Plenums and Casings for Field-Fabricated Units

2.9.11.1 Plenum and Casings

Fabricate and erect plenums and casings as shown in MLIT-M, as applicable. Construct system casing of not less than 1.6 mm galvanized sheet steel. Furnish cooling coil drain pans with 25 mm threaded outlet to collect condensation from the cooling coils. Fabricate drain pans from not lighter than 1.6 mm steel, galvanized after fabrication or of 1.3 mm corrosion-resisting sheet steel conforming to JIS G 4305, welded and stiffened. Thermally insulate drain pans exposed to the atmosphere to prevent condensation. Coat insulation with a flame resistant waterproofing material. Provide separate drain pans for each vertical coil section, and a separate drain line for each pan. Size pans to ensure capture of entrained moisture on the downstream-air side of the coil. Seal openings in the casing, such as for piping connections, to prevent air leakage. Size the water seal for the drain to maintain a pressure of at least 500 Pa greater than the maximum negative pressure in the coil space.

2.9.11.2 Casing

Terminate casings at the curb line and bolt each to the curb using galvanized angle, as indicated in MLIT-M.

2.9.11.3 Access Doors

Provide access doors in each section of the casing. Weld doorframes in place, gasket each door with neoprene, hinge with minimum of two brass hinges, and fasten with a minimum of two brass tension fasteners operable from inside and outside of the casing. Where possible, make doors 900 by 450 mm and locate them 450 mm above the floor. Where the space available does not accommodate doors of this size, use doors as large as the space accommodates. Swing doors so that fan suction or pressure holds doors in closed position, airtight. Provide a push-button station, located inside the casing, to stop the supply.

2.9.11.4 Factory-Fabricated Insulated Sheet Metal Panels

Factory-fabricated components are allowed for field-assembled units, provided all requirements specified for field-fabricated plenums and casings are met. Provide panels of modular design, pretested for structural strength, thermal control, condensation control, and acoustical control. Seal and insulate panel joints. Provide and gasket access doors to prevent air leakage. Provide panel construction that is not less than one mm galvanized sheet steel, assembled with fasteners treated against corrosion. Provide standard length panels that deflect not more than 13 mm under operation. Construct details, including joint sealing, not specifically covered, as indicated in MLIT-M. Construct the plenums and casings to withstand the specified internal pressure of the air systems.

2.9.11.5 Duct Liner

Unless otherwise specified, duct liner is not permitted.

2.9.12 Sound Attenuation Equipment

2.9.12.1 Systems with total pressure above 1 kPa

Provide sound attenuators on the discharge duct of each fan operating at a total pressure above 1 kPa, and, when indicated, at the intake of each fan system. Provide sound attenuators elsewhere as indicated. Provide factory fabricated sound attenuators, tested by an independent laboratory for sound and performance characteristics. Provide a net sound reduction as indicated. Maximum permissible pressure drop is not to exceed 157 Pa. Construct traps to be airtight when operating under an internal static pressure of 2.5 kPa. Provide air-side surface capable of withstanding air velocity of 50 m/s. Certify that the equipment can obtain the sound reduction values specified after the equipment is installed in the system and coordinated with the sound information of the system fan to be provided. Provide sound absorbing material conforming to JIS A 9511. Provide sound absorbing material that meets the fire hazard rating requirements for insulation specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. For connection to ductwork, provide a duct transition section. Factory fabricated double-walled internally insulated spiral lock seam and round duct and fittings designed for high pressure air system can be provided if complying with requirements specified for factory fabricated sound attenuators, in lieu of factory fabricated sound attenuators. Construct the double-walled duct and fittings from an outer metal pressure shell of zinc-coated steel sheet, 25 mm thick acoustical blanket insulation, and an internal perforated zinc-coated metal liner. Provide a sufficient length of run to obtain the noise reduction coefficient specified. Certify that the sound reduction value specified can be obtained within the length of duct run provided.

Provide welded or spiral lock seams on the outer sheet metal of the double-walled duct to prevent water vapor penetration. Provide duct and fittings with an outer sheet that conforms to the metal thickness of high-pressure spiral and round ducts and fittings shown in MLIT-M. Provide acoustical insulation with a thermal conductivity "k" of not more than 0.0389 W/m-K at 24 degrees C mean temperature. Provide an internal perforated zinc-coated metal liner that is not less than 0.7 mm with perforations not larger than 6.35 mm in diameter providing a net open area not less than 10 percent of the surface.

2.9.12.2 System with total pressure of 1 kPa and Lower

Use sound attenuators only where indicated. Provide factory fabricated sound attenuators that are constructed of galvanized steel sheets. Provide attenuator with outer casing that is not less than 0.85 mm. Provide fibrous glass acoustical fill. Provide net sound reduction indicated. Obtain values on a test unit not less than 600 by 600 mm outside dimensions made by a certified nationally recognized independent acoustical laboratory. Provide air flow capacity as indicated or required. Provide pressure drop through the attenuator that does not exceed the value indicated, or that is not in excess of 15 percent of the total external static pressure of the air handling system, whichever is less. Acoustically test attenuators with metal duct inlet and outlet sections while under the rated air flow conditions. Include with the noise reduction data the effects of flanking paths and vibration transmission. Construct sound attenuators to be airtight when operating at the internal static pressure indicated or specified for the duct system, but in no case less than 500 Pa.

2.9.12.3 Acoustical Duct Liner

Use fibrous glass designed or flexible elastomeric duct liner for lining ductwork and conforming to the requirements of JIS A 9511, Type I and II. Provide uniform density, graduated density, or dual density liner composition, as standard with the manufacturer. Provide not less than 25 mm thick coated lining. Where acoustical duct liner is used, provide the thermal equivalent of the insulation specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS for liner or combination of liner and insulation applied to the exterior of the ductwork. Increase duct sizes shown to compensate for the thickness of the lining used. [In lieu of sheet metal duct with field-applied acoustical lining, provide acoustically equivalent lengths of fibrous glass duct, elastomeric duct liner or factory fabricated double-walled internally insulated duct with perforated liner.]

2.9.13 Diffusers, Registers, and Grilles

Provide factory-fabricated units of [steel][corrosion-resistant steel][or][aluminum] that distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 0.25 m/s in occupied zone, or dead spots anywhere in the conditioned area. Provide outlets for diffusion, spread, throw, and noise level as required for specified performance. Certify performance according to Japanese Industry Standards (JIS). Provide sound rated and certified inlets and outlets according to MLIT-M. Provide sound power level as indicated. Provide diffusers and registers with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device is acceptable. Provide opposed blade type volume dampers for all diffusers and registers, except

linear slot diffusers. Provide linear slot diffusers with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 2 m above the floor, protect them by a grille or screen.

2.9.13.1 Diffusers

Provide diffuser types indicated. Furnish ceiling mounted units with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Provide diffusers with air deflectors of the type indicated. Provide air handling troffers or combination light and ceiling diffusers conforming to the requirements of UL Electrical Construction for the interchangeable use as cooled or heated air supply diffusers or return air units. Install ceiling mounted units with rims tight against ceiling. Provide sponge rubber gaskets between ceiling and surface mounted diffusers for air leakage control. Provide suitable trim for flush mounted diffusers. For connecting the duct to diffuser, provide duct collar that is airtight and does not interfere with volume controller. Provide return or exhaust units that are similar to supply diffusers.

2.9.13.2 Perforated Plate Diffusers

Provide adjustable [one-way,] [two-way,] [three-way,][ ][four-way] air pattern controls as indicated. Provide diffuser faceplates that do not sag or deflect when operating under design conditions.

2.9.13.3 Linear Diffusers

Make joints between diffuser sections that appear as hairline cracks. Provide alignment slots for insertion of key strips or other concealed means to align exposed butt edges of diffusers.[Equip with plaster frames when mounted in plaster ceiling.] Do not use screws and bolts in exposed face of frames or flanges. Metal-fill and ground smooth frames and flanges exposed below ceiling. Furnish separate pivoted or hinged adjustable air-volume-damper and separate air-deflection blades.

2.9.13.4 Security Ceiling Diffusers

Provide diffusers that are steel with faceplate, fixed diffusion louvers, with flat surface margin, and an opposed blade damper. Provide faceplate that is 1.9 mm minimum with 13 by 13 mm holes on 5 mm spacing and a minimum free area of 45 percent.

2.9.13.5 Registers and Grilles

Provide units that are four-way directional-control type, except provide return and exhaust registers that are fixed horizontal or vertical louver type similar in appearance to the supply register face. Furnish registers with sponge-rubber gasket between flanges and wall or ceiling. Install wall supply registers at least 150 mm below the ceiling unless otherwise indicated. Locate return and exhaust registers 150 mm above the floor unless otherwise indicated. Achieve four-way directional control by a grille face which can be rotated in 4 positions or by adjustment of horizontal and vertical vanes. Provide grilles as specified for registers, without volume control damper.

2.9.13.6 Registers

Double-deflection supply registers.[Provide manufacturer-furnished

volume dampers. Provide volume dampers of the group-operated, opposed-blade type and key adjustable by inserting key through face of register. Operating mechanism must not project through any part of the register face. Automatic volume control devices are acceptable.][Provide exhaust and return registers as specified for supply registers, except provide exhaust and return registers that have a single set of nondirectional face bars or vanes having the same appearance as the supply registers.][Set face bars or vanes at [_____] degrees.]

2.9.13.7 Security Supply Air Registers Except in Cells

Provide supply air registers, except in prisoner cells and prisoner holding cells, that are steel with individually adjustable horizontal and vertical vanes, perforated faceplate, flat surface margin and opposed blade damper. Put vertical vanes in front; with 19 mm o.c. vane spacing. Provide a 1.9 mm (minimum) perforated faceplate with 13 by 13 mm holes on 5 mm spacing and a minimum free area of 45 percent.

2.9.13.8 Security Return and Other Air Registers Except in Cells

Provide return, exhaust, transfer and relief air registers, except in prisoner cells and prisoner holding cells, that are steel with perforated faceplate, flat surface margin, opposed blade damper, and duct mounting sleeve. Provide 14 gage (minimum) faceplate with 13 by 13 mm holes on 5 mm spacing and a minimum free area of 45 percent.

2.9.13.9 Security Supply Air Registers in Cells

Provide supply air registers in prisoner cells and prisoner holding cells that are steel with perforated faceplate, flat surface margin, extension sleeve, opposed blade damper, and back mounting flanges. Provide a 1.9 mm (minimum) faceplate with 13 by 13 mm holes on 5 mm spacing and a minimum free area of 45 percent. Provide a 14 gage (minimum) wall sleeve.

2.9.13.10 Security Return and Other Type Air Registers in Cells

Provide steel return, exhaust, transfer and relief air registers in prisoner cells and prisoner holding cells with perforated faceplate, flat surface margin, wall sleeve, opposed blade damper, and back mounting flanges. Provide 1.9 mm (minimum) faceplate with 13 by 13 mm holes on 5 mm spacing and a minimum free area of 45 percent. Provide a 14 gage (minimum)wall sleeve.

2.9.14 Louvers

Provide louvers for installation in exterior walls that are associated with the air supply and distribution system as specified in Section [07 60 00 FLASHING AND SHEET METAL] [08 91 00 METAL [WALL][AND][DOOR] LOUVERS].

2.9.15 Air Vents, Penthouses, and Goosenecks

Fabricate air vents, penthouses, and goosenecks from galvanized steel [or aluminum] sheets with galvanized[or aluminum] structural shapes. Provide sheet metal thickness, reinforcement, and fabrication that conform to MLIT-M. Accurately fit and secure louver blades to frames. Fold or bead edges of louver blades for rigidity and baffle these edges to exclude driving rain. Provide air vents, penthouses, and goosenecks with bird screen.

2.9.16 Bird Screens and Frames

Provide bird screens that conform to JIS G 3553, No. 2 mesh, aluminum or stainless steel. Provide "medium-light" rated aluminum screens. Provide "light" rated stainless steel screens. Provide removable type frames fabricated from either stainless steel or extruded aluminum.

2.9.17 Radon Exhaust Ductwork

Fabricate radon exhaust ductwork installed in or beneath slabs from Schedule 40 PVC pipe that conforms to JIS K 6741. Use solvent cement conforming to JIS K 6741 to make joints. Otherwise provide metal radon exhaust ductwork as specified herein.

2.10 AIR SYSTEMS EQUIPMENT

2.10.1 Fans

Test and rate fans according to JIS B 8330. Calculate system effect on air moving devices in accordance with JIS B 8330 where installed ductwork differs from that indicated on drawings. Install air moving devices to minimize fan system effect. Where system effect is unavoidable, determine the most effective way to accommodate the inefficiencies caused by system effect on the installed air moving device. The sound power level of the fans must not exceed 85 dBA when tested according to JIS B 8330 and rated in accordance with JIS B 8330. Connect fans to the motors either directly or indirectly with V-belt drive. Use V-belt drives designed for not less than [150] [or 140] [or 120] percent of the connected driving capacity. Provide variable pitch motor sheaves for 11 kW and below, and fixed pitch as defined by MLIT-M the fan shaft and the motor shaft. This is a non-adjustable speed. Select variable pitch sheaves to drive the fan at a speed which can produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, provide a replaceable sheave when needed to achieve system air balance. Provide motors for V-belt drives with adjustable rails or bases. Provide removable metal guards for all exposed V-belt drives, and provide speed-test openings at the center of all rotating shafts. Provide fans with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Provide fan and motor assemblies with vibration-isolation supports or mountings as indicated. Use vibration-isolation units that are standard products with published loading ratings. Select each fan to produce the capacity required at the fan static pressure indicated. Provide sound power level as indicated. Obtain the sound power level values according to JIS B 8330. Provide standard JIS C 9603, arrangement, rotation, and discharge as indicated.

2.10.1.1 Centrifugal Fans

Provide fully enclosed, single-width single-inlet, or double-width double-inlet centrifugal fans, with JIS B 8330 as required or indicated for the design system pressure. Provide impeller wheels that are rigidly constructed and accurately balanced both statically and dynamically. [Provide forward curved or backward-inclined airfoil design fan blades in wheel sizes up to 750 mm. Provide backward-inclined airfoil design fan blades for wheels over 750 mm in diameter]. [Provide open-wheel radial type booster fans for exhaust dryer systems, and fans suitable for conveying lint and the temperatures encountered. Equip the fan shaft with

a heat slinger to dissipate heat buildup along the shaft. Install an access (service) door to facilitate maintenance to these fans.] Provide fan wheels over 900 mm in diameter with overhung pulleys and a bearing on each side of the wheel. Provide fan wheels 900 mm or less in diameter that have one or more extra long bearings between the fan wheel and the drive. Provide sleeve type, self-aligning and self-oiling bearings with oil reservoirs, or precision self-aligning roller or ball-type with accessible grease fittings or permanently lubricated type. Connect grease fittings to tubing for serviceability from a single accessible point. Provide L50 rated bearing life at not less than the requirement of JIS B 1518 as defined by JIS B 1521 and JIS B 1534. Provide steel, accurately finished fan shafts, with key seats and keys for impeller hubs and fan pulleys. Provide fan outlets of ample proportions, designed for the attachment of angles and bolts for attaching flexible connections. Provide[[manually] [automatically] operated inlet vanes on suction inlets. Provide [manually] [automatically] operated outlet dampers.] Unless otherwise indicated, provide motors that do not exceed 1800 rpm and have [open] [dripproof] [totally enclosed] [explosion-proof] enclosures. [Provide [manual] [magnetic] [across-the-line] [reduced-voltage-start] type motor starters with [general-purpose] [weather-resistant] [watertight] enclosure.] [Provide remote manual switch with pilot indicating light where indicated.]

2.10.1.2 In-Line Centrifugal Fans

Provide in-line fans with centrifugal backward inclined blades, stationary discharge conversion vanes, internal and external belt guards, and adjustable motor mounts. Mount fans in a welded tubular casing. Provide a fan that axially flows the air in and out. Streamline inlets with conversion vanes to eliminate turbulence and provide smooth discharge air flow. Enclose and isolate fan bearings and drive shafts from the air stream. Provide precision, self aligning ball or roller type fan bearings that are sealed against dust and dirt and are permanently lubricated. Provide L50 rated bearing life at not less than the requirement of JIS B 1518 as defined by JIS B 1521 and JIS B 1534.[Provide motors with [open][dripproof][totally enclosed] [explosion-proof] enclosure.] [Provide [manual] [magnetic] motor starters across-the-line with [general-purpose] [weather-resistant] [explosion-proof] enclosures.][Provide remote manual switch with pilot indicating light where indicated.]

2.10.1.3 Axial Flow Fans

Provide axial flow fans complete with drive components and belt guard, with steel housing, cast fan wheel, cast or welded steel diffusers, fan shaft, bearings, and mounting frame as a factory-assembled unit. Provide fan wheels that are dynamically balanced and keyed to the fan shaft, with radially projecting blades of airfoil cross-section. Enclose and isolate fan bearings and drive shafts from the air stream. Permanently lubricate fan bearings or provide them with accessible grease fittings. Provide precision self-aligning ball or roller type fan bearings that are sealed against dust and dirt. Provide fan bearings that have a L50 rated bearing life at not less than the requirement of JIS B 1518 of operation as defined by and JIS B 1534. Provide fan inlets with an aerodynamically shaped bell and an inlet cone. Install diffuser or straightening vanes at the fan discharge to minimize turbulence and provide smooth discharge air flow. Furnish fan unit with [inlet and outlet flanges,] [inlet screen,] [duct equalizer section,] and [manual] [automatic] operation adjustable inlet vanes. Unless otherwise indicated, provide motors that do not exceed 1800 rpm and have [open] [dripproof] [totally enclosed]

[explosion-proof] enclosure. [Provide [manual] [magnetic] motor starters across-the-line with [general-purpose] [weather-resistant] [explosion-proof] enclosure.] [Provide remote manual switch with pilot indicating light where indicated.]

2.10.1.4 Centrifugal Type Power Wall Ventilators

Provide [direct][or][V-belt] driven centrifugal type fans with backward inclined, non-overloading wheel. Provide removable and weatherproof motor housing. Provide unit housing that is designed for sealing to building surface and for discharge and condensate drippage away from building surface. Construct housing of heavy gauge aluminum. Equip unit with an [aluminum or plated steel wire discharge bird screen,] [disconnect switch,] [[anodized aluminum][stainless steel] wall grille,] [manufacturer's standard [gravity][motor-operated] damper,] an airtight and liquid-tight metallic wall sleeve. Provide [totally enclosed fan cooled] [dripproof] [explosion-proof] type motor enclosure. Use only lubricated bearings.

2.10.1.5 Centrifugal Type Power Roof Ventilators

Provide [direct][or][V-belt] driven centrifugal type fans with backward inclined, non-overloading wheel. Provide hinged or removable and weatherproof motor compartment housing, constructed of heavy gauge aluminum. Provide fans with [birdscreen,] [disconnect switch,] [[gravity] [motorized] dampers,] [sound curb,] [roof curb,] and [extended base]. Provide [dripproof] [explosion-proof] type motor enclosure. Provide centrifugal type kitchen exhaust fans according to UL 705, fitted with V-belt drive, round hood, and windband upblast discharge configuration, integral residue trough and collection device, with motor and power transmission components located in outside positively air ventilated compartment. Use only lubricated bearings.

2.10.1.6 Propeller Type Power Roof Ventilators

Provide [direct][or][V-belt] driven fans. Provide hinged or removable weathertight fan housing, fitted with framed rectangular base constructed of aluminum or galvanized steel. Provide [totally enclosed fan cooled] [explosion-proof] type motors. Furnish motors with nonfusible, horsepower rated, manual disconnect mount on unit. Furnish fans with [gravity] [motor operated] dampers, [birdscreen][sound curb][roof curb]. Use only lubricated bearings.

2.10.1.7 Air-Curtain Fans

Furnish air curtains with a weatherproof housing constructed of high impact plastic or minimum 1.3 mm rigid welded steel. Provide backward curved, non-overloading, centrifugal type fan wheels, accurately balanced statically and dynamically. Provide motors with totally enclosed fan cooled enclosures. Provide remote manual type motor starters with weather-resistant enclosure actuated when the doorway served is open. Provide air curtains that attain the air velocities specified within 2 seconds following activation. Provide bird screens at air intake and discharge openings. Provide air curtain unit or a multiple unit installation that is at least as wide as the opening to be protected. Provide the air discharge openings to permit outward adjustment of the discharge air. Place installation and adjust according to the manufacturer's written recommendation. Furnish directional controls on air curtains for service windows for easy clean or convenient removal.

Design air curtains to prevent the adjustment of the air velocities specified. Make the interior surfaces of the air curtain units accessible for cleaning. Provide certified test data indicating that the fan can provide the air velocities required when fan is mounted as indicated. Provide air curtains designed as fly fans unless otherwise indicated. [Provide air curtains designed for use in service entranceways that develop an air curtain not less than 75 mm thick at the discharge nozzle. Provide air velocity that is not less than 8 m/s across the entire entryway when measured 900 mm above the floor.] [Provide air curtains designed for use on customer entranceways that develop an air curtain not less than 200 mm thick at the discharge opening. Provide velocity that is not less than 3 m/s across the entire entryway when measured 900 mm above the floor. Equip recirculating type air curtains with readily removable filters, or design the filters for in-position cleaning. Provide readily accessible and easily cleanable air capture compartment or design for in-position cleaning.] [Provide air curtains designed for use on service windows that develop an air curtain not less than 200 mm thick at the discharge opening. Provide air velocity that is not less than 3 m/s across the entire opening of the service window measured 900 mm below the air discharge opening.]

2.10.1.8 Ceiling Exhaust Fans

Provide centrifugal type, direct driven suspended cabinet-type ceiling exhaust fans. Provide fans with acoustically insulated housing. Provide chatter-proof backdraft damper. Provide egg-crate design or louver design integral face grille. Mount fan motors on vibration isolators. Furnish unit with mounting flange for hanging unit from above.

2.10.2 Coils

Provide fin-and-tube type coils constructed of seamless [copper][red brass] tubes and [aluminum][or][copper] fins mechanically bonded or soldered to the tubes.[Provide copper tube wall thickness that is a minimum of [0.406][0.508][0.6096] mm].[Provide red brass tube wall thickness that is a minimum of [0.89][1.24] mm]. [Provide aluminum fins that are [0.14][0.19] mm minimum thickness.][Provide copper fins that are 0.114 mm minimum thickness.] Provide casing and tube support sheets that are not lighter than 1.6 mm galvanized steel, formed to provide structural strength. When required, provide multiple tube supports to prevent tube sag. Mount coils for counterflow service. Rate and certify coils to meet the requirements of JIS B 8616.

2.10.2.1 Direct-Expansion Coils

Provide suitable direct-expansion coils for the refrigerant involved. Provide refrigerant piping that conforms to JIS H 3300 and clean, dehydrate and seal. Provide seamless copper tubing suction headers or seamless or resistance welded steel tube suction headers with copper connections. Provide supply headers that consist of a distributor which distributes the refrigerant through seamless copper tubing equally to all circuits in the coil. Provide circuited tubes to ensure minimum pressure drop and maximum heat transfer. Provide circuiting that permits refrigerant flow from inlet to suction outlet without causing oil slugging or restricting refrigerant flow in coil. Provide field installed coils which are completely dehydrated and sealed at the factory upon completion of pressure tests. Pressure test coils in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku).

2.10.2.2 Water Coils

Install water coils with a pitch of not less than 10 mm/m of the tube length toward the drain end. Use headers constructed of cast iron, welded steel or copper. Furnish each coil with a plugged vent and drain connection extending through the unit casing. Provide removable water coils with drain pans. Pressure test coils in accordance with Japanese Refrigeration Safety Regulations(Nihon-Reitou-Hoan-Kisoku).

2.10.2.3 Steam Heating Coils

Construct steam coils from cast semisteel, welded steel or copper headers, and [red brass][copper] tubes. Construct headers from cast iron, welded steel or copper. Provide fin tube and header section that float within the casing to allow free expansion of tubing for coils subject to high pressure steam service. Provide each coil with a field or factory installed vacuum breaker. Provide single-tube type coils with tubes not less than 13 mm outside diameter, except for steam preheat coils. Provide supply headers that distribute steam evenly to all tubes at the indicated steam pressure. Factory test coils to ensure that, when supplied with a uniform face velocity, temperature across the leaving side is uniform with a maximum variation of no more than 5 percent. Pressure test coils in accordance with in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku).

2.10.2.4 Steam Preheat (Nonfreeze) Coils

Provide steam-distribution-tube type steam (nonfreeze) coils with condensing tubes not less than 25 mm outside diameter for tube lengths 1.5 m and over and 13 mm outside diameter for tube lengths under 1.5 m. Construct headers from cast iron, welded steel, or copper. Provide distribution tubes that are not less than 15 mm outside diameter for tube lengths 1.5 m and over and 10 mm outside diameter for tube lengths under 1.5 m with orifices to discharge steam to condensing tubes. Install distribution tubes concentric inside of condensing tubes and hold securely in alignment. Limit maximum length of a single coil to 3.66 m. Factory test coils to ensure that, when supplied with a uniform face velocity, temperature across the leaving side is uniform with a maximum variation of no more than 5 percent. Pressure test coils in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku).

2.10.2.5 Electric Heating Coil

Provide an electric duct heater coil in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku). Provide duct- or unit-mounted coil. Provide [nickel chromium resistor, single stage, strip] [nickel chromium resistor, single stage, strip or stainless steel, fin tubular] type coil. Provide coil with a built-in or surface-mounted high-limit thermostat interlocked electrically so that the coil cannot be energized unless the fan is energized. Provide galvanized steel or aluminum coil casing and support brackets. Mount coil to eliminate noise from expansion and contraction and for complete accessibility for service.

2.10.2.6 Eliminators

Equip each cooling coil having an air velocity of over 2 m/s through the net face area with moisture eliminators, unless the coil manufacturer guarantees, over the signature of a responsible company official, that no

moisture can be carried beyond the drip pans under actual conditions of operation. Construct of minimum 24 gage [zinc-coated steel] [copper] [copper nickel] [or] [stainless steel], removable through the nearest access door in the casing or ductwork. Provide eliminators that have not less than two bends at 45 degrees and are spaced not more than 63 mm center-to-center on face. Provide each bend with an integrally formed hook as indicated in the JIS A 4009.

2.10.2.7 Sprayed Coil Dehumidifiers

Provide assembly with reinforced, braced, and externally insulated galvanized steel casing, vertical in-line spray pump, bronze self-cleaning spray nozzles, galvanized steel pipe spray headers, adjustable float valve with replaceable neoprene seat, manufacturer's standard cooling coil, and welded black steel drain tank. Provide overflow drain, make-up, and bleed connection.

2.10.2.8 Corrosion Protection for Coastal Installations

_____

2.10.3 Air Filters

List air filters according to requirements of JIS B 9908-1, except list high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test method under the Label Service to meet the requirements of JIS B 9908-1.

2.10.3.1 Extended Surface Pleated Panel Filters

Provide 50 mm depth, sectional, disposable type filters of the size indicated with a MERV of 8 when tested according to JIS B 9908-1. Provide initial resistance at 2.54 m/s that does not exceed 0.09 kPa. Provide UL Class 2 filters, and nonwoven cotton and synthetic fiber mat media. Attach a wire support grid bonded to the media to a moisture resistant fiberboard frame. Bond all four edges of the filter media to the inside of the frame to prevent air bypass and increase rigidity.

2.10.3.2 Extended Surface Nonsupported Pocket Filters

Provide [750][_____] mm depth, sectional, replaceable dry media type filters of the size indicated when tested according to JIS B 9908-1. Provide initial resistance at [2.54][_____] m/s that does not exceed [0.1125][_____] kPa. Provide fibrous glass media, supported in the air stream by a wire or non-woven synthetic backing and secured to a galvanized steel metal header. Provide pockets that do not sag or flap at anticipated air flows. Install each filter [with an extended surface pleated panel filter as a prefilter] in a factory preassembled, side access housing or a factory-made sectional frame bank, as indicated.

2.10.3.3 Cartridge Type Filters

Provide 305 mm depth, sectional, replaceable dry media type filters of the size indicated when tested according to JIS B 9908-1. Provide initial resistance at [2.54][_____] m/s that does not exceed [0.14][_____] kPa. Provide JIS Z 4812, and pleated microglass paper media with corrugated aluminum separators, sealed inside the filter cell to form a totally rigid filter assembly. Fluctuations in filter face velocity or turbulent airflow have no effect on filter integrity or performance. Install each

filter with an extended surface pleated media panel filter as a prefilter in a factory preassembled side access housing, or a factory-made sectional frame bank, as indicated.

2.10.3.4 Sectional Cleanable Filters

Provide [25][50] mm thick cleanable filters. Provide viscous adhesive in 20 L containers in sufficient quantity for 12 cleaning operations and not less than one L for each filter section. Provide one washing and charging tank for every 100 filter sections or fraction thereof; with each washing and charging unit consisting of a tank and [single][double] drain rack mounted on legs and drain rack with dividers and partitions to properly support the filters in the draining position.

2.10.3.5 Replaceable Media Filters

Provide the [dry-media][viscous adhesive] type replaceable media filters, of the size required to suit the application. Provide filtering media that is not less than 50 mm thick fibrous glass media pad supported by a structural wire grid or woven wire mesh. Enclose pad in a holding frame of not less than 1.6 mm galvanized steel, equipped with quick-opening mechanism for changing filter media. Base the air flow capacity of the filter on net filter face velocity not exceeding [1.5][_____] m/s, with initial resistance of [32][_____] Pa.

2.10.3.6 Automatic Renewable Media Filters

Provide the following:

a. Automatic, renewable media filters consisting of a horizontal or vertical traveling curtain of adhesive-coated bonded fibrous glass supplied in convenient roll form, and filter that does not require water supply, sewer connections, adhesive reservoir, or sprinkler equipment as part of the operation and maintenance requirements.

b. Basic frame that is fabricated of not less than 2 mm galvanized steel, and sectional design filters with each section of each filter fully factory assembled, requiring no field assembly other than setting in place next to any adjacent sections and the installation of media in roll form.

c. Each filter complete with initial loading of filter media drive motor adequate to handle the number of sections involved, and [painted steel] [stainless steel] control box containing a warning light to indicate media runout, a runout switch, and a Hand-Off-Auto selector switch.

d. Media feed across the filter face in [full-face increments] [increments] automatically controlled as determined by [filter pressure differential] [time interval control] [time interval control with pressure override] [photo electric control] to provide substantially constant operating resistance to airflow and varying not more than plus or minus 10 percent. Roll or enclose media in such a way that collected particulates can not re-entrain.

e. Rolls of clean media, no less than 19.8 m long, rerolled on disposable spools in the rewind section of the filter after the media has accumulated its design dirt load. Equip rewind section with a compression panel to tightly rewind used media for ease of handling.

Provide media made of continuous, bonded fibrous glass material, UL Class 2, that does not compress more than 6 mm when subjected to air flow at 2.54 m/s. Factory charge media with an odorless and flame retardant adhesive which does not flow while in storage nor when subjected to temperatures up to 79.4 degrees C. Support media on both the leaving and entering air faces. Clean media must have initial resistance that does not exceed 45 Pa at its rated velocity of 2.54 m/s. Set control so that the resistance to air flow is between 100 and 125 Pa unless otherwise indicated.

f. Dust holding capacity, of 80 percent average arrestance under these operating conditions, when operating at a steady state with an upper operating resistance of 125 Pa, that is at least 592 (55) grams of ASHRAE Standard Test Dust per square meter of media area, when tested according to the dynamic testing provisions of JIS B 9908-1.

g. The horizontal type automatic renewable media filters, when used in conjunction with factory fabricated air handling units, that are dimensionally compatible with the connecting air handling units, and horizontal type filter housings with all exposed surfaces factory insulated internally with 25 mm, 24 kg/cubic meter density neoprene coated fibrous glass with thermal conductivity not greater than 0.04 W/m-K of thickness.

h. Access doors for horizontal filters with double wall construction as specified for plenums and casings for field-fabricated units in paragraph DUCT SYSTEMS.

2.10.3.7 Electrostatic Filters

Provide the following:

a. The combination dry agglomerator/extended surface, nonsupported pocket electrostatic filters or the combination dry agglomerator/automatic renewable, media (roll) type electrostatic filters, as indicated (except as modified). Supply each dry agglomerator electrostatic air filter with the correct quantity of fully housed power packs and equip with silicon rectifiers, manual reset circuit breakers, low voltage safety cutout, relays for field wiring to remote indication of primary and secondary voltages, with lamps mounted in the cover to indicate these functions locally. Equip power pack enclosure with external mounting brackets, and low and high voltage terminals fully exposed with access cover removed for ease of installation. Furnish interlock safety switches for each access door and access panel that permits access to either side of the filter, so that the filter is de-energized in the event that a door or panel is opened.

b. Ozone generation within the filter that does not exceed five parts per one hundred million parts of air. Locate high voltage insulators in a serviceable location outside the moving air stream or on the clean air side of the unit. Fully expose ionizer wire supports and furnish ionizer wires precut to size and with formed loops at each end to facilitate ionizer wire replacement.

c. Agglomerator cell plates that allow proper air stream entrainment of agglomerates and prevent excessive residual dust build-up, with cells that are open at the top and bottom to prevent accumulation of agglomerates which settle by gravity. Where the dry agglomerator electrostatic filter is indicated to be the automatic renewable media

type, provide a storage section that utilizes a horizontal or vertical traveling curtain of adhesive-coated bonded fibrous glass for dry agglomerator storage section service supplied in 19.8 m lengths in convenient roll form. Otherwise, provide section construction and roll media characteristics as specified for automatic renewable media filters. Also a dry agglomerator/renewable media combination with an initial air flow resistance, after installation of clean media, that does not exceed 62.3 Pa at 2.54 m/s face velocity.

d. Where the dry agglomerator electrostatic filter is indicated to be of the extended surface nonsupported pocket filter type, provide a storage section as specified for extended surface non-supported pocket filters, with sectional holding frames or side access housings as indicated.

e. A dry agglomerator/extended surface nonsupported pocket filter section combination with initial air flow resistance, after installation of clean filters, that does not exceed 162 Pa at 2.54 m/s face velocity. Furnish front access filters with full height air distribution baffles and upper and lower mounting tracks to permit the baffles to be moved for agglomerator cell inspection and service. When used in conjunction with factory fabricated air handling units, supply side access housings which have dimensional compatibility.

2.10.3.8 High-Efficiency Particulate Air (HEPA) Filters

Provide HEPA filters that meet the requirements of JIS Z 4812 and are individually tested and certified to have an efficiency of not less than [95] [99.97] percent in accordance with JIS B 9927, and an initial resistance at [_____] m/s that does not exceed [_____] Pa. Provide filters that are constructed by pleating a continuous sheet of filter medium into closely spaced pleats separated by corrugated aluminum or mineral-fiber inserts, strips of filter medium, or by honeycomb construction of the pleated filter medium. Provide interlocking, dovetailed, molded neoprene rubber gaskets of 5-10 durometer that are cemented to the perimeter of the [upstream] [downstream] face of the filter cell sides. Provide self-extinguishing rubber-base type adhesive or other materials conforming to fire hazard classification specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Provide filter cell sides that are [19 mm thick exterior grade fire-retardant plywood] [cadmium plated steel] [galvanized steel] assembled in a rigid manner. Provide overall cell side dimensions that are correct to 2 mm, and squareness that is maintained to within 3.2 mm. Provide holding frames that use spring loaded fasteners or other devices to seal the filter tightly within it and that prevent any bypass leakage around the filter during its installed life. Provide air capacity and the nominal depth of the filter as indicated. Install each filter in a factory preassembled side access housing or a factory-made sectional supporting frame as indicated. Provide prefilters of the type, construction and efficiency indicated.

2.10.3.9 Holding Frames

Fabricate frames from not lighter than 1.6 mm sheet steel with rust-inhibitor coating. Equip each holding frame with suitable filter holding devices. Provide gasketed holding frame seats. Make all joints airtight.

2.10.3.10 Filter Gauges

Provide dial type filter gauges, diaphragm actuated draft for all filter stations, including those filters which are furnished as integral parts of factory fabricated air handling units. Provide gauges that are at least 98 mm in diameter, with white dials with black figures, and [graduations] [graduated in 0.0025 kPa,] with a minimum range of 0.25 kPa beyond the specified final resistance for the filter bank on which each gauge is applied. Provide each gauge with a screw operated zero adjustment and two static pressure tips with integral compression fittings, two molded plastic vent valves, two 1.5 m minimum lengths of 6.35 mm diameter [aluminum] [vinyl] tubing, and all hardware and accessories for gauge mounting.

2.11 AIR HANDLING UNITS

2.11.1 Factory-Fabricated Air Handling Units

Provide [single-zone draw-through type][or][single-zone blow-through type][or][multizone blow-through type][blow-through double-deck type][blow-through triple deck type] units as indicated. Units must include fans, coils, airtight insulated casing, [prefilters,] [secondary filter sections,][and][diffuser sections where indicated,] [air blender] adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, [mixing box] [combination sectional filter-mixing box,] [[pan][drysteam][spray type] humidifier,] vibration-isolators, and appurtenances required for specified operation. Provide vibration isolators as indicated. Physical dimensions of each air handling unit must be suitable to fit space allotted to the unit with the capacity indicated. Provide air handling unit that is rated in accordance with JRA 4036.

2.11.1.1 Casings

Provide the following:

a. [Casing sections [[single] [50 mm double] wall type] [as indicated], constructed of a minimum 1.3 mm galvanized steel, or 1.3 mm corrosion-resisting sheet steel conforming to JIS G 4305.][Inner casing of double-wall units that are a minimum one mm solid galvanized steel or corrosion-resisting sheet steel conforming to JIS G 4305.] Design and construct casing with an integral insulated structural galvanized steel frame such that exterior panels are non-load bearing.

b. Individually removable exterior panels with standard tools. Removal must not affect the structural integrity of the unit. Furnish casings with access sections, according to paragraph AIR HANDLING UNITS, inspection doors, and access doors, all capable of opening a minimum of 90 degrees, as indicated.

c. Insulated, fully gasketed, double-wall type inspection and access doors, of a minimum 1.3 mm outer and one mm inner panels made of either galvanized steel or corrosion-resisting sheet steel conforming to JIS G 4305. Provide rigid doors with heavy duty hinges and latches. Inspection doors must be a minimum 300 mm wide by 300 mm high. Access doors must be a minimum 600 mm wide, the full height of the unit casing or a minimum of 1800 mm, whichever is less. [Install a minimum 200 by 200 mm sealed glass window suitable for the intended application, in all access doors.]

d. Double-wall insulated type drain pan (thickness equal to exterior casing) constructed of 1.4 mm [galvanized steel] [corrosion resisting sheet steel conforming to JIS G 4305.] Construct drain pans water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils must not flow across the face of lower coils. Provide intermediate drain pans or condensate collection channels and downspouts, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Construct drain pan to allow for easy visual inspection, including underneath the coil without removal of the coil and to allow complete and easy physical cleaning of the pan underneath the coil without removal of the coil. Provide coils that are individually removable from the casing.

e. Insulate single-wall casing sections handling conditioned air with not less than 25 mm thick, 24 kg/cubic meter density coated fibrous glass material having a thermal conductivity not greater than 0.033 W/m-K. Insulate double-wall casing sections handling conditioned air with not less than 50 mm of the same insulation specified for single-wall casings. Foil-faced insulation is not an acceptable substitute for use with double wall casing. Seal double wall insulation completely by inner and outer panels.

f. Factory applied fibrous glass insulation that conforms to JIS A 9511, except that the minimum thickness and density requirements do not apply. Make air handling unit casing insulation uniform over the entire casing. Foil-faced insulation is not an acceptable substitute for use on double-wall access doors and inspections doors [and casing sections].

g. Duct liner material, coating, and adhesive that conforms to fire-hazard requirements specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Protect exposed insulation edges and joints where insulation panels are butted with a metal nosing strip or coat to meet erosion resistance requirements of JIS A 9511.

h. A latched and hinged inspection door, in the fan and coil sections. Plus additional inspection doors, access doors and access sections [_____][where indicated].

2.11.1.2 Heating and Cooling Coils

Provide coils as specified in paragraph AIR SYSTEMS EQUIPMENT.

2.11.1.3 Air Filters

Provide air filters as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.11.1.4 Fans

Provide the following:

a. Fans that are double-inlet, centrifugal type with each fan in a separate scroll. Dynamically balance fans and shafts prior to installation into air handling unit, then after it has been installed in the air handling unit, statically and dynamically balance the

entire fan assembly. Mount fans on steel shafts, accurately ground and finished.

b. Fan bearings that are sealed against dust and dirt and are precision self-aligning ball or roller type, with L50 rated bearing life at not less than 200,000 hours as defined by JIS B 1521 and JIS B 1534. Provide bearings that are permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Support bearings by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Do not fasten bearings directly to the unit sheet metal casing. Furnish fans and scrolls with coating indicated.

c. Fans that are driven by a unit-mounted, or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Furnish belt guards that are the three-sided enclosed type with solid or expanded metal face. Design belt drives for not less than a 1.3 service factor based on motor nameplate rating.

d. [Motor sheaves that are variable pitch for 20 kW and below and fixed pitch above 20 kW as defined by MLIT-M.] Where fixed sheaves are required, the use of variable pitch sheaves is allowed during air balance, but replace them with an appropriate fixed sheave after air balance is completed. Select variable pitch sheaves to drive the fan at a speed that produces the specified capacity when set at the approximate midpoint of the sheave adjustment. Furnish motors for V-belt drives with adjustable bases, and with [open][splashproof][totally enclosed] enclosures.

e. Motor starters of [manual][magnetic][across-the-line][reduced-voltage-start] type with [general-purpose][weather-resistant][watertight] enclosure. Select unit fan or fans to produce the required capacity at the fan static pressure with sound power level as indicated. Obtain the sound power level values according to JIS B 8330, JIS B 8330.

2.11.1.5 Access Sections and Filter/Mixing Boxes

Provide access sections where indicated and furnish with access doors as shown. Construct access sections and filter/mixing boxes in a manner identical to the remainder of the unit casing and equip with access doors. Design mixing boxes to minimize air stratification and to promote thorough mixing of the air streams.

2.11.1.6 Diffuser Sections

Furnish diffuser sections between the discharge of all housed supply fans [and cooling coils of blow-through single zone units][and][filter sections of those units with high efficiency filters located immediately downstream of the air handling unit fan section]. Provide diffuser sections that are fabricated by the unit manufacturer in a manner identical to the remainder of the unit casing, designed to be airtight under positive static pressures up to [2][_____] kPa and with an access door on each side for inspection purposes. Provide a diffuser section that contains a perforated diffusion plate, fabricated of galvanized steel, Type 316 stainless steel, aluminum, or steel treated for corrosion with manufacturer's standard corrosion-resisting finish, and designed to accomplish uniform air flow across the down-stream [coil][filters] while

reducing the higher fan outlet velocity to within plus or minus 5 percent of the required face velocity of the downstream component.

2.12 TERMINAL UNITS

2.12.1 Room Fan-Coil Units

Provide base units that include galvanized coil casing, coil assembly drain pan [valve and piping package,] [outside air damper,] [wall intake box,] air filter, fans, motor, fan drive, motor switch, an enclosure for cabinet models and casing for concealed models, leveling devices integral with the unit for vertical type units, and sound power levels as indicated. Obtain sound power level data or values for these units according to test procedures based on JIS B 8616. Sound power values apply to units provided with factory fabricated cabinet enclosures and standard grilles. Values obtained for the standard cabinet models are acceptable for concealed models without separate test provided there is no variation between models as to the coil configuration, blowers, motor speeds, or relative arrangement of parts. Provide automatic valves and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS. Fasten each unit securely to the building structure. Provide units with capacity indicated. Provide room fan-coil units that are certified as complying with MLIT-M, and meet the requirements of in accordance wiht Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku).

2.12.1.1 Enclosures

Fabricate enclosures from not lighter than 1.3 mm steel, reinforced and braced. Provide enclosures with front panels that are removable and have 7 mm closed cell insulation or 13 mm thick dual density foil faced fibrous glass insulation. Make the exposed side of a high density, erosion-proof material suitable for use in air streams with velocities up to 23 m/s. Provide a discharge grille that is [adjustable] [fixed] and that is of such design as to properly distribute air throughout the conditioned space. Plastic discharge and return grilles are acceptable provided the plastic material is certified by the manufacturer to be classified as flame resistant and the material complies with the heat deflection criteria per in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku). Provide galvanized or factory finished ferrous metal surfaces with corrosion resistant enamel, and access doors or removable panels for piping and control compartments, plus easy access for filter replacement. Provide duct discharge collar for concealed models.

2.12.1.2 Fans

Provide steel or aluminum, multiblade, centrifugal type fans. In lieu of metal, fans and scrolls could be of non-metallic materials of suitably reinforced compounds with smooth surfaces. Dynamically and statically balance the fans. Provide accessible assemblies for maintenance. Disassemble and re-assemble by means of mechanical fastening devices and not by epoxies or cements.

2.12.1.3 Coils

Fabricate coils from not less than 10 mm outside diameter seamless copper tubing, with copper or aluminum fins mechanically bonded or soldered to the tubes. Provide coils with not less than 13 mm outside diameter flare

or sweat connectors, accessory piping package with thermal connections suitable for connection to the type of control valve supplied, and manual air vent. Test coils hydrostatically at 2000 kPa or under water at 1700 kPa air pressure. Provide coils suitable for 1400 kPa working pressure. Make provisions for coil removal.

2.12.1.4 Drain Pans

Size and locate drain and drip pans to collect all water condensed on and dripping from any item within the unit enclosure or casing. Provide condensate drain pans designed for self-drainage to preclude the buildup of microbial slime and thermally insulated to prevent condensation and constructed of not lighter than 0.9 mm type 304 stainless steel or noncorrosive ABS plastic. Provide insulation with a flame spread rating not over 25 without evidence of continued progressive combustion, a smoke developed rating no higher than 50, and of a waterproof type or coated with a waterproofing material. Design drain pans so as to allow no standing water and pitch to drain. Provide minimum 19 mm NPT or 15 mm OD drain connection in drain pan. Provide plastic or metal auxiliary drain pans to catch drips from control and piping packages, eliminating insulation of the packages; if metal, provide auxiliary pans that comply with the requirements specified above. Extend insulation at control and piping connections 25 mm minimum over the auxiliary drain pan.

2.12.1.5 Manually Operated Outside Air Dampers

Provide manually operated outside air dampers according to the arrangement indicated, and parallel airfoil type dampers of galvanized construction. Provide blades that rotate on stainless steel or nylon sleeve bearings.

2.12.1.6 Filters

Provide disposable type filter that complies with JIS B 9908-1. Provide filters in each unit that are removable without the use of tools.

2.12.1.7 Motors

Provide motors of the permanent split-capacitor type with built-in thermal overload protection, directly connected to unit fans. Provide motor switch with two or three speeds and off, manually operated, and mounted on an identified plate [inside the unit below or behind an access door][or][adjacent to the room thermostat][as indicated]. In lieu of the above fan speed control, a solid-state variable-speed controller having a minimum speed reduction of 50 percent is allowed. Provide motors with permanently-lubricated or oilable sleeve-type or combination ball and sleeve-type bearings with vibration isolating mountings suitable for continuous duty. Provide a motor power consumption, shown in watts, at the fan operating speed selected to meet the specified capacity that does not exceed the following values:

Free Discharge Motors			
Unit Capacity (L/S)	Maximum Power Consumption (Watts)		
	115V	230V	277V
94	70	110	90
142	100	110	110
189	170	150	150
283	180	210	220
378	240	240	230
472	310	250	270
566	440	400	440

High Static Motors	
Unit Capacity (L/S)	Maximum Power Consumption (Watts)
94	145
142	145
189	210
283	320
378	320
472	530
566	530

2.12.2 Coil Induction Units

Provide base unit that includes air plenums, air-discharge nozzles, air discharge grilles, recirculation grilles, water coil assembly, valve and piping package, condensate drain pan, and adjustable air-balancing dampers, plus an enclosure for cabinet models and casing for concealed models. Make each unit capable of producing not less than the capacity indicated without exceeding the indicated static pressure. Provide a sound power level as indicated with power level data or values for these units based on tests conducted according to or JIS Z 8734. Sound power values apply to units provided with factory fabricated cabinet enclosures and standard grilles. The values obtained for the standard cabinet models are acceptable for concealed models without separate tests, provided there is no variation between models as to coil configuration, air discharge

nozzles, air balancing dampers, or relative arrangement of parts. Provide automatic valves and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS. Secure each unit to the building structure. Provide units with capacity indicated.

2.12.2.1 Enclosures

Fabricate enclosures from not lighter than 1.2 mm steel, reinforced and braced. Provide a removable front panel of enclosure and insulate when required acoustically and to prevent condensation. Provide discharge grilles that are [adjustable][integrally stamped] and properly distribute air throughout the conditioned space. Plastic discharge and return grilles are not acceptable. Provide access doors for all piping and control compartments.

2.12.2.2 Air Plenums

Fabricate plenums from galvanized steel with interior acoustically baffled and lined with sound absorbing material to attenuate the sound power from the primary air supply to the room. Provide heat-resistant nozzles that are integral with or attached airtight to the plenum. Where coil induction units are supplied with vertical runouts, furnish a streamlined, vaned, mitered elbow transition piece for connection between the unit and ductwork. Provide an adjustable air-balancing damper in each unit.

2.12.2.3 Coils

Fabricate coils from not less than 10 mm outside diameter seamless copper tubing, with copper or aluminum fins, mechanically bonded or soldered to the tubes. Furnish coil connections with not less than 13 mm outside diameter flare or sweat connectors, accessory piping package with terminal connections suitable for connection to the type of control valve supplied, and manual air vent. Test coils hydrostatically at 2000 kPa or under water at 1700 kPa air pressure and provide coils suitable for 1400 kPa working pressure.

2.12.2.4 Screens

Provide easily accessible lint screens or throwaway filters for each unit.

2.12.2.5 Drain Pan

Size and locate drain and drip pans to collect condensed water dripping from any item within the unit enclosure. Provide drain pans constructed of not lighter than 0.9 mm steel, galvanized after fabrication, and thermally insulated to prevent condensation. Provide insulation that has a flame spread rating not over 25 without evidence of continued progressive combustion, a smoke developed rating no higher than 50, and that is a waterproof type or coated with a waterproofing material. In lieu of the above, drain pans constructed of die-formed 0.8 mm steel are allowed, formed from a single sheet and galvanized after fabrication and insulated and coated as for the 0.9 mm steel material or of die-formed 0.9 mm type 304 stainless steel insulated as specified above. Pitch drain pans to drain. Provide drain connection when a condensate drain system is indicated. Make connection a minimum 19 mm NPT or 15 mm OD.

2.12.3 Variable Air Volume (VAV) and Dual Duct Terminal Units

a. Provide VAV and dual duct terminal units that are the type, size, and

capacity shown, mounted in the ceiling or wall cavity, plus units that are suitable for single or dual duct system applications. Provide actuators and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS. For each VAV terminal unit, provide a temperature sensor in the unit discharge ductwork.

b. Provide unit enclosures that are constructed of galvanized steel not lighter than 0.85 mm or aluminum sheet not lighter than 1.3 mm. Provide single or multiple discharge outlets as required. Units with flow limiters are not acceptable. Provide unit air volume that is factory preset and readily field adjustable without special tools. Provide reheat coils as indicated.

c. Attach a flow chart to each unit. Base acoustic performance of the terminal units upon units tested according to JRA 4036 with the calculations prepared in accordance with JIS B 8616. Provide sound power level as indicated. Show discharge sound power for minimum and [375][_____] Pa inlet static pressure.

2.12.3.1 Constant Volume, Single Duct Terminal Units

Provide constant volume, single duct, terminal units that contain within the casing, a constant volume regulator. Provide volume regulators that control air delivery to within plus or minus 5 percent of specified air flow subjected to inlet pressure from 200 to 1500 Pa.

2.12.3.2 Variable Volume, Single Duct Terminal Units

Provide variable volume, single duct, terminal units with a calibrated air volume sensing device, air valve or damper, actuator, and accessory relays. Provide units that control air volume to within plus or minus 5 percent of each air set point volume as determined by the thermostat with variations in inlet pressures from 200 to 1500 Pa. Provide units with an internal resistance not exceeding 100 Pa at maximum flow range. Provide external differential pressure taps separate from the control pressure taps for air flow measurement with a 0 to 250 Pa range.

2.12.3.3 Variable Volume, Single Duct, Fan-Powered Terminal Units

Provide variable volume, single duct, fan-powered terminal units with a calibrated air volume sensing device, air valve or damper, actuator, fan and motor, and accessory relays. Provide units that control primary air volume to within plus or minus 5 percent of each air set point as determined by the thermostat with variations in inlet pressure from 200 to 1500 Pa. Provide unit fan that is centrifugal, direct-driven, double-inlet type with forward curved blades. Provide either single speed with speed controller or three-speed, permanently lubricated, permanent split-capacitor type fan motor. Isolate fan/motor assembly from the casing to minimize vibration transmission. Provide factory furnished fan control that is wired into the unit control system. Provide a factory-mounted pressure switch to operate the unit fan whenever pressure exists at the unit primary air inlet or when the control system fan operates.

2.12.3.4 Dual Duct Terminal Units

Provide dual duct terminal units with hot and cold inlet valve or dampers that are controlled in unison by single or dual actuators. Provide actuator as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES,

subparagraph CONTROLS. Provide unit that controls delivered air volumes within plus or minus 5 percent with inlet air variations from 250 to 2000 Pa in either duct. Include mixing baffles with the unit casing. Provide cabinet and closed duct leakage that does not exceed 2 percent of maximum rated air volume. Provide units with an internal resistance that does not exceed [_____] Pa at maximum flow range.

2.12.3.5 Reheat Units

2.12.3.5.1 Hot Water Coils

Provide fin-and-tube type hot-water coils constructed of seamless copper tubes and copper or aluminum fins mechanically bonded or soldered to the tubes. Provide headers that are constructed of cast iron, welded steel or copper. Provide casing and tube support sheets that are 1.6 mm, galvanized steel, formed to provide structural strength. Provide tubes that are correctly circuited for proper water velocity without excessive pressure drop and are drainable where required or indicated. At the factory, test each coil at not less than 1700 kPa air pressure and provide coils suitable for 1400 kPa working pressure. Install drainable coils in the air handling units with a pitch of not less than 10 mm per m of tube length toward the drain end. Coils must conform to the provisions of JIS B 8616.

2.12.3.5.2 Steam Coils

Provide steam coils constructed of cast semisteel, welded steel, or copper headers, red-brass or copper tubes, and copper or aluminum fins mechanically bonded or soldered to the tubes. Roll and bush, braze or weld tubes into headers. Provide coil casings and tube support sheets, with collars of ample width, that are not lighter than 1.6 mm galvanized steel formed to provide structural strength. When required, furnish multiple tube supports to prevent tube sag. Float the fin tube and header section within the casing to allow free expansion of tubing for coils subject to high pressure steam service. Provide coils that are factory pressure tested and capable of withstanding 1700 kPa hydrostatic test pressure or 1400 kPa air pressure, and are for [700] [1400] kPa steam working pressure. Provide steam-distribution tube type preheat coils with condensing tubes having not less than 15 mm outside diameters. Provide distribution tubes that have not less than 10 mm outside diameter, with orifices to discharge steam to condensing tubes. Install distribution tubes concentric inside of condensing tubes held securely in alignment. Limit the maximum length of a single coil to 120 times the diameter of the outside tube. Other heating coils must be single tube type with an outside diameter not less than 13 mm. Provide supply headers that distribute steam evenly to all tubes at the indicated steam pressure. Provide coils that conform to the provisions of JIS B 8616.

2.12.3.5.3 Electric Resistance Heaters

Provide the duct-mounting type electric resistance heaters consisting of a nickel-chromium resistor mounted on refractory material and a steel or aluminum frame for attachment to ductwork. Provide electric duct heater that meets the requirement of JIS C 9803 and is provided with a built-in or surface-mounted high-limit thermostat. Interlock electric duct heaters electrically so that they cannot be energized unless the fan is running.

2.12.4 Unit Ventilators

Provide unit ventilators that include an enclosure, [galvanized casing,] [cold-rolled steel casing with corrosion resistant coating,] coil assembly, [resistance heating coil assembly,] [valve and piping package,] drain pan, air filters, fan assembly, fan drive, motor, motor controller, dampers, damper operators, and sound power level as indicated. Obtain sound power level data or values for these units according to test procedures based on MLIT-M. Sound power values apply to units provided with factory fabricated cabinet enclosures and standard grilles, when handling standard flow for which the unit air capacity is rated. Secure each unit to the building structure. Provide the unit ventilators with capacity indicated. Provide the year-round classroom type unit ventilator with automatic controls arranged to properly heat, cool, and ventilate the room. Provide automatic valves and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS.

2.12.4.1 Enclosures

Fabricate enclosures from not lighter than 1.6 mm galvanized steel, reinforced and braced, or all welded framework with panels to provide equivalent strength. Provide casing that is acoustically and thermally insulated internally with not less than 13 mm thick dual density fibrous glass insulation. Make the exposed side a high density, erosion-proof material suitable for use in air streams with velocities up to 246 m/s. Fasten the insulation with waterproof, fire-resistant adhesive. Design front panel for easy removal by one person. Provide discharge grilles that [have adjustable grilles or grilles with adjustable vanes and] properly distribute air throughout the conditioned space. Provide return grilles that are removable where front panel does not provide access to interior components. Plastic discharge or return grilles are not acceptable. Furnish removable panels or access doors for all piping and control compartments. Provide fan switch that is key operated or accessible through a locked access panel. Install gaskets at the back and bottom of the unit for effective air seal, as required.

2.12.4.2 Electric Resistance Heating Elements

Provide electric resistance heating elements that are of the sheathed, finned, tubular type, or of the open resistance type designed for direct exposure to the air stream. Provide heating element electrical characteristics as indicated. Where fan motor or control voltage is lower than required for the electric-resistance heating element, install a fused factory mounted and wired transformer.

2.12.4.3 Fans

Provide fans that meet the requirements as specified in paragraph AIR SYSTEMS EQUIPMENT. Provide galvanized steel or aluminum, multiblade, centrifugal type fans, dynamically and statically balanced. Equip fan housings with resilient mounted, self-aligning permanently lubricated ball bearings, sleeve bearings, or combination ball and sleeve bearings, capable of not less than 2000 hours of operation on one oiling. Provide direct-connected fans.

2.12.4.4 Coils

Provide coils that are circuited for a maximum water velocity of 2.4 m/s without excessive pressure drop and are otherwise as specified for hot

water coils in paragraph TERMINAL UNITS.

2.12.4.5 Drain Pans

Size and locate drain and drip pans to collect all condensed water dripping from any item within the unit enclosure. Provide drain pans constructed of not lighter than 1.2 mm steel, galvanized after fabrication, and thermally insulated to prevent condensation. Provide insulation that is coated with a fire-resistant waterproofing material. In lieu of the above, drain pans constructed of die-formed 1.0 mm steel is allowed, formed from a single sheet and galvanized after fabrication and insulated and coated as for the 1.3 mm steel material, or of die-formed 1.3 mm type 304 stainless steel insulated as specified above. Pitch drain pans to drain. Furnish drain connection unless otherwise indicated. Make the minimum connection 19 mm NDT or 18 mm OD.

2.12.4.6 Filters

Disposable type rated in accordance with ASHRAE 52.2, installed upstream of coil.

2.12.4.7 Dampers

Provide an outside air proportioning damper on each unit. In addition, provide a vane to prevent excessive outside air from entering unit and to prevent blow-through of outside air through the return air grille under high wind pressures. Where outside air and recirculated air proportioning dampers are provided on the unit, an additional vane is not required. Provide face and bypass dampers for each unit to ensure constant air volume at all positions of the dampers. Furnish each unit with a factory installed control cam assembly, pneumatic motor, or electric motor to operate the face and bypass dampers and outside air damper or outside air and recirculated air dampers in the sequence as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS.

2.12.4.8 Motors

Provide permanent split-capacitor type motors with built-in thermal overload protection and automatic reset. Mount motor on a resilient mounting, isolated from the casing and suitable for operation on electric service available. Provide a manually operated motor switch that provides for 2 or 3 speeds and off, mounted on an identified plate [inside the unit below or behind an access door][or][adjacent to the room thermostat][as indicated]. In lieu of speed control, provide a solid state variable speed controller having minimum speed reduction of 50 percent.

2.12.4.9 Outside Air Intakes

Provide the manufacturer's standard design outside air intakes furnished with 13 mm mesh bird screen or louvers on 13 mm centers.

2.13 ENERGY RECOVERY DEVICES

2.13.1 Rotary Wheel

Provide unit that is a factory fabricated and tested assembly for air-to-air energy recovery by transfer of sensible heat from exhaust air to supply air stream, with device performance according to JIS B 8628 and that delivers an energy transfer effectiveness of not less than

[70][85][_____] percent with cross-contamination not in excess of [0.1][1.0][_____] percent of exhaust airflow rate at system design differential pressure, including purging sector if provided with wheel. Provide exchange media that is chemically inert, moisture-resistant, fire-retardant, laminated, nonmetallic material which complies with NFPA 90A. Isolate exhaust and supply streams by seals which are static, field adjustable, and replaceable. Equip chain drive mechanisms with ratcheting torque limiter or slip-clutch protective device. Fabricate enclosure from galvanized steel and include provisions for maintenance access. Provide recovery control and rotation failure provisions as indicated.

2.13.2 Run-Around-Coil

Provide assembly that is factory fabricated and tested air-to-liquid-to-air energy recovery system for transfer of sensible heat from exhaust air to supply air stream and that delivers an energy transfer effectiveness not less than that indicated without cross-contamination with maximum energy recovery at minimum life cycle cost. Computer optimize components for capacity, effectiveness, number of coil fins per inch, number of coil rows, flow rate, heat transfer rate of [_____] percent by volume of [ethylene][propylene] glycol solution, and frost control. Provide coils that conform to paragraph AIR HANDLING UNITS. Provide related pumps, and piping specialties that conform to requirements of [Section 23 63 00.00 10 COLD STORAGE REFRIGERATION SYSTEMS][Section 23 57 10.00 10 FORCED HOT WATER HEATING SYSTEMS USING WATER AND STEAM HEAT EXCHANGERS][23 69 00.00 20 REFRIGERATION EQUIPMENT FOR COLD STORAGE] [_____].

2.13.3 Heat Pipe

Provide a device that is a factory fabricated, assembled and tested, counterflow arrangement, air-to-air heat exchanger for transfer of sensible heat between exhaust and supply streams and that delivers an energy transfer effectiveness not less than that indicated without cross-contamination. Provide heat exchanger tube core that is [15][18][25] mm nominal diameter, seamless aluminum or copper tube with extended surfaces, utilizing wrought aluminum Alloy 3003 or Alloy 5052, temper to suit. Provide maximum fins per unit length and number of tube rows as indicated. Provide tubes that are fitted with internal capillary wick, filled with a refrigerant complying with in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku), selected for system design temperature range, and hermetically sealed. Refrigerants containing chlorofluorocarbons (CFC) are prohibited. Provide heat exchanger frame that is constructed of not less than 1.6 mm galvanized steel and fitted with intermediate tube supports, and flange connections. Provide tube end-covers and a partition of galvanized steel to separate exhaust and supply air streams without cross-contamination and in required area ratio.[Provide a drain pan constructed of welded Type 300 series stainless steel.] Provide heat recovery regulation by [system face and bypass dampers and related control system as indicated][interfacing with manufacturer's standard tilt-control mechanism for summer/winter operation, regulating the supply air temperature and frost prevention on weather face of exhaust side at temperature indicated]. Coil must be fitted with pleated flexible connectors.

2.13.4 Desiccant Wheel

Provide counterflow supply, regeneration airstreams, a rotary type

dehumidifier designed for continuous operation, and extended surface type wheel structure in the axial flow direction with a geometry that allows for laminar flow over the operating range for minimum air pressure differentials. Provide the dehumidifier complete with a drive system utilizing a fractional-horsepower electric motor and speed reducer assembly driving the rotor. Include a slack-side tensioner for automatic take-up for belt-driven wheels. Provide an adsorbing type desiccant material. Apply the desiccant material to the wheel such that the entire surface is active as a desiccant and the desiccant material does not degrade or detach from the surface of the wheel which is fitted with full-face, low-friction contact seals on both sides to prevent cross leakage. Provide rotary structure that has underheat, overheat and rotation fault circuitry. Provide wheel assembly with a warranty for a minimum of five years.

2.13.5 Plate Heat Exchanger

Provide energy recovery ventilator unit that is factory-fabricated for indoor installation, consisting of a flat plate cross-flow heat exchanger, cooling coil, supply air fan and motor and exhaust air fan and motor. The casing must be 1 mm G90, galvanized steel, double wall construction with 25 mm insulation. Provide fibrous desiccant cross-flow type heat exchanger core capable of easy removal from the unit.

2.14 FACTORY PAINTING

Factory paint new equipment, which are not of galvanized construction. Paint with a corrosion resisting paint finish according to JIS H 8641 or JIS G 3302. Clean, phosphatize and coat internal and external ferrous metal surfaces with a paint finish which has been tested according to JIS Z 2371 JIS K 5600-7-9, and JIS K 5600-5-5 or JIS K 5600-5-6. Submit evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 500 hours for units to be installed outdoors. Provide rating of failure at the scribe mark that is not less than 6, average creepage not greater than 3 mm. Provide rating of the inscribed area that is not less than 10, no failure. On units constructed of galvanized steel that have been welded, provide a final shop docket of zinc-rich protective paint on exterior surfaces of welds or welds that have burned through from the interior according to JIS H 8641.

Field paint factory painting that has been damaged prior to acceptance by the Contracting Officer in compliance with the requirements of paragraph FIELD PAINTING OF MECHANICAL EQUIPMENT.

2.15 SUPPLEMENTAL COMPONENTS/SERVICES

2.15.1 Chilled, Condenser, or Dual Service Water Piping

The requirements for chilled, condenser, or dual service water piping and accessories are specified in Section 23 64 26 CHILLED, CHILLED-HOT, AND CONDENSER WATER PIPING SYSTEMS

2.15.2 Refrigerant Piping

The requirements for refrigerant piping are specified in Section 23 23 00 REFRIGERANT PIPING.

2.15.3 Water or Steam Heating System Accessories

The requirements for water or steam heating accessories such as expansion tanks and steam traps are specified in Section [23 52 00 HEATING BOILERS][23 21 13.00 20 LOW TEMPERATURE WATER (LTW) HEATING SYSTEM][23 22 26.00 20 STEAM SYSTEM AND TERMINAL UNITS].

2.15.4 Condensate Drain Lines

Provide and install condensate drainage for each item of equipment that generates condensate in accordance with Section [22 00 00 PLUMBING, GENERAL PURPOSE][23 64 26 CHILLED, CHILLED-HOT, AND CONDENSER WATER PIPING SYSTEMS] except as modified herein.

2.15.5 Backflow Preventers

The requirements for backflow preventers are specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

2.15.6 Insulation

The requirements for shop and field applied insulation are specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.15.7 Controls

The requirements for controls are specified in [Section 23 05 93 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS][and][Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC][and][Section 23 09 53.00 20 SPACE TEMPERATURE CONTROL SYSTEMS].

2.16 RADIANT PANELS

2.16.1 Hydronic Modular Panels

2.16.1.1 Panels

Modular radiant panels will fit into a standard 600 mm x 600 mm or 600 mm x 1200 mm suspended T-Bar ceiling grid or flush mounted on a drywall ceiling. For flush mounted ceiling applications, the manufacturer will provide a one piece extruded aluminum frame. Panels shall be supported from the T-bar assembly. Panels shall be [14 gauge] or [16 gauge] extruded aluminum or sheet steel.

2.16.1.2 Heat Sink

The modular panels shall use extruded aluminum with integrated heat sinks on the back to transfer heat between copper tubes and the panel face.

2.16.1.3 Water Tubes

Tubes shall consist of JIS H 3300 [13 mm] [16 mm] O.D. nominal copper tubing. Water connections will be suitable for solder or compression fittings. Heat pads will be used between the soldered fitting and the panel to protect the panel surface. The manufacturer will provide water pressure drop data as well as heating output data derived from tests in accordance with JIS A 1400 (heating). The panels will have the capacity to have multiple passes with connections either on the [same end] or

[opposite ends], dependent on the number of passes.

2.16.1.4 Finish

All visible components shall be powder coated with highly emissive powder coat polyester paint for optimal radiative properties as well as durability and easy cleaning. Standard finish color shall be white.

2.16.1.5 Performance

Manufacturer will provide water pressure drop data as well as heat and cool output data derived from tests in accordance with JIS A 1400 (heating).

2.16.1.6 Capacity

Modular radiant panel capacity will be tested and certified by manufacturer in accordance with JIS A 1400 (heating) to meet the required performance. Should any performance rating, chilled or hot water supply temperature, water pressure drop, etc. deviate from the schedule, the manufacturer will submit the updated capacity. [The manufacturer will have factory testing facility available to perform performance test of units in accordance with said standard.]

2.16.1.7 Water Connections

Connections will be shipped sealed to limit the introduction of dust and dirt during shipping and construction.

2.16.1.8 Installation

Panels will be installed as recommended by the manufacturer.

2.16.1.9 Accessories

Stainless steel braded hoses, 300 mm or 450 mm long will be supplied with the panels.

The top of the heating and cooling panels shall be covered with 38 mm thick 16kg/m3 formaldehyde-free fiber glass insulation with a minimum R = 0.79 m2 deg C/W. The insulation shall be covered with a foil scrim kraft vapor barrier facing.

2.16.2 Hydronic Linear Panels

2.16.2.1 Panels

Linear radiant panels must use extruded aluminum with integrated heat sinks on the back to transfer heat between copper tubes and the panel face. The linear radiant panel is to radiate or absorb heat from or to the zone below. Panels must be [14 gauge] or [16 gauge] extruded aluminum.

2.16.2.2 Heat Sink

The modular panels must use extruded aluminum with integrated heat sinks on the back to transfer heat between copper tubes and the panel face.

2.16.2.3 Water Tubes

Tubes must consist of JIS H 3300 13 mm or 16mm O.D. nominal copper tubing. Water connections will be suitable for solder or compression fittings. The manufacturer will provide water pressure drop data as well as heating output data derived from tests in accordance with JIS A 1400 (heating).

2.16.2.4 Mounting

Units must be provided with mounting hardware as required for mounting in T-Bar applications or ceiling flush mounting. The manufacturer's standard hardware for mounting panels abutting each other must be submitted for approval.

2.16.2.5 Finish

All visible components must be powder coated with highly emissive powder coat polyester paint for optimal radiative properties as well as durability and easy cleaning. Standard finish color must be white.

2.16.2.6 Performance

Manufacturer must provide water pressure drop data as well as heat output data derived from tests in accordance with JIS A 1400(heating).

2.16.2.7 Capacity

Modular radiant panel capacity must be tested and certified by manufacturer in accordance with JIS A 1400(heating) to meet the required performance. Should any performance rating, chilled or hot water supply temperature, water pressure drop, etc. deviate from the schedule, the manufacturer must submit the updated capacity. The manufacturer must have factory testing facility available to perform performance test of units in accordance with said standard.

2.16.2.8 Water Connections

Connections will be shipped sealed to limit the introduction of dust and dirt during shipping and construction.

2.16.2.9 Accessories

Stainless steel braded hoses, 300 mm or 450 mm long will be supplied with the panels.

The top of the heating and cooling panels must be covered with 38 mm thick 16kg/m3 formaldehyde-free fiber glass insulation with a minimum R = 0.79 m2 deg C/W. The insulation must be covered with a foil scrim kraft vapor barrier facing.

2.16.3 Prefabricated Radiant-Heating Electric Panels

2.16.3.1 Description

Sheet metal enclosed panel with heating element suitable for [lay-in installation flush with T-bar ceiling grid] [or surface mounting] [or recessed mounting].

2.16.3.2 Panel

Minimum 0.7 mm thick, galvanized steel sheet back panel riveted to minimum 1.0 mm thick, galvanized steel sheet front panel with fused-on crystalline surface.

2.16.3.3 Heating Element

Powdered graphite sandwiched between sheets of electric insulation.

2.16.3.4 Electrical Connections

Nonheating, high-temperature, insulated-copper leads, factory connected to heating element.

2.16.3.5 Exposed-Side Panel Finish

[Apply silk-screened finish to match appearance of Architect selected acoustical ceiling tiles.] [Baked-enamel finish in color as selected by Architect.]

2.16.3.6 Surface-Mounting Trim

Sheet metal with baked-enamel finish in color as selected by Architect.

2.16.3.7 Wall Thermostat

Bimetal, sensing elements; with contacts suitable for [low] [line]-voltage circuit, and manually operated on-off switch with contactors, relays, and control transformers.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

a. Install materials and equipment in accordance with the requirements of the contract drawings and approved manufacturer's installation instructions. Accomplish installation by workers skilled in this type of work. Perform installation so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.

b. No installation is permitted to block or otherwise impede access to any existing machine or system. Install all hinged doors to swing open a minimum of 120 degrees. Provide an area in front of all access doors that clears a minimum of [910][_____] mm. In front of all access doors to electrical circuits, clear the area the minimum distance to energized circuits JIS HB 71 (Electrical-Safety Related work practices)and an additional [910][_____] mm.

c. Except as otherwise indicated, install emergency switches and alarms in conspicuous locations. Mount all indicators, to include gauges, meters, and alarms in order to be easily visible by people in the area.

3.2.1 Condensate Drain Lines

Provide water seals in the condensate drain from all [units]. Provide a depth of each seal of 50 mm plus 0.1 mm for each Pa, of the total static pressure rating of the unit to which the drain is connected. Provide water seals that are constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Provide pipe cap or plug cleanouts where indicated. Connect drains indicated to connect to the sanitary waste system using an indirect waste fitting. Insulate air conditioner drain lines as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.2.2 Equipment and Installation

Provide frames and supports for tanks, compressors, pumps, valves, air handling units, fans, coils, dampers, and other similar items requiring supports. Floor mount or ceiling hang air handling units as indicated. Anchor and fasten as detailed. Set floor-mounted equipment on not less than 150 mm concrete pads or curbs doweled in place unless otherwise indicated. Make concrete foundations heavy enough to minimize the intensity of the vibrations transmitted to the piping, duct work and the surrounding structure, as recommended in writing by the equipment manufacturer. In lieu of a concrete pad foundation, build a concrete pedestal block with isolators placed between the pedestal block and the floor. Make the concrete foundation or concrete pedestal block a mass not less than three times the weight of the components to be supported. Provide the lines connected to the pump mounted on pedestal blocks with flexible connectors. Submit foundation drawings as specified in paragraph DETAIL DRAWINGS. Provide concrete for foundations as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.2.3 Access Panels

Install access panels for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance of sufficient size, and locate them so that the concealed items are easily serviced and maintained or completely removed and replaced. Provide access panels as specified in Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS.

3.2.4 Flexible Duct

Install pre-insulated flexible duct in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Provide hangers, when required to suspend the duct, of the type recommended by the duct manufacturer and set at the intervals recommended.

3.2.5 Metal Ductwork

Install according to MLIT-M unless otherwise indicated. Install duct supports for sheet metal ductwork according to MLIT-M, unless otherwise specified. Do not use friction beam clamps indicated in MLIT-M. Anchor risers on high velocity ducts in the center of the vertical run to allow ends of riser to move due to thermal expansion. Erect supports on the risers that allow free vertical movement of the duct. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C-clamps are used, provide retainer

clips.

3.2.5.1 Underground Ductwork

Provide PVC plastisol coated galvanized steel underground ductwork with coating on interior and exterior surfaces and watertight joints. Install ductwork as indicated. Maximum burial depth is 2 m.

3.2.5.2 Radon Exhaust Ductwork

Perforate subslab suction piping where indicated. Install PVC joints.

3.2.5.3 Light Duty Corrosive Exhaust Ductwork

For light duty corrosive exhaust ductwork, use PVC plastisol coated galvanized steel with PVC coating on interior [surfaces][and exterior surfaces][and epoxy wash primer coating on exterior surfaces].

3.2.6 FRP Ductwork

Provide fibrous glass reinforced plastic ducting and related structures that conform to JIS A 4009. Provide flanged joints where indicated. Crevice-free butt lay-up joints are acceptable where flanged joints are not indicated. When ambient temperatures are lower than 10 degrees C, heat cure joints by exothermic reaction heat packs.

3.2.7 Kitchen Exhaust Ductwork

3.2.7.1 Ducts Conveying Smoke and Grease Laden Vapors

Provide ducts conveying smoke and grease laden vapors that conform to requirements of NFPA 96. Make seams, joints, penetrations, and duct-to-hood collar connections with a liquid tight continuous external weld. Provide duct material that is a [minimum 1.3 mm, Type 304L or 316L, stainless steel] [minimum 1.6 mm carbon steel]. [Include with duct construction an external perimeter angle sized in accordance with MLIT-M, except place welded joint reinforcement on maximum of 600 mm centers; continuously welded companion angle bolted flanged joints with flexible ceramic cloth gaskets where indicated; pitched to drain at low points; welded pipe coupling-plug drains at low points; welded fire protection and detergent cleaning penetration; steel framed, stud bolted, and flexible ceramic cloth gasketed cleaning access provisions where indicated. Make angles, pipe couplings, frames, bolts, etc., the same material as that specified for the duct unless indicated otherwise.]

3.2.7.2 Exposed Ductwork

Provide exposed ductwork that is fabricated from minimum 1.3 mm, Type 304L or 316L, stainless steel with continuously welded joints and seams. Pitch ducts to drain at hoods and low points indicated. Match surface finish to hoods.

3.2.7.3 Concealed Ducts Conveying Moisture Laden Air

Fabricate concealed ducts conveying moisture laden air from minimum [1.3 mm, Type 300 series, stainless steel] [1.6 mm, galvanized steel] [0.55 mm, tempered copper sheet]. Continuously weld, braze, or solder joints to be liquid tight. Pitch ducts to drain at points indicated. Make transitions to other metals liquid tight, companion angle bolted and gasketed.

3.2.7.4 Constraction

Ducts shall be constructed of and supported by carbon steel not less than 1.37 mm in thickness or stainless steel not less than 1.09 mm in thickness. All seams, joints, penetrations shall have external weld except duct-to-hood collar connections shall not require a liquidtight continuous external weld as required in NFPA 96.

3.2.7.5 Access Panels

On vertical ductwork where personnel entry is possible, access shall be provided at the top of the vertical riser to accommodate descent. Where personnel entry is not possible, adequate access for cleaning shall be provided on each floor. The exhaust duct shall have a slope downstream of the exhaust air. Access panels shall be of the same material and thickness as the duct. Access panels shall have a gasket or sealant that is rated for 815.6 celsius degrees (1500 F) and shall be greasetight. For hoods with dampers in the exhaust or supply collar, an access panel for cleaning and inspection shall be provided in the duct or the hood within 457 mm of the damper. Access panels shall be provided at the side or at the top of the duct, whichever is more accessible, and at changes of direction. Horizontal duct shall have access panels at 8 feet interval.

3.2.8 Acoustical Duct Lining

Apply lining in cut-to-size pieces attached to the interior of the duct with nonflammable fire resistant adhesive conforming to ASTM C916, Type I, and manufacture's reconnected material, NFPA 90A, UL 723, and ASTM E84. Provide top and bottom pieces that lap the side pieces and are secured with welded pins, adhered clips of metal, nylon, or high impact plastic, and speed washers or welding cup-head pins installed according to MLIT-M. Provide welded pins, cup-head pins, or adhered clips that do not distort the duct, burn through, nor mar the finish or the surface of the duct. Make pins and washers flush with the surfaces of the duct liner and seal all breaks and punctures of the duct liner coating with the nonflammable, fire resistant adhesive. Coat exposed edges of the liner at the duct ends and at other joints where the lining is subject to erosion with a heavy brush coat of the nonflammable, fire resistant adhesive, to prevent delamination of glass fibers. Apply duct liner to flat sheet metal prior to forming duct through the sheet metal brake. Additionally secure lining at the top and bottom surfaces of the duct by welded pins or adhered clips as specified for cut-to-size pieces. Other methods indicated in MLIT-M to obtain proper installation of duct liners in sheet metal ducts, including adhesives and fasteners, are acceptable.

3.2.9 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, perform temporary dust control protection. Protect the distribution system (supply and return) with temporary seal-offs at all inlets and outlets at the end of each day's work. Keep temporary protection in place until system is ready for startup.

3.2.10 Insulation

Provide thickness and application of insulation materials for ductwork, piping, and equipment according to Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Externally insulate outdoor air intake ducts and

plenums [up to the point where the outdoor air reaches the conditioning unit][or][up to the point where the outdoor air mixes with the return air stream].

3.2.11 Duct Test Holes

Provide holes with closures or threaded holes with plugs in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Plug insulated duct at the duct surface, patched over with insulation and then marked to indicate location of test hole if needed for future use.

3.2.12 Power Roof Ventilator Mounting

Provide foamed 13 mm thick, closed-cell, flexible elastomer insulation to cover width of roof curb mounting flange. Where wood nailers are used, predrill holes for fasteners.

3.2.13 Power Transmission Components Adjustment

Test V-belts and sheaves for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Uniformly load belts on drive side to prevent bouncing. Make alignment of direct driven couplings to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.3 EQUIPMENT PADS

Provide equipment pads to the dimensions shown or, if not shown, to conform to the shape of each piece of equipment served with a minimum 75 mm margin around the equipment and supports. Allow equipment bases and foundations, when constructed of concrete or grout, to cure a minimum of [28][14][_____] calendar days before being loaded.

3.4 CUTTING AND PATCHING

Install work in such a manner and at such time that a minimum of cutting and patching of the building structure is required. Make holes in exposed locations, in or through existing floors, by drilling and smooth by sanding. Use of a jackhammer is permitted only where specifically approved. Make holes through masonry walls to accommodate sleeves with an iron pipe masonry core saw.

3.5 CLEANING

Thoroughly clean surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within the building structure. Before final acceptance, clean mechanical equipment, including piping, ducting, and fixtures, and free from dirt, grease, and finger marks. When the work area is in an occupied space such as office, laboratory or warehouse [_____] protect all furniture and equipment from dirt and debris. Incorporate housekeeping for field construction work which leaves all furniture and equipment in the affected area free of construction generated dust and debris; and, all floor surfaces vacuum-swept clean.

3.6 PENETRATIONS

Provide sleeves and prepared openings for duct mains, branches, and other penetrating items, and install during the construction of the surface to be penetrated. Cut sleeves flush with each surface. Place sleeves for round duct 380 mm and smaller. Build framed, prepared openings for round duct larger than 380 mm and square, rectangular or oval ducts. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Provide 25 mm clearance between penetrating and penetrated surfaces except at grilles, registers, and diffusers. Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber conforming with JIS A 9504, Type 1, Class B-2.

3.6.1 Sleeves

Fabricate sleeves, except as otherwise specified or indicated, from 1 mm thick mill galvanized sheet metal. Where sleeves are installed in bearing walls or partitions, provide black steel pipe conforming with JIS G 3452, Schedule 20.

3.6.2 Framed Prepared Openings

Fabricate framed prepared openings from 1 mm galvanized steel, unless otherwise indicated.

3.6.3 Insulation

Provide duct insulation in accordance with Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS continuous through sleeves and prepared openings except firewall penetrations. Terminate duct insulation at fire dampers and flexible connections. For duct handling air at or below 16 degrees C, provide insulation continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air.

3.6.4 Closure Collars

Provide closure collars of a minimum 100 mm wide, unless otherwise indicated, for exposed ducts and items on each side of penetrated surface, except where equipment is installed. Install collar tight against the surface and fit snugly around the duct or insulation. Grind sharp edges smooth to prevent damage to penetrating surface. Fabricate collars for round ducts 380 mm in diameter or less from 1 mm galvanized steel. Fabricate collars for square and rectangular ducts, or round ducts with minimum dimension over 380 mm from 1.40 mm galvanized steel. Fabricate collars for square and rectangular ducts with a maximum side of 380 mm or less from 1 mm galvanized steel. Install collars with fasteners a maximum of 150 mm on center. Attach to collars a minimum of 4 fasteners where the opening is 300 mm in diameter or less, and a minimum of 8 fasteners where the opening is 500 mm in diameter or less.

3.6.5 Firestopping

Where ducts pass through fire-rated walls, fire partitions, and fire rated chase walls, seal the penetration with fire stopping materials as specified in Section 07 84 00 FIRESTOPPING.

3.7 FIELD PAINTING OF MECHANICAL EQUIPMENT

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except clean to bare metal on metal surfaces subject to temperatures in excess of 50 degrees C. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Provide aluminum or light gray finish coat.

3.7.1 Temperatures less than 50 degrees C

Immediately after cleaning, apply one coat of pretreatment primer applied to a minimum dry film thickness of 0.0076 mm, one coat of primer applied to a minimum dry film thickness of 0.0255 mm; and two coats of enamel applied to a minimum dry film thickness of 0.0255 mm per coat to metal surfaces subject to temperatures less than 50 degrees C.

3.7.2 Temperatures between 50 and 205 degrees C

Apply two coats of 205 degrees C heat-resisting enamel applied to a total minimum thickness of 0.05 mm to metal surfaces subject to temperatures between 50 and 205 degrees C.

3.7.3 Temperatures greater than 205 degrees C

Apply two coats of heat-resisting paint applied to a total minimum dry film thickness of 0.05 mm to metal surfaces subject to temperatures greater than 205 degrees C.

3.7.4 Finish Painting

The requirements for finish painting of items only primed at the factory, and surfaces not specifically noted otherwise, are specified in Section 09 90 00 PAINTS AND COATINGS.

3.7.5 Color Coding Scheme for Locating Hidden Utility Components

Use scheme in buildings having suspended grid ceilings. Provide color coding scheme that identifies points of access for maintenance and operation of components and equipment that are not visible from the finished space and are accessible from the ceiling grid, consisting of a color code board and colored metal disks. Make each colored metal disk approximately 13 mm diameter and secure to removable ceiling panels with fasteners. Insert each fastener into the ceiling panel so as to be concealed from view. Provide fasteners that are manually removable without the use of tools and that do not separate from the ceiling panels when the panels are dropped from ceiling height. Make installation of colored metal disks follow completion of the finished surface on which the disks are to be fastened. Provide color code board that is approximately 1 m wide, 750 mm high, and 13 mm thick. Make the board of wood fiberboard and frame under glass or 1.6 mm transparent plastic cover. Make the color code symbols approximately 19 mm in diameter and the related lettering in 13 mm high capital letters. Mount the color code board [where indicated] [in the mechanical or equipment room]. Make the color code system as indicated below:

Color	System	Item	Location
[_____]	[_____]	[_____]	[_____]

3.8 IDENTIFICATION SYSTEMS

Provide identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and item number on all valves and dampers. Provide tags that are 35 mm minimum diameter with stamped or engraved markings. Make indentations black for reading clarity. Attach tags to valves with No. 12 AWG 2 mm diameter corrosion-resistant steel wire, copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

3.9 DUCTWORK LEAK TEST

Perform ductwork leak test for the entire air distribution and exhaust system, including fans, coils, [filters, etc.][filters, etc. designated as static pressure Class 750 Pa through Class 2500 Pa.] Provide test procedure, apparatus, and report that conform to JIS Z 2330. The maximum allowable leakage rate is [_____] L/s. Complete ductwork leak test with satisfactory results prior to applying insulation to ductwork exterior or concealing ductwork.

3.10 DUCTWORK LEAK TESTS

The requirements for ductwork leak tests are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

3.11 DAMPER ACCEPTANCE TEST

Submit the proposed schedule, at least 2 weeks prior to the start of test. Operate all fire dampers and smoke dampers under normal operating conditions, prior to the occupancy of a building to determine that they function properly. Test each fire damper equipped with fusible link by having the fusible link cut in place. Test dynamic fire dampers with the air handling and distribution system running. Reset all fire dampers with the fusible links replaced after acceptance testing. To ensure optimum operation and performance, install the damper so it is square and free from racking.

3.12 TESTING, ADJUSTING, AND BALANCING

The requirements for testing, adjusting, and balancing are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC. Begin testing, adjusting, and balancing only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.13 PERFORMANCE TESTS

After testing, adjusting, and balancing is complete as specified, test each system as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Record the testing during the applicable season. Make corrections and adjustments as necessary to produce the conditions indicated or specified. Conduct capacity tests and general

operating tests by an experienced engineer. Provide tests that cover a period of not less than [_____] days for each system and demonstrate that the entire system is functioning according to the specifications. Make coincidental chart recordings at points indicated on the drawings for the duration of the time period and record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

Submit test reports for the [ductwork leak test, and] performance tests in booklet form, upon completion of testing. Document phases of tests performed including initial test summary, repairs/adjustments made, and final test results in the reports.

3.14 CLEANING AND ADJUSTING

Provide a temporary bypass for water coils to prevent flushing water from passing through coils. Inside of [room fan-coil units][coil-induction units,] [air terminal units,] [unit ventilators,] thoroughly clean ducts, plenums, and casing of debris and blow free of small particles of rubbish and dust and then vacuum clean before installing outlet faces. Wipe equipment clean, with no traces of oil, dust, dirt, or paint spots. Provide temporary filters prior to startup of all fans that are operated during construction, and provide new filters after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. Perform and document that proper "Indoor Air Quality During Construction" procedures have been followed; provide documentation showing that after construction ends, and prior to occupancy, new filters were provided and installed. Maintain system in this clean condition until final acceptance. Properly lubricate bearings with oil or grease as recommended by the manufacturer. Tighten belts to proper tension. Adjust control valves and other miscellaneous equipment requiring adjustment to setting indicated or directed. Adjust fans to the speed indicated by the manufacturer to meet specified conditions. Maintain all equipment installed under the contract until close out documentation is received, the project is completed and the building has been documented as beneficially occupied.

3.15 RADIANT PANELS

3.15.1 Installation

Install radiant panels level and plumb, maintaining sufficient clearance for normal services and maintenance.

3.15.2 Soldering

When soldering copper fittings at the panel, a heat pad will be used to protect the panel finish.

3.15.3 Connections

Install piping adjacent to radiant panels to allow for service and maintenance.

3.16 OPERATION AND MAINTENANCE

3.16.1 Operation and Maintenance Manuals

Submit [six] [_____] manuals at least 2 weeks prior to field training. Submit data complying with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA. Submit Data Package 3 for the items/units listed under SD-10 Operation and Maintenance Data

3.16.2 Operation And Maintenance Training

Conduct a training course for the members of the operating staff as designated by the Contracting Officer. Make the training period consist of a total of [_____] hours of normal working time and start it after all work specified herein is functionally completed and the Performance Tests have been approved. Conduct field instruction that covers all of the items contained in the Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations. Submit the proposed On-site Training schedule concurrently with the Operation and Maintenance Manuals and at least 14 days prior to conducting the training course.

-- End of Section --

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SECTION 23 64 10

WATER CHILLERS, VAPOR COMPRESSION TYPE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 1518	(2013) Rolling Bearings-Dynamic Load Ratings and Rating Life
JIS B 1521	(2012) Rolling Bearings-Deep Groove Ball Bearings
JIS B 1534	(2013) Rolling Bearings-Tapered Roller Bearings
JIS B 6801	(2003) Manual Blowpipes for Welding, Cutting and Heating
JIS B 8608	(1994) Refrigerating Systems-Test Methods-General Requirements
JIS B 8267	(2015) Construction of Pressure Vessel
JIS B 8613	(1994) Water Chilling Unit
JIS B 8623	(2002) Testing Methods of Refrigerant Condensing Units
JIS C 4212	(2010) Low-Voltage Three-Phase Squirrel-Cage High-Efficiency Induction Motors (Amendment 1)
JIS F 0602	(1995) Shipbuilding-Non-Asbestos Gaskets to Cargo Piping System-Application Standard
JIS G 3101	(2017) Rolled Steels for General Structure (Amendment 1)
JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS H 8641	(2007) Hot Dip Galvanized Coatings

JIS Z 2371 (2015) Methods of Salt Spray Testing

MLIT MECHANICAL STANDARD SPECIFICATION

MLIT-M (2019) Public Building Construction Standard Specification

THE JAPAN REFRIGERATION AND AIR CONDITIONING INDUSTRY ASSOCIATION (JRAIA)

JRA JRA Standard

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval or for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Water Chiller; G

Water Chiller - Field Acceptance Test Plan

SD-06 Test Reports

Field Acceptance Testing

Water Chiller - Field Acceptance Test Report

System Performance Tests

SD-07 Certificates

Refrigeration System;

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

1.3 CERTIFICATIONS

1.3.1 Ozone Depleting Substances Technician Certification

All technicians working on equipment that contain ozone depleting refrigerants must be certified Technician to meet requirements in Refrigerant Handling Technician (Reibai-Furonrui-Toriatsukai Gijutsusha) under Japan Refrigeration and Air-Conditioning Industry Association. Provide copies of technician certifications to the Contracting Officer at least 14 calendar days prior to work on any equipment containing these refrigerants.

1.4 SAFETY REQUIREMENTS

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to

operating personnel must be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices must be installed so that proper operation of equipment is not impaired. Welding and cutting safety requirements must be in accordance with JIS B 6801.

1.5 DELIVERY, STORAGE, AND HANDLING

Stored items must be protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation will be the Contractor's responsibility. Any materials found to be damaged must be replaced at the Contractor's expense. During installation, piping and similar openings must be capped to keep out dirt and other foreign matter.

1.6 PROJECT REQUIREMENTS

1.6.1 Verification of Dimensions

The Contractor must become familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

Materials and equipment will be standard Commercial cataloged products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. These products must have a two year record of satisfactory field service prior to bid opening. The two year record of service must include applications of equipment and materials under similar circumstances and of similar size. Products having less than a two year record of satisfactory field service will be acceptable if a certified record of satisfactory field service for not less than 6000 hours can be shown. The 6000 hour service record must not include any manufacturer's prototype or factory testing. Satisfactory field service must have been completed by a product that has been, and presently is being sold or offered for sale on the commercial market through the following copyrighted means: advertisements, manufacturer's catalogs, or brochures. Equivalent shall be supported by a product representative and service organization located in Japan

2.2 MANUFACTURER'S STANDARD NAMEPLATES

[Major equipment including chillers, compressors, compressor drivers, condensers, water coolers, receivers, refrigerant leak detectors, heat exchanges, fans, and motors must have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment. Plates must be durable and legible throughout equipment life. Plates must be fixed in prominent locations with nonferrous screws or bolts.]

[Nameplates are required on major components if the manufacturer needs to provide specific engineering and manufacturing information pertaining to the particular component. Should replacement of this component be required, nameplate information will insure correct operation of the unit after replacement of this component.]

2.3 ELECTRICAL WORK

a. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown, must be provided. For packaged equipment, the manufacturer must provide controllers including the required monitors and timed restart.

b. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with JIS C 4212.

c. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system, and that meet the efficiency ratings for premium efficiency motors in accordance with JIS C 4212.

d. Provide motors in accordance with JIS C 4212 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Motors must be rated for continuous duty with the enclosure specified. Motor duty requirements must allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque must be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. [Motor bearings must be fitted with grease supply fittings and grease relief to outside of the enclosure.] Motor enclosure type may be either TEAO or TEFC.

2.4 SELF-CONTAINED WATER CHILLERS, VAPOR COMPRESSION TYPE

Unless necessary for delivery purposes, units must be assembled, leak-tested, charged (refrigerant and oil), and adjusted at the factory. In lieu of delivery constraints, a chiller may be assembled, leak-tested, charged (refrigerant and oil), and adjusted at the job site by a factory representative. Unit components delivered separately must be sealed and charged with a nitrogen holding charge. Parts weighing 23 kg or more which must be removed for inspection, cleaning, or repair, such as motors, gear boxes, cylinder heads, casing tops, condenser, and cooler heads, must have lifting eyes or lugs. Chiller must be provided with a single point wiring connection for incoming power supply. Chiller's condenser and water cooler must be provided with [standard] water boxes with [grooved mechanical] [flanged] [welded] connections.

2.4.1 Scroll, Reciprocating, or Rotary Screw Type

Chiller must be certified for performance per JIS B 8613. The chiller's performance must be rated in accordance with JIS B 8613. Chiller must conform to Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku). As a minimum, chiller must include the following components as defined in paragraph CHILLER COMPONENTS.

a. Refrigerant and oil

b. Structural base

c. Chiller refrigerant circuit

d. Controls package

e. Scroll, reciprocating, or rotary screw compressor

f. Compressor driver, [electric motor] [gas-engine]

g. Compressor driver connection

h. Water cooler (evaporator)

i. [Air][Water]-cooled condenser coil

j. Heat recovery condenser

k. Receiver

l. Tools

2.4.2 Centrifugal or Rotary Screw Type

Chiller must be certified for performance per JIS B 8613. The chiller's performance must be rated in accordance with JIS B 8613. Chiller must conform to Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku). As a minimum, chiller must include the following components as defined in paragraph CHILLER COMPONENTS.

a. Refrigerant and oil

b. Structural base

c. Chiller refrigerant circuit

d. Controls package

e. Centrifugal or rotary screw compressor

f. Compressor driver, [electric motor] [gas-engine] [steam turbine]

g. Compressor driver connection

h. Water cooler (evaporator)

i. [Air][Water]-cooled condenser coil

j. Heat recovery condenser coil

k. Receiver

l. Purge system for chillers which operate below atmospheric pressure

m. Tools

2.5 SPLIT-SYSTEM WATER CHILLER, VAPOR COMPRESSION TYPE

Total chiller system must be certified for performance per JIS B 8613. Individual chiller components must be constructed and rated in accordance with the applicable JRA standards. Chiller system must conform to Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku). The construction of chiller must be MLIT-M compliant. The manufacturer must provide certification of compliance. Chiller must be assembled, leak-tested, charged (refrigerant and oil), and adjusted at the job site in strict accordance with manufacturer's recommendations. Unit assembly must be completed in strict accordance with manufacturer's recommendations. Chiller must operate within capacity range and speed recommended by the manufacturer. Parts weighing 23 kg or more which must be removed for inspection, cleaning, or repair, must have lifting eyes or lugs. Chiller must include all customary auxiliaries deemed necessary by the manufacturer for safe, controlled, automatic operation of the equipment. Chiller's water cooler must be provided with [standard] [marine] water boxes with [grooved mechanical] [flanged] [welded] connections. Chillers must operate at partial load conditions without increased vibration over normal vibration at full load, and must be capable of continuous operation down to minimum capacity. As a minimum, chiller must include the following components as defined in paragraph CHILLER COMPONENTS.

a. Refrigerant and oil

b. Structural base

c. Chiller refrigerant circuit

d. Controls package

e. Receiver

f. Tools

2.5.1 Compressor-Chiller Unit

As a minimum, the compressor-chiller unit must include the following components as defined in paragraph CHILLER COMPONENTS.

a. Scroll, reciprocating, or rotary screw compressor

b. Compressor driver, electric motor

c. Compressor driver connection

d. Water cooler (evaporator)

2.5.2 Condensing Unit

As a minimum, the condensing unit must include the following components as defined in paragraph CHILLER COMPONENTS.

a. Scroll, reciprocating, or rotary screw compressor

b. Compressor driver, electric motor

c. Compressor driver connection

d. Air or water cooled condenser

2.5.3 Remote Air-Cooled Condenser

Condenser must be a factory-fabricated and assembled unit, consisting of coils, fans, and condenser fan motors. Condenser must be rated in accordance with JIS B 8623. [Unless the condenser coil is completely protected through inherent design, louvered panel coil guards must be provided by the manufacturer to prevent physical damage to the coil.] Manufacturer must certify that the condenser and associated equipment are designed for the submitted condensing temperature. For design conditions, if matched combination catalog ratings matching remote condensers to compressors are not available, the Contractor must furnish a crossplotting of the gross heat rejection of the condenser against the gross heat rejection of the compressor, for the design conditions to show the compatibility of the equipment furnished.

2.5.3.1 Condenser Casing

Condenser casing must be aluminum not less than [1.016] [2.032] mm or hot-dip galvanized steel not lighter than 18 gauge 1.311 mm or JIS G 3302. [Condensers having horizontal air discharge must be provided with discharge baffle to direct air upward, constructed of the same material and thickness as the casing].

2.5.3.2 Coil

[Condenser coil must be of the extended-surface fin-and-tube type and must be constructed of seamless [copper] [or] tubes with compatible [copper] [or] [aluminum] fins. Fins must be soldered or mechanically bonded to the tubes and installed in a metal casing. Coils must be circuited and sized for a minimum of 3 degrees C subcooling and full pumpdown capacity. Coil must be factory leak and pressure tested after assembly in accordance with or in Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku) for Japanese Standard product][The condenser coil must be of the microchannel heat exchanger technology (MCHX) type consisting of a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds in a two-pass arrangement. Provide coils constructed of aluminum alloys for fins, tubes, and manifolds. Coil must be factory leak and pressure tested after assembly in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku) for Japanese product.]

Coil must be entirely coated in accordance with the requirements of paragraph COIL CORROSION PROTECTION.

2.5.3.3 Fans

Provide propeller type fans as best suited for the application. Fans must be direct. Fans must be statically and dynamically balanced.

2.5.3.4 Condenser Sizing

Size condensers for full capacity at 16.67 degrees C temperature difference between entering outside air and condensing refrigerant. Subcooling must not be considered in determining compressor and condenser capacities. For design conditions, submit a cross-plot of net refrigeration effect of compressor to establish net refrigeration effect

and compatibility or JIS B 8608 of equipment furnished.

2.5.3.5 Low Ambient Control

Provide factory mounted head pressure control for operation during low ambient conditions. Head pressure must be controlled by [fan cycling,] [fan speed control,]. Low ambient control must permit compressor operation below[4.4 degrees C][[_____] degrees C].

2.5.3.6 High Ambient Unloading

Provide unloading capability to allow operation in high ambient conditions [[_____] degrees C] above design conditions.

2.5.4 Remote Water-Cooled Condenser

Condenser must be a factory-fabricated and assembled unit constructed and rated in accordance with JIS B 8623. Condenser may be of either the shell-and-coil or shell-and-tube type design. Condenser's refrigerant side must be designed and factory pressure tested to comply with in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku) for Japanese standard. Condenser's water side must be designed and factory pressure tested. Condensers must be complete with pressure relief valve or rupture disk, water drain connections, refrigerant charging valve, refrigerant valves, liquid-level indicating devices, and stand or saddle. Low pressure refrigerant condenser must be provided with a purge valve located at the highest point in the condenser to purge non-condensibles trapped in the condenser. Condenser shell must be constructed of seamless or welded steel. Coil bundles must be totally removable and arranged to drain completely. Tubes may be either seamless copper, plain, integrally finned with smooth bore or integrally finned with enhanced bore. Each tube must be individually replaceable, except for the coaxial tubes. Tubes must be installed into carbon mild steel tube sheets by rolling. Tube baffles must be properly spaced to provide adequate tube support and cross flow. Condenser performance must be based on water velocities per JIS B 8623 and a fouling factor per JIS B 8613. Water-cooled condensers may be used for refrigerant storage in lieu of a separate liquid receiver, if the condenser storage capacity is 20 percent in excess of the fully charged system for remote water cooled condensers. As a minimum, the condenser must include the following components as defined in paragraph CHILLER COMPONENTS.

a. Liquid-level indicating devices.

b. Companion flanges, bolts, and gaskets for flanged water connections.

2.6 CHILLER COMPONENTS

2.6.1 Refrigerant and Oil

Refrigerants must be one of the fluorocarbon gases. Refrigerants must have number designations and safety classifications in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku) for Japanese standard. CFC-based refrigerants are prohibited. Refrigerants must have an Ozone Depletion Potential (ODP) no greater than 0.0, with the exception of R-123. Provide SDS sheets for all refrigerants.

2.6.2 Structural Base

Chiller and individual chiller components must be provided with a factory-mounted structural steel base (welded or bolted) or support legs. Chiller and individual chiller components must be isolated from the building structure by means of [molded neoprene isolation pads.] [vibration isolators with published load ratings. Vibration isolators must have isolation characteristics as recommended by the manufacturer for the unit supplied and the service intended.]

2.6.3 Chiller Refrigerant Circuit

Chiller refrigerant circuit must be completely piped and factory leak tested in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku) for Japanese standard. [For multicompressor units, not less than 2 independent refrigerant circuits must be provided.]Circuit must include as a minimum a [combination filter and drier,] combination sight glass and moisture indicator, an electronic or thermostatic expansion valve with external equalizer or float valve, charging ports, compressor service valves for field-serviceable compressors, and superheat adjustment.

2.6.4 Controls Package

Provide chillers with a complete [factory-mounted] [remote-mounted where indicated], microprocessor based operating and safety control system. Controls package must contain as a minimum a digital display, an on-auto-off switch, [motor starters,] [variable frequency motor controller,] [disconnect switches,] power wiring, and control wiring. Controls package must provide operating controls, monitoring capabilities, programmable setpoints, safety controls, and [BAS] [UMCS] interfaces as defined below.

2.6.4.1 Operating Controls

Chiller must be provided with the following adjustable operating controls as a minimum.

a. Leaving chilled water temperature control

b. Adjustable timer or automated controls to prevent a compressor from short cycling

c. Automatic lead/lag controls (adjustable) for multi-compressor units

d. Load limiting

e. System capacity control to adjust the unit capacity in accordance with the system load and the programmable setpoints. Controls must automatically re-cycle the chiller on power interruption.

f. Startup and head pressure controls to allow system operation at all ambient temperatures down to [_____] degrees C.

[g. Fan sequencing for air-cooled condenser

]2.6.4.2 Monitoring Capabilities

During normal operations, the control system must be capable of monitoring

and displaying the following operating parameters. Access and operation of display must not require opening or removing any panels or doors.

a. Entering and leaving chilled water temperatures

b. [Entering and leaving chilled water pressure][Chilled water flow]

c. [Entering and leaving condenser water pressure][Condenser water flow]

d. Self diagnostic

e. Operation status

f. Operating hours

g. Number of starts

h. Compressor status (on or off)

i. Compressor load (percent)

j. Refrigerant discharge and suction pressures

k. Magnetic bearing levitation status (if applicable)

l. Magnetic bearing temperatures (if applicable)

m. Oil pressure

n. Condenser water entering and leaving temperatures

o. Number of purge cycles over the last 7 days

2.6.4.3 Configurable Setpoints

The control system must be capable of being configured directly at the unit's interface panel. [No parameters may be capable of being changed without first entering a security access code.] The programmable setpoints must include the following as a minimum:

a. Leaving Chilled Water Temperature

b. Leaving Condenser Water Temperature

c. Time Clock/Calendar Date

2.6.4.4 Safety Controls with Manual Reset

Chiller must be provided with the following safety controls which automatically shutdown the chiller and which require manual reset.

a. Low chilled water temperature protection

b. High condenser refrigerant discharge pressure protection

c. Low evaporator pressure protection

d. Chilled water flow detection

e. High motor winding temperature protection

f. Low oil flow protection if applicable

g. Magnetic bearing controller (MBC), Internal fault (if applicable)

h. MBC, High bearing temperature (if applicable)

i. MBC, Communication fault (if applicable)

j. MBC, Power supply fault (if applicable)

k. Motor current overload and phase loss protection

2.6.4.5 Safety Controls with Automatic Reset

Chiller must be provided with the following safety controls which automatically shutdown the chiller and which provide automatic reset.

a. Over/under voltage protection

b. Chilled water flow interlock

c. MBC, Vibration (if applicable)

d. MBC, No levitation (if applicable)

e. Phase reversal protection

2.6.4.6 Remote Alarm

During the initiation of a safety shutdown, a chiller's control system must be capable of activating a remote alarm bell. In coordination with the chiller, the Contractor must provide an alarm circuit (including transformer if applicable) and a minimum 100 mm diameter alarm bell. Alarm circuit must activate bell in the event of machine shutdown due to the chiller's monitoring of safety controls. The alarm bell must not sound for a chiller that uses low-pressure cutout as an operating control.

2.6.4.7 Utility Monitoring and Control System Interface

Provide a Utility Monitoring and Control System (UMCS) interface meeting the requirements of Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC and the requirements of [Section 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS] [or] [Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS]. The interface must provide all system operating conditions, capacity controls, and safety shutdown conditions as network points. In addition, the following points must be overridable via the network interface:

a. Unit Start/Stop

b. Leaving Chilled Water Temperature Setpoint

c. Leaving Condenser Water Temperature Setpoint

2.6.5 Compressor(s)

2.6.5.1 Scroll Compressor(s)

Compressors must be of the hermetically sealed design. Compressors must be mounted on vibration isolators to minimize vibration and noise. Rotating parts must be statically and dynamically balanced at the factory to minimize vibration. Lubrication system must be centrifugal pump type equipped with a means for determining oil level and an oil charging valve. Crankcase oil heater must be provided.[Provide continuous compressor unloading to [10 percent][15 percent] of full-load capacity by way of variable speed compressor motor controller or variable unloading of the scroll.]

2.6.5.2 Rotary Screw Compressor(s)

Compressors must operate stably for indefinite time periods to at least 25 percent capacity reduction without gas bypass external to the compressor. Provision must be made to insure proper lubrication of bearings and shaft seals on shutdown with or without electric power supply. Rotary screw compressors must include:

a. An open or hermetic, positive displacement, oil-injected design directly driven by the compressor driver. Allow access to internal compressor components for repairs, inspection, and replacement of parts.

b. Rotors must be solid steel, possessing sufficient rigidity for proper operation.

c. A maximum rotor operating speed no greater than 3600 RPM. Provide cast iron rotor housing.

d. Casings of cast iron, precision machined for minimal clearance about periphery of rotors with minimal clearance at rotor tops and rotor ends.

e. A lubrication system of the forced-feed type that provides oil at the proper pressure to all parts requiring lubrication.

f. Bearing housing must be conservatively loaded and rated for an L(10) life of not less than the requirement of JIS B 1518. Shaft main bearings of the sleeve type with heavy duty bushings or rolling element type in accordance with JIS B 1521, JIS B 1534.

g. A differential oil pressure or flow cutout to allow the compressor to operate only when the required oil pressure or flow is provided to the bearings.

h. [A temperature- or pressure-initiated, hydraulically actuated, single-slide-valve, capacity-control system to provide minimum automatic capacity modulation from 100 percent to 15 percent.] [Use a Variable Frequency Drive (VFD) to modulate capacity modulation from 100 percent to 15 percent.]

i. An oil separator and oil return system to remove oil entrained in the refrigerant gas and automatically return the oil to the compressor.

j. Crankcase oil heaters must be provided.

2.6.5.3 Centrifugal Compressor(s)

Centrifugal compressors may be either single or multistage, having dynamically balanced impellers, either direct or gear driven by the compressor driver. Impellers must be over-speed tested at 1.2 times the impeller-shaft speed. Impeller shaft must be steel with sufficient rigidity for proper operation at any required operating speed. Compressors must be capable of variable speed operation and may have either oil-free bearing drives or oil-lubricated bearing drives. Centrifugal compressors must include:

a. Shaft main bearings that are either oil lubricated, oil free ceramic or magnetic levitated. The oil lubricated bearings must be the rolling element type in accordance with JIS B 1521 JIS B 1534, journal type with bronze or babbitt liners, or of the aluminum-alloy one-piece insert type. Oil lubricated or oil free ceramic bearings must be rated for an L(10) life of not less than the JIS B 1518 requirement. Magnetic levitated main shaft bearings must be in accordance with ISO 14839-1, ISO 14839-2, ISO 14839-3, ISO 14839-4, and provided with radial and axial magnetic levitated bearings (combination permanent and electro magnets) to levitate the shaft thereby eliminating metal to metal contact and thus eliminating the need for oil. The active magnetic bearings must be equipped with an automatic vibration reduction and balancing system. Each bearing position must be sensed by position sensors and provide real time positioning of the rotor shaft, controlled by on-board digital electronics. In the event of a power failure, the magnetic bearings will remain in operation throughout the compressor coast-down using a reserve power supply. Provide mechanical bearings designed for emergency touchdowns, as a backup to the magnetic bearings.

b. Casing of cast iron, aluminum, or steel plate with split sections gasketed and bolted or clamped together.

c. Lubrication system of the forced-feed type that provides oil at the proper pressure to all parts requiring lubrication.

d. Provisions to ensure proper lubrication of bearings and shaft seals prior to starting and upon stopping with or without electric power supply (if applicable). On units providing forced-feed lubrication prior to starting, a differential oil pressure cutout interlocked with the compressor starting equipment must allow the compressor to operate only when the required oil pressure is provided to the bearings (if applicable).

e. Oil sump heaters controlled as recommended by the manufacturer.

f. Temperature-or pressure-actuated prerotation vane, variable geometry diffuser or suction damper to provide automatic capacity modulation from 100 percent capacity to 25 percent capacity. If operation to 25 percent capacity cannot be achieved without providing gas bypass external to the compressor, then the Contractor must indicate in the equipment submittal the load percent at which external hot gas bypass is required to prevent surge and to provide the specified capacity reduction and its impact on performance.

2.6.6 Compressor Driver, Electric Motor

Components such as motors, [starters], [variable speed drives] and wiring must be in accordance with paragraph ELECTRICAL WORK. [Motor starter][Variable frequency drive] must be [unit mounted] [remote mounted] as indicated with [starter][variable frequency drive] type, wiring, and accessories coordinated with the chiller manufacturer.

2.6.7 Compressor Driver Connections

[Each compressor must be driven by a V-belt drive or direct connected through a flexible coupling, except that flexible coupling is not required on hermetic units. V-belt drives must be designed for not less than 150 percent of the driving motor capacity. Flexible couplings must be of the type that does not require lubrication.] [Each machine driven through speed-increasing gears must be so designed as to assure self-alignment, interchangeable parts, proper lubrication system, and minimum unbalanced forces. Bearings must be of the sleeve or roller type. Gear cases must be oil tight. Shaft extensions must be provided with seals to retain oil and exclude all dust.

]2.6.8 Water Cooler (Evaporator)

Cooler must be of the shell-and-coil or shell-and-tube type design. Cooler shell must be constructed of seamless or welded steel. Coil bundles must be totally removable and arranged to drain completely. Tubes must be seamless copper, plain, integrally finned with smooth bore or integrally finned with enhanced bore. Each tube must be individually replaceable. Tubes must be installed into carbon mild steel tube sheets by rolling. Tube baffles must be properly spaced to provide adequate tube support and cross flow. Performance must be based on a water velocity not less than0.91 m/s nor more than 3.7 m/s and a fouling factor per JIS B 8613.

Brazed plate heat exchanger must be constructed of 304 or 316 stainless steel, designed to a refrigerant-side working pressure of 3,000 kPa and a waterside working pressure of 1,000 kPa. Evaporator must be factory tested at 1.1 times maximum allowable refrigerant side working pressure and 1.5 times maximum allowable water side working pressure. Provide cooler heaters to protect the evaporator to an ambient ofminus 29 degrees C. Provide cooler with factory-installed flow switches. All water connections must use either flanged or grooved-pipe connections. Factory insulate all cold surfaces.

2.6.9 Air-Cooled Condenser Coil

[Condenser coil must be of the extended-surface fin-and-tube type and must be constructed of seamless [copper] [or] [aluminum] tubes with compatible [copper] [or] [aluminum] fins. Fins must be soldered or mechanically bonded to the tubes and installed in a metal casing. Coils must be circuited and sized for a minimum of 3 degrees C subcooling and full pumpdown capacity. Coil must be factory leak and pressure tested after assembly in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku).][The condenser coil must be of the microchannel heat exchanger technology (MCHX) type consisting of a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds in a two-pass arrangement. Provide coils constructed of aluminum alloys for fins, tubes, and manifolds. Coil must be factory leak and pressure tested after assembly in accordance with Japanese Refrigeration Safety Regulations

(Nihon-Reitou-Hoan-Kisoku).]

Coil must be entirely coated in accordance with the requirements of paragraph COIL CORROSION PROTECTION.

2.6.10 Water-Cooled Condenser Coil

Condenser must be of the shell-and-coil or shell-and-tube type design. Condenser's refrigerant side must be designed and factory pressure tested to comply with in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku). Condenser's water side must be designed and factory pressure tested for not less than [1,000] [1,700] [2000] kPa. Condensers must be complete with refrigerant relief valve/rupture disc assembly, water drain connections, and refrigerant charging valve. Low pressure refrigerant condenser must be provided with a purging device to purge non-condensibles trapped in the condenser while keeping refrigerant emissions below requirements of MLIT-M. Purge units must be certified per MLIT-M. Condenser shell must be constructed of seamless or welded steel. Coil bundles must be totally removable and arranged to drain completely. Tubes must be seamless copper, plain, integrally finned with smooth bore or integrally finned with enhanced bore. Each tube must be individually replaceable, except for the coaxial tubes. Tube baffles must be properly spaced to provide adequate tube support and cross flow. Performance must be based on water velocities not less than 0.91 m/s nor more than 3.7 m/s and a fouling factor per JIS B 8613. Water-cooled condensers may be used for refrigerant storage in lieu of a separate liquid receiver, if the condenser storage capacity is 5 percent in excess of the fully charged system for single packaged systems.

2.6.11 Heat Recovery Condenser Coil

Condenser must be of the shell-and-coil or shell-and-tube type design and must not be a part of the standard condenser. Condenser must be provided and installed by the chiller manufacturer. Condenser's refrigerant side must be designed and factory pressure tested to comply with in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku). Condenser's water side must be designed and factory pressure tested for not less than [1,000] [1,700] [2000] kPa. Condenser must have performance characteristics as indicated on the drawings. Condenser shell must be constructed of seamless or welded steel. Coil bundles must be totally removable and arranged to drain completely. Tubes must be seamless copper, plain, integrally finned with smooth bore or integrally finned with enhanced bore. Each tube must be individually replaceable, except for the coaxial tubes. Tube baffles must be properly spaced to provide adequate tube support and cross flow. Performance must be based on water velocities not less than 0.91 m/s nor more than 3.7 m/s and a fouling factor per JIS B 8613.

2.6.12 Receivers

Receiver must bear a stamp certifying compliance with JIS B 8267 and must meet the requirements in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku). Inner surfaces must be thoroughly cleaned by sandblasting or other approved means. Each receiver must have a storage capacity not less than 20 percent in excess of that required for the fully-charged system. Each receiver must be equipped with inlet, outlet drop pipe, drain plug, purging valve, in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku), and two

bull's eye liquid-level sight glasses. Sight glasses must be in the same vertical plane, 90 degrees apart, perpendicular to the axis of the receiver, and not over 75 mm horizontally from the drop pipe measured along the axis of the receiver. In lieu of bull's eye sight glass, external gauge glass with metal glass guard and automatic closing stop valves may be provided.

2.6.13 Chiller Purge System

Chillers which operate at pressures below atmospheric pressure must be provided with a purge system in accordance with MLIT-M. Purge system must automatically remove air, water vapor, and non-condensible gases from the chiller's refrigerant. Purge system must condense, separate, and return all refrigerant back to the chiller. Purge system must not discharge to occupied areas, or create a potential hazard to personnel. Purge system must include a purge pressure gauge, number of starts counter, and an elapsed time meter. Purge system must include lights or an alarm which indicate excessive purge or an abnormal air leakage into chiller.

2.6.14 Tools

One complete set of special tools, as recommended by the manufacturer for field maintenance of the system, must be provided. Tools must be mounted on a tool board in the equipment room or contained in a toolbox as directed by the Contracting Officer.

2.7 ACCESSORIES

2.7.1 Refrigerant Leak Detector

Detector must be the continuously-operating, halogen-specific type. Detector must be appropriate for the refrigerant in use. Detector must be specifically designed for area monitoring and must include [a single sampling point] [[_____] sampling points] installed where indicated. Detector design and construction must be compatible with the temperature, humidity, barometric pressure and voltage fluctuations of the operating area. Detector must have an adjustable sensitivity such that it can detect refrigerant at or above 3 parts per million (ppm). Detector must be supplied factory-calibrated for the appropriate refrigerant(s). Detector must be provided with an alarm relay output which energizes when the detector detects a refrigerant level at or above the TLV-TWA (or toxicity measurement consistent therewith) for the refrigerant(s) in use. The detector's relay must be capable of initiating corresponding alarms and ventilation systems as indicated on the drawings. Detector must be provided with a failure relay output that energizes when the monitor detects a fault in its operation. [Detector must be compatible with the facility's Building Control Network (BCN). The BCN must be capable of generating an electronic log of the refrigerant level in the operating area, monitoring for detector malfunctions, and monitoring for any refrigerant alarm conditions.]

2.7.2 Refrigerant Relief Valve/Rupture Disc Assembly

The assembly must be a combination pressure relief valve and rupture disc designed for refrigerant usage. The assembly must be in accordance with JIS B 8267 and in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku). The assembly must be provided with a pressure gauge assembly which will provide local indication if a rupture disc is broken. Rupture disc must be the non-fragmenting type.

2.7.3 Refrigerant Signs

Refrigerant signs must be a medium-weight aluminum type with a baked enamel finish. Signs must be suitable for indoor or outdoor service. Signs must have a white background with red letters not less than 13 mm in height.

2.7.3.1 Installation Identification

Each new refrigerating system must be provided with a refrigerant sign which indicates the following as a minimum:

a. Contractor's name.

b. Refrigerant number and amount of refrigerant.

c. The lubricant identity and amount.

d. Field test pressure applied.

2.7.3.2 Controls and Piping Identification

Refrigerant systems containing more than 50 kg of refrigerant must be provided with refrigerant signs which designate the following as a minimum:

a. Valves or switches for controlling the refrigerant flow [, the ventilation system,] and the refrigerant compressor(s).

b. Pressure limiting device(s).

2.7.4 Automatic Tube Brush Cleaning System

2.7.4.1 Brush and Basket Sets

One brush and basket set (one brush and two baskets) must be furnished for each condenser tube. Brushes must be made of nylon bristles, with titanium wire. Baskets must be polypropylene.

2.7.4.2 Flow-Diverter Valve

Each system must be equipped with one flow-diverter valve specifically designed for the automatic tube brush cleaning system and have parallel flow connections. The flow-diverter valve must be designed for a working pressure of [1,000][1,700][2000] kPa. End connections must be flanged. Each valve must be provided with an electrically operated air solenoid valve and position indicator.

2.7.4.3 Control Panel

The control panel must provide signals to the diverter valve at a preset time interval to reverse water flow to drive the tube brushes down the tubes and then signal the valve to reverse the water flow to drive the brushes back down the tubes to their original position. The controller must have the following features as a minimum:

a. Timer to initiate the on-load cleaning cycle.

b. Manual override of preset cleaning cycle.

c. Power-on indicator.

d. Diverter-position indicator.

e. Cleaning-cycle-time adjustment

f. Flow-switch bypass.

2.7.5 Gaskets

Gaskets must conform to JIS F 0602 - classification for compressed sheet with nitrile binder and acrylic fibers.

2.7.6 Bolts and Nuts

Bolts and nuts, except as required for piping applications, must be in accordance with JIS G 3101. The bolt head must be marked to identify the manufacturer and the standard with which the bolt complies in accordance with JIS G 3101.

2.8 FABRICATION

2.8.1 Factory Coating

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, must be factory finished with the manufacturer's standard finish, except that items located outside of buildings must have weather resistant finishes that will withstand [125] [500] hours exposure to the salt spray test specified in JIS Z 2371 using a 5 percent sodium chloride solution. Immediately after completion of the test, the specimen must show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 3 mm on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used must be coated with a zinc-rich coating conforming to JIS H 8641.

2.8.2 Factory Applied Insulation

Chiller must be provided with factory installed insulation on surfaces subject to sweating including the water cooler, suction line piping, economizer, and cooling lines. Insulation on heads of coolers may be field applied, however it must be installed to provide easy removal and replacement of heads without damage to the insulation. Where motors are the gas-cooled type, factory installed insulation must be provided on the cold-gas inlet connection to the motor per manufacturer's standard practice. Factory insulated items installed outdoors are not required to be fire-rated. As a minimum, factory insulated items installed indoorsmust have a flame spread index no higher than 75 and a smoke developed index no higher than 150. Factory insulated items (no jacket) installed indoors and which are located in air plenums, in ceiling spaces, and inattic spaces must have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Insulation must be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket must be tested as a composite material. Jackets, facings, and adhesives must have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E84.

2.8.3 Coil Corrosion Protection

Provide coil with a uniformly applied [epoxy electrodeposition] [phenolic] [vinyl] type coating to all coil surface areas without material bridging between fins. Submit product data on the type coating selected, the application process used, and verification of conformance with the salt spray test requirement. Coating must be applied at either the coil or coating manufacturer's factory. Coating process must ensure complete coil encapsulation. Salt spray test shall be in accordance with JIS Z 2371.

2.9 SUPPLEMENTAL COMPONENTS/SERVICES

2.9.1 Chilled and Condenser Water Piping and Accessories

Chilled and condenser water piping and accessories must be provided and installed in accordance with Section 23 64 26 CHILLED, CHILLED-HOT, AND CONDENSER WATER PIPING SYSTEMS.

2.9.2 Refrigerant Piping

Refrigerant piping for split-system water chillers must be provided and installed in accordance with Section 23 23 00 REFRIGERANT PIPING.

2.9.3 Cooling Tower

Cooling towers must be provided and installed in accordance with Section 23 65 00 COOLING TOWERS AND REMOTE EVAPORATIVELY-COOLED CONDENSERS.

2.9.4 Temperature Controls

Chiller control packages must be fully coordinated with and integrated [into the temperature control system indicated in Section 23 30 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM and [Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC] and [Section 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS] [or] [Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS]] [into the existing air-conditioning system].

PART 3 EXECUTION

3.1 INSTALLATION

Installation of water chiller systems including materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing must be in accordance with the manufacturer's written installation instructions, including the following:

(1) Water chiller - installation instructions

3.1.1 Installation Instructions

Provide manufacturer's standard catalog data, at least [5] [_____] weeks prior to the purchase or installation of a particular component, highlighted to show features such as materials, dimensions, options, performance and efficiency. Data must include manufacturer's recommended installation instructions and procedures. Data must be adequate to demonstrate compliance with contract requirements.

3.1.2 Vibration Isolation

If vibration isolation is specified for a unit, vibration isolator literature must be included containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations.

3.1.3 Posted Instructions

Provide posted instructions, including equipment layout, wiring and control diagrams, piping, valves and control sequences, and typed condensed operation instructions. The condensed operation instructions must include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions must be framed under glass or laminated plastic and be posted where indicated by the Contracting Officer.

3.1.4 Verification of Dimensions

Provide a letter including the date the site was visited, conformation of existing conditions, and any discrepancies found.

3.1.5 System Performance Test Schedules

Provide a schedule, at least [2] [_____] weeks prior to the start of related testing, for the system performance tests. The schedules must identify the proposed date, time, and location for each test.

3.1.6 Certificates

Where the system, components, or equipment are specified to comply with requirements of Japanese Industrial Standards, proof of such compliance must be provided. The label or listing of the specified agency must be acceptable evidence.

3.1.7 Operation and Maintenance Manuals

Provide [Six] [_____] complete copies of an operation manual in bound 216 by 279 mm booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least [4] [_____] weeks prior to the first training course. The booklets must include the manufacturer's name, model number, and parts list. The manuals must include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features. [Six] [_____] complete copies of maintenance manual in bound 216 by 279 booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals must include piping and equipment layouts and simplified wiring and control diagrams of the system as installed.

3.1.8 Connections to Existing Systems

Notify the Contracting Officer in writing at least 15 calendar days prior to the date the connections are required. Obtain approval before interrupting service. Furnish materials required to make connections into existing systems and perform excavating, backfilling, compacting, and other incidental labor as required. Furnish labor and tools for making actual connections to existing systems.

3.1.9 Refrigeration System

3.1.9.1 Equipment

Refrigeration equipment and the installation thereof must conform to in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku) for Japanese standard. Necessary supports must be provided for all equipment, appurtenances, and pipe as required, including frames or supports for compressors, pumps, cooling towers, condensers, water coolers, and similar items. Compressors must be isolated from the building structure. If mechanical vibration isolators are not provided, vibration absorbing foundations must be provided. Each foundation must include isolation units consisting of machine and floor or foundation fastenings, together with intermediate isolation material. Other floor-mounted equipment must be set on not less than a 150 mm concrete pad doweled in place. Concrete foundations for floor mounted pumps must have a mass equivalent to three times the weight of the components, pump, base plate, and motor to be supported. In lieu of concrete pad foundation, concrete pedestal block with isolators placed between the pedestal block and the floor may be provided. Concrete pedestal block must be of mass not less than three times the combined pump, motor, and base weights. Isolators must be selected and sized based on load-bearing requirements and the lowest frequency of vibration to be isolated. Isolators must limit vibration to [_____] percent at lowest equipment rpm. Lines connected to pumps mounted on pedestal blocks must be provided with flexible connectors. Foundation drawings, bolt-setting information, and foundation bolts must be furnished prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Concrete for foundations must be as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. Equipment must be properly leveled, aligned, and secured in place in accordance with manufacturer's instructions.

3.1.9.2 Field Refrigerant Charging

a. Initial Charge: Upon completion of all the refrigerant pipe tests, the vacuum on the system must be broken by adding the required charge of dry refrigerant for which the system is designed, in accordance with the manufacturer's recommendations. Contractor must provide the complete charge of refrigerant in accordance with manufacturer's recommendations. Upon satisfactory completion of the system performance tests, any refrigerant that has been lost from the system must be replaced. After the system is fully operational, service valve seal caps and blanks over gauge points must be installed and tightened.

b. Refrigerant Leakage: If a refrigerant leak is discovered after the system has been charged, the leaking portion of the system must immediately be isolated from the remainder of the system and the refrigerant must be pumped into the system receiver or other suitable container. The refrigerant must not be discharged into the atmosphere.

c. Contractor's Responsibility: The Contractor must, at all times during the installation and testing of the refrigeration system, take steps to prevent the release of refrigerants into the atmosphere. The steps must include, but not be limited to, procedures which will minimize the release of refrigerants to the atmosphere and the use of refrigerant recovery devices to remove refrigerant from the system and

store the refrigerant for reuse or reclaim. At no time must more than 85 g of refrigerant be released to the atmosphere in any one occurrence. Any system leaks within the first year must be repaired in accordance with the specified requirements including material, labor, and refrigerant if the leak is the result of defective equipment, material, or installation.

3.1.9.3 Oil Charging

Except for factory sealed units, two complete charges of lubricating oil for each compressor crankcase must be furnished. One charge must be used during the performance testing period, and upon the satisfactory completion of the tests, the oil must be drained and replaced with the second charge.

3.1.10 Mechanical Room Ventilation

Mechanical ventilation systems must be in accordance with Section 23 30 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.1.11 Field Applied Insulation

Field installed insulation must be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS, except as defined differently herein.

3.1.12 Field Painting

Painting required for surfaces not otherwise specified, and finish painting of items only primed at the factory are specified in Section 09 90 00 PAINTS AND COATINGS.

3.2 MANUFACTURER'S FIELD SERVICE

The services of a factory-trained representative must be provided for [_____] days. The representative shall advise on the following:

a. Hermetic machines:

(1) Testing hermetic water-chilling unit under pressure for refrigerant leaks; evacuation and dehydration of machine to an absolute pressure of not over 300 micrometers.

(2) Charging the machine with refrigerant.

(3) Starting the machine.

b. Open Machines:

(1) Erection, alignment, testing, and dehydrating.

(2) Charging the machine with refrigerant.

(3) Starting the machine.

3.3 CLEANING AND ADJUSTING

Equipment must be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Provide temporary filters for all fans that are

operated during construction. Perform and document that proper Indoor Air Quality During Construction procedures have been followed; this includes providing documentation showing that after construction ends, and prior to occupancy, new filters were provided and installed. System must be maintained in this clean condition until final acceptance. Bearings must be properly lubricated with oil or grease as recommended by the manufacturer. Belts must be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment must be adjusted to setting indicated or directed. Fans must be adjusted to the speed indicated by the manufacturer to meet specified conditions. At least one week before the official equipment warranty start date, all condenser coils on air-cooled water chillers and split-system water chillers must be cleaned in accordance with the chiller manufacturer's instructions. This work covers two coil cleanings. The condenser coils must be cleaned with an approved coil cleaner by a service technician, factory trained by the chiller manufacturer. The condenser coil cleaner must not have any detrimental affect on the materials or protective coatings on the condenser coils. Testing, adjusting, and balancing must be as specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

3.4 FIELD ACCEPTANCE TESTING

3.4.1 Test Plans

a. Manufacturer's Test Plans: Within [120][_____] calendar days after contract award, submit the following plans:

(1) Water chiller - Field Acceptance Test Plan

Field acceptance test plans must be developed by the chiller manufacturer detailing recommended field test procedures for that particular type and size of equipment. Field acceptance test plans developed by the installing Contractor, or the equipment sales agency furnishing the equipment, will not be acceptable.

The Contracting Officer will review and approve the field acceptance test plan for each of the listed equipment prior to commencement of field testing of the equipment. The approved field acceptance tests of the chiller and subsequent test reporting.

b. Coordinated testing: Indicate in each field acceptance test plan when work required by this section requires coordination with test work required by other specification sections. Furnish test procedures for the simultaneous or integrated testing of tower system controls which interlock and interface with controls for the equipment provided under [Section 23 09 53.00 20, SPACE TEMPERATURE CONTROL SYSTEMS or Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC][Section 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS] [or] [Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS].

c. Prerequisite testing: Chillers for which performance testing is dependent upon the completion of the work covered by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC must have that work completed as a prerequisite to testing work under this section. Indicate in each field acceptance test plan when such prerequisite work is required.

d. Test procedure: Indicate in each field acceptance test plan each equipment manufacturers published installation, start-up, and field acceptance test procedures. Include in each test plan a detailed step-by-step procedure for testing automatic controls provided by the manufacturer.

Each test plan must include the required test reporting forms to be completed by the Contractor's testing representatives. Procedures must be structured to test the controls through all modes of control to confirm that the controls are performing with the intended sequence of control.

Controller must be verified to be properly calibrated and have the proper set point to provide stable control of their respective equipment.

e. Performance variables: Each test plan must list performance variables that are required to be measured or tested as part of the field test.

Include in the listed variables performance requirements indicated on the equipment schedules on the design drawings. Chiller manufacturer must furnish with each test procedure a description of acceptable results that have been verified.

Chiller manufacturer must identify the acceptable limits or tolerance within which each tested performance variable must acceptably operate.

f. Job specific: Each test plan must be job specific and must address the particular cooling towers and particular conditions which exist in this contract. Generic or general preprinted test procedures are not acceptable.

g. Specialized components: Each test plan must include procedures for field testing and field adjusting specialized components, such as hot gas bypass control valves, or pressure valves.

3.4.2 Testing

a. Each water chiller system must be field acceptance tested in compliance with its approved field acceptance test plan and the resulting following field acceptance test report submitted for approval:

(1) Water chiller - Field Acceptance Test Report

b. Manufacturer's recommended testing: Conduct the manufacturer's recommended field testing in compliance with the approved test plan. Furnish a factory trained field representative authorized by and to represent the equipment manufacturer at the complete execution of the field acceptance testing.

c. Operational test: Conduct a continuous 24 hour operational test for each item of equipment. Equipment shutdown before the test period is completed shall result in the test period being started again and run for the required duration. For the duration of the test period, compile an operational log of each item of equipment. Log required entries every two hours. Use the test report forms for logging the operational variables.

d. Notice of tests: Conduct the manufacturer's recommended tests and the operational tests; record the required data using the approved reporting forms. Notify the Contracting Officer in writing at least 15 calendar days prior to the testing. Within 30 calendar days after acceptable completion of testing, submit each test report for review and approval.

e. Report forms: Type data entries and writing on the test report forms. Completed test report forms for each item of equipment must be reviewed, approved, and signed by the Contractor's test director. The manufacturer's field test representative must review, approve, and sign the report of the manufacturer's recommended test. Signatures must be accompanied by the person's name typed.

f. Deficiency resolution: The test requirements acceptably met; deficiencies identified during the tests must be corrected in compliance with the manufacturer's recommendations and corrections retested in order to verify compliance.

3.5 SYSTEM PERFORMANCE TESTS

[Six] [_____] copies of the report must be provided in bound 216 by 279 mm booklets.

3.5.1 General Requirements

Before each refrigeration system is accepted, tests to demonstrate the general operating characteristics of all equipment must be conducted by the manufacturer's approved start-up representative experienced in system start-up and testing, at such times as directed. Tests must cover a period of not less than 48 hours for each system and must demonstrate that the entire system is functioning in accordance with the drawings and specifications. Corrections and adjustments must be made as necessary and tests must be re-conducted to demonstrate that the entire system is functioning as specified. Prior to acceptance, service valve seal caps and blanks over gauge points must be installed and tightened. Any refrigerant lost during the system startup must be replaced. If tests do not demonstrate satisfactory system performance, deficiencies must be corrected and the system must be retested. Tests must be conducted in the presence of the Contracting Officer. Water and electricity required for the tests will be furnished by the Government. Any material, equipment, instruments, and personnel required for the test must be provided by the Contractor. Field tests must be coordinated with Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

3.5.2 Test Report

The report must document compliance with the specified performance criteria upon completion and testing of the system. The report must indicate the number of days covered by the tests and any conclusions as to the adequacy of the system. The report must also include the following information and must be taken at least three different times at outside dry-bulb temperatures that are at least 3 degrees C apart:

a. Date and outside weather conditions.

b. The load on the system based on the following:

(1) The refrigerant used in the system.
(2) Condensing temperature and pressure.
(3) Suction temperature and pressure.
(4) Running current, voltage and proper phase sequence for each phase of all motors.
(5) The actual on-site setting of all operating and safety controls.
(6) Chilled water pressure, flow and temperature in and out of the chiller.
(7) The position of the [capacity-reduction gear] at machine off, one-third loaded, one-half loaded, two-thirds loaded, and fully loaded.

3.6 DEMONSTRATIONS

Contractor must conduct a training course for the operating staff as designated by the Contracting Officer. The training period must consist of a total [_____] hours of normal working time and start after the system is functionally completed but prior to final acceptance tests. The training course must cover all of the items contained in the approved operation and maintenance manuals as well as demonstrations of routine maintenance operations.

Provide a schedule, at least [2] [_____] weeks prior to the date of the proposed training course, which identifies the date, time, and location for the training.

-- End of Section --

SECTION 23 64 26

CHILLED, CHILLED-HOT, AND CONDENSER WATER PIPING SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2018) Standard for the Installation of Air Conditioning and Ventilating Systems

ASTM INTERNATIONAL (ASTM)

ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 1178	(2015) Foundation Bolts (Amendment 1)
JIS B 1180	(2014) Hexagon Head Bolts and Hexagon Head Screws
JIS B 1181	(2014) Hexagon Nuts and Hexagon Thin Nuts
JIS B 2011	(2013) Bronze, Gate, Globe, Angle, and Check Valves (Amendment 2)
JIS B 2031	(2015) Gray Cast Iron Valves (Amendment 1)
JIS B 2032	(2013) Wafer Type Rubber-Seated Butterfly Valves
JIS B 2220	(2012) Steel Pipe Flanges
JIS B 2301	(2013) Screwed Type Malleable Cast Iron Pipe Fittings
JIS B 2311	(2015) Steel Butt-Welding Pipe Fittings for Ordinary Use
JIS B 2313	(2015) Steel Plate Butt-Welding Pipe Fittings
JIS B 2316	(2017) Steel Socket-Welding Pipe Fittings
JIS B 2352	(2013) Bellows Type Expansion Joints
JIS B 2404	(2018) Dimensions of Gaskets for Use with Pipe Flanges

JIS B 6801	(2003) Manual Blowpipes for Welding, Cutting and Heating
JIS B 7505-1	(2017) Aneroid Pressure Gauges-Part 1: Bourdon Tube Pressure Gauges
JIS B 8285	(2010) Welding Procedure Qualification Test for Pressure Vessels
JIS B 8301	(2009) Technical Specifications for Centrifugal Pumps-Class II
JIS B 8308	(2009) Technical Specifications for Centrifugal Pumps-Class II
JIS B 8410	(2015) Pressure Reducing Valves for Water Works
JIS B 8414	(2011) Relief Valves for Hot Water Appliances (Amendment 3)
JIS C 4212	(2010) Low-Voltage Three-Phase Squirrel-Cage High-Efficiency Induction Motors (Amendment 1)
JIS F 0602	(1995) Shipbuilding-Non-Asbestos Gaskets to Cargo Piping System-Application Standard
JIS G 3106	(2017) Rolled Steels for Welded Structure (Amendment 1)
JIS G 3201	(2008) Carbon Steel Forgings for General Use (Amendment 1)
JIS G 3202	(2008) Carbon Steel Forgings for Pressure Vessels (Amendment 1)
JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS G 3454	(2019) Carbon Steel Pipes for Pressure Service (Amendment 1)
JIS G 3456	(2019) Carbon Steel Pipes for High Temperature Service
JIS G 4051	(2018) Carbon Steels for Machine Structural Use (Amendment 1)
JIS G 4053	(2018) Low-Alloyed Steels for Machine Structural Use (Amendment 1)
JIS G 4107	(2015) Alloy Steel Bolting Materials for High Temperature Service (Amendment 1)
JIS G 4303	(2012) Stainless Steel Bars
JIS G 5502	(2007) Spheroidal Graphite Iron Castings

JIS G 5705	(2018) Malleable Iron Castings
JIS H 3300	(2018) Copper and Copper Alloy Seamless Pipes and Tubes
JIS H 3401	(2001) Pipe Fittings of Copper and Copper Alloys
JIS H 5120	(2016) Copper and Copper Alloy Castings
JIS K 0102	(2019) Testing Methods for Industrial Wastewater (Amendment 1)
JIS K 2234	(2018) Engine Antifreeze Coolants
JIS R 3453	(2006) Compressed Fiber Jointing (Amendment 1)
JIS Z 2371	(2015) Methods of Salt Spray Testing
JIS Z 3197	(2012) Test Methods for Soldering Fluxes
JIS Z 3202	(2007) Copper and Copper Alloy Gas Welding Rods
JIS Z 3284-1	(2014) Solder Paste-Part 1: Kinds and Quality Classification
JIS Z 3422-1	(2003) Specification and Approval of Welding Procedures for Metallic Materials-Welding Procedure Tests-Arc and Gas Welding of Steels and Arc Welding of Nickel and Nickel Alloys
JIS Z 3801	(2018) Standard Qualification Test and Acceptance Requirements for Manual Welding Technique
JIS Z 8802	(2011) Methods for Determination of PH of Aqueous Solutions

THE SOCIETY OF HEATING, AIR-CONDITIONING AND SANITARY ENGINEERS OF JAPAN (SHASE)

SHASE-S003	(2012) Sleave Type Expansion Pipe Joints

MLIT MECHANICAL STANDARD SPECIFICATION

MLIT-M	(2019) Public Building Construction Standard Specification

WATER SUPPLY LAW

PSCP	Performance Standard Compliant Product
CCPV	(2016) Construction Code of Pressure Vessel

JAPAN VALVE MANUFACTURERS ASSOCIATION

JV-5 (2008) Pipe end Anticorrosion Screwed Valve

1.2 SYSTEM DESCRIPTION

Provide the water systems having the minimum service (design) temperature-pressure rating indicated. Provision of the piping systems, including materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with the required and advisory provisions of MLIT-M except as modified or supplemented by this specification section or design drawings. This specification section covers the water systems piping which is located within, on, and adjacent to building(s) within the building(s) 1.66 meter line.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pumps; G[[]]

SD-06 Test Reports

Piping Welds NDE Report

Pressure Tests Reports; G[[]]

Report shall be provided in bound 216 by 279 mm booklets. In the reports, document all phases of the tests performed. Include initial test summaries, all repairs/adjustments made, and the final test results.

Condenser Water Quality Test Reports; G[[]]

Test reports, each month for a period of one year after project completion, in bound 216 by 279 mm booklets. In the reports, identify the chemical composition of the condenser water. Also include the comparison of the manufacturer's recommended operating conditions for the cooling tower and condenser in relation to the condition of the condenser water. Document in the report any required corrective action taken.

One-Year Inspection Report For Cooling Water; G[[]]

At the completion of one year of service, in bound 216 by 279 mm inch booklets. In the report, identify the condition of each cooling tower and condenser. Include a comparison of the condition of the cooling tower and condenser with the manufacturer's recommended operating conditions. Identify all actions taken by the Contractor and manufacturer to correct deficiencies during the first year of service.

SD-10 Operation and Maintenance Data

Requirements for data packages are specified Section 01 78 23 OPERATION AND MAINTENANCE DATA, except as supplemented and modified by this specification section.

Submit spare parts data for each different item of equipment specified, with operation and maintenance data packages. Include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

Submit a list of qualified permanent service organizations with operation and maintenance data packages. Include service organization addresses and service area or expertise. The service organizations shall be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

Water Treatment Systems

An operation manual in bound 216 by 279 mm booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown. Include testing procedures used in determining water quality.

A maintenance manual in bound 216 by 279 mm booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide.

Calibrated Balancing Valves, Data Package 3;

Automatic Flow Control Valves, Data Package 3;

Pump Discharge Valve, Data Package 2;

Water Temperature Mixing Valve, Data Package 3;

Water Temperature Regulating Valves, Data Package 3;

Water Pressure Reducing Valve, Data Package 3;

Pressure Relief Valve, Data Package 2;

Combination Pressure and Temperature Relief Valves, Data Package 2;

Expansion Joints, Data Package 2;

Pumps, Data Package 3; G[[]]

Combination Strainer and Pump Suction Diffuser, Data Package 2;

Expansion Tanks, Data Package 2; G[[]]

Air Separator Tanks, Data Package 2; G[[]]

1.4 MODIFICATIONS TO REFERENCES

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.4.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.4.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.5 SAFETY REQUIREMENTS

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices shall be installed so that proper operation of equipment is not impaired.

1.6 DELIVERY, STORAGE, AND HANDLING

Protect stored items from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, cap piping and similar openings to keep out dirt and other foreign matter. Any porous materials found to be contaminated with mold or mildew will be replaced at the Contractor's expense. Non-porous materials found to be contaminated with mold or mildew will be disinfected and cleaned prior to installation.

1.7 PROJECT/SITE CONDITIONS

1.7.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.7.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and shall arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

1.7.3 Accessibility

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening.

The two year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures.

Products having less than a 2 year field service record shall be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. System components shall be environmentally suitable for the indicated locations.

The equipment items shall be supported by service organizations. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

2.2 STEEL PIPING

Water piping shall be steel pipe. Provide steel piping with a Japanese Industrial Standards (JIS) Class 125 service rating, which for 66 degrees C the pressure rating is 1207 kPa.

2.2.1 Pipe

Steel pipe, conform to JIS G 3454, Schedule 40 and MLIT-M.

2.2.2 Fittings and End Connections (Joints)

Piping and fittings 25 mm and smaller shall have threaded connections. Piping and fittings larger than 25 mm and smaller than 80 mm shall have either threaded, [grooved,] or welded connections. Piping and fittings 80 mm and larger shall have [grooved,] welded, or flanged connections. The

manufacturer of each fitting shall be permanently identified on the body of the fitting.

2.2.2.1 Threaded Connections

Use threaded fitting conforming to JIS B 2301. Use threaded unions conforming to JIS B 2301. Use threaded pipe nipples conforming to MLIT-M.

2.2.2.2 Flanged Connections

Flanges shall conform to JIS B 2220. Gaskets shall be nonasbestos compressed material in accordance with JIS B 2404, 1.59 mm thickness, full face or self-centering flat ring type. These gaskets shall contain aramid fibers bonded with styrene butadeine rubber (SBR) or nitrile butadeine rubber (NBR). Bolts, nuts, and bolt patterns shall conform to JIS B 1180.

2.2.2.3 Welded Connections

Welded valves and pipe connections (both butt-welds and socket-welds types) shall conform to JIS B 2301. Butt-welded fittings shall conform to JIS B 2311. Socket-welded fittings shall conform to JIS B 2316. Welded fittings shall be identified with the appropriate grade and marking symbol.

2.2.2.4 Grooved Mechanical Connections For Steel

Rigid grooved mechanical connections may only be used in serviceable aboveground locations where the temperature of the circulating medium does not exceed 110 degrees C. Flexible grooved connections shall be used only as a flexible connector with grooved pipe system. Unless otherwise specified, grooved piping components shall meet the corresponding criteria specified for the similar welded, flanged, or threaded component specified herein.

Each grooved mechanical joint shall be a system, including coupling housing, gasket, fasteners, all furnished by the same manufacturer. Joint installation shall be in compliance with joint manufacturer's written instructions.

Use fitting and coupling houses of malleable iron conforming to JIS G 5705; steel conforming JIS G 3454. Use gaskets of molded synthetic rubber with central cavity, pressure responsive configuration and conforming to MLIT-M. Grooved mechanical connections shall conform to MLIT-M. Coupling nuts and bolts shall be steel and shall conform to MLIT-M. Pipe connections and fittings shall be the product of the same manufacturer. Provide joint installation be in compliance with joint manufacturer's written instructions.

2.2.2.5 Dielectric Waterways and Flanges

Provide dielectric waterways with a water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint. When dry, insulation barrier shall be able to withstand a 600-volt breakdown test. Provide dielectric waterways constructed of galvanized steel and have threaded end connections to match connecting piping. Dielectric waterways shall be suitable for the required operating pressures and temperatures. Provide dielectric flanges with the same pressure ratings as standard flanges and provide complete electrical isolation between connecting pipe and/or equipment as described herein for dielectric waterways.

2.3 PIPING FOR STEAM AND CONDENSATE

Steam and condensate piping for 1034-, 2413-, 13790-, 41369- kilopascal service shall be black carbon steel (BCS). Steam and condensate piping includes fittings, unions, flanges, gaskets, and bolting.

2.3.1 Type BCS-150 (1034 kilopascal Service)

Pipe or tube (DN6 through DN25): Schedule 40 for steam, Schedule 80 for condensate, seamless black carbon steel, conforming to JIS G 3456.

Fittings (DN6 through DN50): 2068 kilopascal working steam pressure (wsp) banded malleable iron, screwed end, conforming to JIS G 5705 and JIS B 2301.

Fittings (DN6 through DN50): 15- or 20- megapascal water, oil, or gas (wog) forged carbon steel, socket weld or screwed end, conforming to JIS G 3201 and JIS G 3202 and JIS B 2316.

Fittings (DN65 through DN250): Wall thickness to match pipe, long radius, butt weld, black carbon steel, conforming to JIS B 2313, Grade WPB, and JIS B 2313.

Unions (DN6 through DN50): 1724 kilopascal wsp, malleable iron, screwed end, ground joint, with brass or bronze seat insert, conforming to JIS B 2301.

Unions (DN6 through DN50): 15- or 20- megapascal wog, forged carbon steel; socket weld through 50 millimeter, screwed end through 25 millimeter, conforming to JIS G 3201 and JIS G 3202 and JIS B 2316, with ground joint and stainless-steel seat insert

Flanges (DN65 through DN250): 1034-kilopascal, forged carbon steel, welding neck, with raised face or flat face and concentric finish, conforming to JIS G 3201 and JIS G 3202.

Flange Gaskets: Compressed non-asbestos sheet conforming to JIS F 0602, Type 1, P1161A or JIS R 3453, coated on both sides with graphite or similar lubricant, containing not less than 75-percent non-asbestos fiber materials

Bolting: Bolting and flange bolting shall be hexhead and shall conform to JIS B 1178. Heavy hex-nuts shall conform to JIS B 1181 Square-head bolts and nuts are not acceptable.

2.3.2 Type BCS-350 (2413 kilopascalService)

Pipe or tube (DN6 through DN25): Schedule 40 for steam, Schedule 80 for condensate; seamless black carbon steel, conforming to JIS G 3456.

Fittings (DN6 through DN50): 15- or 20- megapascal wog to match pipe wall, forged carbon steel, socket weld or screwed end, conforming to JIS G 3201 and JIS G 3202 and JIS B 2316.

Fittings (DN6 through DN25): Schedule 40, long-radius, butt weld, black carbon steel, conforming to JIS B 2313, Grade WPB, and JIS B 2313.

Unions (DN6 through DN50): 15- or 20- megapascal wog to match pipe wall, forged carbon steel, socket weld through 50 millimeter, screwed end through

25 millimeter, conforming to JIS G 3201 and JIS G 3202 and JIS B 2316, with ground joint and stainless-steel seat insert

Flanges (DN65 through DN250): 2068 kilopascal, forged carbon steel, weld neck, with raised face and concentric serrated finish, conforming to JIS G 4051

Gaskets: Spiral-wound, non-asbestos-fiber-filled, carbon steel, with centering provisions, conforming to MLIT-M.

Bolting: Heavy hex-head, carbon-steel bolts or bolt studs and semifinished heavy hexnuts, conforming to JIS B 1178.

Square-head bolts are not acceptable.

2.4 PIPING FOR HIGH-PRESSURE COMPRESSED-AIR SYSTEMS

High-pressure compressed-air condensate piping includes fittings, unions, flanges, gaskets, and bolting.

2.4.1 Type BCS-2,000 (15 megapascal Service)

Pipe or tube (DN6 through DN80): Schedule 40, seamless black carbon steel, conforming to JIS G 3456 or JIS G 3454.

Fittings (DN6 through DN40): 15 megapascal wog, forged carbon steel, socket weld, conforming to JIS G 3201 and JIS G 3202 and JIS B 2316.

Fittings (DN50 through DN80): Schedule 40, long radius, butt weld, black carbon steel, conforming to JIS B 2313 and JIS B 2313.

Flanges (DN25 through DN80): 6200 kilopascal, forged carbon steel, welding neck, with raised face and concentric serrated finish, conforming to JIS G 3201 and JIS G 3202 or JIS G 4051.

Gaskets: Spiral wound, non-asbestos-fiber-filled, carbon steel, with centering provisions, conforming to MLIT-M.

Bolting: Alloy-steel bolt studs conforming to JIS G 4107and JIS G 4303, and semifinished heavy hex-nuts, conforming to JIS G 4051, JIS G 4303 and JIS G 4053.

2.4.2 Type BCS-6,000 (41368-kilopascal Service)

Pipe or tube (DN15 through DN80): Seamless, black carbon steel, conforming to JIS G 3456, or JIS G 3454.

Fittings (DN15 through DN40): 41.3 megapascal wog, forged carbon steel, socket weld, conforming to JIS G 3201 and JIS G 3202 and JIS B 2316

Fittings (DN50 through DN80): Long-radius, butt weld, black carbon steel, conforming to JIS B 2313, JIS B 2313, and JIS G 3456

Flanges (DN50 through DN80): 17.2 megapascal, forged carbon steel, welding neck with raised face and concentric serrated finish, conforming to JIS G 3201 and JIS G 3202.

Gaskets: Spiral-wound, non-asbestos-filled, carbon steel, with centering provisions, conforming to MLIT-M.

Bolting: Alloy steel bolt studs conforming to JIS G 4107and JIS G 4303, and semifinished heavy hex-nuts, conforming to JIS G 4051, JIS G 4303 and JIS G 4053.

2.5 COPPER TUBING

Provide copper tubing and fittings with a JIS H 3300 Class 125 service rating, which for 66 degrees C, the pressure rating is 1207 kPa.

2.5.1 Tube

Use copper tube conforming to JIS H 3300, Type L or M for aboveground tubing, and Type K for buried tubing.

2.5.2 Fittings and End Connections (Solder and Flared Joints)

Wrought copper and bronze solder joint pressure fittings, including unions ands flanges, shall conform to JIS H 3401. Provide adapters as required. Cast copper alloy solder-joint pressure fittings , including unions and flanges, shall conform to JIS H 3401. Cast copper alloy fittings for flared copper tube shall conform to JIS H 3401 and JIS H 5120. JIS H 3300 copper pipe nipples with threaded end connections shall conform to JIS H 3300.

Copper tubing of sizes larger than 100 mm shall have brazed joints. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment.

Extracted brazed tee joints may be used if produced with an acceptable tool and installed in accordance with tool manufacturer's written procedures.

2.5.3 Grooved Mechanical Connections For Copper

Rigid grooved mechanical connections may only be used in serviceable aboveground locations where the temperature of the circulating medium does not exceed 110 degrees C. Flexible grooved connections shall be used only as a flexible connector with grooved pipe system. Unless otherwise specified, grooved piping components shall meet the corresponding criteria specified for the similar welded, flanged, or threaded component specified herein.

Each grooved mechanical joint shall be a system, including coupling housing, gasket, fasteners, all furnished by the same manufacturer. Joint installation shall be in compliance with joint manufacturer's written instructions.

Grooved fitting and mechanical coupling housing shall be ductile iron conforming to JIS G 5502. Provide gaskets for use in grooved joints shall constructed of molded synthetic polymer of pressure responsive design and shall conform to MLIT-M for circulating medium up to 110 degrees C. Provide grooved joints in conformance with MLIT-M.

2.5.4 Solder

Provide solder in conformance with JIS Z 3284-1, grade Sb5, tin-antimony alloy. Solder flux shall be liquid or paste form, non-corrosive and conform to JIS Z 3197.

2.5.5 Brazing Filler Metal

Filler metal shall conform to JIS Z 3202, Type BAg-5 with AWS Type 3 flux, except Type BCuP-5 or BCuP-6 may be used for brazing copper-to-copper joints.

2.6 VALVES

Provide valves with a Japanese standard service rating.

Valves in sizes larger than 25 mm and used on steel pipe systems, may be provided with rigid grooved mechanical joint ends. Such grooved end valves shall be subject to the same requirements as rigid grooved mechanical joints and fittings and, shall be furnished by the same manufacturer as the grooved pipe joint and fitting system.

2.6.1 Gate Valve

Gate valves 65 mm and smaller shall conform to JIS B 2011 Class 125 and shall be bronze with wedge disc, rising stem and threaded, soldered, or flanged ends. Gate valves 80 mm and larger shall conform to JIS B 2031, Class 125, cast iron with bronze trim, outside screw and yoke, and flanged or threaded ends.

2.6.2 Globe and Angle Valve

Globe and angle valves 65 mm and smaller shall conform to JIS B 2011, Class 125. Globe and angle valves 80 mm and larger shall conform to JIS B 2031, Class 125.

2.6.3 Check Valve

Check valves 65 mm and smaller shall conform to JIS B 2011. Check valves 80 mm and larger shall conform to JIS B 2031, Class 125.

2.6.4 Butterfly Valve

Butterfly valves shall conform to JIS B 2032 and JIS B 2011, Type 1 and shall be either the wafer or lug type. Valves smaller than 200 mm shall have throttling handles with a minimum of [two][seven] locking positions. Valves 200 mm and larger shall have totally enclosed manual gear operators with adjustable balance return stops and position indicators.

2.6.5 Plug Valve

Plug valves 50 mm and larger shall conform to JIS B 2031, have flanged or threaded ends, and have cast iron bodies with bronze trim. Valves 50 mm and smaller shall be bronze with NPT connections for black steel pipe and brazed connections for copper tubing. Valve shall be lubricated, non-lubricated, or tetrafluoroethylene resin-coated type. Valve shall be resilient, double seated, trunnion mounted with tapered lift plug capable of 2-way shutoff. Valve shall operate from fully open to fully closed by rotation of the handwheel to lift and turn the plug. [Valve shall a weatherproof operators with mechanical position indicators.] Valves 200 mm or larger shall be provided with manual gear operators with position indicators.

2.6.6 Ball Valve

Full port design. Ball valves 15 mm and larger shall conform to JV-5 and shall be cast iron or bronze with threaded, soldered, or flanged ends. Valves 200 mm or larger shall be provided with manual gear operators with position indicators. Ball valves may be provided in lieu of gate valves.

2.6.7 Square Head Cocks

Provide copper alloy or cast-iron body with copper alloy plugs, suitable for 125 psig water working pressure.

2.6.8 Calibrated Balancing Valves

Copper alloy or cast iron body, copper alloy or stainless internal working parts. Provide valve calibrated so that flow can be determined when the temperature and pressure differential across valve is known. Valve shall have an integral pointer which registers the degree of valve opening. Valve shall function as a service valve when in fully closed position. Valve shall be constructed with internal seals to prevent leakage and shall be supplied with preformed insulation.

Provide valve bodies with tapped openings and pipe extensions with positive shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable differential pressure meter connections to verify the pressure differential. Provide metal tag on each valve showing the liters per second flow for each differential pressure reading. [In lieu of the balancing valve with integral metering connections, a ball valve or plug valve with a separately installed orifice plate or venturi tube may be used for balancing.]

2.6.9 Automatic Flow Control Valves

Valve shall automatically maintain the constant flow indicated on the design drawings. Valve shall modulate by sensing the pressure differential across the valve body. Valve shall be selected for the flow required and provided with a permanent nameplate or tag carrying a permanent record of the factory-determined flow rate and flow control pressure levels. Provide valve that controls the flow within 5 percent of the tag rating. Valve materials shall be the same as specified for the ball or plug valves.

Provide valve that are [electric][or][pneumatic] type as indicated. Valve shall be capable of positive shutoff against the system pump head, valve bodies shall be provided with tapped openings and pipe extensions with shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings and differential meter, suitable for the operating pressure specified. Provide the meter complete with hoses, vent, integral metering connections, and carrying case as recommended by the valve manufacturer.

2.6.10 Pump Discharge Valve

Valve shall shall perform the functions of a nonslam check valve, a manual balancing valve, and a shutoff. Valve shall be of cast iron or ductile iron construction with bronze and/or stainless steel accessories. Provide an integral pointer on the valve which registers the degree of valve opening. Flow through the valve shall be manually adjustable from bubble

tight shutoff to full flow. Valves smaller than 50 mm shall have NPT connections. Valves 50 mm and larger shall have flanged or grooved end connections. Valve design shall allow the back seat for the stem to be replaced in the field under full line pressure.

2.6.11 Water Temperature Mixing Valve

Provide water temperature mixing valve that meets performance standards (PSCP)of the water supply Law.

2.6.12 Water Temperature Regulating Valves

Provide copper alloy body, direct acting, pilot operated, for the intended service.

2.6.13 Water Pressure Reducing Valve

Valve, JIS B 8410 for water service, copper alloy body.

2.6.14 Pressure Relief Valve

Valve shall prevent excessive pressure in the piping system when the piping system reaches its maximum heat buildup. Valve, JIS B 8414 and shall have cast iron bodies with corrosion resistant internal working parts. The discharge pipe from the relief valve shall be the size of the valve outlet unless otherwise indicated.

2.6.15 Combination Pressure and Temperature Relief Valves

JIS B 8414, copper alloy body, automatic re-seating, test lever, and discharge capacity based on AGA temperature steam rating.

2.6.16 Float Valve

[Angle pattern] [Globe pattern]. Valve bodies 80 mm nominal pipe size and smaller shall be bronze. Valve bodies larger than 80 mm shall be cast iron or bronze. Steel parts shall be corrosion resistant. Where float rods are extended for tank applications, extension shall be properly supported and guided to avoid bending of float rod or stressing of valve pilot linkage.

2.6.17 Drain Valves

Valves, JIS B 2011 gate valves. Valve shall be manually-operated, 20 mm pipe size and above with a threaded end connection. Provide valve with a water hose nipple adapter. [Freeze-proof type valves shall be provided in installations exposed to freezing temperatures.]

2.6.18 Air Venting Valves

[Automatic type air venting shall be the ball-float type with brass/bronze or brass bodies, 300 series corrosion-resistant steel float, linkage and removable seat.] Air venting valves on water coils shall have not less than 3 mm threaded end connections. Air venting valves on water mains shall have not less than 20 mm threaded end connections. Air venting valves on all other applications shall have not less than 15 mm threaded end connections.

2.6.19 Vacuum Relief Valves

JIS B 8414

2.7 PIPING ACCESSORIES

2.7.1 Strainer

Strainer, MLIT-M, except as modified and supplemented in this specification. Strainer shall be the cleanable, basket or "Y" type, the same size as the pipeline. Strainer bodies shall be fabricated of cast iron with bottoms drilled, and tapped. Provide blowoff outlet with pipe nipple, gate valve, and discharge pipe nipple. The bodies shall have arrows clearly cast on the sides indicating the direction of flow.

Provide strainer with removable cover and sediment screen. The screen shall be made of minimum 0.8 mm [corrosion-resistant steel,] with small perforations numbering not less than 60 per square centimeter to provide a net free area through the basket of at least 3.30 times that of the entering pipe. The flow shall be into the screen and out through the perforations.

2.7.2 Combination Strainer and Pump Suction Diffuser

Angle type body with removable strainer basket and internal straightening vanes, a suction pipe support, and a blowdown outlet and plug. Strainer shall be in accordance with MLIT-M, except as modified and supplemented by this specification. Unit body shall have arrows clearly cast on the sides indicating the direction of flow.

Strainer screen shall be made of minimum 0.8 mm [corrosion-resistant steel,] with small perforations numbering not less than 60 per square centimeter to provide a net free area through the basket of at least 3.30 times that of the entering pipe. Flow shall be into the screen and out through the perforations. Provide an auxiliary disposable fine mesh strainer which shall be removed 30 days after start-up. Provide warning tag for operator indicating scheduled date for removal.

Casing shall have connection sizes to match pump suction and pipe sizes, and be provided with adjustable support foot or support foot boss to relieve piping strains at pump suction. Provide unit casing with blowdown port and plug. Provide a magnetic insert to remove debris from system.

2.7.3 Flexible Pipe Connectors

Provide flexible bronze or stainless steel piping connectors with single braid. Equip flanged assemblies with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Provide covers to protect the bellows where indicated.

2.7.4 Pressure and Vacuum Gauges

Gauges, JIS B 7505-1 with throttling type needle valve or a pulsation dampener and shut-off valve. Provide gauges with 115 mm dial, brass or aluminum case, bronze tube, and siphon. Gauge shall have a range from 0 kPa to approximately 1.5 times the maximum system working pressure. Each

gauge range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range.

2.7.5 Temperature Gauges

Temperature gauges, shall be the industrial duty type and be provided for the required temperature range. Provide gauges with fixed thread connection, dial face gasketed within the case; and an accuracy within 2 percent of scale range. Gauges shall have Celsius scale in 1 degree graduations scale (black numbers) on a white face. The pointer shall be adjustable. Rigid stem type temperature gauges shall be provided in thermal wells located within 1.5 m of the finished floor. Universal adjustable angle type or remote element type temperature gauges shall be provided in thermal wells located 1.5 to 2.1 m above the finished floor or in locations indicated. Remote element type temperature gauges shall be provided in thermal wells located 2.1 m above the finished floor or in locations indicated.

2.7.5.1 Stem Cased-Glass

Stem cased-glass case shall be polished stainless steel or cast aluminum, 229 mm long, with clear acrylic lens, and non-mercury filled glass tube with indicating-fluid column.

2.7.5.2 Bimetallic Dial

Bimetallic dial type case shall be not less than 89 mm stainless steel, and shall be hermetically sealed with clear acrylic lens. Bimetallic element shall be silicone dampened and unit fitted with external calibrator adjustment.

2.7.5.3 Liquid-, Solid-, and Vapor-Filled Dial

Liquid-, solid-, and vapor-filled dial type cases shall be not less than 89 mm, stainless steel or cast aluminum with clear acrylic lens. Fill shall be nonmercury, suitable for encountered cross-ambients, and connecting capillary tubing shall be double-braided bronze.

2.7.5.4 Thermal Well

Thermal well shall be identical size, 15 or 20 mm NPT connection, brass or stainless steel. Where test wells are indicated, provide captive plug-fitted type 15 mm NPT connection suitable for use with either engraved stem or standard separable socket thermometer or thermostat. Mercury shall not be used in thermometers. Extended neck thermal wells shall be of sufficient length to clear insulation thickness by 25 mm.

2.7.6 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, guides, and supports shall be in accordance with MLIT-M.

2.7.7 Escutcheons

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Secure plates in place by internal spring tension or set screws. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

2.7.8 Expansion Joints

2.7.8.1 Slip-Tube Type

Slip-tube expansion joints, SHASE-S003. Joints shall be provided with internally-externally alignment guides, injected semi-plastic packing, and service outlets. End connections shall be flanged or beveled for welding as indicated. Initial settings shall be made in accordance with the manufacturer's recommendations to compensate for ambient temperature at time of installation. Pipe alignment guides shall be installed as recommended by the joint manufacturer.

2.7.8.2 Flexible Ball Type

Flexible ball expansion joints shall be capable of 360 degrees rotation plus 15 degrees angular flex movement. Joints shall be constructed of carbon steel with the exterior spherical surface of carbon steel balls plated with a minimum 0.12 mm of hard chrome in accordance with MLIT-M. Joint end connections shall be threaded for piping 50 mm or smaller. Joint end connections larger than 50 mm shall be grooved, flanged, or beveled for welding. Provide joint with pressure-molded composition gaskets suitable for continuous operation at twice design temperature.

2.7.8.3 Bellows Type

Bellows expansion type joints, JIS B 2352 with Type 304 stainless steel corrugated bellows, reinforced with equalizing rings, internal sleeves, and external protective covers. Joint end connections shall be grooved, flanged, or beveled for welding. Guiding of piping on both sides of expansion joint shall be in accordance with the published recommendations of the manufacturer of the expansion joint.

2.8 PUMPS

Pumps shall be the electrically driven, non-overloading, centrifugal type which conform to JIS B 8308 and JIS B 8301. Pumps shall be selected at or within 5 percent of peak efficiency. Pump curve shall rise continuously from maximum capacity to shutoff. Pump motor shall conform to JIS C 4212, be [open] [splash-proof] [totally enclosed], and have sufficient wattage for the service required. Pump motor shall have the required capacity to prevent overloading with pump operating at any point on its characteristic curve. Pump speed shall not exceed 3,600 rpm, except where the pump head is less than 180 kPa, the pump speed shall not exceed 1,750 rpm. Pump motor shall be equipped with an across-the-line magnetic controller in a industrial use, dust tight enclosure with "START-STOP" switch in the cover.

2.8.1 Construction

Each pump casing shall be designed to withstand the discharge head specified plus the static head on system plus 50 percent of the total, but not less than 862 kPa. Pump casing and bearing housing shall be close grained cast iron. High points in the casing shall be provided with manual air vents; low points shall be provided with drain plugs. Provide threaded suction and discharge pressure gage tapping with square-head plugs.

Impeller shall be statically and dynamically balanced. Impeller, impeller wearing rings, glands, casing wear rings, and shaft sleeve shall be

bronze. Shaft shall be carbon or alloy steel, turned and ground. Bearings shall be ball-bearings, roller-bearings, or oil-lubricated bronze-sleeve type bearings, and be efficiently sealed or isolated to prevent loss of oil or entrance of dirt or water.

[Pump and motor shall be mounted on a common cast iron base having lipped edges and tapped drainage openings or structural steel base with lipped edges or drain pan and tapped drainage openings.Pump shall be provided with steel shaft coupling guard. Base-mounted pump, coupling guard, and motor shall each be bolted to a fabricated steel base which shall have bolt holes for securing base to supporting surface.] [Close-coupled pump shall be provided with integrally cast or fabricated steel feet with bolt holes for securing feet to supporting surface. Close- coupled pumps shall be provided with drip pockets and tapped openings.] Pump shall be accessible for servicing without disturbing piping connections. Shaft seals shall be mechanical-seals.

2.8.2 Mechanical Shaft Seals

Seals shall be single, inside mounted, end-face-elastomer bellows type with stainless steel spring, brass or stainless steel seal head, carbon rotating face, and tungsten carbide or ceramic sealing face. Glands shall be bronze and of the water-flush design to provide lubrication flush across the face of the seal. Bypass line from pump discharge to flush connection in gland shall be provided, with filter or cyclone particle separator in line.

2.9 EXPANSION TANKS

Tank shall be welded steel, constructed for, and tested to pressure-temperature rating of 862 kPa at 66 degrees C. Provide tanks precharged to the minimum operating pressure. Tank shall have a replaceable polypropylene or butyl lined diaphragm which keeps the air charge separated from the water; shall be the captive air type.

Tanks shall accommodate expanded water of the system generated within the normal operating temperature range, limiting this pressure increase at all components in the system to the maximum allowable pressure at those components. Each tank air chamber shall be fitted with a drain, fill, an air charging valve, and system connections. Tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations. The only air in the system shall be the permanent sealed-in air cushion contained within the expansion tank.

2.10 AIR SEPARATOR TANKS

Design to separate air from water and to direct released air to automatic air vent. Unit shall be of one piece cast-iron construction with internal baffles and two air chambers at top of unit; one air chamber shall have outlet to expansion tank and other air chamber shall be provided with automatic air release device. Tank shall be steel, constructed for, and tested to a construction code of pressure vessel (CCPV) pressure-temperature rating.

2.11 WATER TREATMENT SYSTEMS

When water treatment is specified, the use of chemical-treatment products containing equivalent chromium (CPR) is prohibited.

2.11.1 Water Analysis

Conditions of make-up water to be supplied to the condenser and chilled water systems were reported in accordance with JIS K 0102 and JIS Z 8802 and are as follows:

Date of Sample	[_____]
Temperature	[_____] degrees C
Silica (Sino 2)	[_____] pp (mg/1)
Insoluble	[_____] pp (mg/1)
Iron and Aluminum Oxides	[_____] pp (mg/1)
Calcium (Ca)	[_____] pp (mg/1)
Magnesium (Mg)	[_____] pp (mg/1)
Sodium and Potassium (Nan and AK)	[_____] pp (mg/1)
Carbonate (HO 3)	[_____] pp (mg/1)
Sulfate (SO 4)	[_____] pp (mg/1)
Chloride (JCL)	[_____] pp (mg/1)
Nitrate (NO 3	[_____] pp (mg/1)
Turbidity	[_____] unit
pH	[_____]
Residual Chlorine	[_____] pp (mg/1)
Total Alkalinity	[_____] PM (me/1
Non-Carbonate Hardness	[_____] PM (me/1
Total Hardness	[_____] PM (me/1
Dissolved Solids	[_____] pp (mg/1)
Fluorine	[_____] pp (mg/1)
Conductivity	[_____] McMahon/cm

2.11.2 Chilled and Condenser Water

Water to be used in the chilled and condenser water systems shall be treated to maintain the conditions recommended by this specification as well as the recommendations from the manufacturers of the condenser and evaporator coils. Chemicals shall meet all required local and base environmental regulations for the treatment of evaporator coils and direct

discharge to the sanitary sewer.

2.11.3 Glycol Solution

A [_____] percent concentration by volume of industrial grade [ethylene] [propylene] glycol shall be provided in the chilled water. The glycol shall be tested in accordance with JIS K 2234 with less than 0.013 mm penetration per year for all system metals. The glycol shall contain corrosion inhibitors. Silicate based inhibitors shall not be used. The solution shall be compatible with pump seals, other elements of the system, and water treatment chemicals used within the system.

2.11.4 Water Treatment Services

The services of a company regularly engaged in the treatment of [condenser and chilled] water systems shall be used to determine the correct chemicals required, the concentrations required, and the water treatment equipment sizes and flow rates required. The company shall maintain the chemical treatment and provide all chemicals required for the [condenser] [condenser and chilled] water systems for a period of 1 year from the date of occupancy. The chemical treatment and services provided over the 1 year period shall meet the requirements of this specification as well as the recommendations from the manufacturers of the condenser and evaporator coils. Acid treatment and proprietary chemicals shall not be used.

2.11.5 Chilled Water System

A shot feeder shall be provided on the chilled water piping as indicated. Size and capacity of feeder shall be based on local requirements and water analysis. The feeder shall be furnished with an air vent, gauge glass, funnel, valves, fittings, and piping.

2.11.6 Condenser Water

The water treatment system shall be capable of [automatically] [continuously] feeding chemicals and bleeding the system to prevent corrosion, scale, and biological formations. [Automatic chemical feed systems shall automatically feed chemicals into the condenser water based on varying system conditions.] [Continuous chemical feed systems shall continuously feed chemicals into the condenser water at a constant rate. The system shall be initially set manually based on the water analysis of the make-up water.]

2.11.6.1 Chemical Feed Pump

One pump shall be provided for each chemical feed tank. The chemical feed pumps shall be positive displacement diaphragm type. The flow rate of the pumps shall be adjustable from 0 to 100 percent while in operation. The discharge pressure of pumps shall not be less than 1.5 times the line pressure at the point of connection. The pumps shall be provided with a pressure relief valve and a check valve mounted in the pump discharge.

2.11.6.2 Tanks

Two chemical tanks shall be provided. The tanks shall be constructed of [high density polyethylene] [stainless steel] with a hinged cover. The tanks shall have sufficient capacity to require recharging only once per 7 days during normal operation. A level indicating device shall be included with each tank. An electric agitator shall be provided for each tank.

2.11.6.3 Injection Assembly

An injection assembly shall be provided at each chemical injection point along the condenser water piping as indicated. The injection assemblies shall be constructed of stainless steel. The discharge of the assemblies shall extend to the centerline of the condenser water piping. Each assembly shall include a shutoff valve and check valve at the point of entrance into the condenser water line.

2.11.6.4 Water Meter

Water meters shall be provided with an electric contacting register and remote accumulative counter. The meter shall be installed within the make-up water line, as indicated.

2.11.6.5 Timers

Timers shall be of the automatic reset, adjustable type, and electrically operated. The timers shall be suitable for a 120 volt current of available voltage. The timers shall be located within the water treatment control panel.

2.11.6.6 Water Treatment Control Panel

The control panel shall be a industrial use, drip tight, dust tight enclosure suitable for surface mounting. The panel shall be constructed of stainless steel or steel with a hinged door and lock. The panel shall contain a laminated plastic nameplate identifying each of the following functions:

(1) Main power switch and indicating light
(2) MAN-OFF-AUTO selector switch
(3) Indicating lamp for bleed-off valve
(4) Indicating lamp for each chemical feed pump
(5) Set point reading for each timer

2.11.6.7 Chemical Piping

The piping and fittings shall be constructed of [schedule 80 PVC] [stainless steel] suitable for the water treatment chemicals.

2.11.6.8 Sequence of Operation

[The chemicals shall be added based upon sensing the make-up water flow rate and activating appropriate timers. A separate timer shall be provided for each chemical. The blow down shall be controlled based upon the make-up water flow rate and a separate timer.] [The system shall contain an adjustable valve for continuous blow down. The flow rate from the appropriate chemical tanks shall be manually set at the metering pump for continuous chemical feed.] The injection of the chemical required for biological control shall be controlled by a timer which can be manually set for proper chemical feed. Timer set points, blow down rates, and chemical pump flow rates shall be determined and set by the water treatment company.

2.11.6.9 Test Kits

One test kit of each type required to determine the water quality as

outlined within the operation and maintenance manuals shall be provided.

2.11.6.10 Bleed Line

A bleed line with a flow valve of the needle-valve type sized for the flow requirement or fixed orifice shall be provided in the pump return to the tower. The bleed line shall be extended to the nearest drain for continuous discharge.

2.12 ELECTRICAL WORK

Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers including the required monitors and timed restart.

Provide high efficiency type, single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with JIS C 4212.

Provide polyphase, squirrel-cage medium induction motors, including motors that are part of a system, that meet the efficiency ratings for premium efficiency motors in accordance with JIS C 4212. Provide motors in accordance with JIS C 4212 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor.

Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.

[Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers may be provided to accomplish the same function. Use solid-state variable-speed controllers for motors rated 7.45 kW or less and adjustable frequency drives for larger motors.] [Provide variable frequency drives for motors as specified in Section 26 29 23 VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS.]

2.13 PAINTING OF NEW EQUIPMENT

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

2.13.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided. The factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test.

Salt-spray fog test shall be in accordance with JIS Z 2371, and for that test, the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of 3 mm on either side of the scratch mark. The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen.

If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 50 degrees C, the factory painting system shall be designed for the temperature service.

2.13.2 Shop Painting Systems for Metal Surfaces

Shop painting for metal surface shall be in accordance with MLIT-M.

2.14 FACTORY APPLIED INSULATION

Factory insulated items installed outdoors are not required to be fire-rated. As a minimum, factory insulated items installed indoors shall have a flame spread index no higher than 25 and a smoke developed index no higher than 150. Factory insulated items (no jacket) installed indoors and which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Flame spread and smoke developed indexes shall be determined by ASTM E84.

Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket shall be tested as a composite material. Jackets, facings, and adhesives shall have a flame spread index no higher than 25 and a smoke develop.

2.15 NAMEPLATES

Major equipment including pumps, pump motors, expansion tanks, and air separator tanks shall have the manufacturer's name, type or style, model or serial number on a plate secured to the item of equipment. The nameplate of the distributing agent will not be acceptable. Plates shall be durable and legible throughout equipment life and made of [anodized aluminum][stainless steel][_____]. Plates shall be fixed in prominent locations with nonferrous screws or bolts.

2.16 RELATED COMPONENTS/SERVICES

2.16.1 Drain and Make-Up Water Piping

Requirements for drain and make-up water piping and backflow preventer is specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

2.16.2 Cathodic Protection

Requirements for cathodic protection systems is specified in [Section 26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)] [Section 26 42 13.00 20 CATHODIC PROTECTION BY GALVANIC ANODES][and] [Section 26 42 17.00 10 CATHODIC PROTECTION SYSTEM (IMPRESSED CURRENT)][Section 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT].

2.16.3 Field Applied Insulation

Requirements for field applied insulation is specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.16.4 Field Applied Insulation

Requirements for field installed insulation is specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS, except as supplemented and modified by this specification section.

2.16.5 Field Painting

Requirements for painting of surfaces not otherwise specified, and finish painting of items only primed at the factory, are specified in Section 09 90 00PAINTS AND COATINGS.

2.16.5.1 Color Coding

Requirements for color coding for piping identification are specified in Section 09 90 00 PAINTS AND COATINGS.

2.16.5.2 Color Coding For Hidden Piping

A color coding scheme for locating hidden piping shall be in accordance with [Section 22 00 00 PLUMBING, GENERAL PURPOSE] [Section 22 00 70 PLUMBING, HEALTHCARE FACILITIES].

PART 3 EXECUTION

3.1 INSTALLATION

Cut pipe accurately to measurements established at the jobsite, and work into place without springing or forcing, completely clearing all windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation is not permitted without written approval. Cut pipe or tubing square, remove burrs by reaming, and fashion to permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers.

Notify the Contracting Officer in writing at least 15 calendar days prior to the date the connections are required. Obtain approval before interrupting service. Furnish materials required to make connections into existing systems and perform excavating, backfilling, compacting, and other incidental labor as required. Furnish labor and tools for making actual connections to existing systems.

3.1.1 Welding

Provide welding work specified this section for piping systems in conformance with JIS B 2301, as modified and supplemented by this specification section and the accompanying drawings. The welding work includes: qualification of welding procedures, welders, welding operators, brazers, brazing operators, and nondestructive examination personnel; maintenance of welding records, and examination methods for welds.

3.1.1.1 Employer's Record Documents (For Welding)

Submit for review and approval the following documentation. This

documentation and the subject qualifications shall be in compliance with JIS Z 3801.

a. List of qualified welding procedures that is proposed to be used to provide the work specified in this specification section.

b. List of qualified welders, brazers, welding operators, and brazing operators that are proposed to be used to provide the work specified in this specification section.

c. List of qualified weld examination personnel that are proposed to be used to provide the work specified in this specification section.

3.1.1.2 Welding Procedures and Qualifications

a. Specifications and Test Results: Submit copies of the welding procedures specifications and procedure qualification test results for each type of welding required. Approval of any procedure does not relieve the Contractor of the responsibility for producing acceptable welds. Submit this information on the forms printed in JIS B 8285 or their equivalent.

b. Certification: Before assigning welders or welding operators to the work, submit a list of qualified welders, together with data and certification that each individual is performance qualified as specified. Do not start welding work prior to submitting welder, and welding operator qualifications. The certification shall state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

3.1.1.3 Examination of Piping Welds

Conduct non-destructive examinations (NDE) on piping welds and brazing and verify the work meets the acceptance criteria specified in JIS Z 3801. NDE on piping welds covered by JIS B 2301 is visual inspection only. Submit a piping welds NDE report meeting the requirements specified in JIS B 2301.

3.1.1.4 Welding Safety

Welding and cutting safety requirements shall be in accordance with JIS Z 3422-1 and JIS B 6801.

3.1.2 Directional Changes

Make changes in direction with fittings, except that bending of pipe 100 mm and smaller is permitted, provided a pipe bender is used and wide weep bends are formed. Mitering or notching pipe or other similar construction to form elbows or tees is not permitted. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.

3.1.3 Functional Requirements

Pitch horizontal supply mains down in the direction of flow as indicated. The grade shall not be less than 2 mm in 1 m. Reducing fittings shall be used for changes in pipe sizes. Cap or plug open ends of pipelines and equipment during installation to keep dirt or other foreign materials out

of the system.

Pipe not otherwise specified shall be uncoated. Connections to appliances shall be made with malleable iron unions for steel pipe 65 mm or less in diameter, and with flanges for pipe 80 mm and above in diameter. Connections between ferrous and copper piping shall be electrically isolated from each other with dielectric waterways or flanges.

Piping located in air plenums shall conform to NFPA 90A requirements. Pipe and fittings installed in inaccessible conduits or trenches under concrete floor slabs shall be welded. Equipment and piping arrangements shall fit into space allotted and allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance. Electric isolation fittings shall be provided between dissimilar metals.

3.1.4 Fittings and End Connections

3.1.4.1 Threaded Connections

Threaded connecting shall be in accordance with MLIT-M.

3.1.4.2 Brazed Connections

Brazing, MLIT-M, except as modified herein. During brazing, the pipe and fittings shall be filled with a pressure regulated inert gas, such as nitrogen, to prevent the formation of scale. Before brazing copper joints, both the outside of the tube and the inside of the fitting shall be cleaned with a wire fitting brush until the entire joint surface is bright and clean. Do not use brazing flux. Surplus brazing material shall be removed at all joints. Steel tubing joints shall be made in accordance with the manufacturer's recommendations. Piping shall be supported prior to brazing and not be sprung or forced.

3.1.4.3 Welded Connections

Branch connections shall be made with welding tees or forged welding branch outlets. Pipe shall be thoroughly cleaned of all scale and foreign matter before the piping is assembled. During welding, the pipe and fittings shall be filled with an inert gas, such as nitrogen, to prevent the formation of scale. Beveling, alignment, heat treatment, and inspection of weld shall conform to JIS Z 3801. Weld defects shall be removed and rewelded at no additional cost to the Government. Electrodes shall be stored and dried in accordance with JIS G 3106 or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.4.4 Grooved Mechanical Connections

Prepare grooves in accordance with the coupling manufacturer's instructions. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, or narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.1.4.5 Flared Connections

When flared connections are used, a suitable lubricant shall be used between the back of the flare and the nut in order to avoid tearing the flare while tightening the nut.

3.1.4.6 Flanges and Unions

Except where copper tubing is used, union or flanged joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items. Flanged joints shall be assembled square end tight with matched flanges, gaskets, and bolts. Gaskets shall be suitable for the intended application.

3.1.5 Valves

Isolation gate or ball valves shall be installed on each side of each piece of equipment, at the midpoint of all looped mains, and at any other points indicated or required for draining, isolating, or sectionalizing purpose. Isolation valves may be omitted where balancing cocks are installed to provide both balancing and isolation functions. Each valve except check valves shall be identified. Valves in horizontal lines shall be installed with stems horizontal or above.

3.1.6 Air Vents

Air vents shall be provided at all high points, on all water coils, and where indicated to ensure adequate venting of the piping system.

3.1.7 Drains

Drains shall be provided at all low points and where indicated to ensure complete drainage of the piping. Drains shall be accessible, and shall consist of nipples and caps or plugged tees unless otherwise indicated.

3.1.8 Flexible Pipe Connectors

Connectors shall be attached to components in strict accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the flexible pipe connector manufacturer and shall be provided at the intervals recommended.

3.1.9 Temperature Gauges

Temperature gauges shall be located on coolant supply and return piping at each heat exchanger, on condenser water piping entering and leaving a condenser, at each automatic temperature control device without an integral thermometer, and where indicated or required for proper operation of equipment. Thermal wells for insertion thermometers and thermostats shall extend beyond thermal insulation surface not less than 25 mm.

3.1.10 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MLIT-M, except as supplemented and modified in this specification section. Hangers used to support piping 50 mm and larger shall be fabricated to permit adequate

adjustment after erection while still supporting the load. Piping subjected to vertical movement, when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers.

3.1.10.1 Horizontal Pipe Supports

Horizontal pipe supports shall be spaced as specified in equivalent Japanese Standard and a support shall be installed not over 300 mm from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m apart at valves. Pipe hanger loads suspended from steel joist with hanger loads between panel points in excess of 23 kg shall have the excess hanger loads suspended from panel points.

3.1.10.2 Vertical Pipe Supports

Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 4.5 m, not more than 2.4 m from end of risers, and at vent terminations.

3.1.10.3 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.1.10.4 Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads as specified under Sections 13 48 00 [SEISMIC] BRACING FOR MISCELLANEOUS EQUIPMENT and 23 05 48.19 [SEISMIC] BRACING FOR HVAC [as shown on the drawings.] Structural steel required for reinforcement to properly support piping, headers, and equipment but not shown shall be provided under this section. Material used for support shall be as specified under Section 05 12 00 STRUCTURAL STEEL.

3.1.10.5 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floors or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only. Structural steel brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material used for support shall be as specified under Section 05 12 00 STRUCTURAL STEEL.

3.1.11 Pipe Alignment Guides

Pipe alignment guides shall be provided where indicated for expansion loops, offsets, and bends and as recommended by the manufacturer for expansion joints, not to exceed 1.5 m on each side of each expansion joint, and in lines 100 mm or smaller not more than 600 mm on each side of the joint.

3.1.12 Pipe Anchors

Anchors shall be provided where indicated. Unless indicated otherwise, anchors shall comply with the requirements specified. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results using turnbuckles where required.

Supports, anchors, or stays shall not be attached where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline. Where pipe and conduit penetrations of vapor barrier sealed surfaces occur, these items shall be anchored immediately adjacent to each penetrated surface, to provide essentially zero movement within penetration seal.

3.1.13 Building Surface Penetrations

Sleeves shall not be installed in structural members except where indicated or approved. Except as indicated otherwise piping sleeves shall comply with requirements specified. Sleeves in nonload bearing surfaces shall be galvanized sheet metal, conforming to JIS G 3302. Sleeves in load bearing surfaces shall be uncoated carbon steel pipe, conforming to JIS G 3454 and JIS B 2301, [Schedule 30][Schedule 20][Standard weight]. Sealants shall be applied to moisture and oil-free surfaces and elastomers to not less than 13 mm depth. Sleeves shall not be installed in structural members.

3.1.13.1 Refrigerated Space

Refrigerated space building surface penetrations shall be fitted with sleeves fabricated from hand-lay-up or helically wound, fibrous glass reinforced polyester or epoxy resin with a minimum thickness equal to equivalent size Schedule 40 steel pipe. Sleeves shall be constructed with integral collar or cold side shall be fitted with a bonded slip-on flange or extended collar.

In the case of masonry penetrations where sleeve is not cast-in, voids shall be filled with latex mixed mortar cast to shape of sleeve and flange/external collar type sleeve shall be assembled with butyl elastomer vapor barrier sealant through penetration to cold side surface vapor barrier overlap and fastened to surface with masonry anchors.

Integral cast-in collar type sleeve shall be flashed [as indicated.] [with not less than 100 mm of cold side vapor barrier overlap of sleeve surface.] Normally noninsulated penetrating round surfaces shall be sealed to sleeve bore with mechanically expandable seals in vapor tight manner and remaining warm and cold side sleeve depth shall be insulated with not less than [100][_____]mm of foamed-in-place rigid polyurethane or foamed-in-place silicone elastomer.

Vapor barrier sealant shall be applied to finish warm side insulation surface. Warm side of penetrating surface shall be insulated beyond vapor barrier sealed sleeve insulation for a distance which prevents condensation. Wires in refrigerated space surface penetrating conduit shall be sealed with vapor barrier plugs or compound to prevent moisture migration through conduit and condensation therein.

3.1.13.2 General Service Areas

Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Pipes passing through concrete or masonry wall or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall be of such size as to provide a minimum of 6.35 mm all-around clearance between bare pipe and sleeves or between jacketed-insulation and sleeves. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over-insulation and sleeve shall be sealed in accordance with Section 07 92 00 JOINT SEALANTS.

3.1.13.3 Waterproof Penetrations

Pipes passing through roof or floor waterproofing membrane shall be installed through a 5.17 kg/sq. m copper sleeve, or a 0.81 mm thick aluminum sleeve, each within an integral skirt or flange.

Flashing sleeve shall be suitably formed, and skirt or flange shall extend not less than 200 mm from the pipe and be set over the roof or floor membrane in a troweled coating of bituminous cement. The flashing sleeve shall extend up the pipe a minimum of 50 mm above the roof or floor penetration. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. Penetrations shall be sealed by either one of the following methods.

a. Waterproofing Clamping Flange: Pipes up to and including 250 mm in diameter passing through roof or floor waterproofing membrane may be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.

b. Modular Mechanical Type Sealing Assembly: In lieu of a waterproofing clamping flange, a modular mechanical type sealing assembly may be installed. Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut.

   After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal rubber sealing elements to expand and provide a watertight seal between the pipe/conduit seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals shall provide sleeves of the proper diameters.

3.1.13.4 Fire-Rated Penetrations

Penetration of fire-rated walls, partitions, and floors shall be sealed as specified in Section 07 84 00 FIRESTOPPING.

3.1.13.5 Escutcheons

Finished surfaces where exposed piping, bare or insulated, pass through floors, walls, or ceilings, except in boiler, utility, or equipment rooms, shall be provided with escutcheons. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheon shall be secured to pipe or pipe covering.

3.1.14 Access Panels

Access panels shall be provided where indicated for all concealed valves, vents, controls, and additionally for items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced. Access panels shall be as specified in[Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS][Section 05 51 33 METAL LADDERS][Section 05 52 00 METAL RAILINGS][Section 05 51 00 METAL STAIRS].

3.2 ELECTRICAL INSTALLATION

Install electrical equipment in accordance with NFPA 70 and manufacturers instructions.

3.3 CLEANING AND ADJUSTING

Pipes shall be cleaned free of scale and thoroughly flushed of all foreign matter. A temporary bypass shall be provided for all water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from all water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed.

3.4 FIELD TESTS

Field tests shall be conducted in the presence of the QC Manager or his designated representative to verify systems compliance with specifications. Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor.

3.4.1 Equipment and Component Isolation

Prior to testing, equipment and components that cannot withstand the tests shall be properly isolated.

3.4.2 Pressure Tests

Each piping system shall be hydrostatically tested at a pressure not less than 1297 kPa (gage) for period of time sufficient to inspect every joint in the system and in no case less than 2 hours. Test pressure shall be monitored by a currently calibrated test pressure gauge. Leaks shall be repaired and piping retested until test requirements are met. No leakage or reduction in gage pressure shall be allowed.

Leaks shall be repaired by rewelding or replacing pipe or fittings. Caulking of joints will not be permitted. Concealed and insulated piping

shall be tested in place before concealing.

Submit for approval pressure tests reports covering the above specified piping pressure tests; describe the systems tested, test results, defects found and repaired, and signature of the pressure tests' director. Obtain approval from the QC Manager before concealing piping or applying insulation to tested and accepted piping.

3.4.3 Condenser Water Quality Test Reports

The condenser water system shall be analyzed by the water treatment company a minimum of once a month for a period of one year after system acceptance. Submit for approval the specified condenser water quality test reports. The analysis and resulting reports shall include the following information recorded in accordance with JIS K 0102.

Date of Sample	[_____]
Temperature	[_____] degrees C
Silica (Sino 2)	[_____] pp (mg/1)
Insoluble	[_____] pp (mg/1)
Iron and Aluminum Oxides	[_____] pp (mg/1)
Calcium (Ca)	[_____] pp (mg/1)
Magnesium (Mg)	[_____] pp (mg/1)
Sodium and Potassium (Nan and AK)	[_____] pp (mg/1)
Carbonate (HO 3)	[_____] pp (mg/1)
Sulfate (SO 4)	[_____] pp (mg/1)
Chloride (JCL)	[_____] pp (mg/1)
Nitrate (NO 3	[_____] pp (mg/1)
Turbidity	[_____] unit
pH	[_____]
Residual Chlorine	[_____] ppm (mg/1)
Total Alkalinity	[_____] epm (meq/1)
Non-Carbonate Hardness	[_____] epm (meq/1)
Total Hardness	[_____] epm (meq/1)
Dissolved Solids	[_____] ppm (mg/1)

Fluorine	[_____] ppm (mg/1)
Conductivity	[_____] microhm/cm

3.4.4 Related Field Inspections and Testing

3.4.4.1 Piping Welds

Examination of Piping Welds is specified in the paragraph EXAMINATION OF PIPING WELDS (above).

3.4.4.2 HVAC TAB

Requirements for testing, adjusting, and balancing (TAB) of HVAC water piping, and associated equipment is specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. Coordinate with the TAB team, and provide support personnel and equipment as specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC to assist TAB team to meet the TAB work requirements.

3.5 INSTRUCTION TO GOVERNMENT PERSONNEL

Furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the [chilled water,] [chilled-hot water,][and][condenser water piping system[s]]. Instructors shall be thoroughly familiar with all parts of the installation and shall be instructed in operating theory as well as practical operation and maintenance work. Submit a lesson plan for the instruction course for approval. The lesson plan and instruction course shall be based on the approved operation and maintenance data and maintenance manuals.

Conduct a training course for the operating staff and maintenance staff selected by the Contracting Officer. Give the instruction during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be [one man-day.][[_____][_____] continuous man-days]. Use approximately half of the time for classroom instruction and the other time for instruction at the location of equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

3.6 ONE-YEAR INSPECTION REPORT FOR COOLING WATER

At the conclusion of the one year period, each connecting [cooling tower] [and] [liquid chiller condenser] inspect for problems due to corrosion, scale, and biological growth. If the equipment is found not to conform to the manufacturers recommended conditions, and the water treatment company recommendations have been followed; the water treatment company shall provide all chemicals and labor for cleaning or repairing the equipment as required by the manufacturer's recommendations.

-- End of Section --

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SECTION 23 65 00

COOLING TOWERS AND REMOTE EVAPORATIVELY-COOLED CONDENSERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS C 4203	(2010) Single Phase Induction Motors for General Purpose (Amendment 1)
JIS C 4212	(2010) Low-Voltage Three-Phase Squirrel-Cage High-Efficiency Induction Motors (Amendment 1)
JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS G 5501	(1995) Grey Iron Castings
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS K 7013	(2009)Fibre Reinforced Plastic Pipes (Amendment 1)
JIS Z 2371	(2015) Methods of Salt Spray Testing
JIS Z 8106	(2000) International Electrotechnical Vocabulary Chapter 801 : Acoustics and Electroacoustics

MLIT MECHANICAL STANDARD SPECIFICATION

MLIT-M	(2019) Public Building Construction Standard Specification

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Cooling Towers; G[, [_____]]

Remote Evaporatively-Cooled Condensers

[Packaged Cooling Tower - Field Acceptance Test Plan; G[, [_____]]

][Field-Erected Cooling Tower - Field Acceptance Test Plan; G[, [_____]]

][Packaged Cooling Tower - Field Acceptance Test Report; G[, [_____]]

][Field-Erected Cooling Tower - Field Acceptance Test Report; G[, [_____]]

] SD-07 Certificates

Cooling Tower

Remote Evaporatively-Cooled Condensers

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

Remote Evaporatively-Cooled Condensers

1.3 SAFETY REQUIREMENTS

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel must be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices must be installed so that proper operation of equipment is not impaired. Welding and cutting safety requirements must be in accordance with Occupational Safety and Health Act Enforcement Regulations (Roudou-Anzen-Eiseihou-Sekou-kisoku) for Japanese Standard. [[Catwalk,] [ladder,] [and guardrail] must be provided where indicated and in accordance with[Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS][Section 05 51 33 METAL LADDERS][Section 05 52 00 METAL RAILINGS][Section 05 51 00 METAL STAIRS].]

1.4 DELIVERY, STORAGE, AND HANDLING

Stored items must be protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, piping and similar openings must be capped to keep out dirt and other foreign matter.

1.5 PROJECT/SITE CONDITIONS

1.5.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.5.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The

Contractor must carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and must arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

Materials and equipment must be standard commercial catalogued products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products must have been in satisfactory commercial or industrial use in field service for two years prior to bid opening. The two year use must include applications of equipment and materials under similar circumstances and of similar size. Products having less than a two year field service record will be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. This 6000 hour record must not include any manufacturer's prototype or factory testing. Records of satisfactory field use must be completed by a product that had been, and presently is, sold, or offered for sale on a commercial market through the following copyrighted means: advertisements, manufacturer's catalogs, or brochures. Products must be supported by a service organization located in Japan. System components must be environmentally suitable for the indicated locations.

2.2 MANUFACTURER'S STANDARD NAMEPLATES

Major equipment including cooling towers, cooling tower gear drive assemblies, fans, and motors must have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment. Plates must be durable and legible throughout equipment life. Plates must be fixed in prominent locations.

2.3 ELECTRICAL WORK

a. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown, must be provided. For packaged equipment, the manufacturer must provide controllers including the required monitors and timed restart.

b. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with JIS C 4203.

c. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system, and that meet the efficiency ratings for premium efficiency motors in accordance with JIS C 4212.

d. Provide motors in accordance with JIS C 4212 and of sufficient size to drive the load at the specified capacity without exceeding the

nameplate rating of the motor. Motors must be rated for continuous duty with the enclosure specified. Motor duty requirements must allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque must be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. [Motor bearings must be fitted with grease supply fittings and grease relief to outside of the enclosure.] Motor enclosure type may be either TEAO or TEFC.

e. [Where two-speed motors are indicated, variable-speed controllers may be provided to accomplish the same function.][Use adjustable frequency drives for all variable-speed motor applications.] Provide variable frequency drives for motors as specified in Section 26 29 23 VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS.

f. Provide inverter duty premium efficiency motors for use with variable frequency drives.

2.4 COOLING TOWER MATERIALS

2.4.1 Fiberglass Reinforced Plastic (FRP)

FRP components must be inert, corrosion resistant, and fire-retardant with a thickness of 3.66 kg per square meter. FRP components must contain an ultraviolet (UV) ray inhibitor. Components manufactured of polystyrene will not be permitted.

2.4.2 Zinc-Coated Steel

Components fabricated of zinc-coated steel must be not lighter than 16 gauge 1.613 mm steel, protected against corrosion by a zinc coating. The zinc coating must conform to JIS G 3302, as applicable and have an extra heavy coating of not less than 760g per square meter of surface. Galvanized surfaces damaged due to welding must be coated with zinc rich coating.

2.4.3 High Density Polyethylene (HDPE)

Components manufactured from HDPE must be seamless with a minimum thickness of 10 mm. The material must have the appropriate inhibitors to protect the component from any UV degradation. Tanks and cooling tower shells must be seamlessly molded to minimize water loss/consumption.

2.4.4 Stainless Steel Sheets

Type [304][316].

2.4.5 Concrete

Concrete must conform to Section 03 30 00 CAST-IN-PLACE CONCRETE. Exposed concrete must be rub-finished for smooth and uniform surfaces free of form marks and defects. Honeycomb concrete will not be permitted.

2.4.6 Hardware

Bolts must be cadmium-plated, zinc-coated steel, or Type 304 stainless steel. Each bolt must be provided with neoprene and cadmium-plated steel

washers under the heads. Nails must be silicon bronze, commercial bronze, or stainless steel. Hardware must meet the salt-spray fog test as defined by JIS Z 2371. Angle brackets and similar parts must be zinc-coated steel. Zinc coatings must conform to JIS H 8641 and JIS H 8641, as applicable, and must have an extra heavy coating of not less than 760g per square meter of surface. Nails must be silicon bronze, commercial bronze, or stainless steel. Subject hardware to a salt-spray fog test in accordance with JIS Z 2371. No signs of corrosion must be evident after continuous exposure to a salt spray.

2.5 COOLING TOWERS

2.5.1 Factory Assembled Towers

2.5.1.1 Description

The cooling tower must be of the [induced mechanical draft][or forced mechanical draft] type. The cooling tower must include frames and casings, louvers, drift eliminators, partitions, windbreak baffles, drift-check walls, cold water basin equipment, fans and fan walls, blowers, drives, electric motors, access doors, [working platforms,] inspection plates, and panels.

2.5.1.2 Construction

Tower must be constructed to withstand a wind pressure of not less than 1.44 kilopascal (kPa) on any external surface. Fan deck must be constructed to withstand a live load of not less than 2.87 kPa in addition to the concentrated or distributed loads of equipment mounted on the fan deck.

The hot water distribution system must be of the open basin gravity feed type or the pressurized spray header type design.

2.5.1.3 Tower Frame and Louvers

Provide frame constructed from [galvanized steel][_____]. Intermediate structural members must be provided for rigidity and support of casings, louvers, fill, distribution systems, fan decks, and other equipment. Inlet air louvers must permit free air passage but no splashout, and must be designed to prevent debris and sunlight from entering the cold water basin.

2.5.1.4 Air Inlet And Discharge Connections

On forced draft centrifugal type units, the air inlet and discharge connections must have flanged or lipped projections for connecting to ductwork.

2.5.1.5 Fill

The fill must support expected loads without sag or failure and arranged to effectively break up the water. The fill must be manufactured and performance tested by the cooling tower manufacturer. The fill must be of the materials as specified. Polyvinyl chloride (PVC) fill is suitable for inlet temperatures to 51.7 degrees C on cross flow type units and temperatures to 54.4 degrees C on counterflow type units. Chlorinated polyvinyl chloride(CPVC) fill must be used for applications where inlet temperatures are greater than 54.4 degrees C. Fill must be in accordance

with MLIT-M.

2.5.1.6 Drift Eliminators

Provide drift eliminator sections designed and arranged to effectively trap water droplets entrained in the discharge airstream. Sections must be assembled in easily removable sections for forced mechanical drift tower and counterflow induced mechanical draft tower. Drift eliminators must be constructed of Polyvinyl chloride (PVC) in accordance with MLIT-M.

2.5.1.7 Cold Water Basin Equipment.

Include [galvanized steel] [Type 304 stainless steel] sump with stainless steel removable screen and vortex breaker, float valves, and necessary pipe connections and fittings within the tower. [Provide float valves with adjustable arms. Valve sizes larger than 13 mm pipe size must be the balanced piston type. Valve seats and disks must be replaceable.] [Electronic water level control must be provided.]

Provide cold water basins and casings suitably sealed and flashed at joints and connections to ensure watertight construction.

2.5.1.7.1 Electric Basin Heater

Heater must be the electric immersion type with water-tight junction boxes mounted in the basin with sufficient capacity to maintain the basin water temperature above 12.8 degrees C at an ambient temperature of 4.4 degrees C. Heater must be complete with control thermostat, transformer, contactor, and low water level heater protection.

2.5.1.8 Fans, Blowers, and Drives.

The towers must have axial propeller-type fans having not less than four aluminum alloy or glass-reinforced polypropylene blades or squirrel-cage, centrifugal-type blowers, as applicable. Fans and blowers must be designed and constructed to withstand 50 percent overspeed above normal maximum operating speeds.

If belt drives are utilized, multi-grooved solid back single belt design must be used to avoid uneven belt stretch. Adjustment must be provided for belt tension and drive centers. Belt drives must be designed and constructed for 150 percent overload. Sheaves located in the airstream must be corrosion-resistant material. Shafting for gear drives must have flexible-type couplings requiring no lubrication. The gear assemblies must be enclosed in an oil filled housing provided with fill and drain plugs.

2.5.1.9 Tower Piping

Piping must be schedule 40 PVC and conform to JIS K 7013. Fittings for other piping materials must be of the same material or equal and of the same class and grade as the pipe.

2.5.1.10 Electric Motors

Requirements are specified in paragraph ELECTRICAL WORK.

2.5.1.11 Vibration Cutout Switch.

Provide [electronic vibration cutout switch with auxiliary contacts in a protected position and most effective location, interlocked with the fan wiring to electrically open the motor circuit under excessive fan vibration.]

2.5.1.12 Performance

The factory assembled tower must have Cooling Tower Institute certification that the cooling tower will perform thermally at the rating published by the tower manufacturer in his copyrighted literature.

2.5.1.13 Sound Power Level

Sound power levels, in decibels (dB)with a reference pressure of 0.0002 microbars, of the cooling tower must be not greater than the maximum permitted dB levels for the designated octave band as set forth in Table I or Table II. The sound power level data for the cooling tower must have been verified in tests conducted in accordance with JIS Z 8106.

Table I. Sound Power Level For Induced Mechanical Draft Type

Octave Band (Hz)	63	125	250	500	1000	2000	4000	8000
Sound Power Level (dB)	112	112	110	108	102	98	93	90

Table II. Sound Power Level For Forced Mechanical Draft Type

Octave Band (Hz)	63	125	250	500	1000	2000	4000	8000
Sound Power Level (dB)	112	112	110	108	102	98	93	90

2.5.1.14 Drift Loss

Drift loss must be not greater than 0.005 percent of the water circulated.

2.5.2 Lubrication

The lubricating points must be extended to the outside of the unit for easy accessibility. Where use of high pressure lubricating equipment, 6894 kPa or higher, will damage grease seals or other parts, a suitable warning must be affixed to the equipment in a conspicuous location.

2.5.3 Factory Finish System

[Factory painting system] must have been proven to withstand 125 hours in a salt-spray fog test, except that equipment located outdoors must withstand 500 hours in a salt-spray fog test. Equipment located in a sea coast environment must withstand 3,000 hours in a salt-spray fog test. Salt-spray fog test must be in accordance with JIS Z 2371. For salt-spray

fog test, the acceptance criteria must be as follows: immediately after completion of the test, the paint must show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen must show no signs of rust creepage beyond 3 mm on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment must not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 50 degrees C, the factory painting system must be designed for the temperature service and must have been proven to pass the specified salt-spray test.

2.5.4 Field-Assembled Cooling Towers

Factory fabricated, factory-assembled towers which are shipped to the job site in separate cells or modules must be provided with all appropriate manufacturer's hardware for assembly in the field. Factory fabricated, field-assembled towers must be assembled and adjusted at the job site by a factory representative.

2.5.4.1 Framework, Casing, and Supports

Towers must be designed and constructed to withstand a wind pressure of not less than [1.4] [_____] kPa on external surfaces. Framework, structural supports, and equipment supports must be [zinc-coated steel,] [Type 304 stainless steel,] [air-entrained concrete] [FRP,] [or] [lumber]. Casing (exterior enclosing walls) must be constructed of [zinc-coated steel], [Type 304 stainless steel], [air-entrained concrete] [FRP]. Materials provided for framework, casings and equipment supports must be compatible. Structural supports must be provided in accordance with the recommendations of the manufacturer of the tower unless otherwise indicated.

2.5.4.2 Foundations

Cooling tower foundations must meet the requirements of the cooling tower manufacturer and wind and seismic loads, wind and seismic loads and be as indicated. Foundation design must be based on the load conditions and soil bearing value indicated. Foundation calculations must be submitted with the equipment drawings.

2.5.4.3 Stairways and Ladders

Provide stairs, 60-degree ship ladders or straight-rung ladders of standard design, starting at [ground] [roof] level and extending as high as required to gain access to fan decks and water distribution systems. Stairways and ladders must be hot-dip, zinc-coated steel. Ladders higher than 3.66 meters must have a safety cage.

2.5.4.4 Hand Railings

Steel hand railings must be not less than 1067 mm high around the exterior of each working surface that is 3.66 m or more above the ground, roof, or other supporting construction. Railings must be not smaller than 32 mm zinc-coated steel pipe with standard zinc-coated steel railing.

2.5.4.5 Access Doors

Each tower must be provided with access doors at grade level to provide entry to the interior for service maintenance without removal of the fill. Doors must be provided on each endwall of each cooling tower cell. Frame and brace access doors to prevent damage when opening and closing. Doors must be located adjacent to float controls.

2.5.4.6 Louvers

Air inlets for each cooling tower must be provided with individually removable louvers arranged to prevent the escape of water. Louvers must be constructed of [PVC], [fiberglass reinforced polyester], [zinc-coated steel], [Type 304 stainless steel] [FRP]. Materials provided for casings and louvers must be compatible; one material must not produce stains upon the other. Air intakes must be provided with 25 mm zinc-coated steel mesh.

2.5.4.7 Fan Deck and Cylinder

Each fan must be mounted in a fan cylinder (or stack) to elevate the fan discharge air. Total extension height must not exceed the fan diameter. Each fan cylinder must be provided with a zinc-coated steel, 12 gauge 2.753 mm wire mesh securely mounted to the top of the cylinder in accordance with manufacturer's recommendations. Fan decks must be designed to withstand a live load of not less than [1.9] [2.9] kPa in addition to the concentrated or distributed loads of equipment mounted on the fan decks. [Fan deck and cylinders must be constructed of zinc-coated steel, lumber, Type 304 stainless steel, or FRP and be compatible with the entire tower construction.] [Fan deck must be constructed of precast, reinforced lightweight concrete, in multiple sections, forming a complete, vibration-free base for mounting fan, speed reducer, drive shaft, motor, and fan stacks. Fan cylinders (or stacks) must be constructed of precast, reinforced lightweight concrete in multiple sections, constrained with bands of zinc-coated steel conforming to JIS H 8641, not less than 3 by 75 mm, and bolted to form a compressive load on stack perimeter. Fan cylinder must be secured in place on the fan deck with Class A mortar.]

2.5.4.8 Fans

Fans must be the [centrifugal] [or] [adjustable-pitch propeller] type, constructed of zinc-coated steel, Type 304 stainless steel, aluminum or an aluminum alloy, or FRP. Propeller type fans must have a maximum tip speed of 330 m/minute. Fan blade assembly must be both statically and dynamically balanced after assembly of the cooling tower. Fan hub must be constructed of [zinc-coated steel], [stainless steel], [cast aluminum] with adequate surface protection against corrosion. Complete fan assembly (fan and mounting) must be designed to give maximum fan efficiency and long life when handling saturated air at high velocities. Each cooling tower fan must be provided with a ball and pedestal type vibration limit switch which must stop the corresponding fan motor in the event of sensing excessive fan vibration.

2.5.4.9 Speed Reducers Gears and Drive Shaft

Speed reducer gears must be rated. Reducer must be mounted in accordance with manufacturer's recommendations. Each reducer must be provided with an oil level cutoff switch interlocked to the fan motor. Each reducer must be provided with an oil level sight glass, fill, drain, and vent lines located in a readily accessible position. Drive shafts must be the

full floating type with flexible couplings at both ends and have a service factor of 1.0 or greater. Drive shafts must be of stainless steel, fitted each end with flexible couplings (stainless steel plate type). Each drive shaft must be provided with a galvanized steel guard, to prevent damage to surrounding equipment in case of shaft failure. Provision must be made for lubrication of all bearings. Bearings must be accessible to the extent that each bearing can be lubricated without dismantling fan.

2.5.4.10 Electric Motors

Each motor must be a [single speed], [two speed] [variable speed], totally enclosed, insulation JIS C 4212, continuous-rated type which conforms to JIS C 4212. Motors must have [open], [dripproof], [totally enclosed], [explosion proof] enclosures and be located outside the discharge airstream. Motors must be mounted according to manufacturer's recommendations. Motors must be provided specifically for either pump or fan application and must comply with the requirements of paragraph ELECTRICAL WORK.

2.5.4.11 Cold Water Basin

Basin must be completely watertight and constructed of [zinc-coated steel] [Type 304 stainless steel] [FRP]. Basin must be constructed and installed to ensure that air will not be entrained in outlets when operating and no water will overflow on shutdown. Each individual sump must be provided with an individual outlet. Each outlet must be provided with a 13 mm stainless steel wire mesh, securely mounted to prevent trash from entering the outlet. Each basin must be provided with overflow and drain valve connections. Each basin must be provided with a float-controlled, makeup water valve as indicated. The makeup water must discharge not less than 50 mm or two pipe diameters, whichever is greater, above the top of the basin.

2.5.4.12 Electric Basin Heater

Heater must be the electric immersion type with water-tight junction boxes mounted in the basin with sufficient capacity to maintain the basin water temperature above 4.4 degrees C at an ambient temperature of [_____] degrees C. Heater must be complete with control thermostat, transformer, contactor, and low water level heater protection.

2.5.4.13 Hot Water Distribution System

Water distribution must be the [pressurized-flow] type system which distributes waters evenly over the entire fill surface. Each tower cell must be designed so that a water flow of 140 percent capacity will not cause overflowing or splashing. The distribution system for each cell must include adjustable flow control valves. The entire distribution system must be self-draining and nonclogging. Piping must be either cast iron, ductile iron, threaded-glass-fiber reinforced epoxy pipe, polypropylene, PVC or Schedule 80 black steel.

a. Gravity-Flow System: System must be provided with open basins which include a splash box or baffles to minimize splashing of incoming hot water and holes that evenly distribute the water over the entire decking area. Holes used in a water basin must be provided with ceramic or plastic orifice inserts.

b. Pressurized-Flow System: System must include piping, fittings,

branches, and spray nozzles. Spray nozzles must be schedule 40 PVC. Nozzles must be cleanable, nonclogging, removable, and spaced for even distribution.

c. Basin Cover: Hot water distribution basins must be provided with the tower manufacturer's standard removable, [zinc-coated galvanized steel] [304 stainless steel] [FRP] covers. Covers must prevent airborne debris from entering the basin.

2.5.5 Drift Eliminators

Eliminators must be provided in the tower outlet to limit drift loss to not over [0.005] percent of the circulating water rate. Eliminators must be constructed of polyvinyl chloride (PVC). Eliminators sections must be supported on PVC or FRP tee sections.

2.5.6 Cold Water Basin Equipment.

Include sump with removable screen and vortex breaker, float valves, and necessary pipe connections and fittings within the tower. Provide float valves with adjustable arms. Valve sizes larger than 13 mm pipe size must be the balanced piston type. Valve seats and disks must be replaceable. [Electric water level control must be provided.]

Provide cold water basins and casings suitably sealed and flashed at joints and connections to ensure watertight construction.

2.5.7 Fill (Heat Transfer Surface)

Tower fill must be the [splash] [or] [film] type. Fill material must be free to expand or contract without warping or cracking. No plasticized wood cellulose must be provided for fill material. Fill must be removable or otherwise made accessible for cleaning. Space supports must be corrosion resistant and must prevent warping, sagging, misalignment, or vibration of the fill material. Fill material and supports must be designed to provide for an even mixing of air and water. Fill material must be constructed of [aluminum] [stainless steel] [tile of multi-cell design, set without mortar] [PVC formed sheets, zinc-coated steel] in a pattern, and of sufficient height to meet the performance specifications. [Tile fill must be vitreous, with a low water absorption that will pass a freeze-thaw test conducted. Tile fill must have a minimum crushing strength of 13.8 MPa over the gross area of the tile when the load is applied parallel to the cells. Cast iron tee section lintels supporting the tile fill must conform to JIS G 5501, Class 25, 3.2 mm additional thickness for corrosion. Lintels must be designed with a safety factor of 2 minimum.]

2.5.8 Meters and Controls

Tower must be provided with makeup and blowdown meters, conductivity controller, and overflow alarm.

2.6 REMOTE EVAPORATIVELY-COOLED CONDENSERS

Condenser must include fans, water pump with suction strainer, electric motor and drive equipment, water eliminators if required, condensing coil, liquid receiver if required, water pan or sump, spray nozzles or water-distribution pan, water strainer, water make-up assembly, bleeder with flow valve of the needle valve type sized for the flow required or a

fixed orifice, enclosure with suitable access doors, and air-inlet and outlet openings. No water may carry over into the unit discharge outlet.

2.6.1 Condenser Casing

Enclosure must be constructed of not lighter than 18 gauge 1.311 mm[hot-dip galvanized steel][304 stainless steel], reinforced and braced. Access doors or panels suitably sized and located must be provided for access to water nozzles or distribution pan, coils, and valves for cleaning, repair, or removal of the item. Access doors or panels must be gasketed with synthetic rubber, or equivalent gasket material, and locked in place with thumb screws or catches. One-half inch mesh hot-dip galvanized steel or copper air-inlet screens must be provided on each air inlet.

2.6.2 Refrigerant Section

Condenser coil must be constructed of unfinned copper or steel tubes hot-dip galvanized after fabrication. A refrigerant charging valve must be installed in the liquid line between the receiver cut-off valve and the expansion device. Refrigerant section must be tested in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku) for the refrigerant employed in the system. CFC-based refrigerants are prohibited.

2.6.3 Fans

Fans must be centrifugal or propeller type as best suited for the application. Fans must be direct or V-belt driven. Belt drives must be completely enclosed within the unit casing or equipped with a guard. When belt drive is provided, an adjustable sheave to furnish not less than 20 percent fan-speed adjustment must be provided. Sheave set must be matched and selected to provide the capacity indicated at the approximate midpoint of the adjustment. Fans must be statically and dynamically balanced. Fan motor must be totally enclosed type or open drip-proof and located within an enclosure to be fully protected from the weather.

2.6.4 Water Section

Water eliminators must be constructed of nonferrous metal, of an approved nonmetallic material, or of not lighter than 24 gauge 0.701 mm steel, hot-dip galvanized after fabrication. Spray nozzles must be brass non-clogging type designed to permit easy disassembly, and must be arranged for easy access. Water pump must be bronze-fitted centrifugal or turbine type, and may be mounted as an integral part of the evaporative condenser or remotely on a separate mounting pad. Pump suction must be fully submerged and provided with screened inlet. Water pan or sump must be constructed of not lighter than 14 gauge 1.994 mm steel, hot-dip galvanized after fabrication, or molded acid-resistant glass-fiber-reinforced polyester. Water distribution pan must be constructed of not lighter than 16 gauge 1.613 mm steel, hot-dip galvanized after fabrication. Joints must be watertight. Water pan or sump must be provided with drain, overflow, and make-up water connection with stop valve and float valve. A bleed line with a flow valve of the needle type sized for the flow required or fixed orifice must be provided in the pump discharge line and must be extended to the nearest drain for continuous discharge.

2.7 FABRICATION

Equipment and component items, must have been proven to withstand 125 hours in a salt-spray fog test, except that equipment located outdoors must withstand 500 hours in a salt-spray fog test. Equipment located in a sea coast environment must withstand 3,000 hours in a salt-spray fog test. Salt-spray fog test must be in accordance with JIS Z 2371. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used must be coated with a zinc-rich coating conforming to JIS H 8641.

2.8 SUPPLEMENTAL COMPONENTS/SERVICES

2.8.1 Condenser Water Piping and Accessories

Condenser water piping and accessories must be provided and installed in accordance with Section 23 64 26 CHILLED, CHILLED-HOT, AND CONDENSER WATER PIPING SYSTEMS.

2.8.2 Cooling Tower Water Treatment Systems

Cooling tower water treatment systems must be provided and installed in accordance with Section 23 64 26 CHILLED, CHILLED-HOT AND CONDENSER WATER PIPING SYSTEMS.

2.8.3 Temperature Controls

Cooling towers must be fully coordinated with and integrated [into the temperature control system specified in [Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC][Section 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS] [or] [Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS]] [into the existing air-conditioning system].

PART 3 EXECUTION

3.1 DEMONSTRATIONS

Contractor must conduct a training course for the operating staff as designated by the Contracting Officer. The training period must consist of a total [__8___] hours of normal working time and start after the system is functionally completed but prior to final acceptance tests. The training course must cover all of the items contained in the approved Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations.

Provide a schedule, at least [2] [_____] weeks prior to the date of the proposed training course, which identifies the date, time, and location for the training.

3.2 INSTALLATION

Installation of cooling tower systems including materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing must be in compliance with the manufacturer's written installation instructions, including the following:

(1) Packaged cooling tower - installation instructions

(2) Field-erected cooling tower - installation instructions

3.2.1 Installation Instructions

Provide manufacturer's standard catalog data, at least [5] [_____] weeks prior to the purchase or installation of a particular component, highlighted to show features such as materials of construction, dimensions, options, performance and efficiency. Data must include manufacturer's recommended installation instructions and procedures. Data must be adequate to demonstrate compliance with contract requirements.

3.2.2 Vibration Isolation

If vibration isolation is specified for a unit, vibration isolator literature must be included containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations.

3.2.3 Posted Instructions

Provide posted instructions, including equipment layout, wiring and control diagrams, piping, valves and control sequences, and typed condensed operation instructions. The condensed operation instructions must include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions must be framed under glass or laminated plastic and be posted where indicated by the Contracting Officer.

3.2.4 Verification of Dimensions

Provide a letter including the date the site was visited, conformation of existing conditions, and any discrepancies found.

3.2.5 Demonstrations

Provide a schedule, at least [2] [_____] weeks prior to the date of the proposed training course, which identifies the date, time, and location for the training.

3.2.6 Certificates

Where the system, components, or equipment are specified to comply with requirements of JIS or other Japanese requirements, proof of such compliance must be provided. The label or listing of the specified agency must be acceptable evidence. In lieu of the label or listing, a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency may be submitted.

3.2.7 Operation and Maintenance Manuals

Provide [Six] [_____] complete copies of an operation manual in bound 216 by 279 mm booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least [4] [_____] weeks prior to the first training course. The booklets must include the manufacturer's name, model number, and parts list. The manuals must include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic

operating features. [Six] [_____] complete copies of maintenance manual in bound 216 by 279 booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals must include piping and equipment layouts and simplified wiring and control diagrams of the system as installed.

3.2.8 Connections to Existing Systems

Notify the Contracting Officer in writing at least 15 calendar days prior to the date the connections are required. Obtain approval before interrupting service. Furnish materials required to make connections into existing systems and perform excavating, backfilling, compacting, and other incidental labor as required. Furnish labor and tools for making actual connections to existing systems.

3.3 RELATED FIELD TESTING

3.3.1 Test Plans

a. Manufacturer's Test Plans: Within [120] [_____] calendar days after contract award, submit the following plans:

(1) Packaged cooling tower - field acceptance test plan

(2) Field-erected cooling tower - field acceptance test plan

Field acceptance test plans must developed by the cooling tower manufacturer detailing recommended field test procedures for that particular type and size of equipment. Field acceptance test plans developed by the installing Contractor, or the equipment sales agency furnishing the equipment, will not be acceptable.

The Contracting Officer will review and approve the field acceptance test plan for each of the listed equipment prior to commencement of field testing of the equipment. The approved field acceptance test plans must be the plan and procedures followed for the field acceptance tests of the cooling towers and subsequent test reporting.

b. Coordinated testing: Indicate in each field acceptance test plan when work required by this section requires coordination with test work required by other specification sections. Furnish test procedures for the simultaneous or integrated testing of tower system controls which interlock and interface with controls for the equipment provided under [Section 23 09 53.00 20, SPACE TEMPERATURE CONTROL SYSTEMS] [Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC][Section 23 09 23.01 LONWORKS DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS] [or] [Section 23 09 23.02 BACNET DIRECT DIGITAL CONTROL FOR HVAC AND OTHER BUILDING CONTROL SYSTEMS].

c. Prerequisite testing: Cooling towers for which performance testing is dependent upon the completion of the work covered by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC must have that work completed as a prerequisite to testing work under this section. Indicate in each field acceptance test plan when such prerequisite work is required.

d. Test procedure: Indicate in each field acceptance test plan each equipment manufacturers published installation, start-up, and field

acceptance test procedures. Include in each test plan a detailed step-by-step procedure for testing automatic controls provided by the manufacturer.

Each test plan must include the required test reporting forms to be completed by the Contractor's testing representatives. Procedures must be structured to test the controls through all modes of control to confirm that the controls are performing with the intended sequence of control.

Controllers must be verified to be properly calibrated and have the proper set point to provide stable control of their respective equipment.

e. Performance variables: Each test plan must list performance variables that are required to be measured or tested as part of the field test.

Include in the listed variables performance requirements indicated on the equipment schedules on the design drawings. Tower manufacturer must furnish with each test procedure a description of acceptable results that have been verified.

Tower manufacturer must identify the acceptable limits or tolerances within which each tested performance variable must acceptably operate.

f. Job specific: Each test plan must be job specific and must address the particular cooling towers and particular conditions which exist with this contract. Generic or general preprinted test procedures are not acceptable.

g. Specialized components: Each test plan must include procedures for field testing and field adjusting specialized components, such as hot gas bypass control valves, or pressure valves.

3.4 TESTING

a. Each cooling tower system must be field acceptance tested in compliance with its approved field acceptance test plan and the resulting following field acceptance test report submitted for approval:

(1) Packaged cooling tower - field acceptance test report

(2) Field-erected cooling tower - field acceptance test report

b. Manufacturer's recommended testing: Conduct the manufacturer's recommend field testing in compliance with the approved test plan. Furnish a factory trained field representative authorized by and to represent the equipment manufacturer at the complete execution of the field acceptance testing.

c. Operational test: Conduct a continuous 24 hour operational test for each item of equipment. Equipment shutdown before the test period is completed must result in the test period being started again and run for the required duration. For the duration of the test period, compile an operational log of each item of equipment. Log required entries every two hours. Use the test report forms for logging the operational variables.

d. Notice of tests: Conduct the manufacturer's recommended tests and the operational tests; record the required data using the approved reporting forms. Notify the Contracting Officer in writing at least 15 calendar days prior to the testing. Within 30 calendar days after acceptable completion of testing, submit each test report for review and approval.

e. Report forms: Type data entries and writing on the test report forms. Completed test report forms for each item of equipment must be reviewed, approved, and signed by the Contractor's test director. The manufacturer's field test representative must review, approve, and sign the report of the manufacturer's recommended test. Signatures must be accompanied by the person's name typed.

f. Deficiency resolution: The test requirements acceptably met; deficiencies identified during the tests must be corrected in compliance with the manufacturer's recommendations and corrections retested in order to verify compliance.

g. Towers with thermal performance must have their thermal performance verified by field testing.

-- End of Section --

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SECTION 23 81 00

DECENTRALIZED UNITARY HVAC EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 8607	(2008) Flare Type and Brazing Type Fittings for Refrigerants
JIS B 8615-1	(2013) Non-ducted Air Conditioners and Heat Pumps-Testing and Rating for Performance
JIS B 8616	(2015) Package Air Conditioners
JIS B 9908-1	(2019) Test Method of Air Filter Units for Ventilation and Electric Air Cleaners for Ventilation-Part 1: Technical Specifications, Requirements and Classification System Based Upon Particulate Matter Efficiency
JIS C 4212	(2010) Low-Voltage Three-Phase Squirrel-Cage High-Efficiency Induction Motors (Amendment 1)
JIS C 9730-1	(2019) Automatic Electrical Controls-Part 1: General Requirements
JIS C 9730-2-9	(2010) Automatic Electrical Controls for Household and Similar Use-Part 2-9: Particular Requirements for Temperature Sensing Controls
JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and Strip
JIS H 3300	(2018) Copper and Copper Alloy Seamless Pipes and Tubes
JIS H 3401	(2001) Pipe Fittings of Copper and Copper Alloys

JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS Z 2371	(2015) Methods of Salt Spray Testing

MLIT MECHANICAL STANDARD SPECIFICATION

MLIT-M	(2019) Public Building Construction Standard Specification

JAPAN REFRIGERATION AND AIR CONDITIONING INDUSTRY ASSOCIATION

JRA Standard	Japan Refrigeration and Air Conditioning

THE JAPAN ELECTRICAL MANUFACTURERS' ASSOCIATION (JEMA)

JEM 1038	AC Electromagnetic Contactor
JEM 1167	High Voltage Electromagnetic Contactor

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section with the additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval or for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Field-Assembled Refrigerant Piping

Control System Wiring Diagrams

SD-03 Product Data

Room Air Conditioners

Packaged Terminal Units

Heat Pumps, Air to Air

Air Conditioners

SD-06 Test Reports

Start-Up and Initial Operational Tests

SD-10 Operation and Maintenance Data

Room Air Conditioners, Data Package 3

Packaged Terminal Units, Data Package 3

Heat Pumps, Air to Air, Data Package 3

Air Conditioners, Data Package 3

Filters, Data Package 2

Thermostats, Data Package 2

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.4 QUALITY ASSURANCE

1.4.1 Modification of References

Accomplish work in accordance with the referenced publications, except as modified by this section. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to "the Authority having jurisdiction," "the Administrative Authority," "the Owner," or "the Design Engineer" to mean the Contracting Officer.

1.4.2 Detail Drawing

For refrigerant piping, submit piping, including pipe sizes. Submit control system wiring diagrams.

1.4.3 Safety

Design, manufacture, and installation of unitary air conditioning equipment shall conform to Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku).

1.4.4 Posted Operating Instructions

Submit posted operating instructions for each packaged air conditioning unit.

1.4.5 Sizing

Size equipment based on MLIT-M;do not oversize.

1.4.6 Ozone Depleting Substances Technician Certification

All technicians working on equipment that contain ozone depleting refrigerants must be Refrigerant Handling Technician (Reibai-Furontou-Toriatsukai-Gijutsusha) under Japan Refrigeration and Air-Conditioning Industry Association. Provide copies of technician certifications to the Contracting Officer at least 14 calendar days prior to work on any equipment containing these refrigerants.

1.5 REFRIGERANTS

Refrigerants must have an Ozone Depletion Potential (ODP) no greater than 0.0, with the exception of R-123. CFC-based refrigerants are prohibited. HCFCs and Halons shall not be permitted.

1.6 ENVIRONMENTAL REQUIREMENTS

For proper Indoor Environmental Quality, maintain positive pressure within the building. Meet or exceed filter media efficiency as tested in accordance with JIS B 9908-1.

PART 2 PRODUCTS

2.1 ROOM AIR CONDITIONERS

JIS B 8616. Minimum energy efficiency ratio (EER) shall be in accordance with Room Air Conditioners: Provide units removable from inside the building for servicing without removing the outside cabinet. Construct outside cabinets, including metal grilles to protect condenser coils, of zinc-coated steel or aluminum. Steel and zinc-coated surfaces shall receive at least one coat of primer and manufacturer's standard factory-applied finish Insulate cabinets to prevent condensation and run off of moisture. Provide mounting hardware made of corrosion-resistant material or protected by a corrosion-resistant finish. Provide air filters of the [throw-away] [or] [permanent washable] type removable without the use of tools and arranged to filter both room and ventilating air. Remove condensate by means of a drain or by evaporation and diffusion. Provide with metal or plastic mounting flanges on each side, top, and bottom of unit. For thru-the-wall installations provide aluminum or shop painted zinc-coated steel flanged telescopic wall sleeves. Design wall sleeves to restrict driving rain. For window mounted units provide shop-painted metal mounting brackets, braces, and sill plates. Mount compressors on vibration isolators. Minimum cooling capacity shall be not less than that indicated.

2.1.1 Units for Operation on 100 Volts

Provide 3-wire cords of manufacturer's standard length. If not existing, provide a receptacle within reach of the standard length cord. Cords shall have a 15- or 20-amp, 3-pole, 125-volt ground type plug to match receptacle.

2.1.2 Units for Operation on 200 Volts

Provide 3-wire cords of manufacturer's standard length. If not existing, provide a receptacle within reach of the standard length cord. Cords shall have a 15-, 20-, or 30-amp, 3-pole, 250-volt or manufacturer's standard ground type plug to match receptacle.

2.1.3 Controls

Mount controls in cabinet. Manual controls shall permit operation of either the fan or the fan and refrigerating equipment. Fan control shall provide two fan speed settings. Automatic controls shall include a thermostat for controlling air temperature. Thermostat shall have an adjustable range, including 18 to 28 degrees C and shall automatically turn the refrigeration system on or off to maintain the preselected temperature within plus or minus 20 degrees C.

2.2 PACKAGED TERMINAL UNITS

2.2.1 Heat Pumps

JIS B 8616, air-cooled, split type; [Heat pumps shall have a minimum energy efficiency ratio (EER) of [_____], or a minimum Coefficient of Performance (COP) of [_____], and a minimum integrated part load value (IPLV) of [_____].] [Provide supplemental electric resistance heaters integral with unit.] [Provide units suitable for use with minimal ductwork having a total external static resistance up to 25 Pa.]

2.2.2 Air Conditioners

JIS B 8616, air-cooled, split type. Provide units with [heating only] [cooling only] [combination heating and cooling] section with indicated capacity. Minimum [seasonal]energy efficiency ratio ([S]EER) shall be [[_____] [S]EER.] [Provide units suitable for use with minimal ductwork having a total external static resistance up to 25 Pa.]

2.2.3 Indoor Noise Rating

Rate in accordance with Japanese manufacture's standard ratings. Indoor rating shall not exceed [_____] bels while entire unit is operating at any fan or compressor speed.

2.2.4 Wall Sleeves and Mounts

Provide manufacturer's standard wall sleeves and mounts. Wall sleeves shall have seals designed to restrict driving rain and wind. [Provide unit subbase of the same construction and finish as the sleeve to provide for concealed electrical connection, cord storage, and equipped with unit leveling legs.] [Provide subbase with 24-volt remote control circuitry and wall mounted thermostat.]

2.2.5 Heating Section for Air Conditioners

a. Electric Coils: Electric resistance heating elements with high temperature-limit safety device, factory-mounted, and wired to chassis.

b. Hot Water Coils: Serpentine type constructed of seamless copper tubes with aluminum fins mechanically or hydraulically bonded to tubes. Provide factory-furnished tee and manual air vent on return connection. Factory test coils at twice maximum operating pressure.

c. Steam Coils: Serpentine type constructed of red brass or seamless copper tubes with JIS H 3300 mechanically or hydraulically bonded to tubes. Factory test coils at twice the maximum operating pressure.

d. Heating unit shall have internal thermal insulation having a fire hazard rating not to exceed 25 for flame spread and 50 for smoke developed as determined by ASTM E84 or shall have non-flammable and non-combustible manufacture's standard insulations.

2.2.6 Refrigeration Sections

Completely self-contained, slide-in assembly or removable chassis with welded, hermetically sealed, air-cooled refrigeration system, outdoor fan, indoor fan, control box, and ventilation damper. Provide refrigeration sections capable of installation or removal without the use of tools.

Refrigeration sections shall include refrigeration circuit tubing, wiring, and safety controls, and shall operate down to 2 degrees C outdoor temperature and 21 degrees C indoor temperature, without compressor short cycling while delivering not less than 100 percent of rated cooling capacity. Units shall have drains to the building exterior to eliminate excess driving rain. Condensate shall not drain onto building exterior or interior.

a. Compressors: Hermetic type with vibration isolation devices.

b. Coils: Constructed of seamless copper or aluminum tubing with copper or aluminum fins bonded to tubes. [Coat outdoor air coils with factory applied corrosion resistant treatment. Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins.]

c. Outdoor Fans: Direct connected centrifugal type with aluminum or plastic wheel and forward curved blades or direct connected aluminum propeller type. Design fans so that condensate will evaporate without drip, splash, or spray on building exterior.

d. Indoor Fans: Direct connected centrifugal type with aluminum, galvanized steel, or plastic wheel and forward curved blades. Provide minimum two-speed motor with built-in overload protection.

2.2.7 Ventilation Damper Assembly

Operated by automatic actuator. Dampers shall close on unit shutdown or loss of power and shall open on heating or cooling start-up.

2.2.8 Air Filters

Removable without use of tools, and shall filter both recirculated and ventilating air.

2.2.9 Controls

Provide controls including, an adjustable thermostat, and switches, to regulate room air temperature through control of refrigerant compressors or heating elements. Controls shall at least have positions for off, high or low fan speed for [heating] [and] [cooling], and fan only operation. [Provide remote mounted night set-back thermostat.]

2.3 HEAT PUMPS, AIR TO AIR

Provide factory assembled units complete with accessories, wiring, piping, and controls. Provide units with [outlet grilles.] [supplemental electric heaters.] [humidifiers.] [air filters as specified in the paragraph FILTERS.]

2.3.1 Energy Performance

[Energy performance shall be in accordance with JIS B 8615-1.][Heat pumps shall have [a minimum [seasonal] energy efficiency ratio ([S]EER) of [_____],] [a minimum Heating Seasonal Performance Factor (HSPF) of [_____],] [[_____].]].

2.3.2 Air Coils

Extended-surface fin and tube type with seamless copper or aluminum tubes with copper or aluminum fins securely bonded to the tubes. On coils with all-aluminum construction, provide tubes of aluminum alloy provide fins of aluminum alloy and provide tube sheets of aluminum alloy. [Provide a coating on [outdoor air] [and] [indoor air] coils as specified in the paragraph COATINGS FOR FINNED TUBE COILS. Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins.]

2.3.3 Supplemental Electric Heaters

Provide electrical resistance heaters [integral with the unit] [for remote installation in ductwork]. Heaters shall have a total capacity as indicated. Provide internal fusing for heaters.

2.3.4 Compressors

For compressors above 70 kW, compressor speed shall not exceed 3450 rpm. For equipment over 35 kW, provide automatic capacity reduction of at least 50 percent of rated capacity. Capacity reduction may be accomplished by cylinder unloading, use of multiple, but not more than four compressors, or a combination of the two methods. Units with cylinder unloading shall start with capacity reduction devices in the unloaded position. Units with multiple compressors shall have a means to sequence starting of compressors. Provide compressors with devices to prevent short cycling when shutdown by safety controls. Provide reciprocating compressors with crankcase heaters, and vibration isolators.

2.3.5 Mounting Provisions

Provide units that permit mounting as indicated. [Provide suitable lifting attachment plates to enable equipment to be lifted to normal position.]

2.3.6 Temperature Controls

Provide controls as specified in JIS B 8615-1 and as modified herein. Provide indoor thermostats of the adjustable type that conform to applicable requirements of JIS C 9730-1 and JIS C 9730-2-9. Provide manual means for temperature set-back. Provide thermostats capable of controlling supplemental heat as specified in JIS B 8615-1.

2.3.7 Accessories

In addition to accessories specified in JIS B 8615-1, provide the following accessories for heat pump units.

a. Protective grille around outside unit coils

b. Start capacitor kit

2.4 AIR CONDITIONERS

2.4.1 Split-System Type

Provide separate assemblies designed to be used together. Base ratings on the use of matched assemblies. Units shall have a minimum [SEER] [EER] of

[_____] when tested in accordance with JIS B 8616 or JIS B 8615-1 as applicable. Provide capacity, electrical characteristics and operating conditions as indicated. Condensers shall provide not less than 10 degrees F liquid subcooling at standard ratings.

2.4.2 Single Zone Units

Provide single zone type units arranged to [draw] [or] [blow] through coil sections. [Air may be blown or drawn through heating section.]

2.4.3 Multizone Units

Provide multizone type units arranged to [blow through the cooling and heating sections] [draw through the cooling and heating sections] [blow through the individual cooling and heating coils of each zone].

2.4.4 Heaters

Provide as [an integral part of the evaporator-blower unit] [a separate unit for installation in the duct work]. Provide [steam coils] [hot water coils] [gas heaters] [oil heaters] [electric open coils] [electric strip tubular heaters] [electric fin tubular heaters].

2.4.5 Compressors

For compressors over 70 kW, compressor speed shall not exceed 3450 rpm. For systems over 35 kW provide automatic capacity reduction of at least 50 percent of rated capacity. Capacity reduction may be accomplished by cylinder unloading, use of multi- or variable speed compressors, use of multiple, but not more than four compressors, or a combination of the two methods. Units with cylinder unloading shall start with capacity reduction devices in the unloaded position. Units with multiple compressors shall have means to sequence starting of compressors. Provide compressors with devices to prevent short cycling when shut down by safety controls. Device shall delay operation of compressor motor for at least 3 minutes but not more than 6 minutes. Provide a pumpdown cycle for units 70 kW and over. Provide reciprocating compressors with crankcase heaters in accordance with the manufacturer's recommendations. If compressors are paralleled, provide not less than two independent circuits.

2.4.6 Coils

On coils with all-aluminum construction, provide tubes of aluminum alloy; provide fins of aluminum alloy and provide tube sheets of aluminum alloy. Provide a separate air cooled condenser circuit for each compressor or parallel compressor installation. [Provide a coating on [condenser] [and] [evaporator] coils and fins as specified in the paragraph COATINGS FOR FINNED TUBE COILS. Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins.]

2.4.7 Condenser Controls

Provide start-up and head pressure controls to allow for system operation at ambient temperatures down to [_____] degrees C.

2.4.8 Fans

Provide belt-driven evaporator fans with adjustable pitch pulleys; except

for units less than 17 1/2 kW capacity, direct drive with at least two speed taps may be used. Select pulleys at approximately midpoint of the adjustable range.

2.4.9 Filters

Provide filters of the type specified in this section.

2.4.10 Filter Boxes

Provide when filters are not included integral with air conditioning units. Construct of not less than No. 20 US gage steel with track, hinged access doors with latches, and gaskets between frame and filters. Arrange filters to filter outside and return air. Provide removable filter assemblies, replaceable without the use of tools.

2.4.11 Mixing Boxes

Provide of the physical size to match the basic unit and include equal sized flanged openings, sized to individually handle full air flow. Arrange openings as indicated. Provide openings with dampers of parallel or opposed blade type. Provide opposed blade type for modulating dampers and parallel type for two-position dampers. Connect damper shafts together by one continuous linkage bar. Arrange dampers for [automatic] [or] [manual] operation so that when one starts to close from its opened position, the other starts to open from its closed position.

2.4.12 Thermostats

Provide adjustable type that conforms to applicable requirements of JIS C 9730-1 and JIS C 9730-2-9. Provide combination heating-cooling type with contacts hermetically sealed against moisture, corrosion, lint, dust, and foreign material. Design to operate on not more than 0.83 degrees C differential and of suitable range calibrated in degrees C. Provide adjustable heat anticipation and fixed cooling anticipation. Provide two independent temperature sensing elements electrically connected to control the compressor and heating equipment, respectively. Accomplish manual switching for system changeover from heating to cooling or cooling to heating and fan operation through the use of a thermostat subbase. Provide system selector switches to provide "COOL" and "OFF" and "HEAT" and fan selector switches to provide "AUTOMATIC" and "ON." Provide relays, contactors, and transformers located in a panel or panels for replacement and service.

2.4.12.1 Cooling

a. When thermostat is in "COOL" position with fan selector switch in "AUTO" position, compressor, evaporator fan, and condenser fan shall cycle together.

b. When thermostat is in "COOL" position with fan selector switch in "ON" position, compressor, and condenser fan shall cycle together and evaporator fan shall run continuously.

2.4.12.2 Heating

a. When thermostat is in "HEAT" position with fan selector switch in "AUTO" position, heater and supply air fan shall cycle together. Provide a separate thermostat to keep the fan running until the heater

cools.

b. When thermostat is in "HEAT" position with fan selector switch in "ON" position, heater shall cycle and supply air fan shall run continuously.

2.4.12.3 Supply Air Fan

a. When fan selector switch is in "AUTO" position with thermostat in "OFF" position, fan shall not run.

b. When fan selector switch is in "ON" position, fan shall run continuously.

2.5 FILTERS

Provide filters to filter outside air and return air and locate [as indicated] [inside air conditioners] [inside filter box] [inside combination air filter mixing box]. Provide [replaceable (throw-away)] [high efficiency] [cleanable (reusable)] type. Filters shall conform to JIS B 9908-1. Polyurethane filters shall not be used on units with multiframe filters.

2.5.1 Replaceable Type Filters

Throw-away frames and media, standard dust holding capacity, 1.79 m/s maximum face velocity, and [25 mm] [50 mm] thick. Filters shall be in accordance with JIS B 9908-1.

2.5.2 High Efficiency Filters

Filters shall have a 99.97% efficiency on 0.30 pm particle when tested in accordance with JIS B 9908-1. Filter assembly shall include; holding frame and fastener assembly, filter cartridge, mounting frame, and retainer assembly. Reinforce filter media with glass fiber mat. Pressure drop across clean filter shall not exceed [_____] Pa gage. Precede high efficiency filters with a replaceable type filter.

2.5.3 Cleanable Type Filters

Provide sufficient oil to coat filters six times based on one pint of oil per each 0.93 square meter of filter area. Provide washing and charging tanks for cleaning and coating filters. Filters shall be in accordance with JIS B 9908-1.

2.5.4 Manometers

Provide inclined-type manometers for filter stations of 944 L/s capacity or larger including filters furnished as integral parts of air-handling units and filters installed separately. Provide sufficient length to read at least 250 Pa with 10 major graduations, and equipped with spirit level. Equip manometers with overpressure safety traps to prevent loss of fluid, and two three-way vent valves for checking zero setting. [Mercury shall not be used as the operating fluid.]

2.6 COATINGS FOR FINNED TUBE COILS

Where stipulated in equipment specifications of this section, coat finned tube coils of the affected equipment as specified below. Apply coating at the premises of a company specializing in such work. Degrease and prepare

for coating in accordance with the coating applicator's procedures for the type of metals involved. Completed coating shall show no evidence of softening, blistering, cracking, crazing, flaking, loss of adhesion, or "bridging" between the fins.

2.6.1 Phenolic Coating

Provide a resin base thermosetting phenolic coating. Apply coating by immersion dipping of the entire coil. Provide a minimum of two coats. Bake or heat dry coils following immersions. After final immersion and prior to final baking, spray entire coil with particular emphasis given to building up coating on sheared edges. Total dry film thickness shall be 0.064 to 0.076 mm.

2.6.2 Chemical Conversion Coating with Polyelastomer Finish Coat

Dip coils in a chemical conversion solution to molecularly deposit a corrosion resistant coating by electrolysis action. Cure conversion coating at a temperature of 43 to 60 degrees C for a minimum of 3 hours. Coat coil surfaces with a complex polymer primer with a dry film thickness of 0.025 mm. Cure primer coat for a minimum of 1 hour. Using dip tank method, provide three coats of a complex polyelastomer finish coat. After each of the first two finish coats, cure the coils for 1 hour. Following the third coat, spray a fog coat of an inert sealer on the coil surfaces. Total dry film thickness shall be 0.064 to 0.076 mm. Cure finish coat for a minimum of 3 hours. Coating materials shall have 300 percent flexibility, operate in temperatures of minus 46 to plus 104 degrees C, and protect against atmospheres of a pH range of 1 to 14.

2.6.3 Vinyl Coating

Apply coating using an airless fog nozzle. For each coat, make at least two passes with the nozzle. Materials to be applied are as follows:

Total dry film thickness, 0.165 mm maximum.

Vinyl Primer, 24 percent solids by volume: One coat 0.051 mm thick

Vinyl Copolymer, 30 percent solids by volume: One coat 0.114 mm thick.

2.7 MOTORS AND STARTERS

JIS C 4212 or JEM 1038, and JEM 1167. Variable speed. Motors less than 3/4 kW shall meet JIS C 4212 requirements. Motors 3/4 kW and larger shall meet JIS C 4212 requirements. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Provide motors to operate at full capacity with a voltage variation of plus or minus 10 percent of the motor voltage rating. Motor size shall be sufficient for the duty to be performed and shall not exceed its full load nameplate current rating when driven equipment is operated at specified capacity under the most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, the Contractor shall make the necessary adjustments to the wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. [Provide reduced voltage type motor starters.] Provide [general-purpose] [weather-resistant] [watertight] [explosion proof] type starter enclosures.

2.8 REFRIGERANT PIPING AND ACCESSORIES

Provide accessories as specified in [JIS B 8615-1 and] this section. Provide suction line accumulators as recommended by equipment manufacturer's installation instructions. [Provide a filter-drier in the liquid line.]

2.8.1 Factory Charged Tubing

Provide extra soft, deoxidized, bright annealed copper tubing conforming to JIS H 3300, factory dehydrated and furnished with a balanced charge of refrigerant recommended by manufacturer of equipment being connected. Factory insulate suction line tubing with 9.52 mm minimum thickness of closed cell, foamed plastic conforming to manufacturer's standard close cell foamed plastic material with a permeance rating not to exceed 1.0. Provide quick-connectors with caps or plugs to protect couplings. Include couplings for suction and liquid line connections of the indoor and outdoor sections.

2.8.2 Field-Assembled Refrigerant Piping

Material and dimensional requirements for field-assembled refrigerant piping, valves, fittings, and accessories shall conform to in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku) for Japanese product and JIS H 3300 and JIS B 8607, except as herein specified. Factory clean, dehydrate, and seal piping before delivery to the project location. Provide seamless copper tubing, hard drawn, Type K or L, conforming to JIS H 3300, except that tubing with outside diameters of 6.35 mm and 9.52 mm shall have nominal wall thickness of not less than 7.62 mm and 0.81 mm, respectively. Soft annealed copper tubing conforming to JIS H 3300 may be used where flare connections to equipment are required only in nominal sizes less than one inch outside diameter.

2.8.3 Fittings

JIS H 3401 for solder-joint fittings. Recommended by manufacturer for flared tube fittings.

2.8.4 Pipe Hangers and Supports

Pipe hangers and supports shall be in accordance with MLIT-M.

2.8.5 Pipe Sleeves

Provide sleeves where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 6.35 mm space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with insulation and caulk at both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass, or provide a segmented elastomeric seal.

2.8.5.1 Sleeves in Masonry and Concrete Walls, Floors, and Roofs

Provide Schedule 40 or Standard Weight zinc-coated steel pipe sleeves. Extend sleeves in floor slabs 80 mm above finished floor.

2.8.5.2 Sleeves in Partitions and Non-Masonry Structures

Provide zinc-coated steel sheet sleeves having a nominal weight of not less than 4.39 kg per square meter, in partitions and other than masonry and concrete walls, floors, and roofs.

2.9 FINISHES

Provide steel surfaces of equipment including packaged terminal units, heat pumps, and air conditioners, that do not have a zinc coating conforming to JIS H 8641, JIS G 3302 or a duplex coating of zinc and paint, with a factory applied coating or paint system. Provide a coating or paint system on actual equipment identical to that on salt-spray test specimens with respect to materials, conditions of application, and dry-film thickness.

2.10 SOURCE QUALITY CONTROL

2.10.1 Salt-Spray Tests

Salt-spray test the factory-applied coating or paint system of equipment including packaged terminal units, heat pumps, and air conditioners in accordance with JIS Z 2371.

2.11 MANUFACTURER'S STANDARD NAMEPLATES

Major equipment including cooling towers, cooling tower gear drive assemblies, fans, and motors must have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment. Plates must be durable and legible throughout equipment life. Plates must be fixed in prominent locations.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

Install equipment and components in a manner to ensure proper and sequential operation of equipment and equipment controls. Install equipment not covered in this section, or in manufacturer's instructions, as recommended by manufacturer's representative. Provide proper foundations for mounting of equipment, accessories, appurtenances, piping and controls including, but not limited to, supports, vibration isolators, stands, guides, anchors, clamps and brackets. Foundations for equipment shall conform to equipment manufacturer's recommendation, unless otherwise indicated. Set anchor bolts and sleeves using templates. Provide anchor bolts of adequate length, and provide with welded-on plates on the head end embedded in the concrete. Level equipment bases, using jacks or steel wedges, and neatly grout-in with a nonshrinking type of grouting mortar. Locate equipment to allow working space for servicing including shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, access to water heads and valves of shell and tube equipment, tube cleaning or replacement, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines. Provide electric isolation between dissimilar metals for the purpose of minimizing galvanic corrosion.

3.1.1 Packaged Terminal Air Conditioners and Heat Pumps

Wall sleeve installation shall provide a positive weathertight and

airtight seal.

3.1.2 Unitary Air Conditioning System

Install as indicated, in accordance with requirements in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku) for Japanese product, and the manufacturer's installation and operational instructions.

3.1.3 Room Air Conditioners

Install units in accordance with manufacturer's instructions. Provide structural mountings, closures, and seals for weathertight assembly. Pitch unit as recommended by manufacturer to ensure condensate drain to drain pan without overflow.

3.2 PIPING

Brazing, bending, forming and assembly of refrigerant piping shall conform to JIS H 3300 and JIS B 8607.

3.2.1 Pipe Hangers and Supports

Design and fabrication of pipe hangers, supports, and welding attachments shall conform to MLIT-M. Installation of hanger types and supports for bare and covered pipes shall conform to MLIT-M. Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MLIT-M.

3.2.2 Refrigerant Piping

Cut pipe to measurements established at the site and work into place without springing or forcing. Install piping with sufficient flexibility to provide for expansion and contraction due to temperature fluctuation. Where pipe passes through building structure pipe joints shall not be concealed, but shall be located where they may be readily inspected. Install piping to be insulated with sufficient clearance to permit application of insulation. Install piping as indicated and detailed, to avoid interference with other piping, conduit, or equipment. Except where specifically indicated otherwise, run piping plumb and straight and parallel to walls and ceilings. Trapping of lines will not be permitted except where indicated. Provide sleeves of suitable size for lines passing through building structure. Braze refrigerant piping with silver solder. Inside of tubing and fittings shall be free of flux. Clean parts to be jointed with emery cloth and keep hot until solder has penetrated full depth of fitting and extra flux has been expelled. Cool joints in air and remove flame marks and traces of flux. During brazing operation, prevent oxide film from forming on inside of tubing by slowly flowing dry nitrogen through tubing to expel air. Make provisions to automatically return oil on halocarbon systems. Installation of piping shall comply with JIS H 3300 and JIS B 8607.

3.2.3 Returning Oil From Refrigerant System

Install refrigerant lines so that gas velocity in the evaporator suction line is sufficient to move oil along with gas to the compressor. Where equipment location requires vertical risers, line shall be sized to maintain sufficient velocity to lift oil at minimum system loading and corresponding reduction of gas volume. Install a double riser when excess

velocity and pressure drop would result from full system loading. Larger riser shall have a trap, of minimum volume, obtained by use of 90- and 45-degree ells. Arrange small riser with inlet close to bottom of horizontal line, and connect to top of upper horizontal line. Do not install valves in risers.

3.2.4 Refrigerant Driers, Sight Glass Indicators, and Strainers

Provide refrigerant driers, sight glass liquid indicators, and strainers in refrigerant piping in accordance with [this section] when not furnished by the manufacturer as part of the equipment. Install driers in liquid line with service valves and valved bypass line the same size as liquid line in which dryer is installed. Size of driers shall be determined by piping and installation of the unit on location. Install dryers of 820 mL and larger vertically with the cover for removing cartridge at the bottom. Install moisture indicators in the liquid line downstream of the drier. Indicator connections shall be the same size as the liquid line in which it is installed. These devices shall be provided as optional accessories.

3.2.5 Strainer Locations and Installation

Locate strainers close to equipment they are to protect. Provide a strainer in common refrigerant liquid supply to two or more thermal valves in parallel when each thermal valve has a built-in strainer. Install strainers with screen down and in direction of flow as indicated on strainer's body.

3.2.6 Solenoid Valve Installation

Install solenoid valves in horizontal lines with stem vertical and with flow in direction indicated on valve. If not incorporated as integral part of the valve, provide a strainer upstream of the solenoid valve. Provide service valves upstream of the solenoid valve, upstream of the strainer, and downstream of the solenoid valve. Remove the internal parts of the solenoid valve when brazing the valve.

3.3 AUXILIARY DRAIN PANS, DRAIN CONNECTIONS, AND DRAIN LINES

Provide auxiliary drain pans under units located above finished ceilings or over mechanical or electrical equipment where condensate overflow will cause damage to ceilings, piping, and equipment below. Provide separate drain lines for the unit drain and auxiliary drain pans. Trap drain pans from the bottom to ensure complete pan drainage. Provide drain lines full size of drain opening. Traps and piping to drainage disposal points shall conform to Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.4 ACCESS PANELS

Provide access panels for concealed valves, controls, dampers, and other fittings requiring inspection and maintenance.

3.5 AIR FILTERS

Allow access space for servicing filters. Install filters with suitable sealing to prevent bypassing of air. Perform and document that proper Indoor Air Quality During Construction procedures have been followed; this includes providing documentation showing that after construction ends, and prior to occupancy, new filters were provided and installed.

3.6 FLASHING AND PITCH POCKETS

Provide flashing and pitch pockets for equipment supports and roof penetrations and flashing where piping or ductwork passes through exterior walls in accordance with Section 07 60 00 FLASHING AND SHEET METAL.

3.7 IDENTIFICATION TAGS AND PLATES

Provide equipment, gages, thermometers, valves, and controllers with tags numbered and stamped for their use. Provide plates and tags of brass or suitable nonferrous material, securely mounted or attached. Provide minimum letter and numeral size of 3.18 mm high.

3.8 FIELD QUALITY CONTROL

3.8.1 Leak Testing

Upon completion of installation of air conditioning equipment, test factory- and field-installed refrigerant piping with an electronic-type leak detector. Use same type of refrigerant to be provided in the system for leak testing. When nitrogen is used to boost system pressure for testing, ensure that it is eliminated from the system before charging. Minimum refrigerant leak field test pressure shall be as specified in accordance with Japanese Refrigeration Safety Regulations (Nihon-Reitou-Hoan-Kisoku) for Japanese standard. If leaks are detected at time of installation or during warranty period, remove the entire refrigerant charge from the system, correct leaks, and retest system.

3.8.2 Evacuation, Dehydration, and Charging

After field charged refrigerant system is found to be without leaks or after leaks have been repaired on field-charged and factory-charged systems, evacuate the system using a reliable gage and a vacuum pump capable of pulling a vacuum of at least 133 Pa absolute. Evacuate system in accordance with the triple-evacuation and blotter method or in accordance with equipment manufacturer's printed instructions and recharge system.

3.8.3 Start-Up and Initial Operational Tests

Test the air conditioning systems and systems components for proper operation. Adjust safety and automatic control instruments as necessary to ensure proper operation and sequence. Conduct operational tests for not less than 8 hours.

3.8.4 Performance Tests

Upon completion of evacuation, charging, startup, final leak testing, and proper adjustment of controls, test the systems to demonstrate compliance with performance and capacity requirements. Test systems for not less than 8 hours, record readings hourly. At the end of the test period, average the readings, and the average shall be considered to be the system performance. Record the following readings:

[_____]
[_____]

3.9 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurements commonly agreed on by the manufacturers or other parties. The inch-pound and metric measurements shown are as follows:

Products	Inch-Pound	Metric
a. [_____]	[_____]	[_____]

-- End of Section --

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SECTION 25 05 11

CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 135	(2016) BACnet—A Data Communication Protocol for Building Automation and Control Networks

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 802.1x	(2010) Local and Metropolitan Area Networks - Port Based Network Access Control

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST FIPS 201-2	(2013) Personal Identity Verification (PIV) of Federal Employees and Contractors

U.S. DEPARTMENT OF DEFENSE (DOD)

DODI 8551.01	(2014) Ports, Protocols, and Services Management (PPSM)
DTM 08-060	(2008) Policy on Use of Department of Defense (DoD) Information Systems - Standard Consent Banner and User Agreement

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Wireless Communication Request; G[, [_____]]

Device Account Lock Exception Request; G[, [_____]]

Multiple IP Connection Device Request; G[, [_____]]

Contractor Computer Cybersecurity Compliance Statements; G[, [_____]]

Contractor Temporary Network Cybersecurity Compliance Statements; G [, [_____]]

SD-02 Shop Drawings

User Interface Banner Schedule; G[, [_____]]

Network Communication Report; G[, [_____]]

Cybersecurity Riser Diagram; G[, [_____]]

Control System Inventory Report; G[, [_____]]

Cybersecurity Interconnection Schedule; G[, [_____]]

SD-03 Product Data

Control System Cybersecurity; G[, [_____]]

SD-11 Closeout Submittals

Password Summary Report; G[, [_____]]

Device Audit Record Upload Software; G[, [_____]]

1.3 CYBERSECURITY DOCUMENTATION

[1.3.1 Cybersecurity Interconnection Schedule

Provide a completed Cybersecurity Interconnection Schedule documenting connections between the installed system and other systems. See Attachment 25 05 11-A.

]1.3.2 Network Communication Report

Provide a network communication report. See Attachment 25 05 11-B.

1.3.3 Control System Inventory Report

Provide a Control System Inventory report. See Attachment 25 05 11-C.

1.3.4 Cybersecurity Riser Diagram

Provide a Cybersecurity Riser Diagram.

1.4 SOFTWARE UPDATE LICENSING

In addition to all other licensing requirements, all software licensing must include licensing of the following software updates for a period [of no less than 5 years][___]:

a. Security and bug-fix patches issued by the software manufacturer.

b. Security patches to address any vulnerability identified in the National Vulnerability Database at http://nvd.nist.gov with a Common Vulnerability Scoring System (CVSS) severity rating of MEDIUM or higher.

1.5 CYBERSECURITY DURING CONSTRUCTION

In addition to the control system cybersecurity requirements indicated in this section, meet following requirement throughout the construction process.

1.5.1 Contractor Computer Equipment

Contractor owned computers may be used for construction. When used, contractor computers must meet the following requirements:

1.5.1.1 Operating System

The operating system must be an operating system currently supported by the manufacturer of the operating system. The operating system must be current on security patches and operating system manufacturer required updates.

1.5.1.2 Anti-Malware Software

The computer must run anti-malware software from a reputable software manufacturer. Anti-malware software must be a version currently supported by the software manufacturer, must be current on all patches and updates, and must use the latest definitions file. All computers used on this project must be scanned using the installed software at least once per day.

1.5.1.3 Passwords and Passphrases

The passwords and passphrases for all computers must be changed from their default values. Passwords must be a minimum of eight characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.5.1.4 Contractor Computer Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Computer Cybersecurity Compliance Statements for each company using contractor owned computers that will be connected to network controllers during construction. See Attachment 25 05 11-D.

1.5.2 Temporary IP Networks

Temporary contractor-installed IP networks may be used during construction. When used, temporary contractor-installed IP networks must meet the following requirements:

1.5.2.1 Network Boundaries and Connections

The network must not extend outside the project site and must not connect to any IP network other than IP networks provided under this project or Government furnished IP networks provided for this purpose. Any and all

network access from outside the project site is prohibited.

1.5.3 Government Access to Network

Government personnel must be allowed to have complete and immediate access to the network at any time in order to verify compliance with this specification

1.5.4 Temporary Wireless IP Networks

In addition to the other requirements on temporary IP networks, temporary wireless IP (WiFi) networks must not interfere with existing wireless network and must use WPA2 security. Network names (SSID) for wireless networks must be changed from their default values.

1.5.5 Passwords and Passphrases

The passwords and passphrases for all network devices and network access must be changed from their default values. Passwords must be a minimum 8 characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.5.6 Contractor Temporary Network Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Temporary Network Cybersecurity Compliance Statements for each company implementing a temporary IP network. If no temporary IP networks will be used, provide a single copy of the Statement indicating this. See Attachment 25 05 11-E.

1.6 CYBERSECURITY DURING WARRANTY PERIOD

All work performed on the control system after acceptance must be performed using Government Furnished Equipment or equipment specifically and individually approved by the Government.

PART 2 PRODUCTS

(NOT USED)

PART 3 EXECUTION

3.1 ACCESS CONTROL REQUIREMENTS

3.1.1 User Accounts

[3.1.1.1 [_____] Control System Devices

[_____]

]3.1.1.2 Default Requirements for Control System Devices

For control system devices where User Account requirements are not otherwise indicated in this Section:

a. Devices with web interfaces must support user accounts (such as "admin", "user 1", "user 2")or have their web interface disabled.

3.1.2 Unsuccessful Logon Attempts

Except for high availability user interfaces indicated as exempt, devices must meet the indicated requirements for handling unsuccessful logon attempts.

3.1.2.1 Devices Supporting Accounts

Devices which MINIMALLY support accounts [are not required to lock based on unsuccessful logon attempts][must lock the user input when [_____] and must support unlocking of the user input when [_____]].

3.1.2.2 Devices

Devices which FULLY support accounts must meet the following requirements. If a device cannot meet these requirements, document device capabilities to protect from subsequent unsuccessful logon attempts and propose alternate protections in a Device Account Lock Exception Request submittal. Do not implement alternate protection measures without explicit permission from the Government.

a. It must lock the user account when [three][_____] unsuccessful logon attempts occur within a [15 minute][_____] interval.

b. Once an account is locked, the account must stay locked until unlocked by an administrator.

c. Once the indicated number of unsuccessful logon attempts occurs, delay further logon prompts by 5 seconds.

3.1.2.3 High Availability Interfaces Exempt from Unsuccessful Logon Attempts Requirements

[There are no high availability interfaces which are exempt from unsuccessful logon attempts requirements.][The following high availability interfaces are exempt from unsuccessful logon attempts requirements:

High Availability Interfaces Exempt from Unsuccessful Logon Attempts Requirements

User Interface	**Location**	**Action to take in lieu of locking screen**
[_____]	[_____]	[_____]
[_____]	[_____]	[_____]
[_____]	[_____]	[_____]

]

3.1.3 System Use Notification

Web interfaces must display a warning banner meeting the requirements of DTM 08-060.

Devices which are connected to a network and have a user interface must display a warning banner meeting the requirements of DTM 08-060 if capable of doing so. Devices which are connected to a network and have a user interface but are not capable of displaying a banner must have a permanently affixed label displaying an approved banner from DTM 08-060.Labels must be machine printed or engraved, plastic or metal, designed for permanent installation, must use a font no smaller than 14 point, and must

provide a high contract between font and background colors.

3.1.3.1 User Interface Banner Schedule

Provide a User Interface Schedule using the format indicated showing each user interface provided and how the information banner requirement has been implemented for each user interface.

User Interface Schedule Format (with sample entries)			
User Interface Description	**User Interface Location**	**Type of User Interface**	**Banner Implementation**
Sample 1	Room 1	Remote	DTM 08-060 Banner "A" Displayed at Logon
Sample 2	Room 2	Limited Local	DTM 08-060 Banner "B" on Affixed Label
Sample 3	Room 3	Full Local	DTM 08-060 Banner "B" Displayed on Screen

3.1.4 Permitted Actions Without Identification or Authentication

The control system must require identification and authentication before allowing any actions by a user acting from a user interface which MINIMALLY or FULLY supports accounts.

3.1.5 Wireless Access

Unless explicitly authorized by the Government, do not use any wireless communication. Any device with wireless communication capability is considered to be using wireless communication, regardless of whether or not the device is actively communicating wirelessly, except when wireless communication has been physically permanently disabled (such as through the removal of the wireless transceiver).

3.1.5.1 Wireless IP Communications

[Unless specifically approved and installed in accordance with the project site requirements, d][D]o not install wireless IP networks, including: do not install a wireless access point; do not install or configure an ad-hoc wireless network; do not install or configure a WiFi Direct communication.

When explicitly authorized by the Government, wireless IP communication may be used to communicate with an existing wireless network.

3.1.5.2 Non-IP Wireless Communication

When non-IP wireless communication is explicitly authorized by the Government, use the maximum level of encryption supported by the specific protocol employed and select signal strength and radiated power to the minimum necessary for reliable communication.

3.1.5.3 Wireless Communication Request

Provide a report documenting the proposed use of wireless communication prior to beginning construction using the Wireless Communication Request Schedule. See Attachment 25 05 11-F.

3.2 CYBERSECURITY AUDITING

3.2.1 Audit Events, Content of Audit Records, and Audit Generation

For devices that have STIG/SRGs related to audit events, content of audit records or audit generation, comply with the requirements of those STIG/SRGs.

3.2.1.1 Computers

For each computer, provide the capability to select audited events and the content of audit logs. Configure computers to audit the indicated events, and to record the indicated information for each auditable event

3.2.1.1.1 Audited Events

Configure each computer to audit the following events:

a. Successful and unsuccessful attempts to access, modify, or delete privileges, security objects, security levels, or categories of information (e.g. classification levels)

a. Successful and unsuccessful logon attempts

b. Privileged activities or other system level access

c. Starting and ending time for user access to the system

d. Concurrent logons from different workstations

e. Successful and unsuccessful accesses to objects

f. All program initiations

g. All direct access to the information system

h. All account creations, modifications, disabling, and terminations

i. All kernel module load, unload, and restart

3.2.1.1.2 Audit Event Information To Record

Configure each computer to record, for each auditable event, the following information (where applicable to the event):

a. What type of event occurred

b. When the event occurred

c. Where the event occurred

d. The source of the event

e. The outcome of the event

f. The identity of any individuals or subjects associated with the event

3.2.1.2 For HVAC Control System Devices

3.2.1.2.1 HVAC Control System Devices FULLY Supporting User Accounts

For devices FULLY supporting accounts, provide the capability to select audited events, and the contents of audit logs. Configure devices to audit the following events:

a. Successful and unsuccessful logon attempts to the device

b. Starting and ending time for user access to the device

c. All account creations, modifications, disabling, and terminations

d. All device shutdown and startup

Configure the device to record for each event the following information (as applicable): the type of event, when the event occurred and the identity of any individuals or subjects associated with the event

3.2.1.2.2 Other HVAC Control System Devices

There are no requirements to perform auditing at HVAC field devices that do not FULLY support accounts.

[3.2.1.3 [_____] Control System Devices

[_____]

]3.2.1.4 Default Requirements for Control System Devices

For control system devices where Audit Events, Content of Audit Records, and Audit Generation are not otherwise indicated in this Section:

3.2.1.4.1 Devices Which FULLY Support Accounts

For each device which FULLY supports accounts, provide the capability to select audited events and the content of audit logs. Configure devices to audit the indicated events, and to record the indicated information for each auditable event

3.2.1.4.1.1 Audited Events

Configure each device to audit the following events:

a. Successful and unsuccessful attempts to access, modify, or delete privileges, security objects, security levels, or categories of information (e.g. classification levels)

a. Successful and unsuccessful logon attempts

b. Privileged activities or other system level access

c. Starting and ending time for user access to the system

d. Concurrent logons from different workstations

e. All account creations, modifications, disabling, and terminations

f. All kernel module load, unload, and restart

3.2.1.4.1.2 Audit Event Information To Record

Configure each computer to record, for each auditable event, the following information (where applicable to the event):

a. what type of event occurred

b. when the event occurred

c. where the event occurred

d. the source of the event

e. the outcome of the event

f. the identity of any individuals or subjects associated with the event

3.2.1.4.2 Devices Which Do Not FULLY Support Accounts

For each Device which does not FULLY support accounts configure the device to audit all device shutdown and startup events and to record for each event the type of event and when the event occurred.

3.2.2 Audit Storage Capacity and Audit Upload

{For Reference Only: This subpart (and its subparts) relates to AU-4; CCI-001848, CCI-001849}

a. For devices that have STIG/SRGs related to audit storage capacity (CCI-001848 or CCI-001849) comply with the requirements of those STIG/SRGs.

b. For non-computer control system devices capable of generating audit records, provide [60][_____] days worth of secure local storage, assuming [10][_____] auditable events per day.[

c. For computers, provide storage for at least [_____] audit records.]

3.2.2.1 Device Audit Record Upload Software

For each non-computer device required to audit events, provide, and license to the Government, software implementing a secure mechanism of uploading audit records from the device to a computer and of exporting the uploaded audit records as a [Microsoft Excel file][comma separated value text file][Microsoft Excel file or comma separated value text file][_____]. Where different devices use different software, provide software of each type required to upload audit logs from all devices.

[Install device audit record upload software on the furnished front end computer in [_____].][Install device audit record upload software on [_____].]Submit copies of device audit record upload software. If there are no non-computer devices requiring auditing, provide a document stating

this in lieu of this submittal.

3.2.3 Response to Audit Processing Failures

{For Reference Only: This subpart (and its subparts) relates to AU-5; CCI-000139, CCI-000140, CCI-001490}.

Front end computers associated with auditing must, in the case of a failure in the auditing system, notify [_____] via [e-mail][_____]. In case of an audit failure, if possible, continue to collect audit records by [overwriting existing audit records][_____].

3.2.4 Time Stamps

3.2.4.1 Computers

Computers generating audit records must have internal clocks capable of providing time with a resolution of 1 second. Clocks must not drift more than 10 seconds per day.

Configure the system so that each computer generating audit records maintains accurate time to within 1 second.

3.2.4.2 For HVAC Control System Devices

[Time stamp requirements for HVAC Control Systems are as indicated in the HVAC Control System specifications.][Devices generating audit records must have internal clocks capable of providing time with a resolution of 1 second. Clocks cannot drift more than 10 seconds per day. Configure the system so that each device generating audit records maintains accurate time to within 1 second.]

[3.2.4.3 [_____] Control System Devices

[_____][Time stamp requirements for [_____] Control Systems are as indicated in the Control System specifications.][Devices generating audit records must have internal clocks capable of providing time with a resolution of 1 second. Clocks cannot drift more than 10 seconds per day. Configure the system so that each device generating audit records maintains accurate time to within 1 second.]

]3.2.4.4 Default Requirements for Control System Devices

For control system devices where Time Stamps requirements are not otherwise indicated in this Section: Devices generating audit records must have internal clocks capable of providing time with a resolution of 1 second. Clocks must not drift more than 10 seconds per day. Configure the system so that each device generating audit records maintains accurate time to within 1 second.

3.3 REQUIREMENTS FOR LEAST FUNCTIONALITY

For devices that have a STIG or SRG related to Requirements for Least Functionality (such as configuration settings and port and device I/O access for least functionality), install and configure the device in accordance with that STIG or SRGs.

For HVAC Control Systems: Do not provide devices with user interfaces where one was not required. Do not use a networked sensor or actuator

where a non-networked sensor or actuator would suffice.

For Other Control Systems: [Do not provide devices with user interfaces where one was not required.] [Do not use a networked sensor or actuator where a non-networked sensor or actuator would suffice.]

3.3.1 Non-IP Control Networks

When control system specifications require particular communication protocols, use only those communication protocols and only as specified. Do not implement any other communication protocol, or use any protocol on ports other than those specified.

When control system specifications do not indicate requirements for communication protocols, use only those protocols required for operation of the system as specified.

3.3.2 IP Control Networks

Do not use nonsecure functions, ports, protocols and services as defined in DODI 8551.01 unless those ports, protocols and services are specifically required by the control system specifications or otherwise specifically authorized by the Government. Do not use ports, protocols and services that are not specified in the control system specifications or required for operation of the control system.

3.4 SAFE MODE AND FAIL SAFE OPERATION

For all control system components with an applicable STIG or SRG, configure the component in accordance with all applicable STIGs and SRGs.

3.5 IDENTIFICATION AND AUTHENTICATION

3.5.1 User Identification and Authentication

{For Reference Only: This subpart (and its subparts) relates to IA-2,(1),(12); CCI-000764, CCI-000765, CCI-001953, CCI-001954}

a. Devices that FULLY support accounts must uniquely identify and authenticate organizational users.

b. Devices which allow network access to privileged accounts must implement multifactor authentication for network access to privileged accounts.

3.5.1.1 HVAC Control Systems Devices

Identification and Authentication for network access to privileged accounts must be implemented by either accepting and electronically verify Personal Identity Verification (PIV) credentials or inheriting identification and authentication from the operating system.

3.5.1.2 Electronic Security System Devices

Identification and Authentication for network access to privileged accounts must be implemented by [accepting and electronically verifying Personal Identity Verification (PIV) credentials][or][inheriting identification and authentication from the operating system][or][_____].

[3.5.1.3 [_____] Control System Devices

[_____]

]3.5.1.4 Default Requirements for Control System Devices

For control system devices where User Identification and Authentication requirements are not otherwise indicated in this Section, User Identification and Authentication for network access to privileged accounts must be implemented by [accepting and electronically verify Personal Identity Verification (PIV) credentials][or][inheriting identification and authentication from the operating system][or][_____].

3.5.2 Authenticator Management

3.5.2.1 Authentication Type

3.5.2.1.1 For HVAC Control System Devices

Unless otherwise indicated:

a. Software which FULLY supports accounts and which runs on a computer must use [password-based authentication or hardware token-based authentication][password-based authentication][hardware token-based authentication].

b. Other devices which FULLY support accounts must use password-based authentication.

c. Devices MINIMALLY supporting accounts must use password-based authentication.

[3.5.2.1.2 [_____] Control System Devices

[_____]

]3.5.2.1.3 Default Requirements for Control System Devices

For control system devices where Authentication Type requirements are not otherwise indicated in this Section:

a. Software which FULLY supports accounts and which runs on a computer must use [password-based authentication or hardware token-based authentication][password-based authentication][hardware token-based authentication].

b. Other devices which FULLY support accounts must use [either password-based authentication or hardware token-based authentication][password-based authentication][hardware token-based authentication].

c. Devices MINIMALLY supporting accounts must use [either password-based authentication or hardware token-based authentication][password-based authentication][hardware token-based authentication].

3.5.2.2 Password-Based Authentication Requirements

3.5.2.2.1 Passwords for Computers
All computers supporting password-based authentication must enforce the

following requirements:

a. Minimum password length of 12 characters

b. Password must contain at least one uppercase character.

c. Password must contain at least one lowercase character.

d. Password must contain at least one numeric character.

e. Password must contain at least one special character.

f. Password must have a minimum lifetime of 24 hours.

g. Password must have a maximum lifetime of 60 days. When passwords expire, prompt users to change passwords. Do no lock accounts due to expired passwords.

h. Password must differ from previous five passwords, where differ is defined as changing at least 50 percent of the characters.

i. Passwords must be cryptographically protected during storage and transmission.

3.5.2.2.2 Passwords for Non-Computer Devices FULLY Supporting Accounts

All non-computer devices FULLY supporting accounts and supporting password-based authentication must enforce the following requirements:

a. Minimum password length of twelve (12) characters

b. Password must contain at least one uppercase character.

c. Password must contain at least one lowercase character.

d. Password must contain at least one numeric character.

e. Password must contain at least one special character.

f. Password must have a maximum lifetime of sixty (60) days. When passwords expire, prompt users to change passwords. Do no lock accounts due to expired passwords.

g. Password must differ from previous five (5) passwords, where differ is defined as changing at least fifty percent of the characters.

h. Passwords must be cryptographically protected during storage and transmission.

3.5.2.2.3 Passwords for Web Interfaces

Passwords for connecting to a web interface supporting password-based authentication must enforce the following requirements:

a. Minimum password length of 12 characters

b. Password must contain at least one uppercase character.

c. Password must contain at least one lowercase character.

d. Password must contain at least one numeric character.

e. Password must contain at least one special character.

f. Password must have a maximum lifetime of 60 days. When passwords expire, prompt users to change passwords. Do no lock accounts due to expired passwords.

g. Password must differ from previous five passwords, where differ is defined as changing at least 50 percent of the characters.

h. Passwords must be cryptographically protected during storage and transmission.

3.5.2.2.4 Passwords for Devices Minimally Supporting Accounts

Devices minimally supporting accounts must support passwords with a minimum length of [four][_____] characters.

3.5.2.2.5 Password Configuration and Reporting

For all devices with a password, change the password from the default password. Coordinate selection of passwords with [_____]. Do not use the same password for more than one device unless specifically instructed to do so. Provide a Password Summary Report documenting the password for each device and describing the procedure to change the password for each device.

Do not provide the Password Summary Report in electronic format. Provide [two][_____] hardcopies of the Password Summary Report, each copy in its own sealed envelope.

3.5.2.3 Hardware Token-Based Authentication Requirements

Devices supporting hardware token-based authentication must use Personal Identity Verification (PIV) credentials for the hardware token.

3.5.3 Authenticator Feedback

{For Reference Only: This subpart relates to IA-6; CCI-000206}

Devices must never show authentication information, including passwords, on a display. Devices that momentarily display a character as it is entered, and then obscure the character, are acceptable. For devices that have STIGs or SRGs related to obscuring of authenticator feedback (CCI-000206), comply with the requirements of those STIGS/SRGs.

3.5.4 Device Identification and Authentication

All computers must use IEEE 802.1x for authentication to the network. All web servers running on computers must use HTTPS[and must implement HTTPS using web server certificates obtained from [_____]].[When wireless IP devices are permitted, they must use [_____] for authentication.]

3.5.4.1 For HVAC Control System Devices

Devices using Fox Protocol must use HTTPS[using a web server certificate obtained from [_____]]. [Devices using Fox Protocol must support IEEE 802.1x.][Devices using Ethernet must support IEEE 802.1x.

][Devices using BACnet must support Network Security as specified in Clause 24 of ASHRAE 135.]

[3.5.4.2 [_____] Control System Devices

[_____]

]3.5.4.3 Default Requirements for Control System Devices

For control system devices where Device Identification and Authentication requirements are not otherwise indicated in this Section: [Devices using Ethernet must support IEEE 802.1x.]Devices using HTTP as a control protocol must use HTTPS[using a web server certificate obtained from [_____]] instead.

3.5.5 Cryptographic Module Authentication

{For Reference Only: This subpart (and its subparts) relates to IA-7; CCI-000803}

For devices that have STIG/SRGs related to cryptographic module authentication (CCI-000803), comply with the requirements of those STIG/SRGs.

3.6 EMERGENCY POWER

[Emergency power is specified in the control system and equipment specifications.][_____]

3.7 DURABILITY TO VULNERABILITY SCANNING

All IP devices must be scannable, such that the device can be scanned by industry standard IP network scanning utilities without harm to the device, application, or functionality.

[Computers must respond to scans from [_____] by responding with a [_____].]For control system devices other than computers:

3.7.1 HVAC Control System Devices Other Than Computers

HVAC control system devices other than computers are not required to respond to scans.

[3.7.2 [_____] Control System Devices Other Than Computers

[_____] control system devices other than computers [must respond to scans from [_____] by responding with a [_____]][are not required to respond to scans].

]3.7.3 Default Requirements for Control System Devices

Non-computer control system devices where Durability to Vulnerability Scanning requirements are not otherwise indicated in this Section [must respond to scans from [_____] by responding with a [_____]][are not required to respond to scans].

3.8 FIPS 201-2 REQUIREMENT

{For Reference Only: This subpart (and its subparts) relates to SA-4

(10); CCI-003116}

Devices in the following systems which implement PIV must be on the NIST FIPS 201-2 approved product list: [NONE][electronic security systems(ESS)][_____].

3.9 DEVICES WITH CONNECTION TO MULTIPLE IP NETWORKS

Except for Ethernet switches, do not use more than one physical connection to IP networks on the same device unless doing so is both required by the project specifications and the specific application is approved. If a device with multiple IP connections is required, provide a Multiple IP Connection Device Request using the Multiple IP Connection Device Request Schedule to request approval for each device.

3.10 SYSTEM AND COMMUNICATION PROTECTION

3.10.1 Denial of Service Protection, Process Isolation and Boundary Protection

To the greatest extent practical, implement control logic in non-computer hardware and without reliance on the network.

[3.10.2 Cryptographic Protection

For devices that have STIG/SRGs related to cryptographic protection (CCI-002450), comply with the requirements of those STIG/SRGs. Ensure that [all][IP][_____] network traffic is encrypted using NSA-approved cryptography; provision of digital signatures and hashing, and FIPS-validated cryptography.

]

3.11 SYSTEM AND INTEGRATION INTEGRITY

3.11.1 Malicious Code Protection

For all computers installed under this project, install and configure malware protection software in accordance with the relevant STIGs.

[3.11.2 Information System Monitoring

[_____]

]

3.12 FIELD QUALITY CONTROL

3.12.1 Tests

In addition to testing and testing support required by other Sections, provide a minimum of [_____] hours of technical support for cybersecurity testing of control systems.

-- End of Section --

Cybersecurity Interconnection Schedule Template

Device ID	Device Description	Foreign Destination	Point of Contact for Destination	Transport layer Protocol	Network Address	Port (if applicable)	MAC (Layer 2) address (if applicable)	Media	Application Protocol	Service (if applicable)	Descriptive Purpose	
UMCS M&C Server	*UMCS M&C Server*	*Exchange Server*	*<IT email POC>*	*IP*	*10.0.5.23*	*TCP/25*	*00:26:B9:B5:A5:34*	*Cat 6*	*SMTP*	*NA*	*email to email-to-SMS service for alarm messaging*	*This is a sample entry for a UMCS front end IAW UFGS 25 10 10*
DDC-5	*AHU-5 Controller*	*UMCS Front End*	*<Energy Manager>*	*IP*	*192.168.45.3*	*UDP/0xBAC0*	*12:34:56:78:9A:BC*	*Cat 5*	*BACnet*	*multiple*	*Trend upload, interactive data sharing with M&C server, alarms*	*These are sample entries for a HVAC building control system IAW UFGS 23 0900 designed to communicate to a separate front end*
DDC-8	*Chiller Controller*	*UMCS Front End*	*<Energy Manager>*	*IP*	*192.168.45.78*	*UDP/0xBAC0*	*DE:F0:12:34:56:78*	*Cat 5*	*BACnet*	*multiple*	*Trend upload, interactive data sharing with M&C server, alarms*	
DDC-3	*Supervisory Controller*	*UMCS Front End*	*<Energy Manager>*	*IP*	*192.168.45.34*	*UDP/0xBAC0*	*9A:BC:DE:F0:12:34*	*Cat 5*	*BACnet*	*Read Property, Write Property*	*Used by front end for demand limiting in building*	
DDC-6	*Lighting Gateway*	*Lutron Lighting Gateway*	*<Lighting system owner>*	*Lon*	*2, 34, 12 (Domain, Subnet, Node)*	*NA*	*AF23:8456:B8D3 (Neuron ID)*	*TP/FT-10*	*Lon*	*NA*	*Communicate occupancy status with lighting system*	*Sample entry for a HVAC system which shares occupancy data with a lighting system via Lon*

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Network Communication Report

Device ID	Device Description	Transport layer Protocol	Network Address	Port (if applicable)	MAC (Layer 2) address (if applicable)	Media	Application Protocol	Service (if applicable)	Descriptive Purpose
LC-M	Lighting Controller (main panel)	IP	0.0.5.23	80	00:24:B9:B5:A5:34	Fiber	SMTP	Commands between base-wide lighting controller and building controller	Lighting Controller for remote video teleconferencing

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Inventory Report Page 1/2

	Device Location									Control System Info				HARDWARE DETAILS							OPERATING SYSTEM & PLATFORM			
Identifier	Installation	Special Area	Facility Number or Identifier	Facility Name or Description	Floor	Room	Location In Room	Enclosure or Mount Type	UPS Power	Architecture Level	Control System Type	Part of which UMCS	Electrical/Mechanical System or Equipment Controlled	Device Type	Device Sub-Type	Device Function	Manufacturer	Product Line	Model #	Serial #	Type of Operating System (OS)	OS Vendor	OS Name	OS Version

Japan Edited Specifications

JES

ATTACHMENT 25 05 11-C Page 1

Inventory Report Page 2/2

Contractor Computer Cybersecurity Compliance Statement

Number of contractor-owned computers used during construction: ____

For each contractor-owned computer, list the make and model of the device, the device serial number, the operating system version, and the anti-malware software version. Attach additional sheets if required to document all computers.

Number of additional sheets attached:_____

	Make/Model	Serial Number(s)	Operating System Type and Version	Anti-Malware Software Type and Version
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

I hereby certify that:

- The information provided above is accurate as of the date this document is signed
- All computers listed will be provided any and all patches and updates released during the period of construction
- The computers listed above will be scanned by Anti-Malware software at least once per day during the period of construction.
- Passwords for computers have been changed from defaults

Signature: _____ Date: _____

Completed By:

Name: _____

Position Title: _____

Company: _____

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Contractor Temporary Network Cybersecurity Compliance Statement

Check ONE: Temporary IP networks (__) WILL or (__) WILL NOT be used

Check ONE: Temporary Wireless IP networks (__) WILL or (__) WILL NOT be used

I hereby certify that:

- Temporary IP networks will not connect to any other IP network.
- Temporary IP networks will not extend outside the project site.
- Temporary Wireless IP networks will use WPA2 encryption.
- There will be NO off-site access of any kind to temporary networks.
- Passwords for network hardware and network access have been changed from defaults.

Signature: _____ Date: _____

Completed By:

Name: _____

Position Title: _____

Company: _____

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Wireless Network Request form (during construction)

												Network connectivity at required points (Y/N)?				
Device ID	Device Description	Location	Receiving Device IDs	Protocol	Encryption (type / bits)	RF Frequency	Radiated Power (dBm)	Free-space range	As-installed range	Approved (Y/N)	Testing Required (Y/N)	Location 1	Location 2	Location 3	....	Location <n>

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SECTION 26 05 48.00 10

SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325	(2017) Steel Construction Manual

ASTM INTERNATIONAL (ASTM)

ASTM E580/E580M	(2020) Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions

JAPANESE ARCHITECTURAL STANDARD SPECIFICAITONS (JASS)

JASS 6	(2007) Structural Steelwork Specification for Building Construction

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS C 8105-2 Series	Luminaires: Particular Requirements for Safety

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2019, with Change 1, 2022) Structural Engineering

UNDERWRITERS LABORATORIES (UL)

UL 1598	(2021; Reprint Jun 2021) Luminaires

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

The requirements for seismic protection measures described in this section shall be applied to the electrical equipment and systems listed below. Structural requirements shall be in accordance with Section 13 48 73 SEISMIC CONTROL FOR MECHANICAL EQUIPMENT.

1.2.2 Electrical Equipment

Electrical equipment shall include the following items to the extent required on the drawings or in other sections of these specifications:

Control Panels	Air Handling Units
Pumps with Motors	Switchgear
Light Fixtures	Unit Substations
Motor Control Centers	Transformers
Switchboards (Floor Mounted)	Storage Racks
Solar Heating Units	[_____]

1.2.3 Electrical Systems

The following electrical systems shall be installed as required on the drawings and other sections of these specifications and shall be seismically protected in accordance with this specification: [_____]

1.2.4 Contractor Designed Bracing

Submit copies of the Design Calculations with the Drawings. Calculations shall be approved, certified, stamped and signed by a Registered Professional Engineer. Calculations shall verify the capability of structural members to which bracing is attached for carrying the load from the brace. Design the bracing in accordance with UFC 3-301-01 and additional data furnished by the Contracting Officer. Resistance to lateral forces induced by earthquakes shall be accomplished without consideration of friction resulting from gravity loads. UFC 3-301-01 uses parameters for the building, not for the equipment in the building; therefore, corresponding adjustments to the formulas shall be required. Loadings determined using UFC 3-301-01 are based on strength design; therefore, AISC 325 or JASS 6 shall be used for the design. Develop the bracing for the following electrical equipment and systems: [_____].

1.2.5 Conduits Requiring No Special Seismic Restraints

Seismic restraints may be omitted from electrical conduit less than 64 mm trade size and [_____]. All other interior conduit, shall be seismically protected as specified.

1.3 EQUIPMENT REQUIREMENTS

Submit detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail, indicating thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction. Submit copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer and shall verify the capability of structural members to which bracing is attached for carrying the load from the brace.

1.3.1 Rigidly Mounted Equipment

The following specific items of equipment: [_____] to be furnished under this contract shall be constructed and assembled to withstand the seismic

forces specified in UFC 3-301-01. Each item of rigid electrical equipment shall be entirely located and rigidly attached on one side only of a building expansion joint. Piping, electrical conduit, etc., which cross the expansion joint shall be provided with flexible joints that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions.

Engine-Generators
Substations
Transformers
Switch Boards and Switch Gears
Motor Control Centers
Free Standing Electric Motors
[_____]

1.3.2 Nonrigid or Flexibly-Mounted Equipment

The following specific items of equipment to be furnished: [_____] shall be constructed and assembled to resist a horizontal lateral force of [_____] times the operating weight of the equipment at the vertical center of gravity of the equipment.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Lighting Fixtures in Buildings
Equipment Requirements

SD-03 Product Data

Lighting Fixtures in Buildings; G[, [_____]]
Equipment Requirements; G[, [_____]]
Contractor Designed Bracing; G[, [_____]]

PART 2 PRODUCTS

2.1 LIGHTING FIXTURE SUPPORTS

Lighting fixtures and supports shall conform to UL 1598 or JIS C 8105-2

2.2 SWAY BRACING MATERIALS

Sway bracing materials (e.g. rods, plates, rope, angles, etc.) shall be as specified in Section 13 48 73 SEISMIC CONTROL FOR MECHANICAL EQUIPMENT.

PART 3 EXECUTION

3.1 SWAY BRACES FOR CONDUIT

Conduit shall be braced as for an equivalent weight pipe in accordance with Section 23 05 48.19 [SEISMIC] BRACING FOR HVAC.

3.2 LIGHTING FIXTURES IN BUILDINGS

Lighting fixtures and supports shall conform to the following:

3.2.1 Pendant Fixtures

Pendant fixtures shall conform to the requirements of UFC 3-301-01.

3.2.2 Ceiling Attached Fixtures

3.2.2.1 Recessed Fixtures

Recessed fluorescent individual or continuous-row mounted fixtures shall be supported by a seismic-resistant suspended ceiling support system built in accordance with [ASTM E580/E580M][Section 09 51 00 ACOUSTICAL CEILINGS]. Seismic protection for the fixtures shall conform to the requirements of UFC 3-301-01. Recessed lighting fixtures not over 25 kg in weight may be supported by and attached directly to the ceiling system runners using screws or bolts, number and size as required by the seismic design. Fixture accessories, including louvers, diffusers, and lenses shall have lock or screw attachments.

3.2.2.2 Surface-Mounted Fixtures

Surface-mounted fluorescent individual or continuous-row fixtures shall be attached to a seismic-resistant ceiling support system built in accordance with [ASTM E580/E580M][Section 09 51 00 ACOUSTICAL CEILINGS]. Seismic protection for the fixtures shall conform to the requirements of UFC 3-301-01.

3.2.3 Assembly Mounted on Outlet Box

A supporting assembly, that is intended to be mounted on an outlet box, shall be designed to accommodate mounting features on [100] [75] mm boxes, plaster rings, and fixture studs.

3.2.4 Wall-Mounted Emergency Light Unit

Attachments for wall-mounted emergency light units shall be designed and secured for the worst expected seismic disturbance at the site.

3.2.5 Lateral Force

Structural requirements for light fixture bracing shall be in accordance with Section 13 48 73 SEISMIC CONTROL FOR MECHANICAL EQUIPMENT.

-- End of Section --

SECTION 26 11 16.00 33

THREE-PHASE, CUBICLE-TYPE PAD-MOUNTED TRANSFORMER

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 1178	(2015) Foundation Bolts (Amendment 1)
JIS C 0920	(2003) Degrees Of Protection Provided By Enclosures (IP Code)
JIS C 1102-1	(2007)Direct Acting Indicating Analogue Electrical Measuring Instruments And Their Accessories Part 1: Definitions And General Requirements Common To All Parts
JIS C 1102-2	(1997) Direct Acting Indicating Analogue Electrical Measuring Instruments And Their Accessories Part 2: Special Requirements For Ammeters And Voltmeters
JIS C 1102-3	(1997) Direct Acting Indicating Analogue Electrical Measuring Instruments And Their Accessories Part 3: Special Requirements For Wattmeters And Varmeters
JIS C 1102-4	(1997) Direct Acting Indicating Analogue Electrical Measuring Instruments And Their Accessories Part 4: Special Requirements For Frequency Meters
JIS C 1102-5	(1997) Direct Acting Indicating Analogue Electrical Measuring Instruments And Their Accessories Part 5: Special Requirements For Phase Meters, Power Factor Meters And Synchroscopes
JIS C 1102-6	(1997) Direct Acting Indicating Analogue Electrical Measuring Instruments And Their Accessories Part 6: Special Requirements For Ohmmeters (Impedance Meters) And Conductance Meters
JIS C 1102-7	(1997) Direct Acting Indicating Analogue Electrical Measuring Instruments And Their Accessories Part 7: Special Requirements For Multi-Function Instruments
JIS C 1102-8	(1997) Direct Acting Indicating Analogue

	Electrical Measuring Instruments And Their Accessories Part 8: Special Requirements For Accessories
JIS C 1103	(1984) Dimensions of Electrical Indicating Instruments for Switchboards
JIS C 1211-1	(2009) Alternating-Current Watt-Hour Meters (For Direct Connection) -- Part 1: General Measuring Instrument
JIS C 1211-2	(2017) Alternating-Current Watt-Hour Meters (For Direct Connection) -- Part 1: General Measuring Instrument
JIS C 1216	(2009) Alternating-Current Watt-Hour Meters (For Connection Through Instrument Transformer) -- Part 1: General Measuring Instrument
JIS C 1263-1	(2009) Var-Hour Meters -- Part 1: General Measuring Instrument
JIS C 1281	(1979) Weather-Proof Performance Of Electricity Meters
JIS C 1283	(2009) Watt-Hour, Var-Hour And Maximum Demand Indicators For Telemetering -- Part 1: General Measuring Instrument
JIS C 3102	(1984) Annealed Copper Wires for Electrical Purposes
JIS C 3611	(1991) Insulated Wires for Cubicle Type Unit Substation for 6.6 KV Receiving
JIS C 3814	(1999) Indoor Post Insulators
JIS C 3851	(2012) Indoor Post Insulator Of Organic Material
JIS C 4304	(2013) 6 KV Oil-Immersed Distribution Transformers
JIS C 4306	(2013) 6 kV mold transformer for distribution
JIS C 4603	(1990) Ac Circuit Breakers For 3.3 kV or 6.6 kV
JIS C 4604	(2017) High Voltage Current-Limiting Fuses
JIS C 4605	(1998) AC Load Break Switches for 3.3 KV or 6.6 KV
JIS C 4606	(R2011) Indoor Use Disconnectors for 3.3 kV or 6.6 kV
JIS C 4607	(1999) Ac Load Break Switches With

	Tripping Device for 3.3 kV or 6.6 kV
JIS C 4608	(2015)Surge arresters for 6.6 kV Cubicle Type Unit Substation
JIS C 4611	(1999) High-voltage alternating current switch-fuse combinations
JIS C 4620	(2018) Cubicle Type High Voltage Power Receiving Units
JIS C 8105-1	(2017) Luminaires - Part 1: General Requirements For Safety
JIS C 8105-2-2	(2003) Luminaires - Part 2. Luminaires Part 2: Particular requirements for safety - Section 2: Recessed luminaires
JIS C 8106	(2015) Luminaires With Led Light Source Fluorescent Lamp For Commercial, Industrial And Public Lighting
JIS C 8201-2-1	(2011) Low-Voltage Switchgear and Control Gear - Part 2-1: Circuit-Breakers
JIS C 8201-2-2	(2011) Low-Voltage Switchgear And Control Gear - Part 2-2: Circuit-Breakers Incorporating Residual Current Protection
JIS C 8201-7-1	(2016) Low-Voltage Switchgear And Control Gear -- Part 7-1: Ancillary Equipment -- Terminal Blocks For Copper Conductors
JIS C 8303	(2007) Plugs And Receptacles For Domestic And Similar General Use
JIS C 8364	(2008) Busways
JIS C 8480	(R2016) Box-Type Switchgear Assemblies for Low-Voltage Distribution Purpose
JIS G 3553	(2011) Crimped Wire Cloth (Amendment 1)
JIS G 3555	(2015) Woven Wire Cloth, 4th Edition, Incl Amendments
JIS G 3555 PW-S	(2015) The most basic way of weaving, where vertical and horizontal lines are kept at regular intervals and intersect each other one by one. (Translated Japanese)
JIS H 3140	(2018) Copper Bus Bars
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS Z 8721	(1993) Color Specification - Specification According To Their Three Attributes

JAPAN WIRE INDUSTRY ASSOCIATION STANDARD (JCS)

JCS 1226	(2003) Soft Stranded Wire

JAPANESE ELECTROTECHNICAL COMMITTEE (JEC)

JEC 2200	(2015) Transformer
JEC 2300	(1998) Vacuum Circuit Breaker
JEC 2310	(2003) Disconnector and Earthing Switch

THE JAPAN ELECTRICAL MANUFACTURERS' ASSOCIATION (JEMA)

JEM 1425	(2011) Metal-enclosed Switch Gear and Control Gear
JEM 1459	(2013) Structure and dimensions of switchboard and control panel

JAPAN POWER CABLE ACCESSORIES ASSOCIATION STANDARDS (JCAA)

JCAA C 3102	(2016) 6600V Cross-linked Polyethylene Insulated Power Cable Rubber Stress Cone Type Cubicle Termination Connection

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT DSKKS	Denki Setsubi Kouji Kanri Shishin (DSKKS) Electrical Construction Supervision Guidelines
MLIT ESS	(2019) MLIT Electrical Standard Specification (ESS)

1.2 RELATED EQUIPMENT

Section 26 00 00.00 20, BASIC ELECTRICAL MATERIAL AND METHOD, applies to this section, with the additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Cubicle Type Unit Substation Including Concrete Foundation

Distribution panel

Cubicle type unit switching station including concrete foundation

Switchgear including concrete foundation

SD-03 Product Data

Transformers; G[[, [ ]]

Primary Cutout (PC)G[, [ ]]

Disconnecting Switches (DS); G[, [ ]]

Load Disconnecting Switches (LDS); G[, [ ]]

Vacuum Circuit Breaker (VCB); G, [ ]]

Load Break Switches (LBS); G[, [ ]]

Load Break Switches (LBS) with tripping device; G[, [ ]]

Load Break Switches (LBS) with fuse; G[, [ ]]

Circuit breaker; G[, [ ]]

Circuit Breaker with GFCI; G[, [ ]]

Automatic Transfer Switch (ATS); G[, [ ]]

Power Fuses (PF); G FIO [, [ ]]

Instruments; G[, [ ]]

Instrument Control Switches; G[, [ ]]

Buzzer

Test Terminal

Lightning Arrester; G[, [ ]]

SD-06 Test Reports

Acceptance Checks and Tests

SD-10 Operation and Maintenance Data

Data Transformer(s), Data Package 5; G[, [ ]]

1.4 QUALITY ASSURANCE

1.4.1 PCB Free Certificate

Submit results of PCB analysis in transformer oil to certify that the transformers installed under this contract are PCB free transformer as specified in Paragraph Also, analysis results shall be required maker name, serial number and other identification data of the transformers which are taken and analyzed oil samples. Analysis results appearing PCB rate shall be submitted to and approved by the Contracting Officer prior to install the transformers. The certificate shall include "PCB analysis report" prepared by the Contractor and "PCB-free certificate" prepared by the transformer manufacturer.

1.4.2 Lead-Containing Paint Material

Use of Lead-containing paint shall not be permitted. Submit the Certification of Lead Free for each enclosure, and field-applied paint in accordance with Section 01 78 00 CLOSEOUT SUBMITTALS.

1.4.3 Cubicle Type Transformer Drawings

Include the following as a minimum:

a. An outline drawing, including front, top, and side views.

b. Nameplate data.

c. Elementary diagrams and wiring diagrams[with terminals identified of watthour meter and current transformers].

d. One-line diagram, including switch(es)[, current transformers, meters, and fuses].

1.4.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, except when more stringent requirements are specified or indicated, as though the word "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with applicable codes and standards unless more stringent requirements are specified or indicated.

1.4.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship, and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.6 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

1.5 MAINTENANCE

1.5.1 Additions to Operation and Maintenance Data

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein. In addition to requirements of Data Package 5, include the following on the actual transformer(s) provided:

a. An instruction manual with pertinent items and information highlighted

b. An outline drawing, front, top, and side views

c. Prices for spare parts and supply list

d. Routine and field acceptance test reports

e. Fuse curves for primary fuses

[f. Information on watthour demand meter, CT's, and fuse block

] g. Actual nameplate diagram

h. Date of purchase

PART 2 PRODUCTS

2.1 GENERAL

MLIT ESS. Substation shall be open-type switchgear for secondary distribution with transformation. The substation assembly shall consist of [one][ ] incoming section, [one][ ] transformer section and [one][ ] distribution section. Dimension and feature of the substation shall be as indicated.

2.2 MATERIALS AND EQUIPMENT

All materials, equipment, and devices shall, as a minimum, meet the requirements of JIS where JIS Standards are established for those items, and the requirements of MLIT ESS. All items shall be new unless specified or indicated otherwise.

2.3 [MODIFICATION OF]CUBICLE TYPE UNIT SUBSTATION

JIS C 4620 and MLIT ESS. [Substation shall be metal enclosed station type cubicle switchgear for secondary distribution with transformation. The substation assembly shall consist of [one][] incoming section, [one][] transformer section and [one][] distribution section. External doors shall be suitable for handle key. Enclosure of the substation, inside enclosure and oil transformers shall be coated by salt-air proofing paint, heavy-duty type. Dimension and feature of the substation shall be as indicated.]

2.4 TRANSFORMERS SECTION

2.4.1 Unit Frame

Unit frame shall conform to JEM 1459.

2.4.2 Transformer

Oil immersed transformer shall conform to JIS C 4304. Transformer shall be high-efficiency type.

[Molded transformer shall conform to JIS C 4306. Transformer shall be high-efficiency type.]

[Extra-high voltage type transformer shall conform to JEC 2200.]

Voltage tap shall be changed by outside setting.

2.4.2.1 Transformer (Insulation) Oil

The use of PCB containing oil shall not be permitted. Before installation of transformer, the new transformer oil shall be tested in accordance with the method described in the latest Law of the Japanese Government, and submit PCB free certificate with its testing method to the Contracting Officer. Materials containing PCBs (0.5 ppm and above) shall not be permitted to use.

2.5 [MODIFICATION OF]CUBICLE TYPE UNIT SWITCHING STATION

JIS C 4620 and MLIT ESS. [Switching station shall be metal enclosed station-type cubicle switchgear for feeder distribution. The switching station assembly shall consist of [one][ ] incoming section, and [one][ ] distribution section. External doors shall be suitable for handle key. Enclosure of the switching station and inside enclosure shall be coated by salt-air proofing paint, heavy-duty type. Dimension and feature of the switching station shall be as indicated.]

2.6 [MODIFICATION OF]SWITCHGEAR

[JIS C 4620] [JEM 1425] and MLIT ESS. [Switchgear shall be metal enclosed [metal-clad] [cubicle] type switchgear for feeder distribution.] The switchgear assembly shall consist of [one] [_____] incoming section, and [one] [_____] distribution section. External doors shall be suitable for handle key. Enclosure of the switchgear and inside enclosure shall be coated by salt-air proofing paint, heavy-duty type. Dimension and feature of the switchgear shall be as indicated.

[2.6.1 Interrupter Switch for Extra-High-voltage

2.6.1.1 Primary Cutout (PC)

As recommended by the primary cutout manufacturer.

2.6.1.2 Disconnecting Switches (DS)

Shall conform to JEC 2310.

2.6.1.3 Vacuum Circuit Breaker (VCB)

Shall conform to JEC 2300.

][2.6.2 Interrupter Switch for High-Voltage

2.6.2.1 Primary Cutout (PC)

Shall conform to JIS C 4620, Appendix C.

2.6.2.2 Load Disconnecting Switches (LDS)

Shall conform to JIS C 4606.

2.6.2.3 Load Break Switches (Lbs)

Shall conform to JIS C 4605.

LDS means fuse less type of Load Break Switches (LBS).

2.6.2.4 Load Break Switches (LBS) With Tripping Device

Shall conform to JIS C 4607.

2.6.2.5 Load Break Switches (LBS) With Fuse

Shall conform to JIS C 4611. Power fuses (PF) shall confrm to JIS C 4604.

2.6.2.6 Vacuum Circuit Breaker (VCB)

Shall conform to JIS C 4603.

]2.7 DISTRIBUTION SECTION

Distribution switchboard shall be circuit breaker-equipped unless indicated otherwise. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by JEM. Where "space only" is indicated, make provisions for future installation of breaker sized as indicated. Directories shall be typed to indicate load served by each circuit and mounted in holder behind transparent protective covering.

2.7.1 Unit Frame

Unit frame shall conform to JEM 1459.

2.7.2 Cubicle Type Cabinet

Cabinet shall conform to cubicle-type [JIS C 4620][JEM 1425]. Additional requirements shall be attached at the end of this section as a reference.

2.7.3 Panelboard Type Cabinet

Cabinet shall conform to JIS C 8480 shall have a mounting plate, and shall be provided with wiring gutters of adequate size at top, bottom and sides.

2.7.3.1 Steel Type

Thickness of steel sheet shall be not less than 2.3 mm.

Thickness of sheet steel for the cabinet shall be not less than 2.3 mm for outdoor installation and for indoor installation.

Cabinet located outside the building shall be of hot dip galvanized steel sheet material.

Cabinets shall be painted in accordance with paragraph FACTORY APPLIED FINISH.

2.7.3.2 Stainless Steel Type

Cabinet shall be of Stainless Steel.

2.7.3.3 Weather Proof Type

Cabinet located outside of building and exposure to weather, shall be weather-proofed box.

Weather-proof cabinet shall conform to JIS C 0920 [(IP44)] [(IP54)] [(IPXX and more)] [as indicated] and exposed screws to weather shall be non-corrosive material.

2.7.4 Interrupter Switch for Low-voltage

2.7.4.1 Circuit Breaker

JIS C 8201-2-1, thermal-magnetic, magnetic or solid-state (electronic) type with interrupting capacity as indicated. Plug-in circuit breakers unacceptable.

Interrupting rating of circuit breakers shall be as indicated. If not shown, do not select circuit breakers less than 10,000A asymmetrical interrupting rating for voltages 240V and under, and 14,000A asymmetrical interrupting rating for 480V and under.

2.7.4.2 Circuit Breaker with GFCI

JIS C 8201-2-2, Plug-in circuit breakers unacceptable. Provide with "push-to-test" button, visible indication of tripped condition, and ability to detect and trip on current imbalance of [15] [30] milliamperes or greater per requirements or as indicated on drawings.

2.7.5 Automatic Transfer Switch (ATS)

As recommended by the auto transfer switch manufacturer.

2.7.6 Power Factor Improvement Equipments

[Provide as indicated on drawings.][_____]

2.7.7 Protective Relays, Metering, and Control Devices

Provide protective relays as indicated [on drawings.] [per manufacturer's recommendations.] [_____]

2.7.7.1 Instruments

General of instruments shall conform to JIS C 1102-1, JIS C 1102-8 and JIS C 1103.

Ammeter (wide-range type), voltmeter (wide-range type) shall conform to

JIS C 1102-2 respectively.

Wattmeters and varmeters shall conform to JIS C 1102-3.

Frequency meters shall conform to JIS C 1102-4.

Phase meters, power factor meters and synchroscopes shall conform to JIS C 1102-5.

Ohmmeters (impedance meters) and conductance meters conform to JIS C 1102-6.

Multi-function instruments shall conform to JIS C 1102-7.

Watt-hour meter with pulse generator shall conform to JIS C 1211-1, JIS C 1211-2, JIS C 1216, JIS C 1281 and JIS C 1283.

Var-hour meter shall conform to JIS C 1263-1.

[Metering shall be compliant with the current Advanced Meter Reading System (AMRS) Electric Meter Specifications.]

2.7.7.2 Instrument Control Switches

Provide rotary cam-operated type with positive means of indicating contact positions.

2.7.7.3 Buzzer

Shall have a sound output rating of at least 90 decibels at 1 m.

2.7.7.4 Test Terminal

Provide current test terminal and voltage test terminal.

2.7.7.5 Pilot and Indicating Lights

Provide transformer, resistor, or diode type.

2.7.7.6 Lightning Arrester

Shall conform to JIS C 4608.

2.7.7.7 Insulators

Shall conform to JIS C 3814, and JIS C 3851.

2.7.7.8 EMCS Terminal

Provide plywood (600 mm x 600mm x 12mm) with terminal blocks, receptacle outlet and associated wiring as indicated on drawings.

2.7.7.9 Space Heater

As indicated on drawings.

2.7.7.10 Receptacles

Provide receptacle outlet for maintenance.

Shall conform to JIS C 8303, grounding-type and duplex type.

2.7.7.11 LED Lighting Fixtures

Provide LED lighting fixtures inside cabinet.

Shall conform to JIS C 8106, JIS C 8105-1 and JIS C 8105-2-2.

2.7.7.12 Roof Fan

As indicated on drawings.

2.7.7.12.1 Air Intake Fan

Provide Air Intake Fan on side wall of receiving panel. Its cover (outdoor hood) shall have minimum 500mm straight portion duct below lower portion of opening for air intake on side wall. Straight portion duct shall be opened forward downside, and opening of duct shall be covered by crimped wire cloth and woven wire cloth with stainless steel (SUS304) frame. Wire clothes shall be fixed to cover by bolts or screws. Requirements for wire clothes are as follows, and their layer shall be following order from downside (outside);

(1) Crimped wire cloth, JIS G 3553, CR-S (SUS304), Wire dia. 1.6mm, mesh size 9mm
(2) Woven wire cloth, JIS G 3555, PW-S (SUS304), Wire dia. 0.65mm, 8 mesh
(3) Woven wire cloth, JIS G 3555 PW-S (SUS304), Wire dia. 0.65mm, 10 mesh

2.8 WIRE AND CABLES

2.8.1 Current Carrying Section

2.8.1.1 Cable Head

Cable head shall be designed for terminating one single conductor cables per phase and shall be arranged for conduits entering from below. Cable head Shall conform to JCAA C 3102.

2.8.1.2 Bus Duct (Busway)

JIS C 8364.

2.8.1.3 Copper Bus Bars

Shall conform to JIS H 3140.

2.8.1.4 Copper Ground Bus Terminal (Copper Bus Bar for Ground Terminal)

Provide a copper ground bus terminal of sufficient amperage and install. Bus bars shall be JIS H 3140.

2.8.1.5 Terminal Blocks

JIS C 8201-7-1.

[2.8.1.6 Extra-High-Voltage Cable (Over 6.6 kV)

Provide as specified in SECTION 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

][2.8.1.7 High Voltage Wire (6.6 kV)

High voltage wire for cubicle type unit substation shall conform to JIS C 3611, Type KIP.

][2.8.1.8 Low-Voltage Cable (600 V)

Provide as specified in SECTION 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

]2.9 CONDUITS

Provide as specified in SECTION 26 20 00, INTERIOR DISTRIBUTION SYSTEM.

2.10 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of JIS C 0920 corrosion-resistance test and the additional requirements as specified herein. Interior and exterior steel surfaces of equipment enclosures shall be thoroughly cleaned and then receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Exterior surfaces shall be free from holes, seams, dents, weld marks, loose scale or other imperfections. Interior surfaces shall receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice. Exterior surfaces shall be primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish. Equipment located indoors shall be ANSI Light Gray,[and equipment located outdoors shall be ANSI[Light Gray][Dark Gray]]. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

2.10.1 Hot Dip Galvanizing

JIS H 8641, Type HDZ35.

2.10.2 Paint of Cabinet

Provide standard factory finishes including rust inhibiting treatment. Unless otherwise specified or indicated finish of outside panels shall be applied factory finish color. Field applied paint shall not be permitted for newly installed panels. The cabinet shall include likely panelboard, power panel, control panel, breaker box, disconnecting switch box, terminal box and steel cabinet for electrical work.

2.10.2.1 Clear Blue

Provide standard factory finishes including rust inhibiting treatment, except that the inside finish of the cabinet shall be vivid orange (2.5YR5/12 of JIS Z 8721) and the outside including exposed parts of trim and door shall be clear blue (2.5PB5/8 of JIS Z 8721).

2.10.2.2 Sand Beige

Provide standard factory finishes including rust inhibiting treatment, except that the inside finish of the cabinet shall be vivid orange (2.5YR5/12 of JIS Z 8721) and the outside including exposed parts of trim and door shall be sand beige (2.5Y8.5/1 of JIS Z 8721).

2.10.2.3 Surrounding

Provide standard factory finishes including rust inhibiting treatment, except that the inside finish of the cabinet shall be vivid orange (2.5YR5/12 of JIS Z 8721) and the outside including exposed parts of trim and door shall match to surrounding wall surface.

2.10.2.4 Fire Red

Provide standard factory finishes including rust inhibiting treatment, except that the inside finish of the cabinet shall be vivid orange (No. 2.5YR5/12 of JIS Z 8721) and the outside including exposed parts of trim and door shall be fire red (No. 7.5R4/14 of JIS Z 8721).

2.10.2.5 Selection of Colors Outside

Selection of color outside cabinet including exposed parts of trim shall be clear blue in the industrial area and mechanical room, unless otherwise specified or indicated. The color of the cabinet located other area shall match to surrounding or sand beige. [Directed by the Contracting Officer.]

2.10.3 Nameplate

Provide as specified in Section 26 00 00.00 20, BASIC ELECTRICAL MATERIALS AND METHODS.

2.11 LEAD-IN POCKET FOR TEMPORARY CABLE

As indicated on drawings.

2.12 WARNING SIGN

Warning sign shall be attached at the end of this section.

2.13 GROUNDING AND BONDING

[Provide grounding and bonding as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION.]

[Provide as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.]

2.14 MATERIALS FOR CONCRETE FOUNDATION

Features and dimension of the concrete foundation shall be as indicated.

2.14.1 Concrete Material

Specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

2.14.2 Anchor Bolt

Anchor bolts shall be JIS B 1178, Type L. Bolts shall be stainless steel material conforming to SUS 304.

2.14.3 Anchor Bolt (Expansion Anchor)

Tubular, multi-slit, internal thread, with stud bolt having a head of the expander shape, as indicated on drawing. Do not use plastic material.

2.14.4 Anchor Bolt (Chemical Anchor)

Shall be a two-part system composed of a threaded rod stud and a sealed glass capsule containing premeasured amounts of epoxy acrylic resin, quartz sand, and a hardener contained in a separate vial within the capsule.

2.14.5 Nuts and Washers

Material shall be stainless steel conforming to SUS 304.

2.15 ADDITIONAL REQUIREMENTS OF THE SUBSTATION SWITCHING STATION SWITCHGEAR

Additional requirements of cubicle type unit substation open type unit substation switching station switchgear shall be attached at the end of this section as a reference.

PART 3 EXECUTION

3.1 INSTALLATION

Unless otherwise indicated, installation shall be performed in accordance with MLIT ESS, MLIT DSKKS and to the requirements specified herein.

3.2 GROUNDING

Provide grounding as indicated, in accordance with [MLIT ESS and MLIT DSKKS,] [except that grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms].

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in [Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION] [Section 26 20 00 Interior Distribution System]. Connect ground conductors to the upper end of ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Transformer Grounding

Provide separate copper grounding conductors and connect them to [the ground girdle as indicated] [copper ground bus terminal]. When work in addition to that indicated or specified is required to obtain the specified ground resistance, the provision of the contract covering "Changes" shall apply.

3.2.3 Grounding and Bonding Equipment

Provide separate copper grounding conductors and connect them to copper ground bus terminal. Solid bare copper wire shall be JIS C 3102: Stranded bare copper wire shall be JCS 1226, except as indicated or specified otherwise.

3.2.4 Ground Girdle (Loop Ground)

Provide a 60 sqmm bare copper-ground girdle around substation switching station switchgear. Girdle shall be buried 305 mm (one foot) deep and placed 915 mm (3 feet) laterally from the substation enclosure. Connect

girdle to enclosure at two opposite places using 60 sqmm copper.

3.2.5 Connections

Make joints in grounding conductors and ground girdle by exothermic weld or compression connector. Exothermic welds and compression connectors shall be installed as specified in [Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION] [Section 26 20 00 Interior Distribution System].

3.2.6 Resistance

[Maximum resistance-to-ground of grounding system shall be as specified in Section 33 71 02.00 20 UNDERGROUND ELECTRICAL DISTRIBUTION.]
[Maximum resistance-to-ground of grounding system shall be as specified in Section 26 20 00 Interior Distribution System.]

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect cubicle type unit substation open type unit substation switching station switchgear furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.4 FIELD APPLIED PAINTING

Field paint shall be specified in Section 09 90 00, PAINTS AND COATINGS.

3.5 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 9 meters apart.

3.6 RESTORATION

Unless otherwise indicated, all existing objects which interfere with new work shall be removed temporary and reinstalled upon completion of new work.

3.7 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

Foundation shall be in accordance with MLIT ESS.

3.7.1 Cast-in-place concrete

Cast-in-place concrete work shall be as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.7.2 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.8 FIELD QUALITY CONTROL

3.8.1 Testing Methods for Each Field Test

Use design documents and requirements specified in this section to develop

test procedures. Procedures shall consist of detailed instructions for a test setup, execution, and evaluation of test results.

Testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test procedures as specified.

3.8.2 Performance of Acceptance Checks and Tests

First Class Construction Electric Management Engineer (1 Kyu Dekikouji Sekou Kanrigishi) shall perform acceptance checks and testing in accordance with the manufacturer's recommendations, and include [the following] visual and mechanical inspections and electrical tests, performed in accordance with Denki Hoan Kyoukai standards, MLIT ESS and MLIT DSKKS.

a. Protection co-ordination curve line

b. Insulation resistance test

c. Withstand voltage test

d. Protective relays test

e. [Leakage current test of transformer]

f. System test

[Grounding system test are performed in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests.]

3.8.3 Equipment Checks and Tests

3.8.3.1 Interrupter Switches

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Confirm correct application of manufacturer's recommended lubricants.

(4) Verify appropriate anchorage and required area clearances.

(5) Verify appropriate equipment grounding.

(6) Verify correct blade alignment, blade penetration, travel stops, and mechanical operation.

(7) [Verify that fuse sizes and types correspond to approved shop drawings.]

(8) [Verify that each fuse holder has adequate mechanical support.]

(9) Verify tightness of accessible bolted electrical connections

by calibrated torque-wrench method. Thermographic surveying[is not][is]required.

(10) Test interlocking systems for correct operation and sequencing.

(11) Verify correct phase barrier materials and installation.

(12) Compare switch blade clearances with industry standards.

(13) Inspect all indicating devices for correct operation

b. Electrical Tests

(1) Perform insulation-resistance tests.

(2) Perform over-potential tests.

(3) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

(4) Measure closed contact-resistance across each switch blade[and fuse holder].

(5) [Measure fuse resistance.]

(6) Verify heater operation.

3.8.3.2 Interrupter Switchgear (LDS, LBS)

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Confirm correct application of manufacturer's recommended lubricants.

(4) Verify appropriate anchorage and required area clearances.

(5) Verify appropriate equipment grounding.

(6) Verify correct blade alignment, blade penetration, travel stops, and mechanical operation.

(7) [Verify that fuse sizes and types correspond to approved shop drawings.]

(8) [Verify that each fuse holder has adequate mechanical support.]

(9) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(10) Test interlocking systems for correct operation and

sequencing.

(11) Verify correct phase barrier materials and installation.

(12) Compare switch blade clearances with industry standards.

(13) Inspect all indicating devices for correct operation

b. Electrical Tests

(1) Perform insulation-resistance tests.

(2) Perform over-potential tests.

(3) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

(4) Measure closed contact-resistance across each switch blade[and fuse holder].

(5) [Measure fuse resistance.]

(6) Verify heater operation.

3.8.3.3 Vacuum Circuit Breaker (VCB)

a. Visual and mechanical inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Confirm correct application of manufacturer's recommended lubricants.

(4) Inspect anchorage, alignment, and grounding.

(5) Perform all mechanical operational tests on both the circuit breaker and its operating mechanism.

(6) Measure critical distances such as contact gap as recommended by manufacturer.

(7) Verify tightness of accessible bolted connections by calibrated torque-wrench method. Thermographic survey[is not][is] required.

(8) Record as-found and as-left operation counter readings.

b. Electrical Tests

(1) Perform a contact-resistance test.

(2) Verify trip, close, trip-free, and antipump function.

(3) Trip circuit breaker by operation of each protective device.

(4) Perform insulation-resistance tests.

(5) Perform vacuum bottle integrity (overpotential) test across each bottle with the breaker in the open position in strict accordance with manufacturer's instructions. Do not exceed maximum voltage stipulated for this test.

3.8.3.4 Metering and Instrumentation

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify tightness of electrical connections.

b. Electrical Tests

(1) Verify accuracy of meters at 25, 50, 75, and 100 percent of full scale.

(2) Calibrate watthour meters according to manufacturer's published data.

(3) Verify all instrument multipliers.

(4) Verify that current transformer[and voltage transformer] secondary circuits are intact.

3.8.3.5 Switchgear Assemblies

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical, electrical, and mechanical condition.

(3) Confirm correct application of manufacturer's recommended lubricants.

(4) Verify appropriate anchorage, required area clearances, and correct alignment.

(5) Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.

(6) Verify that[fuse and] circuit breaker sizes and types correspond to approved shop drawings.

(7) [Verify that current and potential transformer ratios correspond to approved shop drawings.]

(8) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method. Thermographic survey[is not][is] required.

(9) Confirm correct operation and sequencing of electrical and

mechanical interlock systems.

(10) Clean switchgear.

(11) Inspect insulators for evidence of physical damage or contaminated surfaces.

(12) Verify correct barrier[and shutter] installation[and operation].

(13) Exercise all active components.

(14) Inspect all mechanical indicating devices for correct operation.

(15) Verify that vents are clear.

(16) Test operation, alignment, and penetration of instrument transformer withdrawal disconnects.

(17) Inspect control power transformers.

b. Electrical Tests

(1) Perform insulation-resistance tests on each bus section.

(2) Perform overpotential tests.

(3) Perform insulation-resistance test on control wiring; Do not perform this test on wiring connected to solid-state components.

(4) Perform control wiring performance test.

(5) Perform primary current injection tests on the entire current circuit in each section of assembly.

(6) [Perform phasing check on double-ended switchgear to ensure correct bus phasing from each source.]

(7) Verify operation of heaters.

3.8.3.6 Transformers

a. Visual and mechanical inspection

(1) Compare equipment nameplate information with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition. Check for damaged or cracked insulators and leaks.

(3) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(4) Verify correct liquid level in tanks.

(5) Perform specific inspections and mechanical tests as

recommended by manufacturer.

(6) Verify correct equipment grounding.

(7) Verify the presence of transformer surge arresters.

b. Electrical tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter.

(2) Verify that the tap-changer is set at specified ratio.

(3) Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

(4) Perform transformer test in accordance with JEC 2200 and the transformer manufacture's written instruction.

3.8.3.7 Current Transformers

a. Visual and mechanical inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify correct connection.

(4) Verify that adequate clearances exist between primary circuits and secondary circuit.

(5) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(6) Verify that required grounding and shorting connections provide good contact.

b. Electrical tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

(2) Perform insulation-resistance test.

(3) Perform a polarity test.

(4) Perform a ratio-verification test.

3.8.3.8 [Kilowatt Demand Meter][Watthour Meter]

a. Visual and mechanical inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify tightness of electrical connections.

b. Electrical tests

(1) [Calibrate watthour meters according to manufacturer's published data.]

(2) Verify that correct multiplier has been placed on face of meter, where applicable.

(3) Verify that current transformer secondary circuits are intact.

3.8.3.9 Grounding System

a. Visual and mechanical inspection

(1) Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

(1) Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete (not exceed 5 ohms). On systems consisting of a single ground rod perform tests before any wire is connected (not exceed 25 ohms). Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

(2) Submit the measured ground resistance of each ground rod (not exceed 25 ohms) and grounding system (not exceed 5 ohms), indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.8.4 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times of checking and testing.

INSERT 7 DRAWINGS
-- End of Section --

1. REGULATION

MINISTRY OF LAND, INFRASTRUCTURE AND TRANSPORT:

(1) ARCHITECTURAL EQUIPMENT DESIGN STANDARD

(2) PUBLIC ARCHITECTURAL EQUIPMENT CONSTRUCTION SPECIFICATIONS (ELECTRIC CONSTRUCTION)

(3) PUBLIC ARCHITECTURAL EQUIPMENT CONSTRUCTION STANDARD DRAWING (ELECTRIC CONSTRUCTION)

JAPANESE INDUSTRIAL STANDARDS:

C 4620 CUBICLE TYPE HIGH VOLTAGE POWER RECEIVING UNIT

2. CABINET

THE MAIN MATERIAL THAT COMPOSES THE CABINET DEPENDS ON THE FOLLOWING.

	COMPONENT PART	THICKNESS (MM) INDOOR	THICKNESS (MM) OUTDOOR
CUBICLE	SIDE	2.3	2.3
	BOTTOM	3.2	3.2
	ROOF	2.3	2.3
	DOOR	2.3	2.3
	DIVIDER	1.6	1.6
	FRAME	L50x50x6	
	BASE	⊏ 100x50x5	
OPEN PANEL		3.2	—
BASE		⊏ 100x50x5	
		⊏ 150x75x5	

[REMARKS]

1) THE DIVIDER PLATE IS USED AS A PARTITION IN THE SWITCHBOARD.

2) THE DOOR CAN BE LOCKED. AND, AN OPEN DOOR CAN BE FIXED WITH THE STOPPER.

3) MAKE EDGE OF THE DOOR 'L' OR '⊐' BENDING.

4) SLOPE A ROOF OF OUTDOORS TYPE. AND IT IS INCLINE 1/30.

5) THE DIVIDER PLATE IS INSTALLED BETWEEN LOW VOLTAGE TO HIGH-VOLTAGE, BETWEEN HIGH VOLTAGE TO HIGH-VOLTAGE.

ADDITIONAL REQUIREMENT (1)	———	DES: 03/12/08 CHK:
		SHT. 1 OF 7
CONST. CONT. NO.	WO#	DIV. NO.

3. COLOR

BUILDING CATEGORY	FACTORY AND WAREHOUSE				OFFICE				HOUSE					
	OUTDOOR	INDOOR			OUTDOOR	INDOOR			OUTDOOR	INDOOR				
		OFFICE	SERVICE ROOM			OFFICE		SERVICE ROOM		COMMON SPACE		DWELLING	SERVICE ROOM	
		BREAK ROOM	WORK ROOM			DINING	PASSAGE			LOBBY	PASSAGE		ROOF	
		OTHER	WAREHOUSE											
1. UNIT SUBSTATION, SWITCHING STATION, SWITCHGEAR	①	-	②		②	-		②	②	-		-		②
2. PANELBOARD, POWER PANEL,CONTROL PANEL	③	③	③		③	③		③	③	③		④		③
3. COMMUNICATION PANEL(TEL, PA)	③	③	③		③	③		③	③	③		④		③
4. FIRE ALARM PANEL	③	⑤	⑤		③	⑤		⑤	⑤	⑤		-		⑤

INSIDE FINISH OF THE CABINET : ⑥

① : 2.5PB 5/8 ---------- (BLUE)

② :10YR 8/2 ----------(BEIGE/DEEP)

③ :2.5Y 8.5/1 ----------(BEIGE/MIDDLE)

④ :2.5Y 9/1 ----------(BEIGE/PALE)

⑤ :7.5R 4/14 ----------(RED)

⑥ :2.5YR/12 ----------(VIVID ORANGE)

ADDITIONAL REQUIREMENT
(2)

	DES: 03/12/08 CHK:	
	SHT. 2 OF 7	
CONST. CONT. NO.	WO#	DIV. NO.

[REMARKS]

1) ADDITIONAL REQUIREMENTS OF FINISH COLORS AND COATS SHALL BE DETERMINED BY THE GOVERNMENT DUE TO CONCERNING OF ENVIRONMENT, AND AREA REQUIREMENTS.

2) CONDUITS AND BOXES SHALL BE SAME OR VERY SIMILAR COLOR TO THE SURFACE OF THE BUILDING, FACILITY, AND EQUIPMENT, TO BE INSTALLED.

3) THIS TABLE IS SHOWN A BASIC CONCEPT OF FIELD PAINTING UNLESS SPECIFIED OR INDICATED.

4) FACTORY FINISH COLOR FOR CUBICLE ENCLOSURE SHALL BE APPROVED BY THE UTILITY DEPARTMENT, PRY 32, PRIOR TO APPLICATION.

5) CABINETS TO BE PROVIDED IN BUILDING SERVICE ROOMS, MECHANICAL ROOMS, SWITCH ROOMS, SHALL HAVE FACTORY-FINISHED SALT-AIR-PROOF COATING, (TAIEN-TOSOU).

6) CABINETS TO BE PROVIDED OUT OF BUILDINGS, SHALL HAVE FACTORY-FINISHED SALT-AIR-PROOF COATING, HEAVY-DUTY TYPE, (JU-TAIEN-TOSOU).

7) ALL OF THE FACTORY-FINISH COLORS SHALL BE HALF MAT FINISH.

4. STANDARD HANDLE

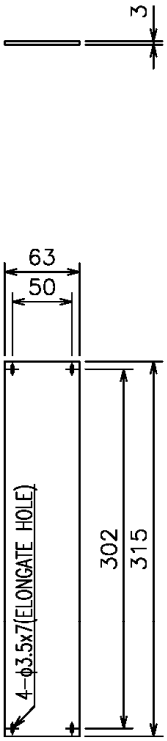
KEY No: A-312-1~3, HL-60, 40, 30

	DES: 03/12/08 CHK:	
	SHT. 3 OF 7	
ADDITIONAL REQUIREMENT (3)	CONST. CONT. NO.	WO# DIV. NO.

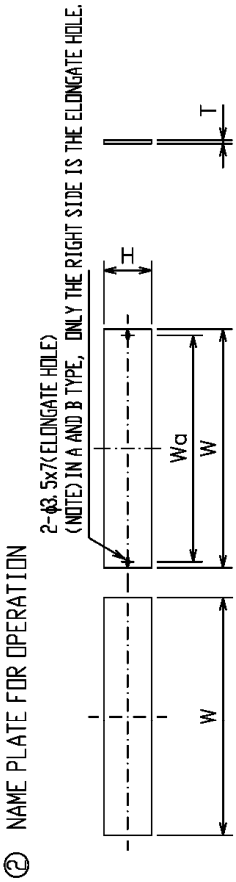
5. NAME PLATE

THE NAME PLATE FOR PANELBOARD AND THE NAME PLATE FOR OPERATION DEPEND ON THE FOLLOWING. (JIS Z 8304)

① NAME PLATE FOR PANELBOARD (INDOOR : ATTACH NYLON RIVET、OUTDOOR: ATTACH SCREW)
(G-2) JEM 1172 (SCALE: 1/5)



② NAME PLATE FOR OPERATION



(STICKING)

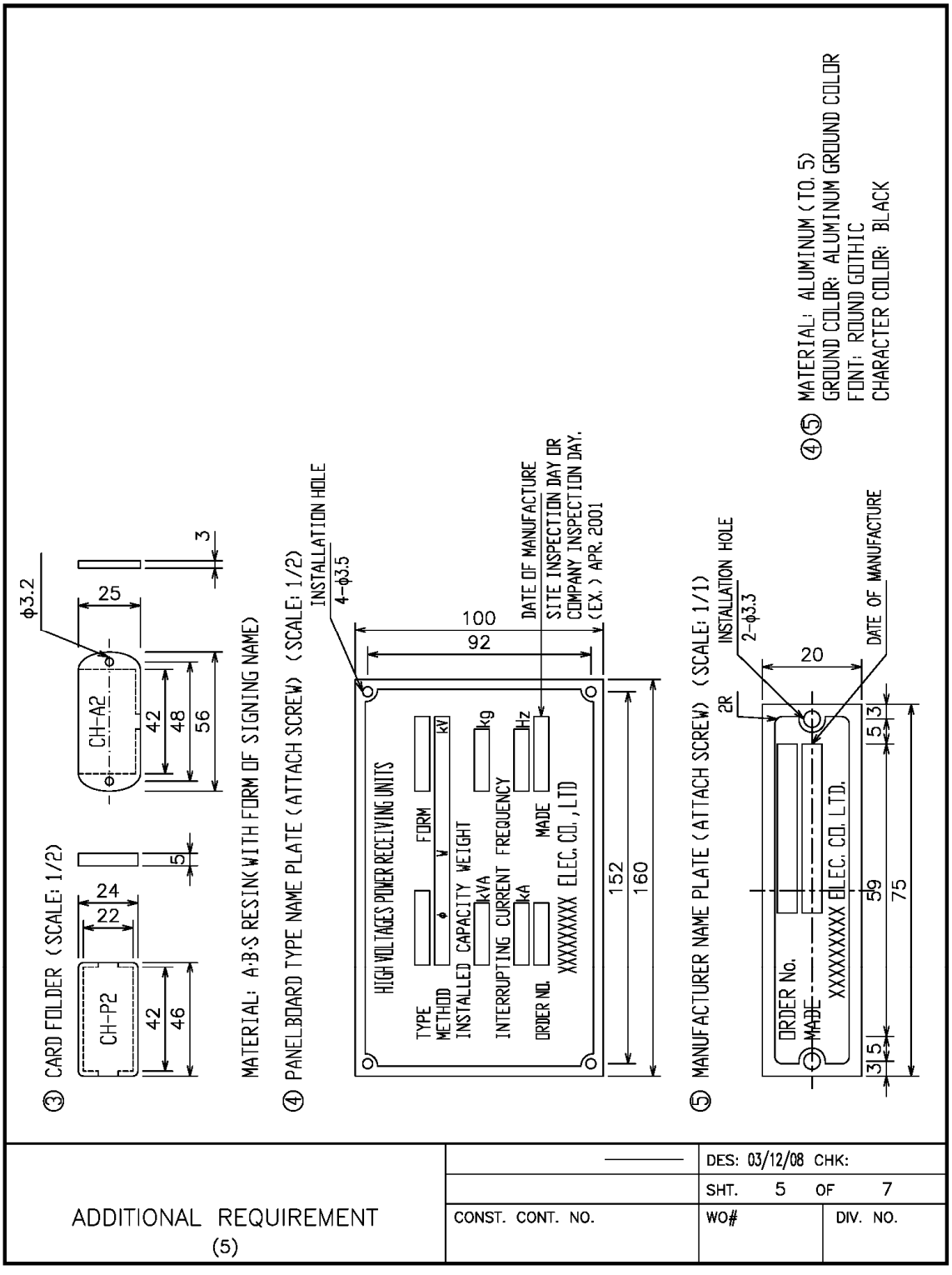
TYPE	W	H	T
A-1	40	12.5	2
B-1	50	16	2
C-1	100	20	2
D-1	150	30	3
E-1	200	40	3

(ATTACH NYLON RIVET OR SCREW)

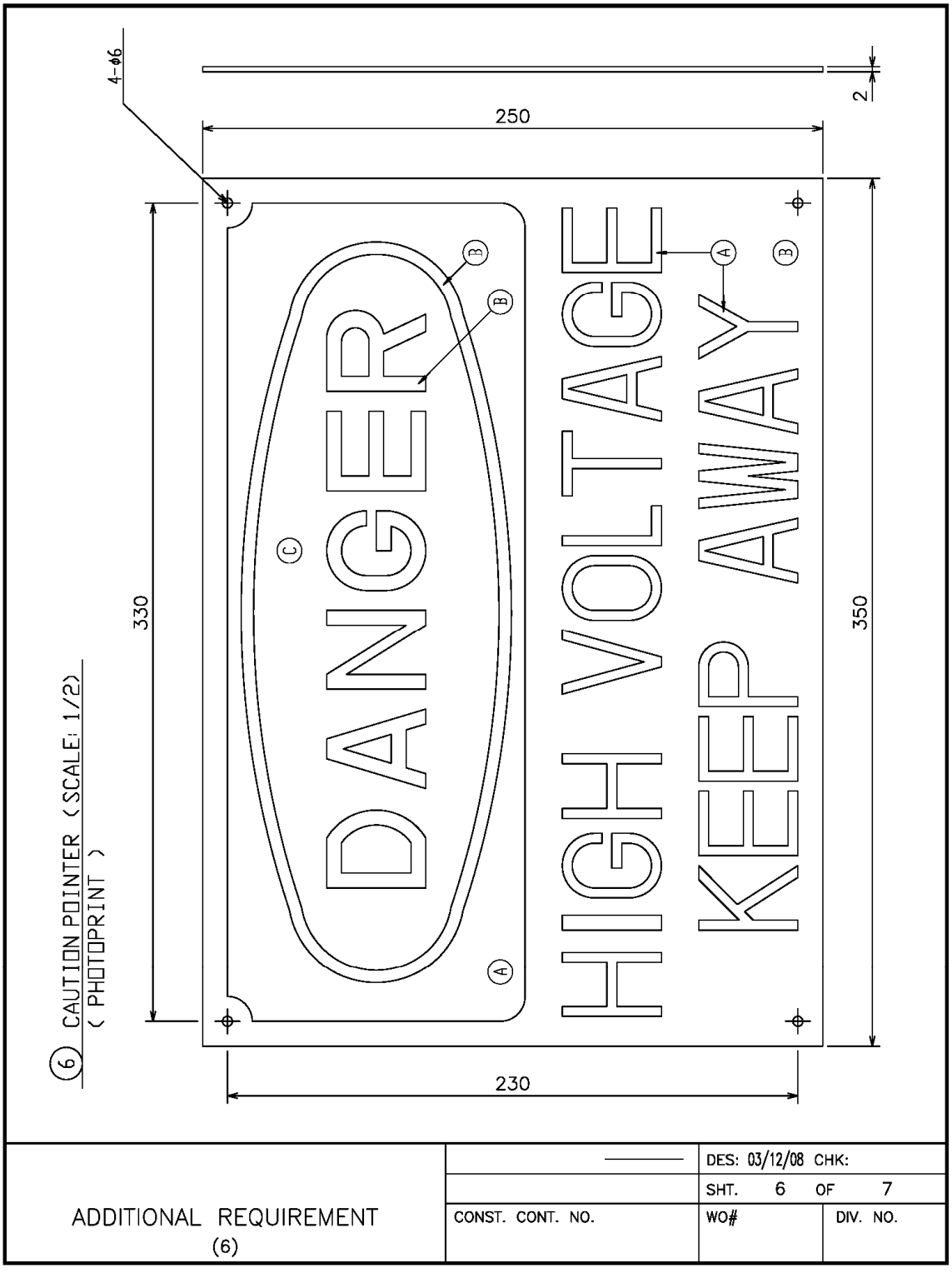
TYPE	W	Wa	H	T
A-2	40	32	12.5	2
B-2	50	42	16	2
C-2	100	90	20	2
D-2	150	140	30	3
E-2	200	190	40	3

MATERIAL: TRANSPARENCY ACRYLIC RESIN,
GROUND COLOR: MILK-WHITE
FONT: ROUND GOTHIC (SCULPTURE FROM THE BACK)
CHARACTER COLOR: BLACK OR RED

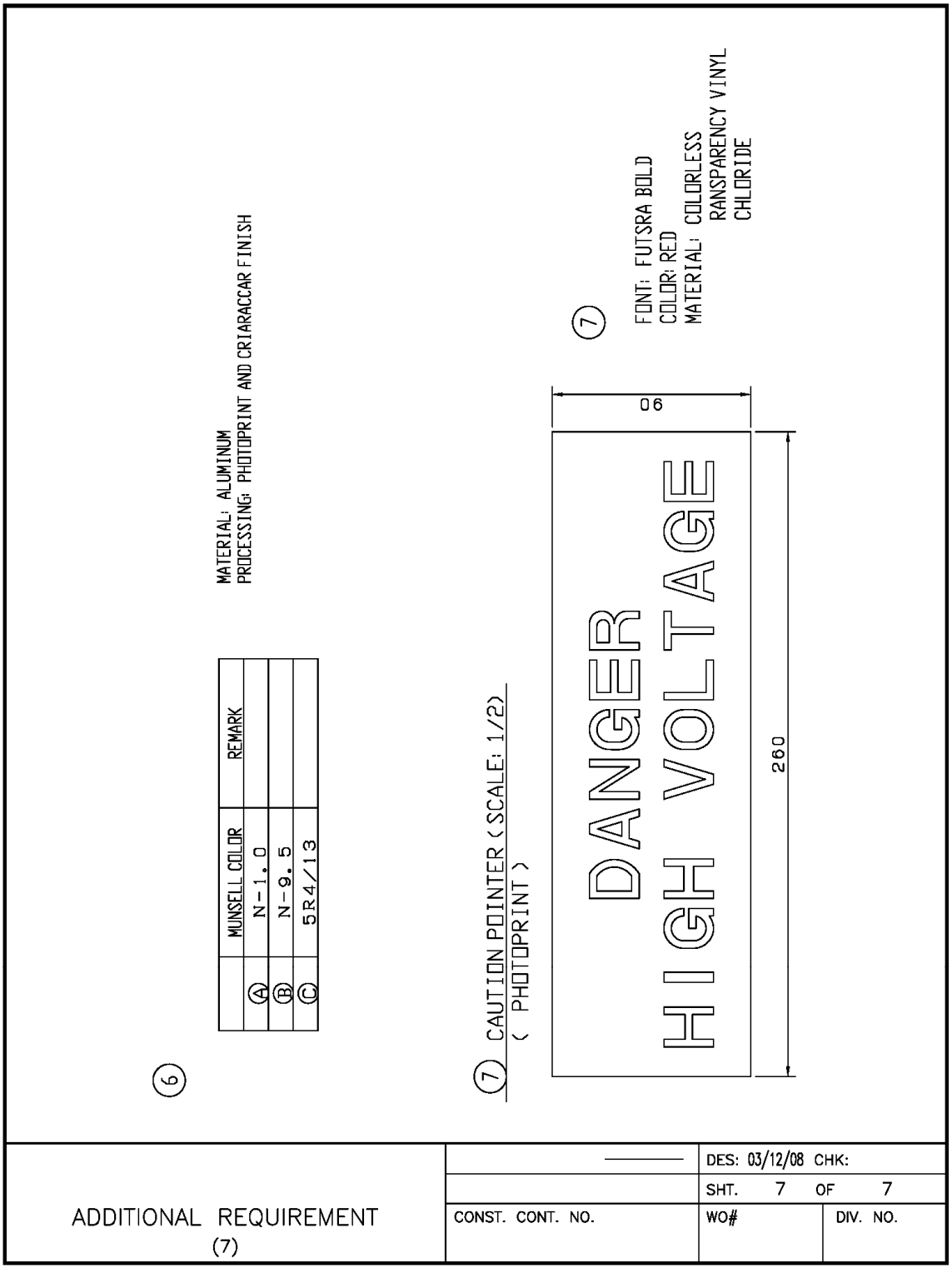
ADDITIONAL REQUIREMENT (4)	DES: 03/12/08 CHK:	
	SHT. 4 OF 7	
CONST. CONT. NO.	WO#	DIV. NO.



ADDITIONAL REQUIREMENT (5)	DES: 03/12/08 CHK:	
	SHT. 5 OF 7	
CONST. CONT. NO.	WO#	DIV. NO.



ADDITIONAL REQUIREMENT (6)	DES: 03/12/08 CHK:	
	SHT. 6 OF 7	
CONST. CONT. NO.	WO#	DIV. NO.


MATERIAL: ALUMINUM
PROCESSING: PHOTOPRINT AND CRIARACCAR FINISH
MUNSELL COLOR
REMARK
Ⓐ N-1.0
Ⓑ N-9.5
Ⓒ 5R4/13
⑥
⑦ CAUTION POINTER (SCALE: 1/2)
(PHOTOPRINT)
DANGER
HIGH VOLTAGE
06
260
⑦
FONT: FUTSRA BOLD
COLOR: RED
MATERIAL: COLORLESS
RANSPARENCY VINYL
CHLORIDE
ADDITIONAL REQUIREMENT
(7)
DES: 03/12/08 CHK:
SHT. 7 OF 7
CONST. CONT. NO.
WO#
DIV. NO.

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SECTION 26 12 19.10

THREE-PHASE, LIQUID-FILLED PAD-MOUNTED TRANSFORMERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. Contractor may substitute compatible Japan Industrial Standard (JIS) or Japan Architectural Standard Specification (JASS) for non-Japanese standards, as approved by the Contracting Officer's representative.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	((2014; Errata 2016) Electric Meters - Code for Electricity Metering

ASTM INTERNATIONAL (ASTM)

ASTM A240/A240M	(2018) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM D117	(2018) Standard Guide for Sampling, Test Methods, and Specifications for Electrical Insulating Liquids
ASTM D1535	(2014; R 2018) Standard Practice for Specifying Color by the Munsell System
ASTM D3487	(2016; E2017) Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus
ASTM D877/D877M	(2013) Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes
ASTM D92	(2012a) Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
ASTM D97	(2017b) Standard Test Method for Pour Point of Petroleum Products

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 386	(2016) Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C37.47	(2011) Standard for High Voltage Distribution Class Current-Limiting Type Fuses and Fuse Disconnecting Switches
IEEE C57.12.00	(2015) General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.12.28	(2014) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C57.12.29	(2014) Standard for Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments
IEEE C57.12.34	(2015) Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers, 10 MVA and Smaller; High Voltage, 34.5 kV Nominal System Voltage and Below; Low Voltage, 15 kV Nominal System Voltage and Below
IEEE C57.12.80	(2010) Standard Terminology for Power and Distribution Transformers
IEEE C57.12.90	(2015; Corr 2017) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.13	(2016) Requirements for Instrument Transformers
IEEE C57.98	(2011) Guide for Transformer Impulse Tests
IEEE C62.11	(2012) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2017; Errata 2017) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

JAPAN ELECTRICAL SAFETY INSPECTION ASSOCIATIONS

Denki Hoan Kyoukai	Japan Standard for Acceptance Testing and Inspections

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT DSKKS	Denki Setsubi Kouji Kanri Shishin (DSKKS) Electrical Construction Supervision Guidelines

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS C 0365	(2007) Protection Against Electric Shock - Common Aspects for Installation and Equipment
JIS C 60364-5-54	(2006) Building Electrical Equipment-Part 5-54: Selection Of Electrical Equipment and Contruction-Grounding Equipment, Protective Conductor and Protective Bonding Conductor
JIS Z 9101	(2018) Graphical symbols -- Safety colours and safety signs -- Part 1: Design principles for safety signs and safety markings

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.7	(2014) Requirements for Watthour Meter Sockets
NEMA 260	(1996; R 2004) Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas
NEMA LI 1	(1998; R 2011) Industrial Laminating Thermosetting Products
NEMA Z535.4	(2011; R 2017) Product Safety Signs and Labels
NEMA/ANSI C12.10	(2011) Physical Aspects of Watthour Meters - Safety Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code
NFPA 70E	(2018; TIA 18-1; TIA 81-2) Standard for Electrical Safety in the Workplace

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)

OECD Test 203	(1992) Fish Acute Toxicity Test

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 712-C-98-075	(1998) Fate, Transport and Transformation Test Guidelines - OPPTS 835.3100- "Aerobic Aquatic Biodegradation"
EPA 821-R-02-012	(2002) Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 431	Energy Efficiency Program for Certain Commercial and Industrial Equipment

UNDERWRITERS LABORATORIES (UL)

UL 467	(2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment

1.2 RELATED REQUIREMENTS

Section 26 08 00 APPARATUS INSPECTION AND TESTING applies to this section, with the additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Pad-mounted Transformer Drawings; G[, [_____]]

SD-03 Product Data

Pad-mounted Transformers; G

SD-06 Test Reports

Acceptance Checks and Tests;

SD-07 Certificates

Transformer Efficiencies;

SD-10 Operation and Maintenance Data

Transformer(s), Data Package 5;

[1.4.1 Government Submittal Review

[Code CI44, NAVFAC LANT, Naval Facilities Engineering Command][_____] will review and approve all submittals in this section requiring Government approval.

]1.4.2 Reduced Submittal Requirements

Transformers designed and manufactured by ABB in Jefferson City, MO; by Easton's Cooper Power Series Transformers in Waukesha, WI; by ERMCO in Dyersburg, TN; or by Howard Industries in Laurel, MS need not submit the entire submittal package requirements of this contract. Instead, submit the following items:

a. A certification, signed by the manufacturer, stating that the manufacturer will meet the technical requirements of this specification.

b. An outline drawing of the transformer with devices identified (paragraph PAD-MOUNTED TRANSFORMER DRAWINGS, item a).

c. ANSI nameplate data of the transformer (paragraph PAD-MOUNTED TRANSFORMER DRAWINGS, item b).

[d. Manufacturer's published time-current curves in PDF format and in electronic format suitable for import or updating into the [EasyPower] [SKM PowerTools for Windows] [_____] computer program of the transformer high side fuses (paragraph PAD-MOUNTED TRANSFORMER DRAWINGS, item e).

] e. Provide transformer test schedule and routine and other tests required by submittal item "SD-09 Manufacturer's Field Reports".

f. Provide acceptance test reports required by submittal item "SD-06 Test Reports".

g. Provide operation and maintenance manuals required by submittal item "SD-10 Operation and Maintenance Data".

1.5 QUALITY ASSURANCE

1.5.1 Pad-Mounted Transformer Drawings

Include the following as a minimum:

a. An outline drawing, including front, top, and side views.

b. IEEE nameplate data.

c. Elementary diagrams and wiring diagrams[with terminals identified of watthour meter and current transformers].

d. One-line diagram, including switch(es)[, current transformers, meters, and fuses].

[e. Manufacturer's published time-current curves in PDF format and in electronic format suitable for import or updating into the [EasyPower] [SKM PowerTools for Windows] [_____] computer program of the transformer high side fuses.

]1.5.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, except of NFPA 70 when more stringent requirements are specified or indicated, as though the word "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with NFPA 70 unless more stringent requirements are specified or indicated.

1.5.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship, and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

1.6 MAINTENANCE

1.6.1 Additions to Operation and Maintenance Data

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein. In addition to requirements of Data Package 5, include the following on the actual transformer(s) provided:

a. An instruction manual with pertinent items and information highlighted

b. An outline drawing, front, top, and side views

c. Prices for spare parts and supply list

d. Routine and field acceptance test reports

e. Fuse curves for primary fuses

[f. Information on watthour demand meter, CT's, and fuse block

] g. Actual nameplate diagram

h. Date of purchase

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be pad-mounted transformers and related accessories are specified in[Section 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION,][Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM,][and] Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.2 THREE-PHASE PAD-MOUNTED TRANSFORMERS

IEEE C57.12.34, IEEE C57.12.28 and as specified herein. Submit manufacturer's information for each component, device, insulating fluid, and accessory provided with the transformer.

2.2.1 Compartments

Provide high- and low-voltage compartments separated by steel isolating barriers extending the full height and depth of the compartments. Compartment doors: hinged lift-off type with stop in open position and three-point latching.

2.2.1.1 High Voltage, Dead-Front

High-voltage compartment contains: the incoming line, insulated high-voltage [load-break][dead-break]connectors, [bushing well inserts,][feed-thru inserts,] six high-voltage [bushing wells][one-piece bushings] configured for loop feed application, load-break switch handle(s), [access to oil-immersed bayonet fuses,][dead-front surge arresters,] tap changer handle, connector parking stands[with insulated standoff bushings],[protective caps,] and ground pad.

[Minimum high-voltage compartment dimensions: IEEE C57.12.34, Figures 16 and 17.

][a. Insulated high-voltage load-break connectors: IEEE 386, rated [15 kV, 95 kV BIL][25 kV, 125 kV BIL][35 kV, 150 kV BIL]. Current rating: 200 amperes rms continuous. Short time rating: 10,000 amperes rms symmetrical for a time duration of 0.17 seconds. Connector must have a steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material.

][b. Insulated high-voltage dead-break connectors: IEEE 386, rated [15 kV, 95 kV BIL][25 kV, 125 kV BIL][35 kV, 150 kV BIL]. Current rating:

600 amperes rms continuous. Short time rating: 25,000 amperes rms symmetrical for a time duration of 0.17 seconds. Connector must have a [200 ampere bushing interface for surge arresters,] steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material.

][c. Bushing well inserts[and feed-thru inserts]: IEEE 386, 200 amperes, [15][25] kV Class. Provide a bushing well insert for each bushing well unless indicated otherwise.[Provide feed-thru inserts as indicated.]

][d. One-piece bushings: IEEE 386, [200][600] amperes, [15][25][35][_____] kV Class.

] e. Load-break switch

[Radial-feed two-position oil-immersed type rated at [15 kV, 95 kV BIL][25 kV, 125 kV BIL][35 kV, 150 kV BIL], with a continuous current rating and load-break rating of [200][300][_____] amperes, and a make-and-latch rating of 12,000 rms amperes symmetrical. Locate the switch handle in the high-voltage compartment.

][Loop feed sectionalizer switches: Provide three, two-position, oil-immersed type switches to permit closed transition loop feed and sectionalizing. Each switch must be rated at [15 kV, 95 kV BIL][25 kV, 125 kV BIL][35 kV, 150 kV BIL], with a continuous current rating and load-break rating of [200][300][_____] amperes, and a make-and-latch rating of 12,000 rms amperes symmetrical. Locate the switch handles in the high-voltage compartment. Operation of switches must be as follows:

ARRANGEMENT NO.	DESCRIPTION OF SWITCH ARRANGEMENT	SWITCH POSITION					
		LINE A SW.		LINE B SW		XFMR. SW	
		OPEN	CLOSE	OPEN	CLOSE	OPEN	CLOSE
1	Line A connected to Line B and both lines connected to transformer		X		X		X
2	Transformer connected to Line A only		X	X			X
3	Transformer connected to Line Bonly	X			X		X
4	Transformer open and loop closed		X		X	X	
5	Transformer open and loop open	X		X		X	

][f. Provide bayonet oil-immersed, expulsion fuses in series with

oil-immersed, partial-range, current-limiting fuses. The bayonet fuse links sense both high currents and high oil temperature in order to provide thermal protection to the transformer. Coordinate transformer protection with expulsion fuse clearing low-current faults and current-limiting fuse clearing high-current faults beyond the interrupting rating of the expulsion fuse. Include an oil retention valve inside the bayonet assembly housing, which closes when the fuse holder is removed, and an external drip shield to minimize oil spills. Display a warning label adjacent to the bayonet fuse(s) cautioning against removing or inserting fuses unless the transformer has been de-energized and the tank pressure has been released.

Bayonet fuse assembly: 150 kV BIL.

Oil-immersed current-limiting fuses: IEEE C37.47; 50,000 rms amperes symmetrical interrupting rating at the system voltage specified.[Connect current-limiting fuses ahead of the radial-feed load-break switch.]

][g. Surge arresters: IEEE C62.11, rated [3][6][9][10][12][15][18][21][24][27][30][36][_____] kV, fully shielded, dead-front, metal-oxide-varistor, elbow type with resistance-graded gap.[Provide three arresters for radial feed circuits.][Provide [three][six] arresters for loop feed circuits.]

] h. Parking stands: Provide a parking stand near each bushing.[Provide insulated standoff bushings for parking of energized high-voltage connectors on parking stands.]

[i. Protective caps: IEEE 386, [200][600] amperes, [15][25][35][_____] kV Class. Provide insulated protective caps (not shipping caps) for insulating and sealing out moisture from unused bushings.

][2.2.1.2 High Voltage, Live-Front

High-voltage compartment contains: the incoming line, transformer high-voltage bushings, load-break switch handle(s),[access to oil-immersed bayonet fuses,][surge arresters,] tap changer handle, insulated phase barriers, and ground pad.

a. Cable terminators: Provide as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

b. Load-break switch

[Radial-feed two-position oil-immersed type rated at [15 kV, 95 kV BIL][25 kV, 125 kV BIL][35 kV, 150 kV BIL], with a continuous current rating and load-break rating of [200][300][_____] amperes, and a make-and-latch rating of 12,000 rms amperes symmetrical. Locate the switch handle in the high-voltage compartment.

][Loop feed sectionalizer switches: Provide three, two-position, oil-immersed type switches to permit closed transition loop feed and sectionalizing. Each switch must be rated at [15 kV, 95 kV BIL][25 kV, 125 kV BIL][35 kV, 150 kV BIL], with a continuous current rating and load-break rating of [200][300][_____] amperes, and a make-and-latch rating of 12,000 rms amperes symmetrical. Locate the switch handles in the high-voltage compartment. Operation of switches must be as follows:

ARRANGEMENT NO.	DESCRIPTION OF SWITCH ARRANGEMENT	SWITCH POSITION					
		LINE A SW.		LINE B SW		XFMR. SW	
		OPEN	CLOSE	OPEN	CLOSE	OPEN	CLOSE
1	Line A connected to Line B and both lines connected to transformer		X		X		X
2	Transformer connected to Line A only		X	X			X
3	Transformer connected to Line B only	X			X		X
4	Transformer open and loop closed		X		X	X	
5	Transformer open and loop open	X		X		X	

][c. Provide bayonet oil-immersed, expulsion fuses in series with oil-immersed, partial-range, current-limiting fuses. The bayonet fuse links sense both high currents and high oil temperature in order to provide thermal protection to the transformer. Coordinate transformer protection with expulsion fuse clearing low-current faults and current-limiting fuse clearing high-current faults beyond the interrupting rating of the expulsion fuse. Include an oil retention valve inside the bayonet assembly housing, which closes when the fuse holder is removed, and an external drip shield to minimize oil spills. Display a warning label adjacent to the bayonet fuse(s) cautioning against removing or inserting fuses unless the transformer has been de-energized and the tank pressure has been released.

Bayonet fuse assembly: 150 kV BIL.

Oil-immersed current-limiting fuses: IEEE C37.47; 50,000 rms amperes symmetrical interrupting rating at the system voltage specified.[Connect current-limiting fuses ahead of the radial-feed load-break switch.]

][d. Surge arresters: IEEE C62.11, rated [3][6][9][10][12][15][18][21][24][27][30][36][_____] kV.[Provide three arresters for radial feed circuits.][Provide [three][six] arresters for loop feed circuits.]

] e. Insulated phase barriers: NEMA LI 1, Type GPO-3, 6.35 mm minimum thickness. Provide vertical barriers between the high-voltage bushings and a single horizontal barrier above the high-voltage bushings.

]2.2.1.3 Low Voltage

Low-voltage compartment contains: low-voltage bushings with NEMA spade

terminals, accessories, metering, stainless steel or laser-etched anodized aluminum diagrammatic transformer nameplate, and ground pad.

a. Include the following accessories: drain valve with sampler device, fill plug, pressure relief device, liquid level gage, pressure-vacuum gage, and dial type thermometer with maximum temperature indicator.

[b. Metering: Provide as specified in Section [26 27 14.00 20 ELECTRICITY METERING][26 27 13.10 30 ELECTRIC METERS].

][c. Metering: NEMA/ANSI C12.10. Provide a socket-mounted electronic programmable outdoor watthour meter, surface mounted flush against the side of the low-voltage compartment as indicated. [Metering shall be compliant with the current Advanced Meter Reading System (AMRS)Electric Meter Specifications.] Program the meter at the factory or in the field. When field programming is performed, turn field programming device over to the Contracting Officer at completion of project. Coordinate the meter to system requirements.

(1) Design: Provide meter designed for use on a 3-phase, 4-wire, [200Y/100][208Y/120][440Y/254][420Y/242][480Y/277] volt system with 3 current transformers. Include necessary KYZ pulse initiation hardware for Energy Monitoring and Control System (EMCS)[as specified in Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC].

(2) Coordination: Provide meter coordinated with ratios of current transformers and transformer secondary voltage.

(3) Class: 20; Form: [9S][_____]; Accuracy: plus or minus 1.0 percent; Finish: Class II

(4) Cover: Polycarbonate and lockable to prevent tampering and unauthorized removal.

(5) Kilowatt-hour Register: five digit electronic programmable type

(6) Demand Register:

(a) Provide solid state

(b) Meter reading multiplier: Indicate multiplier on the meter face.

(c) Demand interval length: programmed for [15][30][60] minutes with rolling demand up to six subintervals per interval.

(7) Meter fusing: Provide a fuse block mounted in the secondary compartment containing one fuse per phase to protect the voltage input to the watthour meter. Size fuses as recommended by the meter manufacturer.

(8) Socket: ANSI C12.7. [Meter socket shall be compliant with the current Advanced Meter Reading System (AMRS) Electric Meter Specifications.] Provide NEMA Type 3R, box-mounted socket having automatic circuit-closing bypass and having jaws compatible with requirements of the meter. Cover unused hub openings with blank hub plates. Paint box [Munsell 7GY3.29/1.5 green][Munsell 5BG7.0/0.4 sky gray (ANSI 70)] [_____] to match the pad-mounted

transformer to which the box-mounted socket is attached. The Munsell color notation is specified in ASTM D1535.

(9) Current transformers: IEEE C57.13. Provide butyl-molded window type current transformers with 600-volt insulation, 10 kV BIL and mount on the low-voltage bushings. Route current transformer leads in a location as remote as possible from the power transformer secondary cables to permit current measurements to be taken with hook-on-ammeters. Provide three current transformers per power transformer with characteristics listed in the following table.

kVA	Sec. Volt	CT Ratio	RF	Meter Acc. Class
[500]	[208Y/120]	[1200/5]	[1.5]	[0.3 thru B-0.5]
[750]	[480Y/277]	[800/5]	[2.0]	[0.3 thru B-0.5]

]2.2.2 Transformer

a. Less-flammable [bio-based] liquid-insulated[or oil-insulated], two winding, 60 hertz, 65 degrees C rise above a 30 degrees C average ambient, self-cooled type.

b. Transformer rated [_____] kVA.

c. Transformer voltage ratings: [_____] V [Delta][_____] - [_____] V [GrdY][_____].[For GrdY - GrdY transformers, provide transformer with five-legged core design for third harmonic suppression.]

d. Tap changer: externally operated, manual type for changing tap setting when the transformer is de-energized. Provide four 2.5 percent full capacity taps, two above and two below rated primary voltage. Indicate which tap setting is in use, clearly visible when the compartment is opened.

e. Minimum tested percent impedance at 85 degrees C:

2.50 for units rated 75kVA and below
2.87 for units rated 112.5kVA to 300kVA
4.03 for 500kVA rated units
5.32 for units rated 750kVA and above

f. Comply with the following audible sound level limits:

kVA	DECIBELS (MAX
75	51
112.5	55
150	55
225	55

300	55
500	56
750	57
1000	58
1500	60
2000	61
2500	62

g. Include:

(1) Lifting lugs and provisions for jacking under base, with base construction suitable for using rollers or skidding in any direction.

[(2) An insulated low-voltage neutral bushing with NEMA spade terminal, and with removable ground strap.

] (3) Provide transformer top with an access handhole.

[(4) kVA rating conspicuously displayed [using 75 mm high yellow letters]on its enclosure.

]2.2.2.1 Specified Transformer Efficiencies

Provide transformer efficiency calculations utilizing the actual no-load and load loss values obtained during the routine tests performed on the actual transformer(s) prepared for this project. Reference no-load losses (NLL) at 20 degrees C. Reference load losses (LL) at 55 degrees C and at 50 percent of the nameplate load. The transformer is not acceptable if the calculated transformer efficiency is less than the efficiency indicated in the "KVA / Efficiency" table below. The table is based on requirements contained within 10 CFR 431, Subpart K. Submit certification, including supporting calculations, from the manufacturer indicating conformance.

kVA	EFFICIENCY (percent)
15	98.65
30	98.83
45	98.92
75	99.03
112.5	99.11

150	99.16
225	99.23
300	99.27
500	99.35
750	99.40
1000	99.43
1500	99.48
2000	99.51
2500	99.53
above 2500	99.54

2.2.3 Insulating Liquid

a. Less-flammable transformer liquids: NFPA 70 and FM APP GUIDE for less-flammable liquids having a fire point not less than 300 degrees C tested per ASTM D92 and a dielectric strength not less than 33 kV tested per ASTM D877/D877M. Provide identification of transformer as "non-PCB" and "manufacturer's name and type of fluid" on the nameplate.

Provide a fluid that is a biodegradable, electrical insulating, and cooling liquid classified by UL and approved by FM as "less flammable" with the following properties:

(1) Pour point: ASTM D97, less than -15 degree C

(2) Aquatic biodegradation: EPA 712-C-98-075, ultimately biodegradable as designated by EPA.

(3) Trout toxicity: OECD Test 203, zero mortality of EPA 821-R-02-012, pass

[b. Mineral oil: ASTM D3487, Type II, tested in accordance with ASTM D117. Provide identification of transformer as "non-PCB" and "Type II mineral oil" on the nameplate.

]2.2.3.1 Liquid-Filled Transformer Nameplates

Provide nameplate information in accordance with IEEE C57.12.00 and as modified or supplemented by this section. Include the following information on the transformer nameplate: "PCB CONTENT LESS THAN 0.1 PPM AT TIME OF MANUFACTURE."

2.2.4 Corrosion Protection

[Provide corrosion resistant bases and cabinets of transformers, fabricated of stainless steel conforming to ASTM A240/A240M, Type 304 or 304L. Base

includes any part of pad-mounted transformer that is within 75 mm of concrete pad.

][Provide entire transformer assembly, including tank and radiator, base, enclosure, and metering enclosure fabricated of stainless steel conforming to ASTM A240/A240M, Type 304 or 304L. Form enclosure of stainless steel sheets. The optional use of aluminum is permitted for the metering enclosure.

] Paint entire transformer assembly [Munsell 7GY3.29/1.5 green][Munsell 5BG7.0/0.4 sky gray (ANSI 70)][_____], with paint coating system complying with IEEE C57.12.28 [and IEEE C57.12.29]regardless of base, cabinet, and tank material. The Munsell color notation is specified in ASTM D1535.

2.3 WARNING SIGNS AND LABELS

Provide warning signs for the enclosures of pad-mounted transformers having a nominal rating exceeding 600 volts in accordance with NEMA Z535.4 and NEMA 260.

a. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28, such as for pad-mounted transformers, provide self-adhesive warning labels (decals, Panduit No. PPSO710D72 or approved equal) on the outside of the high voltage compartment door(s)with nominal dimensions of 178 by 255 mm with the legend "WARNING HIGH VOLTAGE" printed in two lines of nominal 50 mm high letters. Include the work "WARNING" in white letters on an orange background and the words "HIGH VOLTAGE" in black letters on a white background.

[b. When such equipment is guarded by a fence, mount signs on the fence. Provide metal signs having nominal dimensions of 355 by 255 mm with the legend "WARNING HIGH VOLTAGE KEEP OUT" printed in three lines of nominal 75 mm high white letters on an orange and black field.

]2.4 ARC FLASH WARNING LABEL

Provide warning label of potential electrical arc flash hazards for the enclosure of pad-mounted transformers in accordance with NFPA 70E or JIS Z 9101.

2.5 GROUNDING AND BONDING

UL 467 or JIS C 60364-5-54. Provide grounding and bonding as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

[2.6 PADLOCKS

Provide padlocks for pad-mounted equipment[and for each fence gate], keyed [alike][as directed by the Contracting Officer]. Comply with Section 08 71 00 DOOR HARDWARE.

]2.7 CAST-IN-PLACE CONCRETE

[Provide concrete associated with electrical work for other than encasement of underground ducts rated for 30 MPa minimum 28-day compressive strength unless specified otherwise. Conform to the requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE.
]

[Provide concrete associated with electrical work as follows:

a. Composed of fine aggregate, coarse aggregate, portland cement, and water so proportioned and mixed as to produce a plastic, workable mixture.

b. Fine aggregate: hard, dense, durable, clean, and uncoated sand.

c. Coarse aggregate: reasonably well graded from 4.75 mm to 25 mm.

d. Fine and coarse aggregates: free from injurious amounts of dirt, vegetable matter, soft fragments or other deleterious substances.

e. Water: fresh, clean, and free from salts, alkali, organic matter, and other impurities.

f. Concrete associated with electrical work for other than encasement of underground ducts: 30 MPa minimum 28-day compressive strength unless specified otherwise.

g. Slump: Less than 100 mm. Retempering of concrete will not be permitted.

h. Exposed, unformed concrete surfaces: smooth, wood float finish.

i. Concrete must be cured for a period of not less than 7 days, and concrete made with high early strength portland cement must be repaired by patching honeycombed or otherwise defective areas with cement mortar as directed by the Contracting Officer.

j. Air entrain concrete exposed to weather using an air-entraining admixture conforming to ASTM C260/C260M.

k. Air content: between 4 and 6 percent.

]2.8 SOURCE QUALITY CONTROL

2.8.1 Transformer Test Schedule

The Government reserves the right to witness tests. Provide transformer test schedule for tests to be performed at the manufacturer's test facility. Any/all associated costs related to Government personnel travel to witness testing will be solely at the government's expense. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled date.

a. Test Instrument Calibration

(1) Provide a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

(2) Accuracy: Traceable to the National Institute of Standards and Technology.

(3) Instrument calibration frequency schedule: less than or equal to 12 months for both test floor instruments and leased specialty equipment.

(4) Dated calibration labels: visible on all test equipment.

(5) Calibrating standard: higher accuracy than that of the instrument tested.

(6) Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:

(a) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.

(b) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

2.8.2 Design Tests

IEEE C57.12.00, and IEEE C57.12.90. Section 5.1.2 in IEEE C57.12.80 states that "design tests are made only on representative apparatus of basically the same design." Submit design test reports (complete with test data, explanations, formulas, and results), in the same submittal package as the catalog data and drawings for[each of] the specified transformer(s), with design tests performed prior to the award of this contract.

a. Tests: certified and signed by a registered professional engineer.

b. Temperature rise: "Basically the same design" for the temperature rise test means a pad-mounted transformer with the same coil construction (such as wire wound primary and sheet wound secondary), the same kVA, the same cooling type (KNAN), the same temperature rise rating, and the same insulating liquid as the transformer specified.

c. Lightning impulse: "Basically the same design" for the lightning impulse dielectric test means a pad-mounted transformer with the same BIL, the same coil construction (such as wire wound primary and sheet wound secondary), and a tap changer, if specified. Design lightning impulse tests includes the primary windings only of that transformer.

(1) IEEE C57.12.90, paragraph 10.3 entitled "Lightning Impulse Test Procedures," and IEEE C57.98.

(2) State test voltage levels.

(3) Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test report.

d. Lifting and moving devices: "Basically the same design" requirement for the lifting and moving devices test means a test report confirming that the lifting device being used is capable of handling the weight of the specified transformer in accordance with IEEE C57.12.34.

e. Pressure: "Basically the same design" for the pressure test means a pad-mounted transformer with a tank volume within 30 percent of the tank volume of the transformer specified.

f. Short circuit: "Basically the same design" for the short circuit test means a pad-mounted transformer with the same kVA as the transformer

specified.

2.8.3 Routine and Other Tests

IEEE C57.12.00. Routine and other tests: performed in accordance with IEEE C57.12.90 by the manufacturer on[each of] the actual transformer(s) prepared for this project to ensure that the design performance is maintained in production. Submit test reports, by serial number and receive approval before delivery of equipment to the project site. Required tests and testing sequence as follows:

a. Phase relation

b. Ratio

c. No-load losses (NLL) and excitation current

d. Load losses (LL) and impedance voltage

e. Dielectric

(1) Impulse

(2) Applied voltage

(3) Induced voltage

f. Leak

PART 3 EXECUTION

3.1 INSTALLATION

Conform to IEEE C2, JIS C 0365, NFPA 70, and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.2 GROUNDING

NFPA 70 and IEEE C2, except provide grounding systems with a resistance to solid earth ground not exceeding [25][_____] ohms.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Connect ground conductors to the upper end of ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Pad-Mounted Transformer Grounding

Provide a ground ring around the transformer with [60][] sqmm bare copper.[Provide four ground rods in the ground ring, one per corner.][Provide two ground rods in the ground ring at opposite corners.][Provide one ground rod in the ground ring with the ground rod located in the transformer cabinet.] Install the ground rods at least 3000 mm apart from each other. Provide separate copper grounding conductors and connect them to the ground loop as indicated. When work in addition to that indicated or specified is required to obtain the specified ground resistance, the

provision of the contract covering "Changes" applies.

3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector. Install exothermic welds and compression connectors as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.2.4 Grounding and Bonding Equipment

UL 467 or JIS C 60364-5-54, except as indicated or specified otherwise.

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect pad-mounted transformers furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

[3.3.1 Meters and Current Transformers

ANSI C12.1.

]3.4 FIELD APPLIED PAINTING

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

[3.5 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 9 meters apart.

]3.6 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

Mount transformer on concrete slab as follows:

a. Unless otherwise indicated, provide the slab with dimensions at least 200 mm thick, reinforced with a 152 by 152 mm MW19 by MW19 mesh placed uniformly 100 mm from the top of the slab.

b. Place slab on a 150 mm thick, well-compacted gravel base.

c. Install slab such that top of concrete slab is approximately 100 mm above the finished grade with gradual slope for drainage.

d. Provide edges above grade with 15 mm chamfer.

e. Provide slab of adequate size to project at least 200 mm beyond the equipment.

Stub up conduits, with bushings, 50 mm into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.6.1 Cast-In-Place Concrete

Provide cast-in-place concrete work in accordance with the requirements of[Section 03 30 00 CAST-IN-PLACE CONCRETE].

[3.6.2 Sealing

When the installation is complete, seal all entries into the equipment enclosure with an approved sealing method. Provide seals of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

]3.7 FIELD QUALITY CONTROL

3.7.1 Performance of Acceptance Checks and Tests

A First Class Construction Electric Management Engineer (1 Kyu Dekikouji Sekou Kanrigishi) shall perform acceptance checks and testing in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS or Denki Hoan Kyoukai and MLIT DSKKS. Submit reports, including acceptance criteria and limits for each test in accordance with NETA ATS "Test Values" or Denki Hoan Kyoukai "Test Report".

3.7.1.1 Pad-Mounted Transformers

a. Visual and mechanical inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition. Check for damaged or cracked insulators and leaks.

(3) Inspect anchorage, alignment, and grounding.

(4) Verify the presence of PCB content labeling.

(5) Verify the bushings and transformer interiors are clean.

(6) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(7) Verify correct liquid level in tanks and bushings.

(8) Verify that positive pressure is maintained on gas-blanketed transformers.

(9) Perform specific inspections and mechanical tests as recommended by manufacturer.

(10) Verify de-energized tap changer position is left as specified.

[(11) Verify the presence of transformer surge arresters.

] b. Electrical tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter.

(2) Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

[(3) Perform insulation-resistance tests, winding-to-winding and each winding-to-ground. Calculate polarization index. Verify that the tap changer is set at the specified ratio.

(4) Perform turns-ratio tests at all tap positions.

(5) Perform insulation power-factor or dissipation-factor tests on all windings in accordance with test equipment manufacturer’s published data.

(6) Perform power-factor or dissipation-factor tests on each bushing equipped with a power-factor/capacitance tap. In the absence of a power-factor/capacitance tap, perform hot-collar tests.

(7) Measure the resistance of each high-voltage winding in each de-energized tap-changer position. Measure the resistance of each low-voltage winding in each de-energized tap-changer position, if applicable.

(8) Remove and test a sample of insulating liquid for the following: Dielectric breakdown voltage, Acid neutralization number, Specific gravity, Interfacial tension, Color, Visual Condition, Water in insulating liquids (Required on 25 kV or higher voltages and on all silicone-filled units.), and Power factor or dissipation factor.

(9) Perform dissolved-gas analysis (DGA) on a sample of insulating liquid.

][3.7.1.2 Current Transformers

a. Visual and mechanical inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify correct connection.

(4) Verify that adequate clearances exist between primary and secondary circuit wiring.

(5) Verify the unit is clean.

(6) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(7) Verify that all required grounding and shorting connections provide good contact.

(8) Verify correct operation of transformer withdrawal mechanism and grounding operation.

(9) Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

b. Electrical tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

(2) Perform insulation-resistance test.

(3) Perform a polarity test.

(4) Perform a ratio-verification test.

][3.7.1.3 Watthour Meter

a. Visual and mechanical inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify tightness of electrical connections.

b. Electrical tests

(1) Calibrate watthour meters according to manufacturer's published data.

(2) Verify that correct multiplier has been placed on face of meter, where applicable.

(3) Verify that current transformer secondary circuits are intact.

]3.7.1.4 Grounding System

a. Visual and mechanical inspection

(1) Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

(1) Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. Use an instrument equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

(2) Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

[3.7.1.5 Surge Arresters, High- and Extra-High-Voltage

a. Visual and mechanical inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Inspect anchorage, alignment, grounding, and clearances.

(4) Verify the arresters are clean.

(5) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(6) Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.

b. Electrical tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

(2) Perform an insulation-resistance test on each arrester, phase terminal-to-ground.

(3) Test grounding connection.

]3.7.2 Follow-Up Verification

Upon completion of acceptance checks and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, notify the Contracting Officer 5 working days in advance of the dates and times of checking and testing.

-- End of Section --

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SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Contractor may substitute compatible Japan Industrial Standard (JIS), Ministry of Land, Infrastructure and Transport (MLIT), Japan Electrical Safety Inspection Associations, Japanese Electrotechnical Committee (JEC) or Japan Wire Industry Association (JCS) standards for non-Japanese standards, as approved by the Contracting Officer's representative.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1	(2014) Electric Meters - Code For Electricity Metering

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

JAPANESE ELECTROTECHNICAL COMMITTEE (JEC)

JEC 2200	(2015) Transformer

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS C 0365	(2007) Protection Against Electric Shock - Common Aspects for Installation and Equipment
JIS C 0920	(2003) Degrees Of Protection Provided By Enclosures (IP Code)
JIS C 1210	(1979) General Rules for Electricity Meters
JIS C 2336	(2012) Pressure-sensitive polyvinyl chloride tapes for electrical purposes
JIS C 2338	(2012) Polyester adhesive tape for electrical insulation
JIS C 2805	(2010) Crimp terminal for copper wire
JIS C 2806	(2003) Bare crimping sleeve for copper wire
JIS C 2810	(1995) General rules on non-separable type wire connectors for interior wiring
JIS C 3101	(1994) Hard-drawn copper wires for electrical purposes

JIS C 3105	(1994) Hard-drawn copper stranded conductors
JIS C 3341	(2000) Polyvinyl chloride insulated drop service wires
JIS C 3401	(2002) Control Cables
JIS C 3605	(R2002) 600 V Polyethylene Insulated Cables, Type CV
JIS C 3606	(R2003) High-Voltage Cross-Linked Polyethylene Insulated Cables, Type CV or CE
JIS C 3612	(2002) 600V Flame Retardant Polyethylene Insulated Wires
JIS C 4212	(2010) Low-Voltage Three-Phase Squirrel-Cage High-Efficiency Induction Motors (Amendment 1)
JIS C 5381-11	(2014) Low-voltage surge protective devices -- Part 11: Surge protective devices connected to low-voltage power systems -- Requirements and test methods
JIS C 5381-12	(2014) Low-voltage surge protective devices -- Part 12: Surge protective devices connected to low-voltage power distribution systems -- Selection and application principles
JIS C 6436	(1995) Power transformer for electronic equipment
JIS C 8201-2-1	(2011) Low-Voltage Switchgear and Control Gear - Part 2-1: Circuit-Breakers
JIS C 8201-3	(2009) Low-voltage switchgear and control units-Part 3: Switches,Disconnector, disconnecting switch and fuse assembly unit
JIS C 8201-5-1	(2007) Low-Voltage Switchgear And Control Gear - Part 5-1: Control Circuit Devices And Switching Elements - Electromechanical Control Circuit Devices
JIS C 8201-4-1	(2010) Low-voltage switchgear and controlgear -- Part 4-1: Contactors and motor-starters: Electromechanical contactors and motor-starters
JIS C 8201-4-2	(2010) Low-voltage switchgear and controlgear -- Part 4-2: Contactors and motor-starters -- AC semiconductor motor controllers and starters

JIS C 8201-7-1	(2016) Low-Voltage Switchgear And Control Gear -- Part 7-1: Ancillary Equipment -- Terminal Blocks For Copper Conductors
JIS C 8222	(2004) Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs)
JIS C 8269-1	(2016) Low-Voltage Fuses -- Part 1: General Requirements
JIS C 8269-2	(2013) Low voltage fuse-Part 2: Additional requirements for expert fuses(Mainly industrial fuses)
JIS C 8281-1	(2019) Plugs and socket-outlets for household and similar purposes -- Part 1: General requirements
JIS C 8286	(2013) Electrical accessories -- Cord sets and interconnection cord sets
JIS C 8303	(2007) Plugs And Receptacles For Domestic And Similar General Use
JIS C 8304	(2009) Small switches for indoor use
JIS C 8305	(2019) Rigid Steel Conduits
JIS C 8309	(2019) Pliable metal conduits
JIS C 8330	(1999) Fittings for rigid metal conduits
JIS C 8340	(1999)Boxes And Box Covers For Rigid Metal Conduits
JIS C 8350	(1999) Fittings for pliable metal conduits
JIS C 8364	(2008) Busways
JIS C 8380	(1993) Plastic coated steel pipes for cable-ways
JIS C 8411	(2019) Pliable plastics conduits
JIS C 8425	(1984) Plastic surface raceways for interior wiring
JIS C 8430	(2019) Unplasticized polyvinyl chloride (PVC-U) conduits
JIS C 8432	(2019) Fittings of unplasticized polyvinyl chloride (PVC-U) conduits
JIS C 8435	(2018) Boxes And Box Covers Of Plastic Conduits
JIS C 8462-1	(2012) Boxes and enclosures for electrical

	accessories for household and similar fixed electrical installations -- Part 1: General requirements
JIS C 8480	(R2016) Box-Type Switchgear Assemblies for Low-Voltage Distribution Purpose
JIS C 60079-0	(2010) Explosive atmospheres -- Part 0: Equipment -- General requirements
JIS C 60079-14	(2008) Electrical and mechanical equipment used in explosive atmosphere- Part 14: Electrical Equipment in Hazardous Areas (Other Than Mines)
JIS C 60364-5-54	(2006) Building Electrical Equipment-Part 5-54: Selection Of Electrical Equipment and Contruction-Grounding Equipment, Protective Conductor and Protective Bonding Conductor
JIS C 60364-6	(2010) Low-voltage electrical installations -- Part 6: Verification
JIS C 61000-4-7	(2007) Electromagnetic compatibility (EMC) -- Part 4-7: Testing and measurement techniques -- General guide on harmonics and interharmonics measurements and instrumentation
JIS C 61558-1	(2019) Safety of transformers, reactors, power supply units and combinations thereof -- Part 1: General requirements and tests
JIS K 6743	(2016) Unplasticized Poly (Vinyl Chloride) (PVC-U) Pipe Fittings for Water Supply
JIS K 6911	(2006) Thermosetting plastic general test method
JIS K 6741	(2016) Unplasticized Poly (Vinyl Chloride) (PVC-U) Pipes
JIS T 1021	(2019) Hospital grade outlet-sockets and plugs
JIS X 5150	(R2016) Information Technology-Generic Cabling for Customer Premises
JIS Z 9101	(2018) Graphical symbols -- Safety colours and safety signs -- Part 1: Design principles for safety signs and safety markings
JIS Z 9290-1	(2014) Protection Against Lightning - Part 1: General Principles

JAPAN WIRE INDUSTRY ASSOCIATION STANDARD (JCS)

JCS 1226	(2003) Soft Stranded Wire

JAPAN ELECTRICAL SAFETY INSPECTION ASSOCIATIONS

Denki Hoan Kyoukai	Japan Standard for Acceptance Testing and Inspections

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT DSKKS	Denki Setsubi Kouji Kanri Shishin (DSKKS) Electrical Construction Supervision Guidelines
MLIT ESS	(2019) MLIT Electrical Standard Specification (ESS)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70E	(2018; TIA 18-1; TIA 81-2) Standard for Electrical Safety in the Workplace

UNDERWRITERS LABORATORIES (UL)

UL 2043	(2013) Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are[for Contractor Quality Control approval][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government]. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.

SD-02 Shop Drawings

Panelboards; G[, [_____]]

Transformers; G[, [_____]]

Busway; G[, [_____]]

Cable trays; G[, [_____]]

Motor control centers; G[, [_____]]

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Identify circuit terminals on wiring diagrams and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Indicate on the drawings adequate clearance for operation, maintenance, and replacement of operating equipment devices.

Wireways; G[, [_____]]

[Load centers for housing units; G[, [_____]]]

Marking strips drawings; G[, [_____]]

SD-03 Product Data

Receptacles;

Circuit breakers; G[, [_____]]

Switches; G[, [_____]]

Transformers; G[, [_____]]

Enclosed circuit breakers; G[, [_____]]

Motor controllers; G[, [_____]]

[Combination motor controllers; G[, [_____]]]

[Load centers for housing units; G[, [_____]]]

Manual motor starters; G[, [_____]]

[Residential load centers; G[, [_____]]]

[Metering; G[, [_____]]]

[Meter base only; G[, [_____]]]

CATV outlets; G[, [_____]]

Surge protective devices; G[, [_____]]

Include performance and characteristic curves.

SD-06 Test Reports

600-volt wiring test;

Grounding system test;

Transformer tests;

Ground-fault receptacle test;

[SD-10 Operation and Maintenance Data

Electrical Systems, Data Package 5;

Metering, Data Package 5;

Submit operation and maintenance data in accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA and as specified herein.

]1.4 QUALITY ASSURANCE

1.4.1 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" or "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with the mandatory and advisory provisions of applicable codes and standards unless more stringent requirements are specified or indicated.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

1.5 MAINTENANCE

[1.5.1 Electrical Systems

Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system for the building. Include the following:

a. Single line diagram of the "as-built" building electrical system.

b. Schematic diagram of electrical control system (other than HVAC, covered elsewhere).

c. Manufacturers' operating and maintenance manuals on active electrical equipment.

]1.6 WARRANTY

Provide equipment items supported by service organizations that are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

[1.7 SEISMIC REQUIREMENTS

Provide seismic details[conforming to[Section 13 48 00 [SEISMIC] BRACING FOR MISCELLANEOUS EQUIPMENT][and to][Section 26 05 48.00 10 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT]][as indicated].

]PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

As a minimum, meet requirements of UL or Japanese standards, where UL or applicable Japanese codes and standards are established for those items for all materials, equipment, and devices.

2.2 CONDUIT AND FITTINGS

Conform to the following:

2.2.1 Rigid Metallic Conduit or Type G Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit or Type G

JIS C 8305, Type G. Diameter of conduit shall be as indicated.

2.2.2 Rigid Nonmetallic Conduit or Unplasticized Polyvinyl Chloride

JIS C 8430 for Type VE or HIVE conduit of diameter of less than 100mm and JIS K 6741 for Type VP or HIVP conduit diameter or 100mm and larger.

2.2.3 Intermediate Metal Conduit (IMC) or Type C

JIS C 8305, Type C, zinc-coated steel only.

2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT) or Type E Metallic Conduit

JIS C 8305, Type E.

2.2.5 Plastic-Coated Rigid Steel and IMC Conduit or Type G, C or E; LL or LT

JIS C 8380.

2.2.6 Flexible Metal Conduit

JIS C 8309.

2.2.6.1 Liquid-Tight Flexible Metal Conduit, Steel

JIS C 8309.

2.2.7 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

JIS C 8330 and JIS C 8350. Ferrous fittings: cadmium- or zinc-coated in accordance with JIS C 8330 and JIS C 8350.

2.2.7.1 Fittings for Rigid Metal Conduit and IMC or Type G and Type C

Threaded-type. Split couplings unacceptable.

2.2.7.2 Fittings for EMT or Type E Conduit

[Die Cast][Steel][compression][set screw] type.

2.2.8 Fittings for Rigid Nonmetallic Conduit or Unplasticized Polyvinyl Chloride

JIS C 8432 for diameters less than 100mm and JIS K 6743 for diameters 100mm or larger.

2.2.9 Liquid-Tight Flexible Nonmetallic Conduit or Type PF

JIS C 8411, Type PF.

2.3 SURFACE RACEWAY

2.3.1 Surface Metal Raceway

Two-piece painted steel, totally enclosed, snap-cover type.[Provide multiple outlet-type raceway with grounding-type receptacle where indicated. Provide receptacles as specified herein, spaced a minimum of one every [455] [_____] mm.][Wire alternate receptacles on different circuits.]

2.3.2 Surface Nonmetallic Raceway

JIS C 8425, nonmetallic totally enclosed, snap-cover type.[Provide multiple outlet-type raceway with grounding-type receptacle where indicated. Provide receptacles as specified herein, spaced a minimum of one every [455] [_____] mm.][Wire alternate receptacles on different circuits.]

2.4 BUSWAY

JIS C 8364. Provide the following:

a. Buses: [copper][or][aluminum].

b. Busways: rated [_____] volts, [_____] continuous current amperes, three-phase,[three-][four-]wire, and include integral or internal[50-percent] ground bus.

c. Short circuit rating: [[_____] root mean square (rms) symmetrical amperes minimum][as indicated].

[d. Busway systems: suitable for use indoors.

] e. Enclosures: [steel][aluminum] [metallic].

f. Hardware: plated or otherwise protected to resist corrosion.

g. Joints: one-bolt type with through-bolts, which can be checked for tightness without deenergizing system.

h. Maximum hot spot temperature rise at any point in busway at continuous rated load: do not exceed 55 degrees C above maximum ambient temperature of 40 degrees C in any position.

i. Internal barriers to prevent movement of superheated gases.

j. Coordinate proper voltage phasing of entire bus duct system, for example where busway interfaces with transformers, switchgear, switchboards, motor control centers, and other system components.

2.4.1 Feeder Busways

Provide[ventilated, except that vertical busways within 1830 mm of floors must be unventilated,][unventilated, totally enclosed] low-impedance busway. Provide bus bars fully covered with insulating material, except at stabs. Provide an entirely polarized busway system.

2.4.2 Plug-In Busways

Unventilated type. Provide the following:

a. Plug-in units: [fusible, handle-operated, switch type, horsepower-rated][circuit breaker-type][handle-operated, switch type, equipped with high interrupting-capacity, current-limiting fuses].

b. Bus bars: covered with insulating material throughout, except at joints and other connection points.

[c. A hook stick of suitable length for operating plug-in units from the floor.

]2.5 CABLE TRAYS

Provide the following:

a. Cable trays: form a wireway system, with a nominal[[75] [100] [150] mm] depth[as indicated].

b. Cable trays: constructed of[aluminum][copper-free aluminum][steel that has been zinc-coated after fabrication].

c. Cable trays: include splice and end plates, dropouts, and miscellaneous hardware.

d. Edges, fittings, and hardware: finished free from burrs and sharp edges.

e. Fittings: ensure not less than load-carrying ability of straight tray sections and have manufacturer's minimum standard radius.

[f. Radius of bends: [305] [610] [915] mm.][Radius of bends: as indicated.

]2.5.1 Basket-Type Cable Trays

Provide[size as indicated][of nominal[50,][100,][150,][200,][300,][450,][and][600] mm width and [25,][50,][and][100] mm depth] with maximum wire mesh spacing of 50 by 100 mm.

2.5.2 Trough-Type Cable Trays

Provide[size as indicated][of nominal [150] [305] [455] [610] [760] [915] mm width].

2.5.3 Ladder-Type Cable Trays

Provide[size as indicated][of nominal [150] [305] [455] [610] [760] [915] mm width] with maximum rung spacing of [150] [225] [305] [455] mm.

2.5.4 Channel-Type Cable Trays

Provide [size as indicated][of nominal [75] [100] [150] mm width]. Provide trays with one-piece construction having slots spaced not more than 115 mm on centers.

2.5.5 Solid Bottom-Type Cable Trays

Provide[size as indicated][of nominal [150] [305] [455] [610] [760] [915] mm width]. [Provide solid covers.][Do not provide solid covers.]

2.5.6 [Cantilever

Cantilever-type, center-hung cable trays may be provided at the Contractor's option in lieu of other cable tray types specified.

][2.6 OPEN TELECOMMUNICATIONS CABLE SUPPORT

2.6.1 Open Top Cable Supports

Provide open top cable supports in accordance with UL 2043. Provide [[galvanized][zinc-coated][stainless] steel]open top cable supports[as indicated].

2.6.2 Closed Ring Cable Supports

Provide closed ring cable supports in accordance with UL 2043. Provide [[galvanized][zinc-coated][stainless] steel]closed ring cable supports[as indicated].

]2.7 OUTLET BOXES AND COVERS

JIS C 8340, cadmium- or zinc-coated, if ferrous metal. JIS C 8435, if nonmetallic. Rated [IP65 for wet locations] [IP66, 67 or 68 for dust-tight/hazardous locations].

2.7.1 Floor Outlet Boxes

Provide the following:

a. Boxes: [adjustable][nonadjustable] and concrete tight.

b. Each outlet: consisting of[nonmetallic][or][cast-metal] body with threaded openings,[or sheet-steel body with knockouts] for conduits,[adjustable][,][brass flange] ring, and cover plate with [19][25][31.75][53.92] mm threaded plug.

c. Telecommunications outlets: consisting of[surface-mounted, horizontal][flush], aluminum or stainless steel housing with a receptacle as specified and[25 mm bushed side opening][19 mm top opening].

d. Receptacle outlets: consisting of[surface-mounted, horizontal][flush] aluminum or stainless steel housing with duplex-type receptacle as specified herein.

e. Provide gaskets where necessary to ensure watertight installation.

[f. Provide plugs with installation instructions to the Contracting Officer for [5] [_____] percent of outlet boxes for the capping of outlets upon removal of service fittings.

]2.7.2 Outlet Boxes for Telecommunications System

Provide the following:

a. Standard type[100 mm square by 54 mm deep][120 mm square by 54 mm deep].

[b. Outlet boxes for wall-mounted telecommunications outlets: 100 by 54 by 54 mm deep.

] c. Depth of boxes: large enough to allow manufacturers' recommended conductor bend radii.

[d. Outlet boxes for fiber optic telecommunication outlets: include a minimum 10 mm deep single or two gang plaster ring as shown and installed using a minimum 27 mm conduit system.

][e. Outlet boxes for handicapped telecommunications station: 100 by 54 by 54 mm deep.

][2.7.3 Clock Outlet for Use in Other Than Wired Clock System

Provide the following:

a. Outlet box with plastic cover, where required, and single receptacle with clock outlet plate.

b. Receptacle: recessed sufficiently within box to allow complete insertion of standard cap, flush with plate.

c. Suitable clip or support for hanging clock: secured to top plate.

d. Material and finish of plate: as specified in paragraph DEVICE PLATES of this section.

]2.8 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 1640 mL, JIS C 8340, hot-dip, zinc-coated, if sheet steel. Rated [IP65 for wet locations] [IP66, 67 or 68 for dust-tight/hazardous locations].

2.9 WIRES AND CABLES

Provide wires and cables in accordance applicable requirements of Japanese standards for type of insulation, jacket, and conductor specified or indicated. Do not use wires and cables manufactured more than 12 months prior to date of delivery to site.

2.9.1 Conductors

Provide the following:

a. Conductor sizes and capacities shown are based on copper, unless indicated otherwise.

b. Conductors 1.25 sqmm and larger diameter: stranded.

c. Conductors 3.2 mm and smaller diameter: solid.

d. Conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3: stranded unless specifically indicated otherwise.

[e. All conductors: [copper.][Conductors indicated to be 14 sqmm or smaller diameter: copper. Conductors indicated to be 22 sqmm and larger diameter: copper , unless type of conductor material is specifically indicated, or specified, or required by equipment manufacturer.]

][2.9.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to satisfy manufacturer's requirements.

]2.9.1.2 Minimum Conductor Sizes

Provide minimum conductor size in accordance with the following:

a. Branch circuits: 2.0 mm.

b. Class 1 remote-control and signal circuits: 1.6 mm.

c. Class 2 low-energy, remote-control and signal circuits: 1.2 mm.

d. Class 3 low-energy, remote-control, alarm and signal circuits: 0.65

mm.

2.9.2 Color Coding

Provide color coding for service, feeder, branch, control, and signaling circuit conductors.

2.9.2.1 Ground and Neutral Conductors

Provide color coding of ground and neutral conductors as follows:

a. Grounding conductors: Green.

b. Neutral conductors: White or Gray.

c. Exception, where neutrals of more than one system are installed in same raceway or box, other neutrals color coding: white with a different colored (not green) stripe for each.

2.9.2.2 Ungrounded Conductors

Provide color coding of ungrounded conductors in different voltage systems as follows:

a. [480/277][440/254V][420/242V][208/120 volt], three-phase, four-wire

(1) Phase A - red

(2) Phase B - black

(3) Phase C - blue

b. [480 volt][440 volt][420 volt][220 volt][210 volt][208 volt], three-phase, three-wire

(1) Phase A - red

(2) Phase B - black

(3) Phase C - blue

c. [105/210][120/240] volt, single phase, three-wire:

(1) Phase A - red

(2) Phase B - black

[d. On three-phase, four-wire delta system, high leg: orange, as required.

]2.9.3 Insulation

Unless specified or indicated otherwise, provide power and lighting wires rated for 600-volts,[Type EM-IE conforming to JIS C 3612][or][Type EM-CE, EM-CET or EM-ECEQ conforming to JIS C 3605], except that grounding wire may be type TW conforming to JIS C 3612, Type EM-IE; remote-control and signal circuits: Type TW or TF, conforming to JIS C 3401, Type CEV. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.9.4 Bonding Conductors

JIS C 3101, solid bare copper wire for sizes 8 sqmm and smaller diameter; JIS C 3105 and JCS 1226, Class B, stranded bare copper wire for sizes 14 sqmm and larger diameter.

2.9.4.1 Telecommunications Bonding Backbone (TBB)

Provide a copper conductor TBB in accordance with JIS C 60364-5-54 with 14 sqmm minimum size, and sized at 3.3 sqmm per linear meter of conductor length up to a maximum size of 1500 sqmm.[Provide insulated TBB with insulation as specified in the paragraph INSULATION and meeting the fire ratings of its pathway.]

2.9.4.2 Bonding Conductor for Telecommunications

Provide a copper conductor Bonding Conductor for Telecommunications between the telecommunications main grounding busbar (TMGB) and the electrical service ground in accordance with JIS C 60364-5-54. Size the bonding conductor for telecommunications the same as the TBB.

[2.9.5 Service Entrance Cables

Service Entrance (SE) and Underground Service Entrance (USE) Cables, JIS C 3341 and JIS C 3605.

][2.9.6 EM-EEF Cable

JIS C 3605, Type EM-EEF Cable.

][2.9.7 Wire and Cable for 400 Hertz (Hz) Circuits

Insulated copper conductors.

][2.9.8 Metal-Clad Cable

Type MC cable.

][2.9.9 Armored Cable

Type AC cable.

][2.9.10 Mineral-Insulated, Metal-Sheathed Cable

UL listed; Type MI cable. Do not use sheathing containing asbestos fibers.

][2.9.11 Flat Conductor Cable

UL listed; Type FCC.

][2.9.12 Cable Tray Cable or Power Limited Tray Cable

UL listed; type TC or PLTC.

][2.9.13 Cord Sets and Power-Supply Cords

JIS C 8286.

][2.9.14 Polyethylene or Cross-Linked Polyethylene Cable

[Type [CV][CE] conforming to JIS C 3605 for 600V.][Type [CV][CE], conforming to JIS C 3606 for 6.6kV]

]2.10 SPLICES AND TERMINATION COMPONENTS

JIS C 2805, JIS C 2806 and JIS C 2810 for wire connectors and JIS C 2336, JIS C 2338 for insulating tapes. Connectors for 5.5 sqmm and smaller diameter wires: insulated, pressure-type in accordance with JIS C 2805, JIS C 2806 and JIS C 2810 or JIS C 2806 (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.11 DEVICE PLATES

Provide the following:

a. UL listed, one-piece device plates for outlets to suit the devices installed.

b. For metal outlet boxes, plates on unfinished walls: zinc-coated sheet steel or cast metal having round or beveled edges.

c. For nonmetallic boxes and fittings, other suitable plates may be provided.

[d. Plates on finished walls: nylon or lexan, minimum 0.792 mm wall thickness and same color as receptacle or toggle switch with which they are mounted.

][e. Plates on finished walls: satin finish stainless steel or brushed-finish aluminum, minimum 0.792 mm thick.

] f. Screws: machine-type with countersunk heads in color to match finish of plate.

g. Sectional type device plates are not be permitted.

h. Plates installed in wet locations: gasketed and UL listed for "wet locations."

[i. Device plates in areas normally accessible to prisoners: brown or ivory finish nylon-device plates rated for high abuse. Test device plates for compliance with JIS C 8340 and JIS C 8435 for physical strength. Attach device plates with spanner head bolts.

]2.12 SWITCHES

2.12.1 Toggle Switches

JIS C 8304,[single pole][, double pole][, three-way][, and four-way], totally enclosed with bodies of thermoplastic or thermoset plastic and mounting strap with grounding screw. Include the following:

a. Handles: [white][ivory][brown] thermoplastic.

b. Wiring terminals: screw-type, side-wired[or of the solderless pressure type having suitable conductor-release arrangement].

c. Contacts: silver-cadmium and contact arm - one-piece copper alloy.

d. Switches: rated quiet-type ac only, [105][120][210][240][120/277] volts, with current rating and number of poles indicated.

2.12.2 Switch with Red Pilot Handle

Provide the following:

a. Pilot lights that are integrally constructed as a part of the switch's handle.

b. Pilot light color: red and illuminate whenever the switch is closed or "on".

c. Pilot lighted switch: rated 20 amps and [105][120] volts or [210][240][277] volts as indicated.

d. The circuit's neutral conductor to each switch with a pilot light.

2.12.3 Breakers Used as Switches

For [100][120]- and [200][277]-Volt fluorescent fixtures, mark breakers "SWD" in accordance with JIS C 8201-2-1. Provide label adjacent to circuit breaker indicating Breaker used as switch.

2.12.4 Disconnect Switches

JIS C 8201-3. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Utilize Class R fuseholders and fuses for fused switches, unless indicated otherwise. Provide horsepower rated for switches serving as the motor-disconnect means. Provide switches in IP rated enclosure[as indicated] per JIS C 8462-1.

2.13 FUSES

JIS C 8269-1, JIS C 8269-2. Provide complete set of fuses for each fusible[switch][panel][and control center]. Coordinate time-current characteristics curves of fuses serving motors or connected in series with circuit breakers[or other circuit protective devices] for proper operation. Submit coordination data for approval. Provide fuses with a voltage rating not less than circuit voltage.

2.13.1 Fuseholders

Provide in accordance with JIS C 8269-1 or JIS C 8269-2.

2.13.2 Cartridge Fuses, Current Limiting Type (Class R)

JIS C 8269-1 or JIS C 8269-2, [Class[RK-1][RK-5][time-delay type]][Fuse System [A][B][C][D][E][F][G][H][I][J][L]]. Provide only Class R associated fuseholders in accordance with JIS C 8269-1 or JIS C 8269-2.

2.14 RECEPTACLES

Provide the following:

a. [JIS C 8303, JIS C 8281-1, hard use (also designated heavy-duty),][JIS C 8303, JIS C 8281-1 and JIS T 1021, hospital grade,] grounding-type.

b. Ratings and configurations: as indicated.

c. Bodies: [white][ivory][brown].

d. Face and body: thermoplastic supported on a metal mounting strap.

e. Dimensional requirements: per JIS C 8462-1.

f. Screw-type, side-wired wiring terminals or of the solderless pressure type having suitable conductor-release arrangement.

g. Grounding pole connected to mounting strap.

h. The receptacle: containing triple-wipe power contacts and double or triple-wipe ground contacts.

2.14.1 Switched Duplex Receptacles

Provide separate terminals for each ungrounded pole. Top receptacle: switched when installed.

2.14.2 Weatherproof Receptacles

Provide receptacles, UL listed for use in "wet locations" or weather resistant per JIS C 8303. Include cast metal box with gasketed, hinged, lockable and weatherproof while-in-use, [polycarbonate, UV resistant/stabilized][die-cast metal/aluminum] cover plate.

2.14.3 Ground-Fault Circuit Interrupter Receptacles

Duplex type for mounting in standard outlet box. Provide device capable of detecting current leak of 6 milliamperes or greater and tripping for Class A ground-fault circuit interrupter devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.14.4 Special Purpose Receptacles

Receptacles serving [_____] are special purpose.[Provide in ratings indicated.][[_____] configuration, rated [_____] amperes, [_____] volts.][Furnish one matching plug with each receptacle.]

2.14.5 [Plugs

Provide heavy-duty, rubber-covered[three-,][four-,][or][five-]wire cord of required size, install plugs thereon, and attach to equipment. Provide UL listed plugs with receptacles, complete with grounding blades. Where equipment is not available, turn over plugs and cord assemblies to the Government.

]2.14.6 Range Receptacles

[ ] ampere receptacle configuration [as indicated],[flush mounted for housing units,] rated 50 amperes, [105/210][125/250] volts.[Furnish one matching plug with each receptacle.]

2.14.7 Dryer Receptacles

Receptacle configuration [as indicated], rated [ ] amperes, [105/210][125/250] volts.[Furnish one matching plug with each receptacle.]

2.14.8 Tamper-Resistant Receptacles

Provide duplex receptacle with mechanical sliding shutters that prevent the insertion of small objects into its contact slots.

2.15 PANELBOARDS

Provide panelboards in accordance with the following:

[a. JIS C 8480 and JIS C 8480, JIS C 0920 having a short-circuit current rating[as indicated][of 10,000 amperes symmetrical minimum].

b. Panelboards for use as service disconnecting means: additionally conform to manufacturer's recommendations.

c. Panelboards: circuit breaker-equipped.

d. Designed such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL.

e. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the drawings.

f. Use of "Subfeed Breakers" is not acceptable unless specifically indicated otherwise.

g. Main breaker: "separately" mounted["above"][or]["below"] branch breakers.

h. Where "space only" is indicated, make provisions for future installation of breakers.

i. Directories: indicate load served by each circuit in panelboard.

j. Directories: indicate source of service to panelboard (e.g., Panel PA served from Panel MDP).

[k. Provide new directories for existing panels modified by this project as indicated.

] l. Type directories and mount in holder behind transparent protective covering.

[m. Panelboards: listed and labeled for their intended use.

] n. Panelboard nameplates: provided in accordance with paragraph FIELD FABRICATED NAMEPLATES.

][a. JIS C 8480 and JIS C 8480, JIS C 0920.

b. Panelboards for use as service disconnecting: additionally conform to

manufacturer's recommendations..

c. Panelboards: circuit breaker-equipped.

d. Designed such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL.

e. Where "space only" is indicated, make provisions for future installation of breaker sized as indicated.

f. Directories: indicate load served by each circuit of panelboard.

g. Directories: indicate source of service (upstream panel, switchboard, motor control center, etc.) to panelboard.

h. Type directories and mount in holder behind transparent protective covering.

i. Panelboard nameplates: provided in accordance with paragraph FIELD FABRICATED NAMEPLATES.

]2.15.1 Enclosure

Provide panelboard enclosure in accordance with the following:

a. JIS C 0920.

b. Cabinets mounted outdoors or flush-mounted: hot-dipped galvanized after fabrication.

c. Cabinets: painted in accordance with paragraph PAINTING.

d. Outdoor cabinets: Weatherproof rated IP code with[conduit hubs welded to the cabinet][a removable steel plate 7 mm thick in the bottom for field drilling for conduit connections].

e. Front edges of cabinets: form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front.

f. All cabinets: fabricated such that no part of any surface on the finished cabinet deviates from a true plane by more than 3 mm.

g. Holes: provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 15 mm clear space between the back of the cabinet and the wall surface.

h. Flush doors: mounted on hinges that expose only the hinge roll to view when the door is closed.

i. Each door: fitted with a combined catch and lock, except that doors over 600 mm long provided with a three-point latch having a knob with a T-handle, and a cylinder lock.

j. Keys: two provided with each lock, with all locks keyed alike.

k. Finished-head cap screws: provided for mounting the panelboard fronts on the cabinets.

2.15.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Design main buses and back pans so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per JIS C 8480 for connecting grounding conductors; bond to steel cabinet.[In addition to equipment grounding bus, provide second "isolated" ground bus, where indicated.]

[2.15.2.1 Panelboard Neutrals for Non-Linear Loads

Provide in accordance with the following:.

a. UL listed, with panelboard type specifically UL heat rise tested for use on non-linear loads.

b. Panelboard: heat rise tested in accordance with JIS C 8480, except with the neutral assembly installed and carrying 200 percent of the phase bus current during testing.

c. Verification of the testing procedure: provided upon request.

d. Two neutral assemblies paralleled together with cable is not acceptable.

e. Nameplates for panelboard rated for use on non-linear loads: marked "SUITABLE FOR NON-LINEAR LOADS" and in accordance with paragraph FIELD FABRICATED NAMEPLATES.

f. Provide a neutral label with instructions for wiring the neutral of panelboards rated for use on non-linear loads.

]2.15.3 Circuit Breakers

JIS C 8201-2-1,[thermal magnetic-type][solid state-type] having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker will be mounted. Breaker terminals: UL listed as suitable for type of conductor provided.[Where indicated on the drawings, provide circuit breakers with shunt trip devices.] Series rated circuit breakers and plug-in circuit breakers are unacceptable.

2.15.3.1 Multipole Breakers

Provide common trip-type with single operating handle. Design breaker such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.15.3.2 Circuit Breaker With Ground-Fault Circuit Interrupter or Type RCBO

JIS C 8222. [Provide with "push-to-test" button, visible indication of tripped condition, and ability to detect and trip on current imbalance of 6 milliamperes or greater per requirements of JIS C 8222 for Class A ground-fault circuit interrupter.][Provide Residual Current Device (RCBO)

circuit breaker with a leakage current detection of 15 milliamperes or 30 milliamperes to provide ground fault protection.]

2.15.3.3 Arc-Fault Circuit Interrupters

JIS C 8201-2-1. Molded case circuit breakers: rated as indicated.[Two pole arc-fault circuit-interrupters: rated 120/240 volts. The provision of (two) one pole circuit breakers for shared neutral circuits in lieu of (one) two pole circuit breaker is unacceptable.] Provide with "push-to-test" button.

[2.15.4 Fusible Switches for Panelboards

JIS C 8201-3, hinged door-type. Provide switches serving as motor disconnect means rated for kilowatt.

][2.15.5 400 Hz Panelboard and Breakers

Provide panelboards and breakers for use on 400 Hz systems rated and labeled "400 Hz."

[2.15.6 Branch Circuit Monitoring Panelboards

Provide a microprocessor-based panelboard monitoring system having the following features:

a. ANSI C12.1 and IEC 62053-21 Class 1 energy revenue metering accuracy.

b. Direct reading metered or calculated values for up to forty-two branch circuits.

c. Monitored values at the branch circuit level for current (A), power (kW), and energy (kWh).

d. Four user-configurable alarm thresholds.

e. Communications with building automation system using Modbus RTU protocol via RS-485 cable connection.

][2.15.7 Lighting Control Panelboards

Provided a lighting control panelboard having the following features:

a. Minimum sixteen schedules including a 7-day repeating schedule with sixteen daily on/off periods.

b. Minimum sixteen lighting zones grouping branch breakers that are controlled by schedules, manual inputs, or override commands.

c. Electronic clock including real-time, astronomical clock, and leap year and daylight savings time adjustments.

d. Burn-hour tracking.

e. Remote circuit breaker operation.

[f. Master Lighting Control Panelboard with controller to control up to [8] [_____] control bussed located [individually][in slave panelboard] up to [400] [_____] feet away from the master panelboard.

] g. Communications with building automation system using Modbus RTU protocol via RS-485 cable connection.

]][2.16 RESIDENTIAL LOAD CENTERS

Provide residential load centers (RLCs) in accordance with the following:

a. JIS C 8480 and JIS C 8480, JIS C 0920.

b. RLCs for use as service disconnecting means: additionally conform to manufacturer's recommendations.

c. Circuit breaker equipped.

d. Designed such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL.

e. Where "space only" is indicated, make provisions for future installation of breakers sized as indicated.

[f. Provide load centers with keyed locks.

] g. Provide printed directories.

2.16.1 RLC Buses

Support bus bars on bases independent of circuit breakers. Design main buses and back pans so that breakers may be changed without machining, drilling, or tapping. Provide isolated groundable neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per JIS C 8480 for connecting grounding conductors; bond to steel cabinet.

2.16.2 Circuit Breakers

JIS C 8201-2-1, thermal magnetic-type with interrupting capacity[as indicated][of 10,000 minimum amperes rms symmetrical]. Breaker terminals: UL listed as suitable for the type of conductor provided.

2.16.2.1 Multipole Breakers

Provide common trip-type with single operating handle. Provide a breaker design such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any two adjacent breaker poles are connected to alternate phases in sequence.

[2.16.2.2 Circuit Breaker With Ground-Fault Circuit Interrupter or Type RCBO

JIS C 8222. [Provide with "push-to-test" button, visible indication of tripped condition, and ability to detect and trip on current imbalance of 6 milliamperes or greater per requirements of JIS C 8222 for Class A ground-fault circuit interrupter devices.][Provide Residual Current Device (RCBO) circuit breaker with a leakage current detection of 15 milliamperes or 30 milliamperes to provide ground fault protection.]

]2.16.2.3 Arc-Fault Circuit-Interrupters

JIS C 8201-2-1. Molded case circuit breakers: rated as indicated.[Two pole arc-fault circuit-interrupters: rated [105/210][120/240] volts. The provision of (two) one pole circuit breakers for shared neutral circuits in lieu of (one) two pole circuit breaker is unacceptable.] Provide with "push-to-test" button.

][2.17 LOAD CENTERS FOR HOUSING UNITS

Provide single-phase panelboards for housing units on this project in accordance with the following:

a. Load center type, circuit breaker equipped, conforming to JIS C 8480 and JIS C 8480 or JIS C 0920.

b. Panelboards series short-circuit current rating: 22,000 amperes symmetrical minimum for the main breaker and the branch breakers.

c. Panelboards for use as service disconnecting means: additionally conform to manufacturer's recommendations.

d. Designed such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL.

e. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the drawings.

f. Where "space only" is indicated, make provisions for future installation of breakers.

g. Provide cover with latching door.

h. Directories: indicate load served by each circuit in panelboard.

i. Directories: indicate source of service to panelboard (e.g., Panel PA served from panel MDP).

j. Type directories and mount behind in holder with transparent protective covering on inside of panel door.

2.17.1 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Design main buses and back pans so that breakers may be changed without machining, drilling, or tapping. Provide copper or aluminum bus bars, either tin plated or silver plated. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per JIS C 8480 for connecting grounding conductors; bond to steel cabinet.

2.17.2 Circuit Breakers

JIS C 8201-2-1 thermal magnetic type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker will be mounted. Breaker terminals: UL

listed as suitable for type of conductor provided. Half-size and tandem breakers are not acceptable. Provide switch duty rated 15 and 20 ampere breakers. Breakers must not require use of panel trim to secure them to the bus.

2.17.2.1 Multipole Breakers

Provide common trip-type with single operating handle. Design breaker such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any two adjacent breaker poles are connected to Phases A and B respectively.

2.17.2.2 Arc-Fault Circuit-Interrupters

JIS C 8201-2-1. Molded case circuit breakers: rated as indicated.[Two pole arc-fault circuit-interrupters: rated [1050/210][120/240] volts. The provision of (two) one pole circuit breakers for shared neutral circuits in lieu of (one) two pole circuit breaker is unacceptable.] Provide with "push-to-test" button.

]2.18 ENCLOSED CIRCUIT BREAKERS

JIS C 8201-2-1. Individual molded case circuit breakers with voltage and continuous current ratings, number of poles, overload trip setting, and short circuit current interrupting rating as indicated. Enclosure type as indicated.[Provide solid neutral.]

[2.19 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

Motor short-circuit protectors, also called motor circuit protectors (MCPs): JIS C 8201-5-1 and JIS C 8201-2-1, and provided as shown. Provide MSCPs that consist of an adjustable instantaneous trip circuit breaker used only in conjunction with a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection. Rate MSCPs in accordance with MLIT ESS.

]2.20 TRANSFORMERS

Provide transformers in accordance with the following:

a. JEC 2200 and JIS C 61558-1, general purpose, dry-type, self-cooled,[ventilated][unventilated][sealed].

b. Provide transformers in indoor rated or weatherproof IP rated enclosure.

c. Taps for transformers 15 kVA and larger: [Two 2.5 percent taps Full Capacity Above Nominal (FCAN) and four 2.5 percent taps Full Capacity Below Nominal (FCBN)] [Two 2.5 percent taps Full Capacity Above Nominal (FCAN) and two 2.5 percent taps Full Capacity Below Nominal (FCBN)] [_____].

d. Transformer insulation system:

(1) 220 degrees C insulation system for transformers 15 kVA and greater, with temperature rise not exceeding[150][115][80] degrees C under full-rated load in maximum ambient of 40 degrees C.

(2) 180 degrees C insulation for transformers rated 10 kVA and less, with temperature rise not exceeding[150][115][80] degrees C under full-rated load in maximum ambient of 40 degrees C.

[e. Transformer of 150 degrees C temperature rise: capable of carrying continuously 100 percent of nameplate kVA without exceeding insulation rating.

][f. Transformer of 115 degrees C temperature rise: capable of carrying continuously 115 percent of nameplate kVA without exceeding insulation rating.

][g. Transformer of 80 degrees C temperature rise: capable of carrying continuously 130 percent of nameplate kVA without exceeding insulation rating.

][h. Transformers: quiet type with maximum sound level at least 3 decibels less than NEMA standard level for transformer ratings indicated.

]2.20.1 Specified Transformer Efficiency

Transformers, indicated and specified with: [420][440V][480V] primary, 80 degrees C or 115 degrees C temperature rise, kVA ratings of 37.5 to 100 for single phase or 30 to 500 for three phase, energy efficient type. Minimum efficiency, based on factory test results.

2.20.2 [Transformers With Non-Linear Loads

Provide transformers for non-linear loads in accordance JIS C 61000-4-7.

]2.21 MOTORS

Provide motors in accordance with the following:

a. JIS C 4212[except provide fire pump motors as specified in Section 21 30 00] FIRE PUMPS.

b. Provide the size in terms of kW, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified.

c. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters.

d. Rate motors for operation on [200-volt, 3-phase circuits with a terminal voltage rating of 200 volts, and those for operation on [400][440] volt, 3 phase circuits with a terminal voltage rating of [400][440] volts.][208-volt, 3-phase circuits with a terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits with a terminal voltage rating of 460 volts.]

e. Use motors designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating.

f. Unless otherwise indicated, use continuous duty type motors if rated 745 Watts and above.

h. Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches

indicated.

i. Use [Inverter-Rated] [Inverter-Duty] motors designed to operate with adjustable speed drive (ASD).

2.21.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors: high efficiency types corresponding to the applications listed in JIS C 4212. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.21.2 Premium Efficiency Polyphase Motors

Select polyphase motors based on high efficiency characteristics relative to typical characteristics and applications as listed in JIS C 4212. In addition, continuous rated, polyphase squirrel-cage medium induction motors must meet the requirements for premium efficiency electric motors in accordance with JIS C 4212, including the full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.21.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide controllers for motors rated 1-hp (746 watts) and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.21.4 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment[, and motor control equipment forming part of motor control centers or switchgear assemblies, the conduit and wiring connecting such centers, assemblies, or other power sources to equipment] as specified herein. Power wiring and conduit: conform to the requirements specified herein. Control wiring: provided under, and conform to, the requirements of the section specifying the associated equipment.

2.22 MOTOR CONTROLLERS

Provide motor controllers in accordance with the following:

a. JIS C 8201-5-1, JIS C 8201-4-1 and JIS C 8201-4-2,[except fire pump controllers as specified in Section 21 30 00 FIRE PUMPS].

b. Provide controllers with thermal overload protection in each phase, and one spare normally open auxiliary contact, and one spare normally closed auxiliary contact.

c. Provide controllers for motors rated 1-hp (746 kilowatt) and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage.

d. Provide protection for motors from immediate restart by a time adjustable restart relay.

e. When used with pressure, float, or similar automatic-type or maintained-contact switch, provide a hand/off/automatic selector switch with the controller.

f. Connections to selector switch: wired such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position.

g. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices: connected in motor control circuit in "hand" and "automatic" positions.

h. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device: made in accordance with indicated or manufacturer's approved wiring diagram.

[i. Provide selector switch with the means for locking in any position.

] j. Provide a disconnecting means, capable of being locked in the open position, for the motor that is located in sight from the motor location and the driven machinery location. As an alternative, provide a motor controller disconnect, capable of being locked in the open position, to serve as the disconnecting means for the motor if it is in sight from the motor location and the driven machinery location.

l. Overload protective devices: provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case.

m. Cover of combination motor controller and manual switch or circuit breaker: interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position.

[n. Minimum short circuit withstand rating of combination motor controller: [_____] rms symmetrical amperes.

][o. Provide controllers in hazardous locations with classifications as indicated.

]2.22.1 Control Wiring

Provide control wiring in accordance with the following:

a. All control wire: stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type CCE/F meeting JIS C 3401, or Type CEE/F meeting JIS C 3401, and passing the flame tests included in those standards.

b. Current transformer secondary leads: not smaller than 5.5 sqmm

c. Control wire minimum size: 1.6mm

d. Power wiring for [400][440][480]-volt circuits and below: the same type as control wiring with 2.0mm minimum size.

e. Provide wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal points.

2.22.2 Control Circuit Terminal Blocks

Provide control circuit terminal blocks in accordance with the following:

a. JIS C 8201-7-1.

b. Control circuit terminal blocks for control wiring: molded or fabricated type with barriers, rated not less than 600 volts.

c. Provide terminals with removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts.

d. Terminals: not less than 5.5 sqmm in size with sufficient length and space for connecting at least two indented terminals for 5.5 sqmmconductors to each terminal.

e. Terminal arrangement: subject to the approval of the Contracting Officer with not less than four (4) spare terminals or 10 percent, whichever is greater, provided on each block or group of blocks.

f. Modular, pull apart, terminal blocks are acceptable provided they are of the channel or rail-mounted type.

g. Submit data showing that any proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.22.2.1 Types of Terminal Blocks

a. Short-Circuiting Type: Short-circuiting type terminal blocks: furnished for all current transformer secondary leads with provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks: comply with the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.

b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity: provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. Provide terminals of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, provide screws with hexagonal heads. Conducting parts between connected terminals must have adequate contact surface and cross-section to operate without overheating. Provide eEach connected terminal with the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.22.3 Control Circuits

[Control circuits: maximum voltage of [105][120] volts derived from control transformer in same enclosure. Transformers: conform to JIS C 6436, as applicable. Transformers, other than transformers in bridge circuits: provide primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side.[Provide fuses in each ungrounded primary feeder]. Provide one fused secondary lead with the other lead grounded.[For designated systems, as indicated, provide backup power supply, including transformers connected to[emergency power source][_____]. Provide for automatic switchover and alarm upon failure of primary control circuit.]]

[Control circuits: maximum voltage of [105][120] volts derived from a separate control source. Provide terminals and terminal boards. Provide separate control disconnect switch within controller. Provide one fused secondary lead with the other lead grounded.[For designated systems, as indicated, provide backup power supply, including connection to[emergency power source][_____]. Provide for automatic switchover and alarm upon failure of primary control circuit.]]

2.22.4 Enclosures for Motor Controllers

JIS C 8462-1.

2.22.5 Multiple-Speed Motor Controllers and Reversible Motor Controllers

Across-the-line-type, electrically and mechanically interlocked. Multiple-speed controllers: include compelling relays and multiple-button, station-type with pilot lights for each speed.

2.22.6 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations: heavy duty, oil-tight design.

2.22.7 Pilot and Indicating Lights

[Provide LED cluster lamps.][Provide transformer, resistor, or diode type.]

[2.22.8 Reduced-Voltage Controllers

Provide for polyphase motors [_____] kilowatt and larger. Reduced-voltage starters: single-step, closed transition[autotransformer,][reactor,][primary resistor-type,][solid state-type,] or as indicated, with an adjustable time interval between application of reduced and full voltages to motors.[Wye-delta reduced voltage starter or part winding increment starter having adjustable time delay between application of voltage to first and second winding of motor may be used in lieu of the reduced-voltage starters for starting of[motor-generator sets,][centrifugally operated equipment,][or][reciprocating compressors provided with automatic unloaders].]

]2.23 MANUAL MOTOR STARTERS (MOTOR RATED SWITCHES)

[Single][Double][Three] pole designed for[flush][surface] mounting with

overload protection[and pilot lights].

2.23.1 Pilot Lights

[Provide yoke-mounted, seven element LED cluster light module. Color:[green][red][amber][in accordance with JIS C 8201-4-1 and JIS C 8201-4-2].][Provide yoke-mounted, candelabra-base sockets rated 125 volts and fitted with glass or plastic jewels. Provide clear, 6 watt lamp in each pilot switch. Jewels for use with switches controlling motors: green; jewels for other purposes:[white][red][amber].

]2.24 MOTOR CONTROL CENTERS

Provide motor control centers in accordance with the following:

a. JIS C 8201-4-1, JIS C 8201-4-1 and JIS C 8201-4-2.

b. Wiring: in [indoor][weatherproof][] IP rated enclosure per JIS C 0920.

c. Provide control centers suitable for operation on [_____]-volt, [_____]-phase, [_____]-wire, [_____] Hz system with minimum short-circuit withstand and interrupting rating of[100,000][65,000][42,000][25,000][_____] amperes rms symmetrical.

d. Incoming power feeder: [bus duct][cable] entering at the[top][bottom] of enclosure and terminating on[terminal lugs][main protective device].

[e. Main protective device: [molded case circuit breaker][low-voltage power circuit breaker][fusible switch] rated at [_____] amperes rms symmetrical interrupting capacity.

][f. Arrange busing so that control center can be expanded from both ends.

] g. Interconnecting wires: copper.

h. Terminal blocks: plug-in-type so that controllers may be removed without disconnecting individual control wiring.

2.24.1 Bus Systems

Provide the following bus systems. Power bus: be braced to withstand fault current of[100,000][65,000][42,000][25,000][_____] amperes rms symmetrical. Wiring troughs: isolated from horizontal and vertical bus bars.

2.24.1.1 Horizontal and Main Buses

Horizontal bus: continuous current rating of[600][800][1000][1200][_____] amperes. Main bus: [aluminum, tin-plated][copper, silver-plated] enclosed in isolated compartment at top of each vertical section. Main bus: isolated from wire troughs, starters, and other areas.

2.24.1.2 Vertical Bus

Vertical bus: continuous current rating of[300][450][600][_____] amperes, and [aluminum, tin-plated][copper, tin-plated][copper, silver-plated]. Vertical bus: enclosed in flame-retardant, polyester

glass "sandwich."

2.24.1.3 Ground Bus

Copper ground bus: provided full width of motor control center and equipped with necessary lugs.

[2.24.1.4 Neutral Bus

Insulated neutral bus: provided continuous through the motor control center; neutral full rated. Provide lugs of appropriate capacity, as required.

][2.24.2 Combination Motor Controllers

JIS C 8201-5-1 and other requirements in paragraph, MOTOR CONTROLLERS. Provide in controller a[molded case circuit breaker][fusible switch with clips for [_____]-type fuses for branch circuit protection].[Minimum short circuit withstand rating of combination motor controller: [_____] rms symmetrical amperes.][Circuit breakers for combination controllers: [thermal magnetic][magnetic only].]

][2.24.3 Space Heaters

Provide space heaters where indicated on the drawings, controlled using an adjustable 10 to 35 degrees C thermostat, magnetic contactor, and a molded-case circuit breaker[and a [480][400]-[120][100] volt single-phase transformer]. Provide space heaters equipped with 250-watt, [210][240] volt strip elements operated at [105][120] volts and [supplied from the motor control center bus][wired to terminal blocks for connection to [105][120]-volt single-phase power sources located external to the control centers]. Contactors: open type, electrically-held, rated 30 amperes, 2-pole, with 120-volt ac coils.

]2.25 LOCKOUT REQUIREMENTS

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with MLIT ESS. Comply with requirements of Division 23, "Mechanical" for mechanical isolation of machines and other equipment.

2.26 TELECOMMUNICATIONS SYSTEM

Provide system of telecommunications wire-supporting structures (pathway), including: outlet boxes, conduits with pull wires[wireways,][cable trays,] and other accessories for telecommunications outlets and pathway in accordance with the drawings and as specified herein.[Additional telecommunications requirements are specified in Section 27 10 00, BUILDING TELECOMMUNICATIONS CABLING SYSTEM.]

[2.27 COMMUNITY ANTENNA TELEVISION (CATV) SYSTEM

[Additional CATV requirements are specified in[Section 27 54 00.00 20, COMMUNITY ANTENNA TELEVISION (CATV) SYSTEMS.][Section 27 05 14.00 10, CABLE TELEVISION PREMISES DISTRIBUTION SYSTEM.]]

[2.27.1 CATV Outlets

Provide flush mounted, 75-ohm, F-type connector outlet rated from 5 to

1000 MHz in standard electrical outlet boxes[with isolation barrier] with mounting frame.

][2.27.2 CATV Faceplates

Provide modular faceplates for mounting of CATV Outlets.[Faceplate: include designation labels and label covers for circuit identification.] Faceplate color: match outlet and switch coverplates.

][2.27.3 Backboards

[Provide void-free, fire rated interior grade plywood, 19 mm thick,[1200 by 2400 mm][as indicated]. Do not cover the fire stamp on the backboard.][Coordinate CATV backboard requirements with telecommunications backboard requirements as specified in Section 27 10 00, BUILDING TELECOMMUNICATIONS CABLING.]

]]2.28 GROUNDING AND BONDING EQUIPMENT

2.28.1 Ground Rods

JIS C 60364-5-54. Ground rods: [copper-clad steel][solid copper][stainless steel], with minimum diameter of 14mm and minimum length 1500mm. Sectional ground rods are permitted.

[2.28.2 Ground Bus

Copper ground bus: provided in the electrical equipment rooms as indicated.

]2.28.3 Telecommunications [and CATV]Grounding Busbar

Provide corrosion-resistant grounding busbar suitable for[indoor][outdoor] installation in accordance with JIS C 60364-5-54. Busbars: plated for reduced contact resistance. If not plated, clean the busbar prior to fastening the conductors to the busbar and apply an anti-oxidant to the contact area to control corrosion and reduce contact resistance. Provide a telecommunications main grounding busbar (TMGB) in the telecommunications entrance facility[and a (TGB) in all other telecommunications rooms and equipment rooms]. The telecommunications main grounding busbar (TMGB)[and the telecommunications grounding busbar (TGB)]: sized in accordance with the immediate application requirements and with consideration of future growth. Provide telecommunications grounding busbars with the following:

a. Predrilled copper busbar provided with holes for use with standard sized lugs,

b. Minimum dimensions of 6 mm thick by 100 mm wide for the TMGB[and 50 mm wide for TGBs] with length as indicated;

c. Listed by a nationally recognized testing laboratory.

[2.29 HAZARDOUS LOCATIONS

Electrical materials, equipment, and devices for installation in hazardous locations, as defined by JIS: specifically approved by Underwriters' Laboratories, Inc., or Factory Mutual for particular "Class," "Division," and "Group" of hazardous locations involved. Boundaries and

classifications of hazardous locations: as indicated. Equipment in hazardous locations: comply with JIS C 60079-0 and JIS C 60079-14 for electrical equipment and industrial controls and JIS C 60079-0 and JIS C 60079-14for motors.

]2.30 MANUFACTURER'S NAMEPLATE

Provide on each item of equipment a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.31 FIELD FABRICATED NAMEPLATES

Provide field fabricated nameplates in accordance with the following:

a. JIS K 6911.

b. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings.

c. Each nameplate inscription: identify the function and, when applicable, the position.

d. Nameplates: melamine plastic, 3 mm thick, white with [black] [_____] center core.

[e. Provide red laminated plastic label with white center core where indicated.

] f. Surface: matte finish. Corners: square. Accurately align lettering and engrave into the core.

g. Minimum size of nameplates: 25 by 65 mm.

h. Lettering size and style: a minimum of 6.35 mm high normal block style.

2.32 WARNING SIGNS

Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer in accordance with NFPA 70E and JIS Z 9101 for switchboards, panelboards, industrial control panels, and motor control centers. Provide marking that is clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.33 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations in accordance with Section 07 84 00, FIRESTOPPING.

2.34 WIREWAYS

Material: steel[epoxy painted][galvanized] 16 gauge for heights and depths up to 150 by 150 mm, and 14 gauge for heights and depths up to 305 by 305 mm. Provide in length[indicated][required for the application] with[hinged-][screw-] cover enclosure per

[indoor][weatherproof][hazardous] IP rated enclosure perJIS C 8462-1.

[2.35 METERING

JIS C 1210. Provide a self-contained, socket-mounted, electronic programmable outdoor watthour meter. Meter: either programmed at the factory or programmed in the field. Turn field programming device over to the Contracting Officer at completion of project. Coordinate meter to system requirements. [Metering shall be compliant with the current Advanced Meter Reading System (AMRS) specification.]

a. Design: Provide watthour meter designed for use on a single-phase, three-wire,[210/105][240/120][440/254][420/242][480/240] volt system. Include necessary KYZ pulse initiation hardware for Energy Monitoring and Control System (EMCS).

b. Class: 200; Form: [2S][_____], accuracy: plus or minus 1.0 percent; Finish: Class II.

c. Cover: Polycarbonate and lockable to prevent tampering and unauthorized removal.

d. Kilowatt-hour Register: five digit electronic programmable type.

e. Demand Register:

(1) Provide solid state.

(2) Meter reading multiplier: Indicate multiplier on the meter face.

(3) Demand interval length: programmed for[15][30][60] minutes with rolling demand up to six subintervals per interval.

f. Socket: JIS C 1210. Provide [weatherproof][] IP rated, box-mounted socket, ringless, having[manual circuit-closing bypass and having] jaws compatible with requirements of the meter. Provide manufacturers standard enclosure color unless otherwise indicated.

][2.36 METER BASE ONLY

JIS C 1210. Provide [weatherproof][] IP rated, box-mounted socket, ringless, having jaws compatible with requirements of a class: 200 and Form: [2S][_____] self contained watthour meter. Provide gray plastic closing cover and bypass links. Provide manufacturers standard enclosure color unless otherwise indicated.

]2.37 SURGE PROTECTIVE DEVICES

Provide surge protective devices (SPD) which comply with JIS C 5381-11 and JIS C 5381-12 at the service entrance[, load centers] [, panelboards] [, MCC] [and] [_____]. Provide surge protectors in a [indoor][weatherproof] IP rated enclosure per JIS C 8462-1. Use Type 1 or Type 2 SPD and connect on the load side of a dedicated circuit breaker.

[Provide SPDs per JIS Z 9290-1 for the lightning protection system.

]2.38 FACTORY APPLIED FINISH

Provide factory-applied finish on electrical equipment in accordance with the following:

a. JIS C 0920 corrosion-resistance test and the additional requirements as specified herein.

b. Interior and exterior steel surfaces of equipment enclosures: thoroughly cleaned followed by a rust-inhibitive phosphatizing or equivalent treatment prior to painting.

c. Exterior surfaces: free from holes, seams, dents, weld marks, loose scale or other imperfections.

d. Interior surfaces: receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice.

e. Exterior surfaces: primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish.

f. Equipment located indoors: Light Gray,[and equipment located outdoors: [Light Gray][Dark Gray]].

g. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

2.39 SOURCE QUALITY CONTROL

2.39.1 Transformer Factory Tests

Submittal: include routine JEC 2200 and JIS C 61558-1 transformer test results on each transformer and also provide the results of Japanese standard "design" and "prototype" tests that were made on transformers electrically and mechanically equal to those specified.

[2.40 COORDINATED POWER SYSTEM PROTECTION

Prepare analyses as specified in Section 26 28 01.00 10 COORDINATED POWER SYSTEM PROTECTION.

]PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces: conform to requirements of MLIT ESS, IEEE C2, JIS C 0365 and to requirements specified herein.

[3.1.1 Underground Service

Underground service conductors and associated conduit: continuous from service entrance equipment to outdoor power system connection.

][3.1.2 Overhead Service

Overhead service conductors into buildings: terminate at service entrance fittings or weatherhead outside building. Overhead service conductors and

support bracket for overhead conductors are included in[Section 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION.]

][3.1.3 Hazardous Locations

Perform work in hazardous locations, as defined by applicable codes and standards, for particular "Class," "Division," and "Group" of hazardous locations involved. Provide conduit and cable seals where required. Provide conduit with tapered threads.

]3.1.4 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures: labeled and identified as such.

3.1.4.1 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, label each enclosure, new and existing, as one of several enclosures containing service entrance disconnect devices. Label, at minimum: indicate number of service disconnect devices housed by enclosure and indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to paragraph FIELD FABRICATED NAMEPLATES. Use lettering of at least 6.35 mm in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure: provided only as permitted.

3.1.5 Wiring Methods

Provide insulated conductors installed in rigid steel conduit or type G, IMC or type C, rigid nonmetallic conduit or Unplasticized Polyvinyl Chloride, or EMT or Type E, except where specifically indicated or specified otherwise or required to be installed otherwise. Grounding conductor: separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways.[Shared neutral, or multi-wire branch circuits, are not permitted with arc-fault circuit interrupters.] Minimum conduit size: 16 mm in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings: made with metal conduit in fire-rated shafts, with metal conduit extending through shafts for minimum distance of 150 mm. Firestop conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors in accordance with Section 07 84 00, FIRESTOPPING.

3.1.5.1 Pull Wire

Install pull wires in empty conduits. Pull wire: plastic having minimum 890-N force tensile strength. Leave minimum 915 mm of slack at each end of pull wire.

[3.1.5.2 Metal Clad Cable

Install in accordance with manufacturer's requirements, Type MC cable.

][3.1.5.3 Armored Cable

Install in accordance with manufacturer's requirements, Type AC cable.

][3.1.5.4 Flat Conductor Cable

Install in accordance with manufacturer's requirements, Type FCC cable.

]3.1.6 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 150 mm away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.[Run conduits[in crawl space][under floor slab] as if exposed.]

3.1.6.1 Restrictions Applicable to EMT or Type E

a. Do not install underground.

b. Do not encase in concrete, mortar, grout, or other cementitious materials.

c. Do not use in areas subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT or Type E conduit.

d. Do not use in hazardous areas.

e. Do not use outdoors.

f. Do not use in fire pump rooms.

g. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

[3.1.6.2 Restrictions Applicable to Nonmetallic Conduit or Type VE, HIVE, VP, HIVP

a. PVC Schedule 40 and PVC Schedule 80 or Type VE, HIVE, VP, HIVP

(1) Do not use in areas where subject to severe physical damage, including but not limited to, mechanical equipment rooms, electrical equipment rooms, hospitals, power plants, missile magazines, and other such areas.

(2) Do not use in hazardous (classified) areas.

(3) Do not use in fire pump rooms.

(4) Do not use in penetrating fire-rated walls or partitions, or fire-rated floors.

(5) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.

(6) Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

]3.1.6.3 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.6.4 Underground Conduit

Plastic-coated rigid steel; plastic-coated steel IMC or type C, LL or LT; PVC, Type EPC-40 or Type VE, HIVE, VP, HIVP. Convert nonmetallic conduit, other than PVC Schedule 40 or 80 or Type VE, HIVE, VP, HIVP, to plastic-coated rigid, or IMC, steel conduit before rising through floor slab. Plastic coating: extend minimum 150 mm above floor.

[3.1.6.5 Conduit Interior to Buildings for 400 Hz Circuits

Aluminum or nonmetallic. Where 400-Hz circuit runs underground or through concrete, provide PVC Schedule[40][80] or Type VE, HIVE, VP, HIVP conduit.

]3.1.6.6 Conduit for Circuits Rated Greater Than 600 Volts

Rigid metal conduit or Type G only.

3.1.6.7 Conduit Installed Under Floor Slabs

Conduit run under floor slab: located a minimum of [305] [_____] mm below the vapor barrier. Seal around conduits at penetrations thru vapor barrier.

3.1.6.8 Conduit Through Floor Slabs

Where conduits rise through floor slabs, do not allow curved portion of bends to be visible above finished slab.

[3.1.6.9 Conduit Installed in Concrete Floor Slabs

[Rigid steel or Type G; steel IMC or Type C; fiberglass, or PVC, Type EPC-40.][PVC, Type EPC-40, unless indicated otherwise.] Locate so as not to adversely affect structural strength of slabs. Install conduit within middle one-third of concrete slab.[Do not stack conduits.][Do not stack conduits more than two diameters high with minimum vertical separation of [_____] mm.] Space conduits horizontally not closer than three diameters, except at cabinet locations. Curved portions of bends must not be visible above finish slab. Increase slab thickness as necessary to provide minimum 25 mm cover over conduit. Where embedded conduits cross building and/or expansion joints, provide suitable watertight expansion/deflection fittings and bonding jumpers. Expansion/deflection fittings must allow horizontal and vertical movement of raceway. Conduit larger than 27 mm trade size: installed parallel with or at right angles to main reinforcement; when at right angles to reinforcement, install conduit close to one of supports of slab.[Where nonmetallic conduit is used, convert raceway to plastic coated rigid steel or Type G or plastic coated steel IMC or Type C; LL or LT before rising above floor, unless specifically indicated.]

]3.1.6.10 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to

free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 150 mm above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.6.11 Conduit Support

Support conduit by pipe straps, wall brackets, threaded rod conduit hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Do not exceed one-fourth proof test load for load applied to fasteners. Provide vibration resistant and shock-resistant fasteners attached to concrete ceiling. Do not cut main reinforcing bars for any holes cut to depth of more than 40 mm in reinforced concrete beams or to depth of more than 20 mm in concrete joints. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems: supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Do not share supporting means between electrical raceways and mechanical piping or ducts. Coordinate installationwith above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations.[Support exposed risers in wire shafts of multistory buildings by U-clamp hangers at each floor level and at 3050 mm maximum intervals.] Where conduit crosses building expansion joints, provide suitable[watertight] expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 63 mm inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.6.12 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.6.13 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Provide locknuts with sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required.

3.1.6.14 Flexible Connections

Provide flexible steel conduit between 915 and 1830 mm in length for recessed and semirecessed lighting fixtures[; for equipment subject to

vibration, noise transmission, or movement; and for motors]. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size: 16 mm diameter. Provide liquidtight flexible[nonmetallic] conduit in wet and damp locations[and in fire pump rooms] for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections.

3.1.6.15 Telecommunications and Signal System Pathway

Install telecommunications pathway in accordance with JIS X 5150.

a. Horizontal Pathway: Telecommunications pathways from the work area to the telecommunications room: installed and cabling length requirements in accordance with JIS X 5150. Size conduits[, wireways][, and cable trays] in accordance with JIS X 5150[and][as indicated].

b. Backbone Pathway: Telecommunication pathways from the telecommunications entrance facility to telecommunications rooms, and, telecommunications equipment rooms (backbone cabling): installed in accordance with JIS X 5150. Size conduits[, wireways][, and cable trays] for telecommunications risers in accordance with JIS X 5150[and][as indicated].

[3.1.6.16 Community Antenna Television (CATV) System Conduits

Install a system of CATV wire-supporting structures (pathway), including: outlet boxes, conduits with pull wires[wireways,][cable trays,] and other accessories for CATV outlets and pathway in accordance with JIS X 5150. [Provide distribution system with star topology with empty conduit and pullwire from each outlet box to the telecommunications room and empty conduit and pullwire from each telecommunications room to the headend equipment location][Provide distribution system with star topology with empty conduit and pullwire from each outlet to the headend equipment location].

]3.1.7 Busway Installation

Install busways parallel with or at right angles to ceilings, walls, and structural members. Support busways at 1525 mm maximum intervals, and brace to prevent lateral movement. Provide fixed type hinges on risers; spring-type are unacceptable. Provide flanges where busway makes penetrations through walls and floors, and seal to maintain smoke and fire ratings. Provide waterproof curb where busway riser passes through floor. Seal gaps with fire-rated foam and caulk. Provide expansion joints, but only where bus duct crosses building expansion joints. Provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.8 Cable Tray Installation

[Install and ground in accordance with manufacturer's instructions.[In addition, install and ground telecommunications cable tray in accordance with JIS X 5150, and JIS C 60364-5-54]. Install cable trays parallel with or at right angles to ceilings, walls, and structural members. Support[in accordance with manufacturer recommendations but at not more than [1830] [_____] mm intervals][as indicated].[Coat contact surfaces of aluminum connections with an antioxidant compound prior to assembly.] Adjacent cable tray sections: bonded together by connector plates of an

identical type as the cable tray sections. For grounding of cable tray system provide 38 sqmm bare copper wire throughout cable tray system, and bond to each section, except use 60 sqmm aluminum wire if cable tray is aluminum. Terminate cable trays 255 mm from both sides of smoke and fire partitions. Install conductors run through smoke and fire partitions in 103 mm rigid steel conduits with grounding bushings, extending 305 mm beyond each side of partitions. Seal conduit on both ends to maintain smoke and fire ratings of partitions. Firestop penetrations in accordance with Section 07 84 00, FIRESTOPPING. Provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

][Install cable trays parallel with or at right angles to ceilings, walls, and structural members. Support[as indicated][at maximum [1830] [_____] mm] intervals.[In addition, install and ground telecommunications cable tray in accordance with JIS X 5150, and JIS C 60364-5-54][Coat contact surfaces of aluminum connections with an antioxidant compound prior to assembly.] Ensure edges, fittings, and hardware are finished free from burrs and sharp edges. Provide 38 sqmm AWG bare copper wire throughout cable tray system, and bond to each section. Use 60 sqmm aluminum wire if cable tray is aluminum. Install conductors that run though smoke and fire partitions in 103 mm rigid steel conduits with grounding bushing, extending 305 mm beyond each side of partitions. Seal conduit on both ends to maintain smoke and fire ratings of partitions. Provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

][3.1.9 Telecommunications Cable Support Installation

Install open top and closed ring cable supports on 1.2 m to 1.5 m centers to adequately support and distribute the cable’s weight. Use these types of supports to support a maximum of 50 6.4 mm diameter cables. Install suspended cables with at least 75 mm of clear vertical space above the ceiling tiles and support channels (T-bars). Open top and closed ring cable supports: suspended from or attached to the structural ceiling or walls with hardware or other installation aids specifically designed to support their weight.

]3.1.10 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways: cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces,[when surface mounted on interior walls exposed up to 2135 mm above floors and walkways,][or when installed in hazardous areas] and when specifically indicated. Boxes in other locations: sheet steel, except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic[sheathed cable] conduit system. Provide each box with volume required for number of conductors enclosed in box. Boxes for mounting lighting fixtures: minimum 100 mm square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls: square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; provide readily removable fixturesfor access to boxes unless ceiling access panels are provided.

Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel.[Threaded studs driven in by powder charge and provided with lockwashers and nuts[or nail-type nylon anchors] may be used in lieu of wood screws, expansion shields, or machine screws.] In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 610 mm from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.10.1 Boxes

Boxes for use with raceway systems: minimum 40 mm deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets: minimum 100 mm square, except that 100 by 50 mm boxes may be used where only one raceway enters outlet. Telecommunications outlets: a minimum of[100 mm square by 54 mm deep][120 mm square by 54 mm deep][, except for [wall mounted telephones] [and] [outlet boxes for handicap telephone stations]]. Mount outlet boxes flush in finished walls.

3.1.10.2 Pull Boxes

Construct of at least minimum size required [of code-gauge aluminum or galvanized sheet steel,][and][compatible with nonmetallic raceway systems,] except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

[3.1.10.3 Extension Rings

Extension rings are not permitted for new construction. Use only on existing boxes in concealed conduit systems where wall is furred out for new finish.

]3.1.11 Mounting Heights

Mount panelboards,[enclosed] circuit breakers,[motor controller] and disconnecting switches so height of operating handle at its highest position is maximum 1980 mm above floor. Mount lighting switches[and handicapped telecommunications stations][1220 mm above finished floor]. Mount receptacles[and telecommunications outlets] 460 mm above finished floor[, unless otherwise indicated].[Wall-mounted telecommunications outlets: mounted at height[1525 mm above finished floor][indicated].] [Mount other devices as indicated.][Measure mounting heights of wiring devices and outlets[in non-hazardous areas]to center of device or outlet.][Measure mounting heights of receptacle outlet boxes in the[hazardous area][_____] to the bottom of the outlet box.]

[3.1.12 Nonmetallic Sheathed Cable Installation

Where possible, install cables concealed behind ceiling or wall finish. Thread cables through holes bored on approximate centerline of wood members; notching of end surfaces is not permitted. Provide sleeves

through concrete or masonry for threading cables. Install exposed cables parallel to or at right angles to walls or structural members. Protect exposed nonmetallic sheathed cables less than 1220 mm above floors from mechanical injury by installation in conduit or tubing. When cable is used in metal stud construction, insert plastic stud grommets in studs at each point through which cable passes, prior to installation of cable.

][3.1.13 Mineral Insulated, Metal Sheathed (Type MI) Cable Installation

Mineral-insulated, metal-sheathed cable system, Type MI, may be used in lieu of exposed conduit and wiring. Conductor sizes: not less than those indicated for the conduit installation. Fasten cables within 305 mm of each turn or offset and at 830 mm maximum intervals. Make cable terminations in accordance with cable manufacturer's recommendations. Terminate single-conductor cables of a circuit, having capacities of more than 50 amperes, in a single box or cabinet opening. Color code individual conductors in all outlets and cabinets.

]3.1.14 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors 14 sqmm and smaller diameter, provide color coding by factory-applied, color-impregnated insulation. For conductors 22 sqmm and larger diameter, provide color coding by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with[Section 23 09 53.00 20 SPACE TEMPERATURE CONTROL SYSTEMS.][Section [_____], [_____]][Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC][manufacturer's recommendations].[Provide telecommunications system conductor identification as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS.]

3.1.14.1 Marking Strips

Provide marking strips in accordance with the following:

a. Provide white or other light-colored plastic marking strips, fastened by screws to each terminal block, for wire designations.

b. Use permanent ink for the wire numbers

c. Provide reversible marking strips to permit marking both sides, or provide two marking strips with each block.

d. Size marking strips to accommodate the two sets of wire numbers.

e. Assign a device designation in accordance with JIS C 8201-4-1 and JIS C 8201-4-2 to each device to which a connection is made. Mark each device terminal to which a connection is made with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams.

f. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, provide additional wire and cable designations for identification of remote (external) circuits for the Government's wire designations.

g. Prints of the marking strips drawings submitted for approval will be

so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.15 Splices

Make splices in accessible locations. Make splices in conductors 5.5 sqmm and smaller diameter with insulated, pressure-type connector. Make splices in conductors 8 sqmm and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.16 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 0.58 mm. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.17 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.18 Grounding and Bonding

[Provide in accordance with JIS Z 9290-1]. Ground exposed, non-current-carrying metallic parts of electrical equipment,[access flooring support system,] metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, [grounding conductor of nonmetallic sheathed cables,]and neutral conductor of wiring systems.[Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode.][Make ground connection to driven ground rods on exterior of building.][Interconnect all grounding media in or on the structure to provide a common ground potential. This includes lightning protection, electrical service, telecommunications system grounds, as well as underground metallic piping systems. Make interconnection to the gas line on the customer's side of the meter. Use main size lightning conductors for interconnecting these grounding systems to the lightning protection system.] In addition to the requirements specified herein, provide telecommunications grounding in accordance with JIS C 60364-5-54. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.18.1 Ground Rods

Provide cone pointed ground rods. Measure the resistance to ground using the fall-of-potential method described in JIS C 60364-6. Do not exceed 25 ohms under normally dry conditions for the maximum resistance of a driven ground. If this resistance cannot be obtained with a single rod,[_____] additional rods, spaced on center, not less than twice the distance of the length of the rod,[or if sectional type rods are used,[_____] additional

sections may be coupled and driven with the first rod].[In high-ground-resistance, UL listed chemically charged ground rods may be used.] If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, notify the Contracting Officer who will decide on the number of ground rods to add.

3.1.18.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible,[excepting specifically those connections for which access for periodic testing is required,] by exothermic weld or compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Provide tools and dies as recommended by the manufacturer. Use an embossing die code or other standard method to provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.18.3 Ground Bus

Provide a copper ground bus in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of[transformer neutrals and other electrical][electrical] equipment: effectively grounded by bonding to the ground bus. Bond the ground bus to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 100 mm above the floor. Make connections and splices of the brazed, welded, bolted, or pressure-connector type, except use pressure connectors or bolted connections for connections to removable equipment.[For raised floor equipment rooms in computer and data processing centers, provide a minimum of 4, one at each corner, ground buses connected to the building grounding system. Use bolted connections in lieu of thermoweld, so they can be changed as required by additions and/or alterations.]

3.1.18.4 Resistance

Maximum resistance-to-ground of grounding system: do not exceed[5][_____] ohms under dry conditions. Where resistance obtained exceeds[5][_____] ohms, contact Contracting Officer for further instructions.

3.1.18.5 Telecommunications System

Provide telecommunications grounding in accordance with the following:

a. Telecommunications Grounding Busbars: Provide a telecommunications main grounding busbar (TMGB) in the telecommunications entrance facility. Install the TMGB as close to the electrical service entrance grounding connection as practicable.[Provide a telecommunications grounding busbar (TGB) in all other telecommunications rooms and telecommunications equipment rooms. Install the TGB as close to the telecommunications room panelboard as practicable, when equipped. Where a panelboard for telecommunications

equipment is not installed in the telecommunications room, locate the TGB near the backbone cabling and associated terminations. In addition, locate the TGB to provide for the shortest and straightest routing of the grounding conductors. Where a panelboard for telecommunications equipment is located within the same room or space as a TGB, bond that panelboard's alternating current equipment ground (ACEG) bus (when equipped) or the panelboard enclosure to the TGB.] Install telecommunications grounding busbars to maintain clearances as required and insulated from its support. A minimum of 50 mm separation from the wall is recommended to allow access to the rear of the busbar and adjust the mounting height to accommodate overhead or underfloor cable routing.

b. Telecommunications Bonding Conductors: Provide main telecommunications service equipment ground consisting of separate bonding conductor for telecommunications, between the TMGB and readily accessible grounding connection of the electrical service. Grounding and bonding conductors should not be placed in ferrous metallic conduit. If it is necessary to place grounding and bonding conductors in ferrous metallic conduit that exceeds 1 m in length, bond the conductors to each end of the conduit using a grounding bushing or a 14 sqmm conductor, minimum.[Provide a telecommunications bonding backbone (TBB) that originates at the TMGB extends throughout the building using the telecommunications backbone pathways, and connects to the TGBs in all telecommunications rooms and equipment rooms. Install the TBB conductors such that they are protected from physical and mechanical damage. The TBB conductors should be installed without splices and routed in the shortest possible straight-line path. Make the bonding conductor between a TBB and a TGB continuous. Where splices are necessary, the number of splices should be a minimum. Make the splices accessible and located in telecommunications spaces. Connect joined segments of a TBB using exothermic welding, irreversible compression-type connectors, or equivalent. Install all joints to be adequately supported and protected from damage. Whenever two or more TBBs are used within a multistory building, bond the TBBs together with a grounding equalizer (GE) at the top floor and at a minimum of every third floor in between. Do not connect the TBB and GE to the pathway ground, except at the TMGB or the TGB.]

c. Telecommunications Grounding Connections: Telecommunications grounding connections to the TMGB[or TGB]: utilize listed compression two-hole lugs, exothermic welding, suitable and equivalent one hole non-twisting lugs, or other irreversible compression type connections. Bond all metallic pathways, cabinets, and racks for telecommunications cabling and interconnecting hardware located within the same room or space as the TMGB[or TGB] to the TMGB[or TGB respectively]. In a metal frame (structural steel) building, where the steel framework is readily accessible within the room; bond each TMGB[and TGB] to the vertical steel metal frame using a minimum 14 sqmm conductor. Where the metal frame is external to the room and readily accessible, bond the metal frame to the TGB or TMGB with a minimum 14 sqmm conductor. When practicable because of shorter distances and, where horizontal steel members are permanently electrically bonded to vertical column members, the TGB may be bonded to these horizontal members in lieu of the vertical column members. All connectors used for bonding to the metal frame of a building must be listed for the intended purpose.

3.1.19 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications and are provided under the section specifying the associated equipment.

3.1.20 Elevator

Provide circuit to line terminals of elevator controller, and disconnect switch on line side of controller, outlet for control power, outlet receptacle and work light at midheight of elevator shaft, and work light and outlet receptacle in elevator pit.

[3.1.21 Government-Furnished Equipment

Contractor[rough-in for Government-furnished equipment][make connections to Government-furnished equipment] to make equipment operate as intended, including providing miscellaneous items such as plugs, receptacles, wire, cable, conduit, flexible conduit, and outlet boxes or fittings.

]3.1.22 Repair of Existing Work

Perform repair of existing work[, demolition, and modification of existing electrical distribution systems] as follows:

3.1.22.1 Workmanship

Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades involved.

3.1.22.2 Existing Concealed Wiring to be Removed

Disconnect existing concealed wiring to be removed from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.

[3.1.22.3 Removal of Existing Electrical Distribution System

Removal of existing electrical distribution system equipment includes equipment's associated wiring, including conductors, cables, exposed conduit, surface metal raceways, boxes, and fittings,[back to equipment's power source] as indicated.

][3.1.22.4 Continuation of Service

Maintain continuity of existing circuits of equipment to remain. Maintain existing circuits of equipment energized. Restore circuits wiring and power which are to remain but were disturbed during demolition back to original condition.

][3.1.23 Watthour Meters

JIS C 1210.

]3.1.24 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible. Maximum allowed lead length is 900 mm.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. [Painting: as specified in Section 09 90 00 PAINTS AND COATINGS.][Where field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and apply in accordance to manufacturer's instructions.]

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer[5][_____] working days notice prior to[each][_____] test[s].

3.5.1 Devices Subject to Manual Operation

Operate each device subject to manual operation at least five times, demonstrating satisfactory operation each time.

3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring 14 sqmm and larger diameter using instrument which applies voltage of 1,000 volts DC for 600 volt rated wiring and 500 volts DC for 300 volt rated wiring to provide direct reading of resistance. All existing wiring to be reused shall also be tested.

3.5.3 Transformer Tests

Perform the standard, not optional, tests in accordance with the Inspection and Test Procedures for transformers, dry type, air-cooled, 600 volt and below; as specified in Denki Hoan Kyoukai and MLIT DSKKS. Measure primary and secondary voltages for proper tap settings. Tests need not be performed by a recognized independent testing firm or independent electrical consulting firm.

3.5.4 Ground-Fault Receptacle Test

[Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.][Test RCBO circuit breakers in accordance with JIS C 8222, Annex G.]

3.5.5 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

[3.5.6 Watthour Meter

a. Visual and mechanical inspection

(1) Examine for broken parts, shipping damage, and tightness of connections.

(2) Verify that meter type, scales, and connections are in accordance with approved shop drawings.

b. Electrical tests

(1) Determine accuracy of meter.

(2) Calibrate watthour meters to one-half percent.

(3) Verify that correct multiplier has been placed on face of meter, where applicable.

]3.5.7 Phase Rotation Test

Perform phase rotation test to ensure proper rotation of service power prior to operation of new or reinstalled equipment using a phase rotation meter. Follow the meter manual directions performing the test.

-- End of Section --

SECTION 26 23 00

LOW-VOLTAGE SWITCHGEAR

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Contractor may substitute compatible Japan Industrial Standard (JIS) or Japan Electrical Safety Inspection Associations for non-Japanese standards, as approved by the Contracting Officer's representative.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

JAPAN ELECTRICAL SAFETY INSPECTION ASSOCIATIONS

Denki Hoan Kyoukai	Japan Standard for Acceptance Testing and Inspections

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 1048	(2007) Fasteners - Hot Dip Galvanized Coatings
JIS C 0365	(2007) Protection Against Electric Shock - Common Aspects for Installation and Equipment
JIS C 1210	(1979) General Rules for Electricity Meters
JIS C 1731-1	(1998) Instrument Transformers for Testing Purpose and Used with General Instrument Part 1: Current Transformer
JIS C 2110-1	(2016) Solid electrical insulation materials-Test methods for strength of dielectric breakdown-Part 1: Tests by applying commercial frequency alternating voltage
JIS C 5381-11	(2014) Low-voltage surge protective devices -- Part 11: Surge protective devices connected to low-voltage power systems -- Requirements and test methods
JIS C 8201-1	(2007) Low-voltage switchgear and control unit-Part 1: General rules
JIS C 8201-2-1	(2011) Low-Voltage Switchgear and Control Gear - Part 2-1: Circuit-Breakers

JIS C 8201-2-2	(2011) Low-Voltage Switchgear And Control Gear - Part 2-2: Circuit-Breakers Incorporating Residual Current Protection
JIS C 8462-1	(2012) Boxes and enclosures for electrical accessories for household and similar fixed electrical installations -- Part 1: General requirements
JIS C 8480	(R2016) Box-Type Switchgear Assemblies for Low-Voltage Distribution Purpose
JIS C 60364-5-54	(2006) Building Electrical Equipment-Part 5-54: Selection Of Electrical Equipment and Contruction-Grounding Equipment, Protective Conductor and Protective Bonding Conductor
JIS C 60364-6	(2010) Low-voltage electrical installations -- Part 6: Verification
JIS C 61558-1	(2019) Safety of transformers, reactors, power supply units and combinations thereof -- Part 1: General requirements and tests
JIS C 61000-4-5	(2018) Electromagnetic compatibility-Part 4-5: Test and measurement techniques-Surge immunity test
JIS K 6911	(2006) Thermosetting plastic general test method
JIS K 6912	(1995) Laminated Thermosetting Sheets
JIS G 3352	(2014) Deck Plate
JIS G 4304	(2012) Hot-Rolled Stainless Steel Plate, Sheet and Strip
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS Z 2371	(2015) Methods of Salt Spray Testing
JIS Z 9101	(2018) Graphical symbols -- Safety colours and safety signs -- Part 1: Design principles for safety signs and safety markings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70E	(2018; TIA 18-1; TIA 81-2) Standard for Electrical Safety in the Workplace

1.2 RELATED REQUIREMENTS

Section 26 08 00 APPARATUS INSPECTION AND TESTING applies to this section, with the additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor QC approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29, SUSTAINABITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Switchgear Drawings; G[, [_____]]

SD-03 Product Data

Switchgear; G[, [_____]]

SD-06 Test Reports

Acceptance Checks and Tests;

SD-10 Operation and Maintenance Data

Switchgear Operation and Maintenance, Data Package 5;

SD-11 Closeout Submittals

Assembled Operation and Maintenance Manuals;

Equipment Test Schedule;

[Request for Settings;

][Required Settings;
]
[Service Entrance Available Fault Current Label;

]1.5 QUALITY ASSURANCE

1.5.1 Product Data

Include manufacturer's information on each submittal for each component, device and accessory provided with the switchgear including:

a. Circuit breaker type, interrupting rating, and trip devices, including available settings.

b. Manufacturer's instruction manuals and published time-current curves (in electronic format) of the main secondary breaker and largest secondary feeder device.

1.5.2 Switchgear Drawings

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Identify circuit terminals on wiring diagrams and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Indicate on the drawings adequate clearance for operation, maintenance, and replacement of operating equipment devices. Include the nameplate data, size, and capacity on submittal. Also include applicable federal, military, industry, and technical society publication references on submittals. Include the following:

a. One-line diagram including breakers[, fuses][, current transformers, and meters].

b. Outline drawings including front elevation, section views, footprint, and overall dimensions.

c. Bus configuration including dimensions and ampere ratings of bus bars.

d. Markings and NEMA nameplate data[, including fuse information (manufacturer's name, catalog number, and ratings)].

e. Circuit breaker type, interrupting rating, and trip devices, including available settings.

f. Wiring diagrams and elementary diagrams with terminals identified, and indicating prewired interconnections between items of equipment and the interconnection between the items.

g. Manufacturer's instruction manuals and published time-current curves (in electronic format) of the main secondary breaker and largest secondary feeder device. Use this information (designer of record) to provide breaker settings that ensures protection and coordination are achieved. [For Navy installations, provide electronic format curves using SKM's Power Tools for Windows device library electronic format or EasyPower device library format depending on installation modeling software requirements.]

[h. Provisions for future expansion by adding switchgear sections.

]1.5.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" or "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with the mandatory and advisory provisions of applicable codes and standards unless more stringent requirements are specified or indicated.

1.5.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship, and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 year prior to date of delivery to site are not acceptable.

1.6 MAINTENANCE

1.6.1 Switchgear Operation and Maintenance Data

Submit Operation and Maintenance Manuals in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.6.2 Assembled Operation and Maintenance Manuals

Assemble and securely bind manuals in durable, hard covered, water resistant binders. Assemble and index the manuals in the following order with a table of contents:

a. Manufacturer's O&M information required by the paragraph SD-10, OPERATION AND MAINTENANCE DATA.

b. Catalog data required by the paragraph SD-03, PRODUCT DATA.

c. Drawings required by the paragraph SD-02, SHOP DRAWINGS.

d. Prices for spare parts and supply list.

[e. Information on metering.

] f. Design test reports.

g. Production test reports.

1.7 WARRANTY

Provide equipment items that are supported by service organizations reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be switchgear and related accessories are specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION, and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.2 SWITCHGEAR

JIS C 8201-1.

2.2.1 Ratings

Provide equipment with the following ratings:

a. Voltage rating: [480Y/277][440/254][420/242][208Y/120][220][210Y/105][_____] volts AC, [50][60] hertz, [3][4]-wire [three-phase, [3][4]-wire][as indicated].

b. Continuous current rating of the main bus: [_____ amperes][as indicated].

c. Short-circuit current rating: [_____ rms symmetrical amperes][as indicated].

d. UL listed and labeled[for its intended use][as service entrance equipment].

2.2.2 Construction

Provide the following:

a. Switchgear: consisting of vertical sections bolted together to form a rigid assembly and [rear][front and rear] aligned[as indicated].

b. All circuit breakers: [front accessible with rear load connections][as indicated].

c. Compartmentalized switchgear: vertical insulating barriers between the front device section, the main bus section, and the cable compartment[with full front to rear vertical insulating barriers between adjacent sections].

d. Where indicated, "space for future" or "space" means to include all necessary components and hardware to be fully equipped for racking in a circuit breaker element.

e. Insulating barriers: provided in accordance with JIS K 6912 6.35 mm minimum thickness.

[f. Moisture resistant coating: applied to all rough-cut edges of barriers.

][g. Switchgear: Arc-resistant, tested in accordance with manufacturer's requirements.

]2.2.2.1 Enclosure

Provide the following:

a. Enclosure: [outdoor][indoor][weatherproof] IP rated [as indicated] per JIS C 8462-1 [fabricated entirely of 12 gauge, type 304 or 304L stainless steel] per JIS G 4304.

b. Enclosure: bolted together with removable bolt-on side and[hinged] rear covers[, and sloping roof downward toward rear].

[c. Front[and rear] doors: provided with[stainless steel] padlockable vault handles with a three point catch.

][d. Bases, frames and channels of enclosure: corrosion resistant and fabricated of[type 304 or 304L stainless steel][or][galvanized steel]JIS G 4304.

] e. Base: includes any part of enclosure that is within 75 mm of concrete pad.

[f. Galvanized steel: coating per JIS H 8641 and JIS G 3352, and JIS B 1048, as applicable. Galvanize after fabrication where practicable.

] g. Paint color: light gray over rust inhibitor.

[h. Paint coating system: comply with[JIS C 8480 for galvanized steel][and][JIS Z 2371 for stainless steel].

][i. Infrared viewing windows: install to allow the use of an infrared camera or thermal imager direct line of site to inspect electrical connections without requiring the opening of panels and doors. These windows are intended to allow thermographers the ability to inspect the electrical equipment without directly exposing themselves to live electrical components and energized devices.

]2.2.2.2 Bus Bars

Provide the following:

a. Bus bars: [copper with silver-plated contact surfaces][or][aluminum with tin-plated contact surfaces].

(1) Phase bus bars: [uninsulated][insulated with an epoxy finish coating powder or insulating sleeve providing a minimum breakdown voltage in accordance with JIS C 2110-1].

(2) Neutral bus: rated [100][_____] percent of the main bus continuous current rating[as indicated].

b. Make bus connections and joints with hardened steel bolts.

c. Main-bus (through bus): rated at the full ampacity of the main throughout the switchgear.

d. Minimum 6.35 mm by 50.8 mm copper ground bus secured to each vertical section along the entire length of the switchgear.

2.2.2.3 Main Section

Provide the main section consisting of[main lugs only][an individually mounted][air power circuit breaker[with current-limiting fuses]][and utility transformer compartment].

2.2.2.4 Distribution Sections

Provide the distribution section[s] consisting of[[individually mounted,]][air power circuit breakers[with current-limiting fuses]][and utility transformer compartments] as indicated.

[2.2.2.5 Auxiliary Sections

Provide auxiliary sections consisting of indicated[instruments,][metering equipment,][control equipment,][transformer,][and][current transformer compartments] as indicated.

][2.2.2.6 Handles

Provide handles for individually mounted devices of the same design and method of external operation. Label handles prominently to indicate device ampere rating, color coded for device type. Identify ON-OFF indication by handle position and by prominent marking.

]2.2.3 Protective Device

Provide[main and] branch protective devices as indicated.

Provide the following:

a. JIS C 8201-2-1 and JIS C 8201-2-2. [105 Vac][120 Vac][electrically][manually] operated, [unfused][fused], low-voltage power circuit breaker with a short-circuit current rating[of [_____] rms amperes symmetrical][as indicated] at [_____] volts.

b. Breaker frame size: [as indicated][[_____] amperes].

[c. Equip electrically operated breakers with motor-charged, stored-energy closing mechanism to permit rapid and safe closing of the breaker against fault currents within the short time rating of the breaker, independent of the operator's strength or effort in closing the handle.

]2.2.4 Electronic Trip Units

Equip[main and][distribution] breakers[as indicated] with a solid-state tripping system consisting of three current sensors and a microprocessor-based trip unit that provides true rms sensing adjustable time-current circuit protection. Include the following:

a. Current sensors ampere rating: [as indicated][[_____] amperes][the same as the breaker frame rating].

b. Trip unit ampere rating: [as indicated][[_____] amperes].

[c. Ground fault protection: [as indicated][zero sequence sensing][residual type sensing].

][d. Electronic trip units: provide additional features[as indicated]:

]
[(1) [Indicated]Breakers: include long delay pick-up and time settings, and indication of cause of circuit breaker trip.

][(2) Main breakers: include[short delay pick-up and time settings][and][, instantaneous settings][and][ground fault settings][as indicated].

][(3) Distribution breakers: include[short delay pick-up and time settings][, instantaneous settings][, and ground fault settings][as indicated].

][(4) [Main]Breakers: include a digital display for phase and ground current.

][(5) [Main]Breakers: include a digital display for watts, vars, VA, kWh, kvarh, and kVAh.

][(6) [Main]Breakers: include a digital display for phase voltage, and percent THD voltage and current.

][(7) [Main]Breakers: include provisions for communication via a network twisted pair cable for remote monitoring and control. Provide the following communications protocol:[DNP3][Modbus][IEC 61850].

][(8) For electronic trip units that are rated for or can be adjusted to 1,200 amperes or higher, provide arc energy reduction capability with an energy-reducing maintenance switch with local status indicator.

][2.2.5 Metering

[2.2.5.1 Digital Meters

[JIS C 5381-11 and JIS C 61000-4-5 for surge withstand. [Metering shall be compliant with the current Advanced Meter Reading System (AMRS) specification.] Provide true rms, plus/minus one percent accuracy, programmable, microprocessor-based meter enclosed in a sealed case with the following features.]

[Provide meter(s) and connect the meter(s) to the existing Advanced Meter Infrastructure Data Aquisition System (AMI DAS). The contractor shall use the existing government laptop computers to configure the meter using existing software loaded on the computer. The contractor will not be allowed to modify any software or add any additional software to the computer. Alternatively, the government will configure the meter(s), which must be compatible with the existing system, using existing software. Contract shall insure that the meter(s) will transmit the specified data to the DAS. Meters shall be compatible with the Base AMI DAS per NAVFAC Far East requirements.]

a. Display capability:

[(1) Multi-Function Meter: Display a selected phase to neutral voltage, phase to phase voltage, percent phase to neutral voltage THD, percent phase to phase voltage THD; a selected phase current, neutral current, percent phase current THD, percent neutral current; selected total PF, kW, KVA, kVAR, FREQ, kVAh, kWh.

Detected alarm conditions include over/under current, over/under voltage, over/under KVA, over/under frequency, over/under selected PF/kVAR, voltage phase reversal, voltage imbalance, reverse power, over percent THD. Include a Form C KYZ pulse output relay on the meter.

][(2) Power Meter: Display Watts, VARs, and selected KVA/PF. Detected alarm conditions include over/under KVA, over/under PF, over/under VARs, over/under reverse power.

][(3) Volt Meter: Provide capability to be selectable between display of the three phases of phase to neutral voltages and simultaneous display of the three phases of the phase to phase voltages. Detected alarm conditions include over/under voltage, over/under voltage imbalance, over percent THD.

][(4) Ammeter: Display phase A, B, and C currents. Detected alarm conditions include over/under current, over percent THD.

][(5) Digital Watthour Meter: Provide a single selectable display for watts, total kilowatt hours (kWh) and watt demand (Wd). Include a Form C KYZ pulse output relay on the meter.

] b. Design meters to accept[input from standard 5A secondary instrument transformers][and][direct voltage monitoring range to [300][600] volts, phase to phase].

c. Provide programming via a front panel display and a communication interface accessible by a computer.

d. Provide password secured programming stored in non-volatile EEPROM memory.

e. Provide digital communications in a Modbus [RTU] protocol via a [RS232C][RS485] serial port[and an independently addressable [RS232C][RS485] serial port].

f. Provide meter that calculates and stores average max/min demand values with time and date for all readings based on a user selectable sliding window averaging period.

g. Provide meter with programmable hi/low set limits with two dry contact relays when exceeding alarm conditions.

[h. Meter shall have two-way communication with the existing DAS. Provide a communications interface utilizing fiber-optic LC connection.]

][2.2.5.2 Electronic Watthour Meter

[JIS C 1210. Provide a switchgear style electronic programmable watthour meter, semi-flush mounted, as indicated. Meter can be either programmed at the factory or programmed in the field. Turn field programming device over to the Contracting Officer at completion of project. Coordinate meter to system requirements.

a. Design: Provide meter designed for use on a 3-phase, 4-wire, [210Y/105][208Y/120][440Y/254][420Y/242][480Y/277] volt system with 3 current transformers. Include necessary KYZ pulse initiation hardware for Energy Monitoring and Control System (EMCS).

b. Coordination: Provide meter coordinated with ratios of current transformers and transformer secondary voltage.

c. Class: 20. Accuracy: plus or minus 1.0 percent. Finish: Class II.

d. Kilowatt-hour Register: five digit electronic programmable type.

e. Demand Register:

(1) Provide solid state.

(2) Display actual values and readings of the metered circuit. No multipliers must be required.

(3) Demand interval length: programmed for [15][30][60] minutes with rolling demand up to six subintervals per interval.

f. Meter fusing: Provide a fuse block mounted in the metering compartment containing one fuse per phase to protect the voltage input to the watthour meter. Size fuses as recommended by the meter manufacturer.

g. Provide meter with a communications port, RS485, with Modbus RTU serial or Ethernet, Modbus-TCP communications.

JIS C 1731-1. Provide single ratio transformers, [50][60] hertz, [_____] to 5-ampere ratio, [_____] rating factor, with a metering accuracy class of 0.3 through [_____].

[Provide a fuse block mounted in the metering compartment containing one fuse per phase to protect the voltage input to voltage sensing meters. Size fuses as recommended by the meter manufacturer.

]]][2.2.5.3 Submetering

. Provide submetering for [_____] [in accordance with drawings].

]][2.2.6 Transformer

Provide transformer section in switchgear as indicated. Provide the transformer and section that is suitable for the installation. Provide a transformer conforming to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

][2.2.7 Heaters

Provide [105][120]-volt heaters in each switchgear section. Provide heaters of sufficient capacity to control moisture condensation in the section, 250 watts minimum, and controlled by a thermostat[and humidistat] located in the section. Provide industrial type thermostat, high limit, to maintain sections within the range of 15 to 32 degrees C.[Provide humidistat with a range of 30 to 60 percent relative humidity.] Obtain supply voltage for the heaters from a control power transformer within the switchgear. If heater voltage is different than switchgear voltage, provide transformer rated to carry 125 percent of heater full load rating. Provide transformer with a 220 degrees C insulation system with a temperature rise not exceeding 115 degrees C and conforming to JIS C 61558-1.[Energize electric heaters in switchgear assemblies while the equipment is in storage or in place prior to being placed in service.

Provide method for easy connection of heater to external power source. Provide temporary, reliable external power source if commercial power at rated voltage is not available on site.]

]2.2.8 Terminal Boards

Provide with engraved plastic terminal strips and screw type terminals for external wiring between components and for internal wiring between removable assemblies. Provide short-circuiting type terminal boards associated with current transformer. Terminate conductors for current transformers with ring-tongue lugs. Provide terminal board identification that is identical in similar units. Provide color coded external wiring that is color coded consistently for similar terminal boards.

2.2.9 Wire Marking

Mark control and metering conductors at each end. Provide factory installed, white, plastic tubing, heat stamped with black block type letters on factory-installed wiring. On field-installed wiring, provide white, preprinted, polyvinyl chloride (PVC) sleeves, heat stamped with black block type letters. Provide a single letter or number on each sleeve, elliptically shaped to securely grip the wire, and keyed in such a manner to ensure alignment with adjacent sleeves. Provide specific wire markings using the appropriate combination of individual sleeves. Indicate on each wire marker the device or equipment, including specific terminal number to which the remote end of the wire is attached.

2.3 MANUFACTURER'S NAMEPLATE

Provide a nameplate on each item of equipment bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent is not acceptable. This nameplate and method of attachment may be the manufacturer's standard if it contains the required information.

2.4 FIELD FABRICATED NAMEPLATES

JIS K 6911. Provide laminated plastic nameplates for each switchgear, equipment enclosure, relay, switch, and device; as specified in this section or as indicated on the drawings. Identify on each nameplate inscription the function and, when applicable, the position. Provide nameplates of melamine plastic, 3 mm thick, white with [black][_____] center core.[Provide red laminated plastic label with white center core where indicated.] Provide matte finish surface. Provide square corners. Accurately align lettering and engrave into the core. Provide nameplates with minimum size of 25 by 65 mm. Provide lettering that is a minimum of 6.35 mm high normal block style.

2.5 SOURCE QUALITY CONTROL

2.5.1 Equipment Test Schedule

The Government reserves the right to witness tests. Provide equipment test schedules for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled date.

Provide the following as part of test equipment calibration:

a. Provide a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

b. Accuracy: Traceable to the National Institute of Standards and Technology.

c. Instrument calibration frequency schedule: less than or equal to 12 months for both test floor instruments and leased specialty equipment.

d. Dated calibration labels: visible on all test equipment.

e. Calibrating standard: higher accuracy than that of the instrument tested.

f. Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:

(1) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.

(2) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

2.5.2 Switchgear Design Tests

JIS C 8201-1.

2.5.2.1 Design Tests

Furnish documentation showing the results of design tests on a product of the same series and rating as that provided by this specification.

a. Short-circuit current test.

b. Enclosure tests.

c. Dielectric test.

[2.5.2.2 Additional Design Tests

In addition to normal design tests, perform the following tests on the actual equipment. Furnish reports which include results of design tests performed on the actual equipment.

a. Temperature rise tests.

b. Continuous current.

]2.5.3 Switchgear Production Tests

Furnish reports which include results of production tests performed on the actual equipment for this project. These tests include:

a. [50][60]-hertz dielectric tests.

b. Mechanical operation tests.

c. Electrical operation and control wiring tests.

d. Ground fault sensing equipment test.

[2.6 COORDINATED POWER SYSTEM PROTECTION

Provide a power system study as specified in Section 26 28 01.00 10 COORDINATED POWER SYSTEM PROTECTION.

]2.7 ARC FLASH WARNING LABEL

Provide warning label of potential electrical arc flash hazards for switchgear in accordance with NFPA 70E and JIS Z 9101.

[2.8 SERVICE ENTRANCE AVAILABLE FAULT CURRENT LABEL

Provide label on exterior of switchgear used as service equipment listing the maximum available fault current at that location. Include on the label the date that the fault calculation was performed and the contact information for the organization that completed the calculation. Locate this self-adhesive warning label on the outside of the switchgear. Provide label format as indicated.

][2.9 MIMIC BUS LABELING

Provide a mimic bus on the front of the equipment to diagrammatically show the internal bus structure of the lineup.

]PART 3 EXECUTION

3.1 INSTALLATION

Conform to IEEE C2 and JIS C 0365 and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

[3.2 GROUNDING

IEEE C2 and JIS C 0365, except that grounds and grounding systems with a resistance to solid earth ground not exceeding [25][_____] ohms.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Connect ground conductors to the upper end of the ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Equipment Grounding

Provide bare copper cable not smaller than [100 sqmm][] not less than 610 mm below grade connecting to the indicated ground rods. When work in addition to that indicated or specified is directed to obtain the specified ground resistance, the provision of the contract covering "Changes" applies.

3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector. Install exothermic welds and compression connectors as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.2.4 Grounding and Bonding Equipment

JIS C 60364-5-54, except as indicated or specified otherwise.

]3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect equipment furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.3.1 Switchgear

JIS C 8201-1.

3.3.2 Meters and Instrument Transformers

JIS C 1210.

3.3.3 Field Applied Painting

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.3.4 Galvanizing Repair

Repair damage to galvanized coatings per manufacturer's recommendations, zinc rich paint, for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces that repair paint has been applied to.

3.3.5 Field Fabricated Nameplate Mounting

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.4 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

3.4.1 Exterior Location

Mount switchgear on concrete slab as follows:

a. Unless otherwise indicated, provide the slab with dimensions at least 200 mm thick, reinforced with a 150 by 150 mm - MW19 by MW19 (6 by 6 - W2.9 by W2.9) mesh placed uniformly 100 mm from the top of the slab.

b. Place slab on a 150 mm thick, well-compacted gravel base.

c. Install slab such that the top of the concrete slab is approximately 100 mm above the finished grade.

d. Provide edges above grade with 15 mm chamfer.

e. Provide slab of adequate size to project at least 200 mm beyond the equipment.

f. Provide conduit turnups and cable entrance space required by the equipment to be mounted.

g. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant.

h. Cut off and bush conduits 75 mm above slab surface.

i. Provide concrete work as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.4.2 Interior Location

Mount switchgear on concrete slab as follows:

a. Unless otherwise indicated, provide the slab with dimensions at least 100 mm thick.

b. Install slab such that the top of the concrete slab is approximately 100 mm above the finished floor.

c. Provide edges above floor with 15 mm chamfer.

d. Provide slab of adequate size to project at least [200 mm][ ] beyond the equipment.

e. Provide conduit turnups and cable entrance space required by the equipment to be mounted.

f. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant.

g. Cut off and bush conduits 75 mm above slab surface.

h. Provide concrete work as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

i. Provide duct sealing in conduits after cables are installed to prevent entrance of insects and moisture.

3.5 FIELD QUALITY CONTROL

[Submit request for settings of breakers to the Contracting Officer after approval of switchgear and at least 30 days in advance of their requirement.

][Submit Required Settings of breakers to the Contracting Officer after approval of switchgear and at least 30 days in advance of their requirement.

]3.5.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests,

performed in accordance with Denki Hoan Kyoukai.

3.5.1.1 Switchgear

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical, electrical, and mechanical condition.

(3) Verify appropriate anchorage, required area clearances, and correct alignment.

(4) Clean switchgear and verify shipping bracing, loose parts, and documentation shipped inside cubicles have been removed.

(5) Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.

(6) Verify that[fuse and] circuit breaker sizes and types correspond to approved shop drawings as well as to the circuit breaker's address for microprocessor-communication packages.

[(7) Verify that current transformer ratios correspond to approved shop drawings.

] (8) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(9) Confirm correct operation and sequencing of electrical and mechanical interlock systems.

(10) Confirm correct application of manufacturer's recommended lubricants.

(11) Inspect insulators for evidence of physical damage or contaminated surfaces.

(12) Verify correct barrier and shutter installation[and operation].

(13) Exercise all active components.

(14) Inspect all mechanical indicating devices for correct operation.

(15) Verify that filters are in place and vents are clear.

(16) Test operation, alignment, and penetration of instrument transformer withdrawal disconnects.

(17) Inspect control power transformers.

b. Electrical Tests

(1) Perform insulation-resistance tests on each bus section.

(2) Perform dielectric withstand voltage tests.

(3) Perform insulation-resistance test on control wiring; Do not perform this test on wiring connected to solid-state components.

(4) Perform control wiring performance test.

(5) Perform primary current injection tests on the entire current circuit in each section of assembly.

[(6) Perform phasing check on double-ended switchgear to ensure correct bus phasing from each source.

][(7) Verify operation of switchgear heaters.

]3.5.1.2 Circuit Breakers - Low Voltage - Power

a. Visual and Mechanical Inspection

(1) Compare nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Inspect anchorage, alignment, and grounding.

(4) Verify that all maintenance devices are available for servicing and operating the breaker.

(5) Inspect arc chutes.

(6) Inspect moving and stationary contacts for condition, wear, and alignment.

(7) Verify that primary and secondary contact wipe and other dimensions vital to satisfactory operation of the breaker are correct.

(8) Perform all mechanical operator and contact alignment tests on both the breaker and its operating mechanism.

(9) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(10) Verify cell fit and element alignment.

(11) Verify racking mechanism.

(12) Confirm correct application of manufacturer's recommended lubricants.

b. Electrical Tests

(1) Perform contact-resistance tests on each breaker.

(2) Perform insulation-resistance tests.

(3) Adjust Breaker(s) for final settings in accordance with Government

provided settings.

(4) Determine long-time minimum pickup current by primary current injection.

(5) Determine long-time delay by primary current injection.

[(6) Determine short-time pickup and delay by primary current injection.

][(7) Determine ground-fault pickup and delay by primary current injection.

][(8) Determine instantaneous pickup value by primary current injection.

][(9) Activate auxiliary protective devices, such as ground-fault or undervoltage relays, to ensure operation of shunt trip devices; Check the operation of electrically-operated breakers in their cubicle.

] (10) Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, and antipump function.

(11) Verify operation of charging mechanism.

3.5.1.3 Current Transformers

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify correct connection.

(4) Verify that adequate clearances exist between primary and secondary circuit.

(5) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(6) Verify that all required grounding and shorting connections provide good contact.

b. Electrical Tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

(2) Perform insulation-resistance tests.

(3) Perform polarity tests.

(4) Perform ratio-verification tests.

3.5.1.4 Metering and Instrumentation

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify tightness of electrical connections.

b. Electrical Tests

(1) Determine accuracy of meters at 25, 50, 75, and 100 percent of full scale.

(2) Calibrate watthour meters according to manufacturer's published data.

(3) Verify all instrument multipliers.

(4) Electrically confirm that current transformer and voltage transformer secondary circuits are intact.

3.5.1.5 Grounding System

a. Visual and Mechanical Inspection

(1) Inspect ground system for compliance with contract plans and specifications.

b. Electrical Tests

(1) JIS C 60364-6. Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. Use an instrument equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

(2) Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.5.2 Follow-Up Verification

Upon completion of acceptance checks, settings, and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. Trip circuit

breakers by operation of each protective device. Test each item to perform its function not less than three times. As an exception to requirements stated elsewhere in the contract, provide the Contracting Officer 5 working days advance notice of the dates and times for checks, settings, and tests.

-- End of Section --

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SECTION 26 24 13

SWITCHBOARDS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Contractor may substitute compatible Japan Industrial Standard (JIS), Ministry of Land, Infrastructure and Transport (MLIT), Japan Electrical Safety Inspection Associations or Japanese Architectural Standard Specifications (JASS) for non-Japanese standards, as approved by the Contracting Officer's representative.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

JAPANESE ARCHITECTURAL STANDARD SPECIFICAITONS (JASS)

JASS 6	(2015) Structural Steelwork Specification for Building Construction

JAPAN ELECTRICAL SAFETY INSPECTION ASSOCIATIONS

Denki Hoan Kyoukai	Japan Standard for Acceptance Testing and Inspections

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS B 1048	(2007) Fasteners - Hot Dip Galvanized Coatings
JIS C 0365	(2007) Protection Against Electric Shock - Common Aspects for Installation and Equipment
JIS C 1210	(1979) General Rules for Electricity Meters
JIS C 1731-1	(1998) Instrument Transformers for Testing Purpose and Used with General Instrument Part 1: Current Transformer
JIS C 2110-1	(2016) Solid electrical insulation materials-Test methods for strength of dielectric breakdown-Part 1: Tests by applying commercial frequency alternating voltage
JIS C 5381-11	(2014) Low-voltage surge protective devices -- Part 11: Surge protective devices connected to low-voltage power systems -- Requirements and test methods

JIS C 8201-2-1	(2011) Low-Voltage Switchgear and Control Gear - Part 2-1: Circuit-Breakers
JIS C 8201-2-2	(2011) Low-Voltage Switchgear And Control Gear - Part 2-2: Circuit-Breakers Incorporating Residual Current Protection
JIS C 8269-1	(2016) Low-Voltage Fuses -- Part 1: General Requirements
JIS C 8269-2	(2013) Low voltage fuse-Part 2: Additional requirements for expert fuses(Mainly industrial fuses)
JIS C 8462-1	(2012) Boxes and enclosures for electrical accessories for household and similar fixed electrical installations -- Part 1: General requirements
JIS C 8480	(R2016) Box-Type Switchgear Assemblies for Low-Voltage Distribution Purpose
JIS C 60364-5-54	(2006) Building Electrical Equipment-Part 5-54: Selection Of Electrical Equipment and Contruction-Grounding Equipment, Protective Conductor and Protective Bonding Conductor
JIS C 60364-6	(2010) Low-voltage electrical installations -- Part 6: Verification
JIS C 61000-4-5	(2018) Electromagnetic compatibility-Part 4-5: Test and measurement techniques-Surge immunity test
JIS C 61558-1	(2019) Safety of transformers, reactors, power supply units and combinations thereof -- Part 1: General requirements and tests
JIS G 3352	(2014) Deck Plate
JIS G 3601	(2012) Stainless clad steel
JIS G 4304	(2012) Hot-Rolled Stainless Steel Plate, Sheet and Strip
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS K 6911	(2006) Thermosetting plastic general test method
JIS Z 2371	(2015) Methods of Salt Spray Testing
JIS Z 9101	(2018) Graphical symbols -- Safety colours and safety signs -- Part 1: Design principles for safety signs and safety markings

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70E (2018; TIA 18-1; TIA 81-2) Standard for Electrical Safety in the Workplace

1.2 RELATED REQUIREMENTS

Section 26 08 00 APPARATUS INSPECTION AND TESTING applies to this section, with the additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor QC approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29, SUSTAINABITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Switchboard Drawings; G[, [_____]]

SD-03 Product Data

Switchboard; G[, [_____]]

SD-06 Test Reports

Switchboard Design Tests;

SD-10 Operation and Maintenance Data

Switchboard Operation and Maintenance, Data Package 5;

SD-11 Closeout Submittals

Assembled Operation and Maintenance Manuals;

Equipment Test Schedule;

[Request for Settings;

][Required Settings;
]
[Service Entrance Available Fault Current Label;

]1.5 QUALITY ASSURANCE

1.5.1 Product Data

Include manufacturer's information on each submittal for each component, device and accessory provided with the switchboard including:

a. Circuit breaker type, interrupting rating, and trip devices, including available settings.

b. Manufacturer's instruction manuals and published time-current curves (in electronic format) of the main secondary breaker and largest secondary feeder device.

1.5.2 Switchboard Drawings

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Identify circuit terminals on wiring diagrams and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Indicate on the drawings adequate clearance for operation, maintenance, and replacement of operating equipment devices. Include the nameplate data, size, and capacity on submittal. Also include applicable federal, military, industry, and technical society publication references on submittals. Include the following:

a. One-line diagram including breakers[, fuses][, current transformers, and meters].

b. Outline drawings including front elevation, section views, footprint, and overall dimensions.

c. Bus configuration including dimensions and ampere ratings of bus bars.

d. Markings and rated IP code nameplate data[, including fuse information (manufacturer's name, catalog number, and ratings)].

e. Circuit breaker type, interrupting rating, and trip devices, including available settings.

f. Wiring diagrams and elementary diagrams with terminals identified, and indicating prewired interconnections between items of equipment and the interconnection between the items.

g. Manufacturer's instruction manuals and published time-current curves (in electronic format) of the main secondary breaker and largest secondary feeder device. Use this information (designer of record) to provide breaker settings that ensures protection and coordination are achieved. [For Navy installations, provide electronic format curves using SKM's Power Tools for Windows device library electronic format or EasyPower device library format depending on installation modeling software requirements.]

[h. Provisions for future expansion by adding switchboard sections.

]1.5.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" or "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with the mandatory and advisory provisions of applicable codes and standards unless more stringent requirements are specified or indicated.

1.5.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship, and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 year prior to date of delivery to site are not acceptable.

1.6 MAINTENANCE

1.6.1 Switchboard Operation and Maintenance Data

Submit Operation and Maintenance Manuals in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.6.2 Assembled Operation and Maintenance Manuals

Assemble and securely bind manuals in durable, hard covered, water resistant binders. Assemble and index the manuals in the following order with a table of contents:

a. Manufacturer's O&M information required by the paragraph SD-10, OPERATION AND MAINTENANCE DATA.

b. Catalog data required by the paragraph SD-03, PRODUCT DATA.

c. Drawings required by the paragraph SD-02, SHOP DRAWINGS.

d. Prices for spare parts and supply list.

[e. Information on metering.

] f. Design test reports.

g. Production test reports.

1.7 WARRANTY

Provide equipment items that are supported by service organizations reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be switchboards and related accessories are specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION, and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.2 SWITCHBOARD

JIS C 8480.

2.2.1 Ratings

Provide equipment with the following ratings:

a. Voltage rating: [480Y/277][208Y/120][440][440Y/254][420Y/242][220][210Y/105][_____] volts AC, [50][60] hertz, [three-phase, [3][4]-wire][as indicated].

b. Continuous current rating of the main bus: [_____ amperes][as indicated].

c. Short-circuit current rating: [_____ rms symmetrical amperes][as indicated].

d. UL listed and labeled[as service entrance equipment].

2.2.2 Construction

Provide the following:

a. Switchboard: consisting of one or more vertical sections[bolted together to form a rigid assembly] and [rear][front and rear] aligned[as indicated].

b. All circuit breakers: front accessible.

[c. Rear aligned switchboards: front accessible load connections.

][d. Front and rear aligned switchboards[: rear accessible load connections].

] e. Where indicated, "space for future" or "space" means to include a vertical bus provided behind a blank front cover. Where indicated, "provision for future" means full hardware provided to mount a breaker suitable for the location.

f. Completely factory engineered and assembled, including protective devices and equipment indicated with necessary interconnections, instrumentation, and control wiring.

2.2.2.1 Enclosure

Provide the following:

a. Enclosure: [indoor][weatherproof] IP rated per JIS C 8462-1[as indicated][fabricated entirely of 12 gauge, type 304 or 304L stainless steel] per JIS G 3601 and JIS G 4304.

b. Enclosure: bolted together with removable bolt-on side and[hinged] rear covers[, and sloping roof downward toward rear].

[c. Front[and rear] doors: provided with[stainless steel] padlockable vault handles with a three point catch.

][d. Bases, frames and channels of enclosure: corrosion resistant and fabricated of[type 304 or 304L stainless steel][or][galvanized steel]JIS G 3601 and JIS G 4304.

] e. Base: includes any part of enclosure that is within 75 mm of concrete pad.

[f. Galvanized steel: JIS H 8641 and JIS G 3352 coating, and JIS B 1048 and JIS H 8641, as applicable. Galvanize after fabrication where practicable.

] g. Paint color: light gray over rust inhibitor.

[h. Paint coating system: comply with[JIS C 8480 for galvanized steel][and][JIS Z 2371 for stainless steel].

]2.2.2.2 Bus Bars

Provide the following:

a. Bus bars: [copper with silver-plated contact surfaces][or][aluminum with tin-plated contact surfaces].

(1) Phase bus bars: [uninsulated][insulated with a tape wrap or insulating sleeve providing a minimum breakdown voltage in accordance with JIS C 2110-1].

(2) Neutral bus: rated [100][_____] percent of the main bus continuous current rating[as indicated].

b. Make bus connections and joints with hardened steel bolts.

c. Main-bus (through bus): rated at the full ampacity of the main throughout the switchboard.

d. Minimum 6.35 mm by 50.8 mm copper ground bus secured to each vertical section along the entire length of the switchboard.

2.2.2.3 Main Section

Provide the main section consisting of[a combination section with[molded-case circuit breakers] for the[main and] branch devices as indicated][main lugs only][an individually mounted [fixed][air power circuit breaker[with current-limiting fuses]][insulated-case circuit breaker][molded-case circuit breaker]][and utility transformer compartment].

[2.2.2.4 Distribution Sections

Provide the distribution section[s] consisting of[[individually mounted,]][air power circuit breakers[with current-limiting fuses]][insulated-case circuit breakers][molded-case circuit breakers][and utility transformer compartments] as indicated.

][2.2.2.5 Auxiliary Sections

Provide auxiliary sections consisting of indicated[instruments,][metering equipment,][control equipment,][transformer,][and][current transformer compartments] as indicated.

][2.2.2.6 Handles

Provide handles for individually mounted devices of the same design and method of external operation. Label handles prominently to indicate device ampere rating, color coded for device type. Identify ON-OFF indication by handle position and by prominent marking.

]2.2.3 Protective Device

Provide[main and] branch protective devices as indicated.

[2.2.3.1 Power Circuit Breaker

Provide the following:

a. JIS C 8201-2-1 and JIS C 8201-2-2. [120 Vac][100 Vac][electrically][manually] operated [stationary], [unfused][fused], low-voltage power circuit breaker with a short-circuit current rating[of [_____] rms amperes symmetrical][as indicated] at [_____] volts.

b. Breaker frame size: [as indicated][[_____] amperes].

[c. Equip electrically operated breakers with motor-charged, stored-energy closing mechanism to permit rapid and safe closing of the breaker against fault currents within the short time rating of the breaker, independent of the operator's strength or effort in closing the handle.

]][2.2.3.2 Insulated-Case Breaker

Provide the following:

a. JIS C 8201-2-1. UL listed and labeled,[100 percent rated main breaker][standard rated branch breakers],[electrically] [manually]

operated, low voltage, insulated-case circuit breaker, with a short-circuit current rating[of [_____] rms symmetrical amperes][as indicated] at [_____] volts.

b. Breaker frame size: [[_____] amperes][as indicated].

c. Series rated circuit breakers are unacceptable.

][2.2.3.3 Molded-Case Circuit Breaker

Provide the following:

a. JIS C 8201-2-1. UL listed and labeled,[100 percent rated main breaker][standard rated branch breakers],[electrically][manually] operated, low voltage molded-case circuit breaker, with a short-circuit current rating of[[_____] rms symmetrical amperes][as indicated] at [_____] volts.

b. Breaker frame size: [[_____] amperes][as indicated].

c. Series rated circuit breakers are unacceptable.

][2.2.3.4 Fusible Switches

Provide the following:

a. Fusible Switches: quick-make, quick-break, hinged-door type.

[b. Switches serving as motor disconnects: horsepower rated.

] c. Fuses: current-limiting cartridge type conforming to[, Class [RK1][RK5] for 0 to 600 amperes] per JIS C 8269-1 and JIS C 8269-2.

d. Fuseholders: [JIS C 8269-1 and JIS C 8269-2].

][2.2.3.5 Integral Combination Breaker and Current-Limiting Fuses

Provide the following:

a. JIS C 8201-2-1.

b. Integral combination molded-case circuit breaker and current-limiting fuses:[as indicated][rated [_____] amperes] with a minimum short-circuit-current rating equal to the short-circuit-current rating of the switchboard in which the circuit breaker will be mounted.

c. Series rated circuit breakers are unacceptable.

d. Coordination of overcurrent devices of the circuit breaker and current-limiting fuses: for overloads or fault currents of relatively low value, the overcurrent device of the breaker operates to clear the fault. The current-limiting fuses operate to clear the fault for high magnitude short circuits above a predetermined value[crossover point].

e. Housing for the current-limiting fuses: an individual molding readily removable from the front and located at the load side of the circuit breaker. If the fuse housing is removed, a blown fuse is readily evident by means of a visible indicator.

f. Removal of fuse housing causes the breaker contacts to open, and the breaker contacts can not close with the fuse housing removed. The fuse housing can not be inserted with a blown fuse or with one fuse missing. The blowing of any of the fuses causes the circuit breaker contacts to open.

]2.2.4 Electronic Trip Units

Equip[main and][distribution] breakers[as indicated] with a solid-state tripping system consisting of three current sensors and a microprocessor-based trip unit that provides true rms sensing adjustable time-current circuit protection. Include the following:

a. Current sensors ampere rating: [as indicated][[_____] amperes][the same as the breaker frame rating].

b. Trip unit ampere rating: [as indicated][[_____] amperes].

[c. Ground fault protection: [as indicated][zero sequence sensing][residual type sensing].

][d. Electronic trip units: provide additional features[as indicated]:
]
[(1) [Indicated]Breakers: include long delay pick-up and time settings, and LED indication of cause of circuit breaker trip.

][(2) Main breakers: include[short delay pick-up and time settings][and][, instantaneous settings][and][ground fault settings][as indicated].

][(3) Distribution breakers: include[short delay pick-up and time settings][, instantaneous settings][, and ground fault settings][as indicated].

][(4) [Main]Breakers: include a digital display for phase and ground current.

][(5) [Main]Breakers: include a digital display for watts, vars, VA, kWh, kvarh, and kVAh.

][(6) [Main]Breakers: include a digital display for phase voltage, and percent THD voltage and current.

][(7) [Main]Breakers: include provisions for communication via a network twisted pair cable for remote monitoring and control. Provide the following communications protocol:[DNP3][Modbus][IEC 61850].

][(8) For electronic trip units that are rated for or can be adjusted to 1,200 amperes or higher, provide arc energy reduction capability with an energy-reducing maintenance switch with local status indicator.

][2.2.5 Metering

[2.2.5.1 Digital Meters

[JIS C 5381-11 and JIS C 61000-4-5 for surge withstand. [Metering shall be compliant with the current Advanced Meter Reading System (AMRS)

specification.] Provide true rms, plus/minus one percent accuracy, programmable, microprocessor-based meter enclosed in a sealed case with the following features.]

[Provide meter(s) and connect the meter(s) to the existing Advanced Meter Infrastructure Data Aquisition System (AMI DAS). The contractor shall use the existing government laptop computers to configure the meter using existing software loaded on the computer. The contractor will not be allowed to modify any software or add any additional software to the computer. Alternatively, the government will configure the meter(s), which must be compatible with the existing system, using existing software. Contract shall insure that the meter(s) will transmit the specified data to the DAS. Meters shall be compatible with the Base AMI DAS per NAVFAC Far East requirements.]

a. Display capability:

[(1) Multi-Function Meter: Display a selected phase to neutral voltage, phase to phase voltage, percent phase to neutral voltage THD, percent phase to phase voltage THD; a selected phase current, neutral current, percent phase current THD, percent neutral current; selected total PF, kW, KVA, kVAR, FREQ, kVAh, kWh. Detected alarm conditions include over/under current, over/under voltage, over/under KVA, over/under frequency, over/under selected PF/kVAR, voltage phase reversal, voltage imbalance, reverse power, over percent THD. Include a Form C KYZ pulse output relay on the meter.

][(2) Power Meter: Display Watts, VARs, and selected KVA/PF. Detected alarm conditions include over/under KVA, over/under PF, over/under VARs, over/under reverse power.

][(3) Volt Meter: Provide capability to be selectable between display of the three phases of phase to neutral voltages and display of the three phases of the phase to phase voltages. Detected alarm conditions include over/under voltage, over/under voltage imbalance, over percent THD.

][(4) Ammeter: Display phase A, B, and C currents. Detected alarm conditions include over/under current, over percent THD.

][(5) Digital Watthour Meter: Provide a single selectable display for watts, total kilowatt hours (kWh) and watt demand (Wd). Include a Form C KYZ pulse output relay on the meter.

] b. Design meters to accept[input from standard 5A secondary instrument transformers][and][direct voltage monitoring range to [300][600] volts, phase to phase].

c. Provide programming via a front panel display and a communication interface accessible by a computer.

d. Provide password secured programming stored in non-volatile EEPROM memory.

e. Provide digital communications in a Modbus [RTU] protocol via a [RS232C][RS485] serial port[and an independently addressable [RS232C][RS485] serial port].

f. Provide meter that calculates and stores average max/min demand values with time and date for all readings based on a user selectable sliding window averaging period.

g. Provide meter with programmable hi/low set limits with two dry contact relays when exceeding alarm conditions.

[h. Meter shall have two-way communication with the existing DAS. Provide a communications interface utilizing fiber-optic LC connection.]

][2.2.5.2 Electronic Watthour Meter

[JIS C 1210. Provide a switchboard style electronic programmable watthour meter, semi-flush mounted, as indicated. Meter can be either programmed at the factory or programmed in the field. Turn field programming device over to the Contracting Officer at completion of project. Coordinate meter to system requirements.

a. Design: Provide meter designed for use on a 3-phase, 4-wire, [208Y/120][210Y/105][480Y/277][440Y/254][420Y/242] volt system with 3 current transformers. Include necessary KYZ pulse initiation hardware for Energy Monitoring and Control System (EMCS).

b. Coordination: Provide meter coordinated with ratios of current transformers and transformer secondary voltage.

c. Class: 20. Accuracy: plus or minus 1.0 percent. Finish: Class II.

d. Kilowatt-hour Register: five digit electronic programmable type.

e. Demand Register:

(1) Provide solid state.

(2) Meter reading multiplier: Indicate multiplier on the meter face.

(3) Demand interval length: programmed for [15][30][60] minutes with rolling demand up to six subintervals per interval.

f. Meter fusing: Provide a fuse block mounted in the metering compartment containing one fuse per phase to protect the voltage input to the watthour meter. Size fuses as recommended by the meter manufacturer.

g. Provide meter with a communications port, RS485, with Modbus RTU serial or Ethernet, Modbus-TCP communications.

JIS C 1731-1. Provide single ratio transformers, [60 hertz][50 hertz], [_____] to 5-ampere ratio, [_____] rating factor, with a metering accuracy class of 0.3 through [_____].

[Provide a fuse block mounted in the metering compartment containing one fuse per phase to protect the voltage input to voltage sensing meters. Size fuses as recommended by the meter manufacturer.

]]][2.2.5.3 Submetering

Provide submetering for [_____] [in accordance with drawings].

]][2.2.6 Transformer

Provide transformer section in switchboard in accordance with JIS C 8480 and as indicated. Provide the transformer and section that is suitable for the installation.[Test transformers greater than 10 kVA in accordance with JIS C 8480.] Provide a transformer conforming to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

][2.2.7 Heaters

Provide [120-volt][100-volt] heaters in each switchboard section. Provide heaters of sufficient capacity to control moisture condensation in the section, 250 watts minimum, and controlled by a thermostat[and humidistat] located in the section. Provide industrial type thermostat, high limit, to maintain sections within the range of 15 to 32 degrees C.[Provide humidistat with a range of 30 to 60 percent relative humidity.] Obtain supply voltage for the heaters from a control power transformer within the switchboard. If heater voltage is different than switchboard voltage, provide transformer rated to carry 125 percent of heater full load rating. Provide transformer with a 220 degrees C insulation system with a temperature rise not exceeding 115 degrees C and conforming to JIS C 61558-1.[Energize electric heaters in switchboard assemblies while the equipment is in storage or in place prior to being placed in service. Provide method for easy connection of heater to external power source. Provide temporary, reliable external power source if commercial power at rated voltage is not available on site.]

]2.2.8 Terminal Boards

Provide with engraved plastic terminal strips and screw type terminals for external wiring between components and for internal wiring between removable assemblies. Provide short-circuiting type terminal boards associated with current transformer. Terminate conductors for current transformers with ring-tongue lugs. Provide terminal board identification that is identical in similar units. Provide color coded external wiring that is color coded consistently for similar terminal boards.

2.2.9 Wire Marking

Mark control and metering conductors at each end. Provide factory installed, white, plastic tubing, heat stamped with black block type letters on factory-installed wiring. On field-installed wiring, provide white, preprinted, polyvinyl chloride (PVC) sleeves, heat stamped with black block type letters. Provide a single letter or number on each sleeve, elliptically shaped to securely grip the wire, and keyed in such a manner to ensure alignment with adjacent sleeves. Provide specific wire markings using the appropriate combination of individual sleeves. Indicate on each wire marker the device or equipment, including specific terminal number to which the remote end of the wire is attached.

2.3 MANUFACTURER'S NAMEPLATE

Provide a nameplate on each item of equipment bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent is not acceptable. This nameplate and method of attachment may be the manufacturer's standard if it contains the required information.

2.4 FIELD FABRICATED NAMEPLATES

JIS K 6911. Provide laminated plastic nameplates for each switchboard, equipment enclosure, relay, switch, and device; as specified in this section or as indicated on the drawings. Identify on each nameplate inscription the function and, when applicable, the position. Provide nameplates of melamine plastic, 3 mm thick, white with [black][_____] center core.[Provide red laminated plastic label with white center core where indicated.] Provide matte finish surface. Provide square corners. Accurately align lettering and engrave into the core. Provide nameplates with minimum size of 25 by 65 mm. Provide lettering that is a minimum of 6.35 mm high normal block style.

2.5 SOURCE QUALITY CONTROL

2.5.1 Equipment Test Schedule

The Government reserves the right to witness tests. Provide equipment test schedules for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled date.

Provide the following as part of test equipment calibration:

a. Provide a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

b. Accuracy: Traceable to the National Institute of Standards and Technology.

c. Instrument calibration frequency schedule: less than or equal to 12 months for both test floor instruments and leased specialty equipment.

d. Dated calibration labels: visible on all test equipment.

e. Calibrating standard: higher accuracy than that of the instrument tested.

f. Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:

    (1) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.

    (2) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

2.5.2 Switchboard Design Tests

JIS C 8480.

2.5.2.1 Design Tests

Furnish documentation showing the results of design tests on a product of the same series and rating as that provided by this specification.

a. Short-circuit current test.

b. Enclosure tests.

c. Dielectric test.

[2.5.2.2 Additional Design Tests

In addition to normal design tests, perform the following tests on the actual equipment. Furnish reports which include results of design tests performed on the actual equipment.

a. Temperature rise tests.

b. Continuous current.

]2.5.3 Switchboard Production Tests

JIS C 8480. Furnish reports which include results of production tests performed on the actual equipment for this project. These tests include:

a. [60-hertz][50-hertz] dielectric tests.

b. Mechanical operation tests.

c. Electrical operation and control wiring tests.

d. Ground fault sensing equipment test.

[2.6 COORDINATED POWER SYSTEM PROTECTION

Provide a power system study as specified in Section 26 28 01.00 10 COORDINATED POWER SYSTEM PROTECTION.

]2.7 ARC FLASH WARNING LABEL

Provide warning label of potential electrical arc flash hazards for switchboards in accordance with NFPA 70E and JIS Z 9101. .

[2.8 SERVICE ENTRANCE AVAILABLE FAULT CURRENT LABEL

Provide label on exterior of switchboards used as service equipment listing the fault current rating in accordance with NFPA 70E and JIS Z 9101. Locate this self-adhesive warning label on the outside of the switchboard.

]PART 3 EXECUTION

3.1 INSTALLATION

Conform to IEEE C2, JIS C 0365 and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

[3.2 GROUNDING

IEEE C2 and JIS C 0365, except that grounds and grounding systems with a resistance to solid earth ground not exceeding [25][_____] ohms.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Connect ground conductors to the upper end of the ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Equipment Grounding

Provide bare copper cable not smaller than [100 sqmm] not less than 610 mm below grade connecting to the indicated ground rods. When work in addition to that indicated or specified is directed to obtain the specified ground resistance, the provision of the contract covering "Changes" applies.

3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector. Install exothermic welds and compression connectors as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.2.4 Grounding and Bonding Equipment

JIS C 60364-5-54, except as indicated or specified otherwise.

]3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect equipment furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.3.1 Switchboard

JIS C 8480.

3.3.2 Meters and Instrument Transformers

JIS C 1210.

3.3.3 Field Applied Painting

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.3.4 Galvanizing Repair

Repair damage to galvanized coatings using JASS 6, zinc rich paint, for galvanizing damaged by handling, transporting, cutting, welding, or bolting. Do not heat surfaces that repair paint has been applied to.

3.3.5 Field Fabricated Nameplate Mounting

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.4 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

3.4.1 Exterior Location

Mount switchboard on concrete slab as follows:

a. Unless otherwise indicated, provide the slab with dimensions at least 200 mm thick, reinforced with a 150 by 150 mm - MW19 by MW19 (6 by 6 - W2.9 by W2.9) mesh placed uniformly 100 mm from the top of the slab.

b. Place slab on a 150 mm thick, well-compacted gravel base.

c. Install slab such that the top of the concrete slab is approximately 100 mm above the finished grade.

d. Provide edges above grade with 15 mm chamfer.

e. Provide slab of adequate size to project at least 200 mm beyond the equipment.

f. Provide conduit turnups and cable entrance space required by the equipment to be mounted.

g. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant.

h. Cut off and bush conduits 75 mm above slab surface.

i. Provide concrete work as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.4.2 Interior Location

Mount switchboard on concrete slab as follows:

a. Unless otherwise indicated, provide the slab with dimensions at least 100 mm thick.

b. Install slab such that the top of the concrete slab is approximately 100 mm above the finished grade.

c. Provide edges above grade with 15 mm chamfer.

d. Provide slab of adequate size to project at least [200 mm][ ] beyond the equipment.

e. Provide conduit turnups and cable entrance space required by the equipment to be mounted.

f. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant.

g. Cut off and bush conduits 75 mm above slab surface.

h. Provide concrete work as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.5 FIELD QUALITY CONTROL

[Submit request for settings of breakers to the Contracting Officer after approval of switchboard and at least 30 days in advance of their requirement.

][Submit Required Settings of breakers to the Contracting Officer after approval of switchboard and at least 30 days in advance of their requirement.

]3.5.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with Denki Hoan Kyoukai.

3.5.1.1 Switchboard Assemblies

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical, electrical, and mechanical condition.

(3) Verify appropriate anchorage, required area clearances, and correct alignment.

(4) Clean switchboard and verify shipping bracing, loose parts, and documentation shipped inside cubicles have been removed.

(5) Inspect all doors, panels, and sections for paint, dents, scratches, fit, and missing hardware.

(6) Verify that[fuse and] circuit breaker sizes and types correspond to approved shop drawings as well as to the circuit breaker’s address for microprocessor-communication packages.

[(7) Verify that current transformer ratios correspond to approved shop drawings.

] (8) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(9) Confirm correct operation and sequencing of electrical and mechanical interlock systems.

(10) Confirm correct application of manufacturer's recommended lubricants.

(11) Inspect insulators for evidence of physical damage or contaminated surfaces.

(12) Verify correct barrier installation[and operation].

(13) Exercise all active components.

(14) Inspect all mechanical indicating devices for correct operation.

(15) Verify that filters are in place and vents are clear.

(16) Test operation, alignment, and penetration of instrument transformer withdrawal disconnects.

(17) Inspect control power transformers.

b. Electrical Tests

(1) Perform insulation-resistance tests on each bus section.

(2) Perform dielectric withstand voltage tests.

(3) Perform insulation-resistance test on control wiring; Do not perform this test on wiring connected to solid-state components.

(4) Perform control wiring performance test.

(5) Perform primary current injection tests on the entire current circuit in each section of assembly.

[(6) Perform phasing check on double-ended switchboard to ensure correct bus phasing from each source.

][(7) Verify operation of switchboard heaters.

][3.5.1.2 Circuit Breakers - Low Voltage - Power

a. Visual and Mechanical Inspection

(1) Compare nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Inspect anchorage, alignment, and grounding.

(4) Verify that all maintenance devices are available for servicing and operating the breaker.

(5) Inspect arc chutes.

(6) Inspect moving and stationary contacts for condition, wear, and alignment.

(7) Verify that primary and secondary contact wipe and other dimensions vital to satisfactory operation of the breaker are correct.

(8) Perform all mechanical operator and contact alignment tests on both the breaker and its operating mechanism.

(9) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(10) Verify cell fit and element alignment.

(11) Verify racking mechanism.

(12) Confirm correct application of manufacturer's recommended lubricants.

b. Electrical Tests

(1) Perform contact-resistance tests on each breaker.

(2) Perform insulation-resistance tests.

(3) Adjust Breaker(s) for final settings in accordance with Government provided settings.

(4) Determine long-time minimum pickup current by primary current injection.

(5) Determine long-time delay by primary current injection.

[(6) Determine short-time pickup and delay by primary current injection.

][(7) Determine ground-fault pickup and delay by primary current injection.

][(8) Determine instantaneous pickup value by primary current injection.

][(9) Activate auxiliary protective devices, such as ground-fault or undervoltage relays, to ensure operation of shunt trip devices; Check the operation of electrically-operated breakers in their cubicle.

] (10) Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, and antipump function.

(11) Verify operation of charging mechanism.

]3.5.1.3 Circuit Breakers

[Low Voltage - Insulated-Case][and][Low Voltage Molded Case with Solid State Trips]

a. Visual and Mechanical Inspection

(1) Compare nameplate data with specifications and approved shop drawings.

(2) Inspect circuit breaker for correct mounting.

(3) Operate circuit breaker to ensure smooth operation.

(4) Inspect case for cracks or other defects.

(5) Inspect all bolted electrical connections for high resistance using low resistance ohmmeter, verifying tightness of accessible bolted connections and/or cable connections by calibrated torque-wrench method, or performing thermographic survey.

(6) Inspect mechanism contacts and arc chutes in unsealed units.

b. Electrical Tests

(1) Perform contact-resistance tests.

(2) Perform insulation-resistance tests.

(3) Perform Breaker adjustments for final settings in accordance with Government provided settings.

(4) Perform long-time delay time-current characteristic tests

[(5) Determine short-time pickup and delay by primary current injection.

][(6) Determine ground-fault pickup and time delay by primary current injection.

][(7) Determine instantaneous pickup current by primary injection.

][(8) Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, and anti-pump function.

]3.5.1.4 Current Transformers

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify correct connection.

(4) Verify that adequate clearances exist between primary and secondary circuit.

(5) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(6) Verify that all required grounding and shorting connections provide good contact.

b. Electrical Tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

(2) Perform insulation-resistance tests.

(3) Perform polarity tests.

(4) Perform ratio-verification tests.

3.5.1.5 Metering and Instrumentation

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify tightness of electrical connections.

b. Electrical Tests

(1) Determine accuracy of meters at 25, 50, 75, and 100 percent of full scale.

(2) Calibrate watthour meters according to manufacturer's published data.

(3) Verify all instrument multipliers.

(4) Electrically confirm that current transformer and voltage transformer secondary circuits are intact.

3.5.1.6 Grounding System

a. Visual and Mechanical Inspection

(1) Inspect ground system for compliance with contract plans and specifications.

b. Electrical Tests

(1) JIS C 60364-6. Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. Use an instrument equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

(2) Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.5.2 Follow-Up Verification

Upon completion of acceptance checks, settings, and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. Trip circuit

breakers by operation of each protective device. Test each item to perform its function not less than three times. As an exception to requirements stated elsewhere in the contract, provide the Contracting Officer 5 working days advance notice of the dates and times for checks, settings, and tests.

-- End of Section --

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SECTION 26 41 00

LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 81	(2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 780	(2020) Standard for the Installation of Lightning Protection Systems

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 4201	(2003) Protection of Structures Against Lightning
JIS C 60364-5-54	(2006) Building Electrical Equipment-Part 5-54: Selection Of Electrical Equipment and Contruction-Grounding Equipment, Protective Conductor and Protective Bonding Conductor

U.S. AIR FORCE (USAF)

AFI 32-1065	(2017) Grounding Systems

UNDERWRITERS LABORATORIES (UL)

UL 96	(2016) UL Standard for Safety Lightning Protection Components
UL 467	(2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment

1.2 RELATED REQUIREMENTS

1.2.1 Verification of Dimensions

Confirm all details of work, verify all dimensions in field, and advise Contracting Officer of any discrepancy before performing work. Obtain prior approval of Contracting Officer before making any departures from

the design.

1.2.2 System Requirements

Provide a system furnished under this specification consisting of the latest UL or JIS Listed products of a manufacturer regularly engaged in production of lightning protection system components. Comply with NFPA 70, NFPA 780, UL 96 or JIS A 4201.

For specific high-risk Air Force (AF) projects, such as explosives and communications facilities, the design shall reflect the more stringent NFPA/AFMAN requirements. Certification shall be executed by either third-party or AF-approved personnel in accordance with AFMAN standards.

1.2.3 Lightning Protection System Installers Documentation

Provide documentation showing that the installer is certified with a commercial third-party inspection company whose sole work is lightning protection, or is a UL Listed Lightning Protection Installer. In either case, the documentation must show that they have completed and passed the requirements for certification or listing, and have a minimum of 2 years documented experience installing lightning protection systems for DoD projects of similar scope and complexity.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Overall lightning protection system; G[, [_____]]

Each major component; G[, [_____]]

SD-06 Test Reports

Lightning Protection and Grounding System Test Plan; G[, [_____]]

Lightning Protection and Grounding System Test; G[, [_____]]

SD-07 Certificates

Lightning Protection System Installers Documentation; G[, [_____]]

Component UL or JIS Listed and Labeled; G[, [_____]]

Lightning protection system inspection certificate; G[, [_____]]

Roof manufacturer's warranty; G[, [_____]]

1.4 QUALITY ASSURANCE

In each standard referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" or "must" has been substituted

for "should" wherever it appears. Interpret references in these standards to "authority having jurisdiction," or words of similar meaning, to mean Contracting Officer.

1.4.1 Installation Drawings

1.4.1.1 Overall System Drawing

Submit installation shop drawing for the overall lightning protection system. Include on the drawings the physical layout of the equipment (plan view and elevations), mounting details, relationship to other parts of the work, and wiring diagrams.

1.4.1.2 Major Components

Submit detail drawings for each major component including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions.

1.4.2 Component UL or JIS Listed and Labeled

Submit proof of compliance that components are UL or JIS Listed and Labeled.

1.4.3 Lightning Protection and Grounding System Test Plan

Provide a lightning protection and grounding system test plan. Detail both the visual inspection and electrical testing of the system and components in the test plan. Identify (number) the system test points/locations along with a listing or description of the item to be tested and the type of test to be conducted. As a minimum, include a sketch of the facility and surrounding lightning protection system as part of the specific test plan for each structure. Include the requirements specified in paragraph, "Testing of Integral Lightning Protection System" in the test plan.

[1.4.4 Lightning Protection System Inspection Certificate

[Provide certification from a commercial third-party inspection company whose sole work is lightning protection, stating that the lightning protection system complies with NFPA 780 or JIS A 4201. Third party inspection company cannot be the system installer or the system designer.

][Provide certification from a commercial third-party inspection company whose sole work is lightning protection, stating that the lightning protection system complies with NFPA 780 and AFI 32-1065. Third party inspection company cannot be the system installer or the system designer.

] Inspection must cover every connection, air terminal, conductor, fastener, accessible grounding point and other components of the lightning protection system to ensure 100% system compliance. This includes witnessing the tests for the resistance measurements for ground rods with test wells, and for continuity measurements for bonds. It also includes verification of proper surge protective devices for power, data and telecommunication systems. Random sampling or partial inspection of a facility is not acceptable.

]1.5 SITE CONDITIONS

Confirm all details of work, verify all dimensions in field, and advise Contracting Officer of any discrepancy before performing work. Obtain prior approval of Contracting Officer before changing the design.

PART 2 PRODUCTS

2.1 MATERIALS

Do not use a combination of materials that forms an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, provide conductors with protective coatings, such as tin or lead, or oversize conductors. Where a mechanical hazard is involved, increase conductor size to compensate for the hazard or protect conductors. When metallic conduit or tubing is provided, electrically bond conductor to conduit or tubing at the upper and lower ends by clamp type connectors or welds (including exothermic). All lightning protection components, such as bonding plates, air terminals, air terminal supports and braces, chimney bands, clips, connector fittings, and fasteners are to comply with the requirements of UL 96 or JIS A 4201 classes as applicable.

2.1.1 Main and Bonding Conductors

NFPA 780, UL 96 or JIS A 4201 modified materials as applicable.

[2.1.2 Copper Only

Provide copper conductors, except where aluminum conductors are required for connection to aluminum equipment.

]2.2 COMPONENTS

2.2.1 Air Terminals

Provide solid air terminals with a blunt tip. Tubular air terminals are not permitted. Support air terminals more than 600 mm in length by suitable brace, supported at not less than one-half the height of the terminal.

2.2.2 Ground Rods

Provide [ground rods made of [copper-clad steel] [solid copper] conforming to conform to UL 467 or JIS C 60364-5-54.] Provide ground rods that are not less than 20 mm in diameter and 3000 mm in length. Do not mix ground rods of copper-clad steel or solid copper on the job.

[2.2.3 Grounding Plates

Provide grounding plates made of [copper-clad steel][iron][stainless steel] [solid copper] conforming to UL 96 or JIS A 4201.

]2.2.4 Connections and Terminations

Provide connectors for splicing conductors that conform to UL 96 or JIS A 4201, class as applicable. Conductor connections can be made by clamps or welds (including exothermic). Provide style and size connectors

required for the installation.

2.2.5 Connector Fittings

Provide connector fittings for "end-to-end", "Tee", or "Y" splices that conform to NFPA 780, UL 96, or JIS A 4201.

PART 3 EXECUTION

3.1 INTEGRAL SYSTEM

Provide a lightning protection system that meets the requirements of NFPA 780 or JIS A 4201[, including tie-ins to existing lightning protection systems]. Lightning protection system consists of air terminals, roof conductors, down conductors, ground connections, [and] grounding electrodes[and ground ring electrode conductor]. [Expose conductors on the structures except where conductors are required to be in protective sleeves.] Bond secondary conductors with grounded metallic parts within the building. Make interconnections within side-flash distances at or below the level of the grounded metallic parts.

3.1.1 Roof-Mounted Components

Coordinate with the roofing manufacturer and provide certification that the roof manufacturer's warranty is not violated by the installation methods for air terminals and roof conductors.

3.1.1.1 Air Terminals

[Use adhesive shoes with adhesive approved by the roof manufacturer when installing air terminals on "rubber" (EPDM) type roofs.] [In areas of snow or constant wind, ensure that a section of roofing material (minimum dimensional area of 92,900 square mm) is first glued to the roof and then the air terminal is glued to it unless the roof manufacturer recommends another solution.] [Use a standing seam base for installation of air terminals on a standing seam metal roof that does not produce any roof penetrations.]

3.1.1.2 Roof Conductors

[Use adhesive shoes with adhesive approved by the roof manufacturer when installing roof conductors on "rubber" (EPDM) type roofs.] [Use a standing seam base for installation of roof conductors on a standing seam metal roof that does not produce any roof penetrations.] [Roof conductors are to be concealed within the ceiling cavities as much as practicable.]

3.1.2 Down Conductors

Protect exposed down conductors from physical damage as required by NFPA 780 or JIS A 4201. Use Schedule 80 PVC to protect down conductors. Paint the Schedule 80 PVC to match the surrounding surface with paint that is approved for use on PVC. [Down conductors are to be concealed within the wall cavities.]

3.1.3 Ground Connections

Attach each down conductor [and ground ring electrode] to ground rods by welding (including exothermic), brazing, or compression. All connections to ground rods below ground level must be by exothermic weld connection or

with a high compression connection using a hydraulic or electric compression tool to provide the correct circumferential pressure. Accessible connections above ground level and in test wells can be accomplished by mechanical clamping.

3.1.4 Grounding Electrodes

Extend driven ground rods vertically into the existing undisturbed earth for a distance of not less 3000 mm. Set ground rods not less than 915 mm nor more than 2440 mm, from the structure foundation, and at least beyond the drip line for the facility. After the completed installation, measure the total resistance to ground using the fall-of-potential method described in IEEE 81. Maximum allowed resistance of a driven ground rod is [25] [_____] ohms, under normally dry conditions [when a ground ring electrode is not used]. Contact the Contracting Officer for direction on how to proceed when two of any three ground rods, driven not less than 3000 mm into the ground, a minimum of 3000 mm apart, and equally spaced around the perimeter, give a combined value exceeding 50 ohms immediately after having driven. [For ground ring electrode, provide continuous No. 1/0 bare stranded copper cable. Lay ground ring electrode around the perimeter of the structure in a trench not less than 915 mm nor more than 2440 mm from the nearest point of the structure foundation, and at least beyond the drip line for the facility. Install ground ring electrode to a minimum depth of 765 mm. Install a ground ring electrode in earth undisturbed by excavation, not earth fill, and do not locate beneath roof overhang, or wholly under paved areas or roadways where rainfall cannot penetrate to keep soil moist in the vicinity of the cable.]

[_____]

[3.1.5 Grounding Plates

Provide a grounding plate for each down conductor. Set grounding plates not less than 915 mm nor more than 2440 mm, from the structure foundation, and at least beyond the drip line for the facility. Grounding plate is to be buried as deeply in the existing dirt as local conditions allow, without exceeding 3000 mm in depth.

]3.2 APPLICATIONS

3.2.1 Nonmetallic Exterior Walls with Metallic Roof

Bond metal roof sections together which are insulated from each other so that they are electrically continuous, having a surface contact of at least 1935 square mm.

[3.2.2 Personnel Ramps and Covered Passageways

Place a down conductor and a driven ground at one of the corners where the ramp connects to each building or structure. Connect down conductor and driven ground to the ground ring electrode or nearest ground connection of the building or structure. Where buildings or structures and connecting ramps are clad with metal, separately bond the metal of the buildings and ramps to a down conductor as close to grade as possible.

]3.3 INTERFACE WITH OTHER STRUCTURES

[3.3.1 Fences

Bond metal fence and gate systems to the lightning protection system whenever the fence or gate is within 1830 mm of any part of the lightning protection system in accordance with ANSI C2.

][3.3.2 Exterior Overhead Systems

Bond to the nearest down conductor as close to grade as possible. This includes overhead pipes, conduits, cable trays, or any other metallic objects on the exterior of the building that enter a building. In addition, bond pipes, conduits, and cable trays to any metallic objects (such as steel structural support of air handling units or cooling towers) that are within 1830 mm.

]3.4 RESTORATION

Where sod has been removed, place sod as soon as possible after completing the backfilling. Restore, to original condition, the areas disturbed by trenching, storing of dirt, cable laying, and other work. Overfill to accommodate for settling. Include necessary topsoil, fertilizing, liming, seeding, sodding, sprigging or mulching in any restoration. Maintain disturbed surfaces and replacements until final acceptance.

3.5 FIELD QUALITY CONTROL

3.5.1 Lightning Protection and Grounding System Test

Test the lightning protection and grounding system to ensure continuity is not in excess of 1 ohm and that resistance to ground is not in excess of [25] [_____] ohms. Provide documentation for the measured values at each test point. Test the ground rod for resistance to ground before making connections to the rod. Tie the grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Include in the written report: locations of test points, measured values for continuity and ground resistances, and soil conditions at the time that measurements were made. Submit results of each test to the Contracting Officer.

-- End of Section --

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SECTION 26 51 00

INTERIOR LIGHTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Contractor may substitute compatible Japan Industrial Standard (JIS), Japan Luminaires Association (JIL) as approved by the Contracting Officer's representative.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS C 0365	(2007) Protection Against Electric Shock - Common Aspects for Installation and Equipment
JIS C 0920	(2003) Degrees Of Protection Provided By Enclosures (IP Code)
JIS C 7617-1	(2017) Double-capped fluorescent lamps -- Part 1: Safety specifications
JIS C 7620-1	(2017) Self-ballasted fluorescent lamps for general lighting service -- Part 1: Safety specifications
JIS C 8105-1	(2017) Luminaires - Part 1: General Requirements For Safety
JIS C 8105-2-22	(2014) Luminaires - Part 2-22: Particular Requirements - Luminaires For Emergency Lighting
JIS C 8117	(2008) AC supplied electronic ballasts for fluorescent lamps
JIS C 8152-2	(2012) Measurement method of white light emitting diode (LED) for lighting-Part 2: LED modules and LED light engines
JIS C 8152-3	(2013) Measurement method of white light emitting diode (LED) for lightingPart 3: Measurement of luminous flux maintenance rate
JIS C 8153	(2015) DC or AC supplied electronic control gear for LED modules -- Performance requirements

JIS C 8154	(2015) LED modules for general lighting -- Safety specifications
JIS C 8155	(2019) LED modules for general lighting -- Performance requirements
JIS C 8201-4-1	(2010) Low-voltage switchgear and controlgear -- Part 4-1: Contactors and motor-starters: Electromechanical contactors and motor-starters
JIS C 8201-5-1	(2007) Low-Voltage Switchgear And Control Gear - Part 5-1: Control Circuit Devices And Switching Elements - Electromechanical Control Circuit Devices
JIS C 8286	(2013) Electrical accessories -- Cord sets and interconnection cord sets
JIS C 8304	(2009) Small switches for indoor use
JIS C 8462-1	(2012) Boxes and enclosures for electrical accessories for household and similar fixed electrical installations -- Part 1: General requirements
JIS C 5381-11	(2014) Low-voltage surge protective devices -- Part 11: Surge protective devices connected to low-voltage power systems -- Requirements and test methods
JIS C 5381-12	(2014) Low-voltage surge protective devices -- Part 12: Surge protective devices connected to low-voltage power distribution systems -- Selection and application principles
JIS C 5402-20-2	(2005) Electromechanical components for electronic equipment -- Basic testing procedures and measuring methods -- Part 20-2: Test 20b -- Flammability tests -- Fireproofness
JIS C 60079-0	(2010) Explosive atmospheres -- Part 0: Equipment -- General requirements
JIS C 61000-3-2	(2019) Electromagnetic compatibility (EMC) -- Part 3-2: Limits -- Limits for harmonic current emissions
JIS C 9730-2-7	(2019) Automatic electrical controls -- Part 2-7: Particular requirements for timers and time switches
JIS G 3141	(2017) Cold-reduced carbon steel sheet and strip
JIS G 3302	(2019) Hot Dip Zinc Coated Steel Sheet and

	Strip
JIS G 3547	(2015) Cold-rolled stainless steel plate, sheet and strip
JIS G 4309	(2013) Stainless Steel Wires
JIS H 8610	(1999) Electroplated-Coatings of Zinc on Iron or Steel
JIS Z 8113	(1998) Lighting vocabulary
JIS Z 9110	(2010) General rules of recommended lighting levels
JIS Z 9112	(2012) Classification of fluorescent lamps by chromacity and colour rendering property

JAPAN LUMINAIRES ASSOCIATION (JIL)

JIL 4003	Fluorescent Lighting Fixtures with Electronic Ballast

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2018; TIA 18-1; TIA 18-2; TIA 18-3) Life Safety Code

UNDERWRITERS LABORATORIES (UL)

UL 2043	(2013) Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
UL 924	(2016; Reprint May 2018) UL Standard for Safety Emergency Lighting and Power Equipment
UL 94	(2013; Reprint Sep 2017) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

1.2 RELATED REQUIREMENTS

Materials not considered to be luminaires or luminaire accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Luminaires and accessories mounted on exterior surfaces of buildings are specified in Section 26 56 00 EXTERIOR LIGHTING.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, must be as defined in JIS Z 8113

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Data, drawings, and reports must employ the terminology, classifications and methods prescribed by the JIS Z 9110 as applicable, for the lighting system specified. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Occupancy/Vacancy Sensor Coverage Layout;

SD-03 Product Data

Luminaires; G[, [_____]]

Light Sources; G[, [_____]]

Drivers, Ballasts and Generators; G[, [_____]]

LED Luminaire Warranty;

Vacancy Sensors; G[, [_____]]

Dimming Controllers (Dimmers); G[, [_____]]

Lighting Contactor; G[, [_____]]

Timeswitch; G[, [_____]]

Power Hook Luminaire Hangers; G[, [_____]]

Exit Signs; G[, [_____]]

Emergency Lighting Unit (EBU); G[, [_____]]

LED Emergency Drivers; G[, [_____]]

Fluorescent Emergency Ballasts; G[, [_____]]

Occupancy Sensors; G[, [_____]]

Ambient Light Level Sensor ; G[, [_____]]

Lighting Control Panel; G[, [_____]]

SD-06 Test Reports

Occupancy/Vacancy Sensor Verification Tests;

Energy Efficiency;

1.5 QUALITY CONTROL

1.5.1 Luminaire Drawings

Include dimensions, accessories, and installation and construction details. Photometric data, including zonal lumen data, average and minimum ratio, aiming diagram, and computerized candlepower distribution data must accompany shop drawings.

1.5.2 Occupancy/Vacancy Sensor Coverage Layout

Provide floor plans showing coverage layouts of all devices using manufacturer's product information.

1.5.3 Luminaire Design Data

Provide long term lumen maintenance projections for each LED luminaire in accordance with JIS C 8152-3. Data used for projections must be obtained from testing in accordance with JIS C 8152-3 Appendix B.

1.5.4 LED Luminaire - Test Report

Submit test report on manufacturer's standard production model luminaire.

1.5.5 LED Light Source - Test Report

Submit test report on manufacturer's standard production LED light source (package, array or module). Include all applicable and required data, as outlined under "8 Report on Test Results" in JIS C 8152-3.

1.5.6 Photometric Plan

1.5.6.1 Computer-generated Photometric Plans

Computer-generated photometric plans for each space are required to verify proposed luminaires and locations meet the required performance criteria of the design using the applicable light loss factor (LLF).

Target illumination levels are provided for each Interior Application. Depending on the application and the recommendations provided by the IES, values are given as one of the following:

a. Minimum: No values anywhere on the calculation grid may be less than this value, within a 10 percent margin of error.

b. Minimum Average: An average, taken over the entire task area for the application, may not be less than this value, within a 10 percent margin of error.

c. Maximum: No values anywhere on the calculation grid may be greater than this value, within a 10 percent margin of error.

d. Maximum Average: An average, taken over the entire task area for the application, may not be greater than this value, within a 10 percent margin of error.

e. Uniformity: Unless otherwise noted, uniformity is calculated as a ratio of the average calculated illuminance over the minimum calculated illuminance of the calculation grid.

1.5.6.2 Schematic Photometric Plan Calculations

Schematic photometric plan calculations must include:

a. Horizontal illuminance measurements at workplane or other designated height above finished floor, taken at a maximum of every 305 mm across the task area.

b. Average maintained illuminance level.

c. Minimum and maximum maintained illuminance levels.

d. Lighting power density (Watts per square meter).

e. LLF. Recommended LLF is 0.81 for LED luminaires but LLF varies based on environment and application.

1.5.6.3 Final Photometric Plan Calculations

Final photometric plan calculations must include:

a. Horizontal illuminance measurements at workplane or other designated height above finished floor, taken at a maximum of every 305 mm across the task area.

b. Where applicable, vertical illuminance measurements at designated surface, taken at a maximum of every 305 mm across task area.

c. Minimum and maximum maintained illuminance levels.

d. Average maintained illuminance level.

e. Average to minimum and maximum to minimum ratios for horizontal illuminance.

f. Lighting power density (Watts per square meter).

g. LLF. Recommended LLF is 0.81 for LED luminaires but LLF varies based on environment and application.

1.5.7 Occupancy/Vacancy Sensor Verification Tests

Submit test report outlining post-installation coverage and operation of sensors.

1.5.8 Test Laboratories

Test laboratories for JIS C 8152-2 and JIS C 8152-3 test reports must be a Japan Accredited Laboratory for solid-state lighting testing as part of the Energy-Efficient Lighting Products laboratory accreditation program for both LM-79 and LM-80 or JIS C 8152-2 and JIS C 8152-3 testing

1.5.9 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials,

installation, and workmanship must be in accordance with the mandatory and advisory provisions of applicable codes and standards, unless more stringent requirements are specified or indicated.

1.5.10 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory commercial or industrial use for two years prior to bid opening. The two-year period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the two-year period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.10.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.10.2 Material and Equipment Manufacturing Date

Products manufactured more than six months prior to date of delivery to site must not be used, unless specified otherwise.

1.5.10.3 Energy Efficiency

Submit data indicating lumens per watt efficacy and color rendering index of light source.

1.6 WARRANTY

Support all equipment items by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.6.1 LED Luminaire Warranty

a. Provide a written 5 year on-site replacement warranty for material, fixture finish, and workmanship. On-site replacement includes transportation, removal, and installation of new products.

    (1) Include finish warranty to include failure and substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

    (2) Material warranty must include:

        (a) All drivers.

        (b) Replacement when more than 10 percent of LED sources in any lightbar or subassembly(s) are defective or non-starting.

b. Warranty period must begin on date of beneficial occupancy. Provide the Contracting Officer with signed warranty certificates prior to final payment.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be luminaires, luminaire controls, or associated equipment are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Luminaires, luminaire controls, and associated equipment for exterior applications are specified in Section 26 56 00 EXTERIOR LIGHTING.

2.2 LUMINAIRES

JIS C 8105-1, JIS C 61000-3-2 JIS C 8154 and JIS C 8155. Provide luminaires as indicated in luminaire schedule and NL plates or details on project plans. Provide luminaires complete with light sources of quantity, type, and wattage indicated. Provide all luminaires of the same type by the same manufacturer. Luminaires must be specifically designed for use with the driver, ballast or generator and light source provided.

2.2.1 LED Luminaires

Provide luminaires complete with power supplies (drivers) and light sources. Provide design information including lumen output and design life in luminaire schedule on project plans for LED luminaires. LED luminaires must meet the minimum requirements in the following table:

LUMINAIRE TYPE	MINIMUM LUMINAIRE EFFICACY (LE)	MINIMUM COLOR RENDERING INDEX (CRI)
LED TROFFER - 300 x 1200 600 x 600 600 x 1200	90 LPW	80
LED Downlight	50 LPW	90
LED Track or Accent	40 LPW	80
LED Low Bay/High Bay	80 LPW	70
LED Linear Ambient	80 LPW	80

LED luminaires must also meet the following minimum requirements:

a. Luminaires must have a minimum 5 year manufacturer's warranty.

b. Luminaires must have a minimum [_____] lumen maintenance value of [_____] hours as calculated by JIS C 8152-3, with data obtained per JIS C 8152-3 requirements.

c. Luminaire drive current value must be identical to that provided by test data for luminaire in question.

d. Luminaires must be tested to JIS C 8152-2 and JIS C 8152-3, with the results provided as required in the Submittals paragraph of this

specification.

2.2.2 Fluorescent Luminaires

JIS C 8105-1 and JIL 4003. Provide linear and compact fluorescent luminaires complete with housing, ballast and light source. All fluorescent luminaires must be equipped with electronic ballasts.

2.2.3 Induction Luminaires

JIS C 8105-1. Provide induction luminaires complete with housing, generator and light source.

2.2.4 Luminaires for Hazardous Locations

In addition to requirements stated herein, provide [LED,][fluorescent,][HID,][induction] luminaires for hazardous locations which conform to JIS C 60079-0 or which have Factory Mutual certification for the class and division indicated.

2.3 DRIVERS, BALLASTS and GENERATORS

2.3.1 LED Drivers

JIS C 8153, JIS C 8154 and JIS C 8155. LED drivers must be electronic, constant-current type and comply with the following requirements:

a. Output power (watts)and luminous flux (lumens) as shown in luminaire schedule for each luminaire type to meet minimum luminaire efficacy (LE) value provided.

b. Power Factor (PF) greater than or equal to 0.9 over the full dimming range when provided.

c. Current draw Total Harmonic Distortion (THD) of less than 20 percent.

d. Class A sound rating.

e. Operable at input voltage of [120][240][120-277][105][210] volts at [50][60] hertz.

f. Minimum 5 year manufacturer's warranty.

g. RoHS compliant.

h. Integral thermal protection that reduces or eliminates the output power if case temperature exceeds a value detrimental to the driver.

i. UL listed for dry or damp locations typical of interior installations.

j. [Non-dimmable], [step-dimmable to 50 percent output], or fully-dimmable using 0-10V control as indicated in luminaire schedule.

2.3.2 Fluorescent Electronic Ballasts

JIS C 8117. Fluorescent ballasts must not contain any magnetic core and coil components, and must meet the following requirements:

a. Provide with protection as recommended by JIS C 5381-11 and

JIS C 5381-12.

b. Be designed for the wattage and type of light source provided in the luminaire specified, and have circuit diagrams and light source connection information printed on the exterior of the ballast housing.

c. Have a full replacement warranty of five years from date of manufacture.

[d. Provide all fluorescent ballasts as highest-efficiency type.
]

2.3.2.1 T8 Programmed[Instant]-Start Fluorescent Ballasts

Provide programmed[instant]-start T8 electronic fluorescent ballasts with the following characteristics:

a. Total harmonic distortion (THD): Must be [20 percent][_____ percent] (maximum).

b. Input wattage at [120/277][105][210] volts.

[c. Where indicated on project drawings,provide multi-light source luminaires with two or more ballasts to accomplish the switching scenario indicated.
]
[d. A single ballast may be used to serve multiple luminaires if they are continuously mounted and factory manufactured for that installation with an integral wireway.

]2.3.2.2 T5 (long twin tube) and T5HO Fluorescent Ballasts

a. Total harmonic distortion (THD): Not greater than[25 percent when operating one light source,][15 percent when operating two light sources,][and][20 percent when operating three light sources].

b. Input wattage shall be per Annex B, JIS C 8117

[c. Provide three[and four] light source luminaires with two ballasts per luminaire where multilevel switching is indicated.
]
[d. A single ballast may be used to serve multiple fixtures if they are continuously mounted and factory manufactured for that installation with an integral wireway.

]2.3.2.3 Compact Fluorescent Ballasts

Provide programmed-start ballasts for compact fluorescent luminaires.

2.3.2.4 Fluorescent Electronic Dimming Ballasts

Provide fluorescent electronic dimming ballasts with the following characteristics:

a. Comply with JIS C 8117 and JIL 4003, unless specified otherwise. Provide ballast as recommended by JIS C 5381-11 and JIS C 5381-12. Provide dimming capability range from 100 to 5 percent (minimum range) of light output, flicker free. Ballast must start lamp at any preset light output setting without first having to go to full light output.

Provide ballasts designed for the wattage of the light sources used in the indicated application. Provide ballasts designed to operate on the voltage system to which they are connected.

a. Ballast must be capable of starting and maintaining operation at a minimum of minus 17 degrees C unless otherwise indicated.

b. Ballasts for T-5 and smaller light sources must have protection circuits as required by JIS C 7617-1 and JIS C 7620-1 as applicable.

2.3.2.4.1 T-8 Lamp Ballast

Input wattage shall be per Annex B, JIS C 8117

2.3.3 Induction Generators

Generator must be connected, and operate in conjunction with an inductive power coupler or coil(s). Provide solid-state, high-frequency (200 kHz - 2.67 MHz) type, with power factor greater than 0.95, Class A sound rating, maximum input current THD of 15 percent, operating voltage of [105-210][120-240][120-277]V, and a minimum starting temperature of minus 30 degrees F. Provide generator dimmable to a minimum of 50 percent light output.

2.4 LIGHT SOURCES

JIS C 8155. Provide type and wattage as indicated in luminaire schedule on project plans.

2.4.1 LED Light Sources

a. Correlated Color Temperature (CCT) of [3000]3500[4000][_____] degrees K.

b. Minimum Color Rendering Index (CRI) value of 80.

c. High power, white light output utilizing phosphor conversion (PC) process[or mixed system of colored LEDs, typically red, green and blue (RGB)].

d. RoHS compliant.

[2.4.1.1 LED Retrofit T8 Tubes

Provide linear T8 tubular LED light sources to replace fluorescent light sources in renovation or energy conservation projects. Provide only where entire luminaires are not being replaced. Light sources must be compatible with existing instant-start or programmed-start ballasts and have the following requirements:

a. Correlated Color Temperature (CCT) of [3000]3500[4000] degrees K.

b. Total Harmonic Distortion (THD) less than 20 percent, with Power Factor (PF) greater than 90 percent.

c. Minimum lumen per watt efficacy greater than 120.

d. Minimum beam angle of 180 degrees.

e. Minimum 5 year warranty.

f. Minimum Color Rendering Index (CRI) of 80.

]2.4.2 Fluorescent Light Sources

JIS Z 9112. Fluorescent light sources must be low-mercury, energy-savings type and be compliant with the most current TCLP test procedure at the time of manufacture.

2.4.2.1 Linear Fluorescent Light Sources

JIS C 7617-1. Provide linear fluorescent light sources with minimum CRI of 85[_____] and CCT of 3500[_____] degrees K.

2.4.2.1.1 T8 Linear Fluorescent Light Sources

Provide T8 light sources with medium bi-pin base, rated [_____] watts (maximum), [_____] initial lumens (minimum), and with an average rated life of 30,000[_____] hours using a average three hour burn time and programmed-start ballast.

2.4.2.1.2 T5HO (High-Output) Linear Fluorescent Light Sources

Provide T5HO light sources with miniature bi-pin base, rated [_____] watts (maximum), [_____] initial lumens (minimum), and with an average rated life of 30,000[_____] hours using a average three hour burn time and programmed start ballast.

2.4.2.2 Compact Fluorescent (CFL) Light Sources

JIS C 7620-1. Provide compact fluorescent (CFL) light sources with minimum CRI of 82[_____] and CCT of 3500[_____] degrees K.

2.4.3 Induction Light Sources

Provide induction light sources consisting of an electrodeless, inductively-coupled, phosphor-coated fluorescent envelope, with an average rated life of 100,000 hours minimum rated using three hours operation per start. Light sources must be compliant with the most current TCLP test procedure at the time of manufacture.

2.5 LIGHTING CONTROLS

Provide lighting controls and associated equipment in accordance with drawings and applicable energy codes. [Provide network certification for all networked lighting control systems and devices per requirements of Section 25 05 11 CYBERSECURITY FOR FACILITY-RELATED CONTROL SYSTEMS.]

2.5.1 Toggle Switches

Provide line-voltage toggle switches as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.5.2 Dimming Controllers (Dimmers)

JIS C 8304. [120/277][105/210] V[0-10 V] dimmers must provide flicker-free, continuously variable light output throughout the dimming range. Provide radio frequency interference suppression integral to

device. Provide dimmers utilizing [pulse width modulation (PWM)][constant current reduction (CCR) technology]. Provide device with a vertical slider, paddle, rotary button, or toggle (with adjacent vertical slider) type control, with finish to match switches and outlets in same area. Provide back box in wall with sufficient depth to accommodate body of switch and wiring. Devices must be capable of operating at their full rated capacity regardless of being single or ganged-mounted, and be compatible with three-way and four-way switching scenarios. Dimmers must be capable of controlling [two-wire][three-wire][0-10 volt] fluorescent ballasts or LED drivers. Ensure compatibility of dimmer with separate power packs when utilized for lighting control. Dimmers and the ballasts or drivers they control, must be provided from the same manufacturer, or tested and certified as compatible for use together.

2.5.3 Sensors for Lighting Control

UL 94, JIS C 5402-20-2 and JIS C 8201-5-1.

2.5.3.1 Occupancy Sensors

Provide occupancy sensors with coverage patterns as indicated on project plans. Provide no less quantity of sensors as shown on plans, but add additional sensors when required to fulfill coverage requirement for the specific model sensor provided. Sensor must be provided with an adaptive learning function that automatically sets sensor in optimum calibration in a set period of time after installation and a non-volatile memory that saves settings after a power outage. Provide sensors designed for ceiling, wall or wall-box installation as indicated. Operating voltage must be [105][120][210][240][277] volts.[Operating voltage must be 24V in conjunction with a control system or separate power pack which interacts with luminaire being controlled.] Provide housing of high-impact, injection-molded thermoplastic with a multi-segmented lens for PIR and dual technology sensors. Sensor operation requires movement to activate luminaires controlled, and turns luminaires off after a set time of inactivity.[Provide integral photocell mounted in occupancy sensor housing when indicated.]

2.5.3.1.1 Passive Infrared (PIR) Sensors

Provide ceiling or wall-mounted PIR sensors meeting the following requirements:

a. Temperature compensated, dual element sensor and a multi-element fresnel lens (Poly IR4 material).

b. Technology to optimize automatic time delay to fit occupant usage patterns.

c. No minimum load requirement for line voltage sensors and be capable of switching from zero to 800 W at [105][120] VAC, 50/60 Hz and from zero to 1200 W at [210][240][277] VAC, 50/60 Hz. Control voltage sensors must not exceed a maximum load requirement of 20 mA at 24VDC.

d. Time delay of five to 30 minutes in increments of five minutes with a walk through and test mode set by DIP switch.

e. LED indicator that remains active during occupancy.

f. Built-in light level sensor that is operational from 0.8 to 18 lux.

g. Coverage pattern tested to applicable standards.

h. Standard five year warranty.

i. No leakage current to load when in the off mode.

2.5.3.1.2 Ultrasonic Sensors

Provide ceiling-mounted ultrasonic sensors meeting the following requirements:

a. Operate at an ultrasonic frequency of [_____]kHz.

b. LED on exterior of device to indicate occupant detection.

c. Adjustable time delay period of 15 seconds to 15 minutes [_____].

d. Minimum five year warranty.

[e. Provide with isolated relay for integrating control of HVAC or other automated systems.

]2.5.3.1.3 Dual Technology Sensors

Provide dual technology sensors that meet the requirements for PIR sensors and ultrasonic sensors indicated above. If either the passive infrared or ultrasonic sensing registers occupancy, the luminaires must remain on.

2.5.3.1.4 High/Low-Bay Sensors

Provide occupancy sensors specifically designed for high/low-bay mounting application using passive infrared (PIR) technology, with the following characteristics:

a. Input voltage of [120][240][120/277][105][210] volts, at [50][60] hertz.

b. High-impact, injection-molded thermoplastic housing with interchangeable lenses for 360 degree open area coverage or narrow rectangular, warehouse aisle coverage.

c. Utilize zero-crossing circuitry to prevent damage from high inrush current and to promote long life operation.

d. Be designed to mount directly to or adjacent to high or low-bay luminaires.

2.5.3.1.5 Power Packs for Sensors

UL 2043 Power packs used to provide power to one or more lighting control sensors must meet the following requirements:

a. Input voltage - [105][210][120][240][120-277] VAC; output voltage - 24 VDC at 225 mA.

b. Plenum-rated, high-impact thermoplastic enclosure.

c. Utilizes zero-crossing circuitry to prevent damage from inrush current.

d. Maximum load rating of [_____] amps for electronic[_____] lighting loads.

e. RoHS compliant.

2.5.3.2 Vacancy Sensors

Provide vacancy sensors as indicated above under paragraph OCCUPANCY SENSORS, but with requirement of a manual operation to activate luminaires controlled. Provide automatic operation to turn luminaires off after a set period of inactivity.

2.5.4 [Lighting Contactor

JIS C 8201-4-1. Provide an electrically[mechanically]-held lighting contactor housed in a [indoor][weatherproof][ ] rated IP enclosure conforming to JIS C 8462-1. Provide contactor with one[_____] normally-open(NO)[normally closed(NC)], single[double] pole contacts, rated 600 volts, 30 amps. Provide coil operating voltage of [24][120][277][480][105][210][240][400][_____] volts.]

[2.5.5 Timeswitch

JIS C 9730-2-7. [Provide electromechanical type timeswitch with a [24 hour][7 day][astronomic] dial [that changes on/off settings according to seasonal variations of sunset and sunrise]. Provide power to switch from integral synchronous motor with a maximum three watt rating. Rate contacts at 40 amps at [105][210][120][240][120-277] volts for general purpose loads. Provide contacts in a SPST[DPST][SPDT], [normally-open (NO)][normally-closed (NC)] configuration. [Provide switch with an automatic spring mechanism to maintain accurate time for up to 16 hours.] [Provide switch with function that allows automatic control to be skipped on certain selected days of the week.][Provide switch with manual bypass[remote override] control function.]]

[Provide electronic type timeswitch with a [24 hour][7 day][astronomic] programming function [that changes on/off settings according to seasonal variations of sunset and sunrise], providing a total of 56[_____] on/off set points. Provide [12 hour AM/PM][24 hour] type digital clock display format. Provide power outage back-up for switch for a minimum of [seven][_____] days. Provide switch capable of controlling a minimum of [1][2][4][_____] channels or loads. Rate contacts at [30][_____] amps at [105][210][120][240][120/277] volts for general purpose loads. Provide contacts in a SPST[DPST][SPDT], [normally-open (NO)][normally-closed (NC)] configuration. [Provide switch with [function that allows automatic control to be skipped on certain selected days of the week][manual bypass or remote override control][daylight savings time adjustment][additional memory module][momentary function for output contacts][ability for photosensor input].]]

House timeswitch in a surface-mounted, lockable, [indoor][weatherproof][ ] rated IP enclosure constructed of painted steel or plastic polymer conforming to JIS C 8462-1.

]2.5.6 Lighting Control Panel

Provide an electronic, programmable lighting control panel, capable of providing lighting control with input from internal programming, digital

switches, time clocks, and other low-voltage control devices.

Enclose panel hardware in a surface[flush]-mounted, [indoor][weatherproof] rated IP enclosure in accordance with JIS C 0920, painted, steel enclosure, with hinged, lockable access door and ventilation openings. Internal low-voltage compartment must be separated from line-voltage compartment of enclosure with only low-voltage compartment accessible upon opening of door.[Provide additional remote cabinets that communicate back to main control panel.]

Input voltage - [105][210][120/277] V, [50][60] Hz, with internal 24 VDC power supply.

Provide 8[16][32][_____] single-pole latching[return to close] relays rated at [20][30] amps, [120][277][105][210] volts.[Provide provision for relays to close upon power failure that meets UL 924 and JIS C 8105-2-22.]

Relay control module must operate at 24 VDC and be rated to control a minimum of 8[16][32][_____] relays.

2.5.7 Local Area Lighting Controller

Provide controller designed for single area or room with the following requirements:

a. [105][120][210][240][277] volt input, designed for fluorescent or LED lighting loads.

b. 2[_____] zone, with 1[2][_____] relay[s] rated 20 amps[each].

c. Provide daylight harvesting capability with full-range dimming control.

d. Inputs for occupancy sensor, photocell, and low-voltage wall switch.

[e. Provide capability for receptacle load control.

][f. Provide full 'OFF' function with input from external time clock input.

]2.6 EXIT AND EMERGENCY LIGHTING EQUIPMENT

UL 924, JIS C 8105-2-22 and NFPA 101 compliant.

2.6.1 Exit Signs

Provide exit signs consuming a maximum of five watts total.

2.6.1.1 LED Self-Powered Exit Signs

Provide in [UV-stable, thermo-plastic][painted, die-cast aluminum][painted steel] housing with [UL damp label][UL wet label][using clear polycarbonate housing], configured for ceiling[wall][end] mounting. [Provide edge-lit type with clear acrylic, edge-lit face and aluminum trim having clear aluminum[white][chrome][brass][_____] finish.] Provide 150 mm high, 19 mm stroke red[green][_____] lettering on face of sign. Provide chevrons on either side of lettering to indicate direction. Provide single[double] face. Equip with automatic power failure device, test switch, and pilot light, and fully automatic high/low trickle charger in a self-contained power pack. Battery must be sealed, maintenance free

nickel-cadmium type, and must operate unattended for a period of not less than five years. Emergency run time must be a minimum of 1 1/2 hours. LEDs must have a minimum rated life of 10 years. [Provide self-diagnostic circuitry integral to emergency LED driver.]

2.6.1.2 LED Remote-Powered Exit Signs

Provide as indicated above for self-powered type, but without battery and charger. Exit sign must contain provision for [105][210][120][240][120/277] VAC or 6-48 VDC input from remote source.

2.6.2 Emergency Lighting Unit (EBU)

Provide in [UV-stable, thermo-plastic][painted, die-cast aluminum][painted steel] housing with [UL damp label][UL wet label][IP rated enclosure in accordance with JIS C 0920] as indicated. Emergency lighting units must be rated for 12 volts, except units having no remote-mounted lamps and having no more than two unit-mounted light sources may be rated six volts. Equip units with brown-out sensitive circuit to activate battery when input voltage falls to 75 percent of normal. Equip with two[_____] LED, automatic power failure device, test switch, and pilot light, and fully automatic high/low trickle charger in a self-contained power pack. Battery must be sealed, maintenance free [lead-calcium][nickel-cadmium][_____] type, and must operate unattended for a period of not less than five years. Emergency run time must be a minimum of 1 1/2 hours. LEDs must have a minimum rated life of 10 years. [Provide self-diagnostic circuitry integral to emergency LED driver.]

2.6.3 LED Emergency Drivers

Provide LED emergency driver with automatic power failure detection, test switch and LED indicator (or combination switch/indicator) located on luminaire exterior, and fully-automatic solid-state charger, battery and inverter integral to a self-contained housing. [Provide self-diagnostic function integral to emergency driver.]Integral nickel-cadmium[lead-calcium][_____] battery is required to supply a minimum of 90 minutes of emergency power at [5][7][10][_____] watts, [10-50][_____] VDC[compatible with LED forward voltage requirements], constant output. Driver must be RoHS compliant, rated for installation in plenum-rated spaces and damp locations, and be warranted for a minimum of five years.[Provide central lighting inverter(s) to supply a minimum of 90 minutes of emergency power.]

2.6.4 Fluorescent Emergency Ballasts

Provide each 'system' with an automatic power failure device, test switch operable from the exterior of the luminaire (or remotely), a pilot light visible from the exterior of the luminaire, and fully automatic solid-state charger, battery, and inverter integral to a self-contained housing. [Provide self-diagnostic function integral to emergency ballast.] Integral [nickel-cadmium][lead-calcium][_____] battery is required to supply a minimum of 90 minutes of emergency power to one[two][_____] light source[s] within luminaire at a minimum of [500][700][1200][_____] lumens output[each]. Provide open-circuit protection and time-delay function to counteract 'end-of-life' circuitry in normal power ballast from interfering with emergency ballast operation. Ballast must be RoHS compliant, rated for installation in plenum-rated spaces and damp locations, and be warranted for a minimum of five years.[Provide central lighting inverter(s) to supply a minimum of 90

minutes of emergency power.]

[2.6.5 Self-Diagnostic Circuitry for LED and Fluorescent Emergency Drivers/Ballasts

Provide emergency lighting unit with fully-automatic, integral self-testing/diagnostic electronic circuitry. Circuitry must provide for a one minute diagnostic test every 28 days, and a 30 minute diagnostic test every six months, minimum. Any malfunction of the unit must be indicated by LED(s) visible from the exterior of the luminaire. A manual test switch must also be provided to perform a diagnostic test at any given time.

]2.6.6 Central Emergency Lighting System

Provide integrally-housed emergency system rated at [_____] VA/watts, [105][120][210][240][277] volts (input and output), for a minimum period of 90 minutes. Output frequency must be a pure sine wave at [50][60] hertz, with maximum 5 percent total harmonic distortion. Provide system with minimum short circuit rating required for protection against available fault current.

2.6.6.1 System Operation

During normal power operation, system charges batteries as needed and allows normal power to pass through to load. Upon loss of normal power, system automatically transfers to emergency mode without interruption of connected loads. Internal batteries provide a minimum of 90 minutes of emergency power at this time. Upon normal power being restored, system switches back to normal power mode and fully charges batteries within UL-approved time period.

2.6.6.2 Battery Charger

Solid state, monitored, three step float charging type, keeping batteries in a fully charged state. Provide circuitry to prevent deep discharge of batteries in prolonged power outage conditions.

2.6.6.3 Batteries

Provide sealed, lead calcium type, designed to operated unattended without maintenance, for a minimum of 10 years.

2.6.6.4 Enclosure

Provide system in [indoor][weatherproof][ ] rated IP enclosure in accordance with JIS C 0920 painted steel[aluminum] enclosure with exterior-mounted "push-to-test" button and LED indicator.

2.6.6.5 Accessories

Provide [_____] single pole, [_____] ampere output circuit breakers. [Voltmeter and ammmeter for battery[load].]

2.7 LUMINAIRE SUPPORT HARDWARE

2.7.1 Wire

JIS G 3547; Galvanized, soft tempered steel, minimum 2.7 mm in diameter,

or galvanized, braided steel, minimum 2 mm in diameter.

2.7.2 Wire for Humid Spaces

JIS G 4309; Annealed stainless steel, minimum 2.7 mm in diameter.

Annealed nickel-copper alloy, minimum 2.7 mm in diameter.

2.7.3 Threaded Rods

Threaded steel rods, 4.76 mm diameter, zinc or cadmium coated.

2.7.4 Straps

Galvanized steel, 25 by 4.76 mm, conforming to JIS G 3302, with a light commercial zinc coating or JIS G 3141 with an electrodeposited zinc coating conforming to JIS H 8610.

2.8 POWER HOOK LUMINAIRE HANGERS

JIS C 8105-1. Provide an assembly consisting of through-wired power hook housing, interlocking plug and receptacle, power cord, and luminaire support loop. Power hook housing must be cast aluminum having two 19 mm threaded hubs. Support hook must have safety screw. Fixture support loop must be cast aluminum with provisions for accepting 19 mm threaded stems. Power cord must include 410 mm of 3 conductor 1.2 mm Type SO cord or power cord per JIS C 8286. Assembly must be rated [105][120] volts or [210][277] volts, 15 amperes.

2.9 EQUIPMENT IDENTIFICATION

2.9.1 Manufacturer's Nameplate

Each item of equipment must have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.9.2 Labels

Provide labeled luminaires in accordance with JIS C 8105-1 requirements. All luminaires must be clearly marked for operation of specific light sources and ballasts, generators or drivers. Note the following light source characteristics in the format "Use Only _____":

a. Light source diameter code (T-5, T-8), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.

b. Start type (programmed start, instant start) for fluorescent and compact fluorescent luminaires.

c. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

All markings related to light source type must be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when light sources are in place. Ballasts, generators or drivers must have clear markings indicating multi-level outputs and indicate

proper terminals for the various outputs.

2.10 FACTORY APPLIED FINISH

Provide all luminaires and lighting equipment with factory-applied painting system that as a minimum, meets requirements of JIS C 0920 corrosion-resistance test.

2.11 RECESS- AND FLUSH-MOUNTED LUMINAIRES

Provide access to lamp and ballast from bottom of luminaire. Provide trim [and lenses]for the exposed surface of flush-mounted luminaires as indicated on project drawings and specifications.

2.12 SUSPENDED LUMINAIRES

Provide hangers capable of supporting twice the combined weight of luminaires supported by hangers. Provide with swivel hangers to ensure a plumb installation. Provide cadmium-plated steel with a swivel-ball tapped for the conduit size indicated. Hangers must allow fixtures to swing within an angle of 0.79 rad. Brace pendants 1219 mm or longer to limit swinging. Single-unit suspended luminaires must have twin-stem hangers. Multiple-unit or continuous row luminaires must have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Provide rods in minimum 4.57 mm diameter.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations must conform to IEEE C2 and JIS C 0365 and to the requirements specified herein. Install luminaires and lighting controls to meet the requirements of applicable codes and standards. To encourage consistency and uniformity, install luminaires of the same manufacture and model number when residing in the same facility or building.

3.1.1 Light Sources

When light sources are not provided as an integral part of the luminaire, deliver light sources of the type, wattage, lumen output, color temperature, color rendering index, and voltage rating indicated to the project site and install just prior to project completion, if not already installed in the luminaires from the factory.

3.1.2 Luminaires

Set luminaires plumb, square, and level with ceiling and walls, in alignment with adjacent luminaires and secure in accordance with manufacturers' directions and approved drawings. Installation must meet requirements of applicable codes and standards. Mounting heights specified or indicated must be to the bottom of the luminaire for ceiling-mounted luminaires and to center of luminaire for wall-mounted luminaires. Obtain approval of the exact mounting height on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed. Recessed and semi-recessed luminaires must be independently supported from the building structure by a minimum of four wires, straps or rods per luminaire and located near each corner of the luminaire. Ceiling grid

clips are not allowed as an alternative to independently supported luminaires. Round luminaires or luminaires smaller in size than the ceiling grid must be independently supported from the building structure by a minimum of four wires, straps or rods per luminaire, spaced approximately equidistant around. Do not support luminaires by acoustical tile ceiling panels. Where luminaires of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support each independently and provide at least two 19 mm metal channels spanning, and secured to, the ceiling tees for centering and aligning the luminaire. Provide wires, straps, or rods for luminaire support in this section. Luminaires installed in suspended ceilings must also comply with the requirements of Section 09 51 00 ACOUSTICAL CEILINGS.

3.1.3 Suspended Luminaires

Provide suspended luminaires with 0.79 rad swivel hangers so that they hang plumb and level. Locate so that there are no obstructions within the 0.79 rad range in all directions. The stem, canopy and luminaire must be capable of 0.79 rad swing. Pendants, rods, or chains 1.2 meters or longer excluding luminaire must be braced to prevent swaying using three cables at 2.09 rad separation. Suspended luminaires in continuous rows must have internal wireway systems for end to end wiring and must be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Utilize aligning splines on extruded aluminum luminaires to assure minimal hairline joints. Support steel luminaires to prevent "oil-canning" effects. Luminaire finishes must be free of scratches, nicks, dents, and warps, and must match the color and gloss specified. Match supporting pendants with supported luminaire. Aircraft cable must be stainless steel. Canopies must be finished to match the ceiling and must be low profile unless otherwise shown. Maximum distance between suspension points must be 3.1 meters or as recommended by the manufacturer, whichever is less.

3.1.4 Ballasts, Generators and Power Supplies

Typically, provide ballasts, generators, and power supplies (drivers) integral to luminaire as constructed by the manufacturer.

3.1.5 Exit Signs and Emergency Lighting Units

Wire exit signs and emergency lighting units ahead of the local switch, to the normal lighting circuit located in the same room or area.

[3.1.5.1 Exit Signs

Connect exit signs on separate circuits and serve from [an emergency panel][a separate circuit breaker][a fused disconnect switch]. Provide only one source of control, which would be [the circuit breaker in the emergency panel][the separate circuit breaker][the fused disconnect switch]. Paint source of control red and provide lockout capability.

][3.1.5.2 Emergency Lighting from Central Emergency System

Connect emergency lighting from a central emergency system as indicated on the project drawings.

]3.1.6 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations.

3.1.7 Occupancy/Vacancy Sensors

Provide testing of sensor coverage in all spaces where sensors are placed. This should be done only after all furnishings (carpet, furniture, workstations, etc.) have been installed. Provide quantity of sensor units indicated as a minimum. Provide additional units to give full coverage over controlled area. Full coverage must provide hand and arm motion detection for office and administration type areas and walking motion for industrial areas, warehouses, storage rooms and hallways. Locate the sensor(s) as indicated and in accordance with the manufacturer's recommendations to maximize energy savings and to avoid nuisance activation and deactivation due to sudden temperature or airflow changes and usage.

3.1.8 Daylight or Ambient Light Level Sensor

Locate sensor as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for 300 luxor for the indicated light level measured at the work plane for that particular area.

3.2 FIELD APPLIED PAINTING

Paint lighting equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Provide painting as specified in Section 09 90 00 PAINTS AND COATINGS.

-- End of Section --

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Contractor may substitute compatible Japan Industrial Standard (JIS) or Japan Luminaires Association (JIL) for non-Japanese standards, as approved by the Contracting Officer's representative.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5373	(2016) Precast Prestressed Concrete Products
JIS C 0365	(2007) Protection Against Electric Shock - Common Aspects for Installation and Equipment
JIS C 0920	(2003) Degrees Of Protection Provided By Enclosures (IP Code)
JIS C 5381-11	(2014) Low-voltage surge protective devices -- Part 11: Surge protective devices connected to low-voltage power systems -- Requirements and test methods
JIS C 61000-3-2	(2019) Electromagnetic compatibility (EMC) -- Part 3-2: Limits -- Limits for harmonic current emissions
JIS C 8105-1	(2017) Luminaires - Part 1: General Requirements For Safety
JIS C 8105-2-3	(2011) Lighting-Part 2-3: Road and Street Lighting Fixtures Safety requirements
JIS C 8131	(2013) Luminaires for Road Lighting
JIS C 8152-2	(2012) Measurement method of white light emitting diode (LED) for lighting-Part 2: LED modules and LED light engines
JIS C 8152-3	(2013) Measurement method of white light emitting diode (LED) for lightingPart 3: Measurement of luminous flux maintenance rate

JIS C 8153	(2015) DC or AC supplied electronic control gear for LED modules -- Performance requirements
JIS C 8154	(2015) LED modules for general lighting -- Safety specifications
JIS C 8155	(2019) LED modules for general lighting -- Performance requirements
JIS C 8201-5-2	(2017) Low-Voltage Switchgear And Control Gear- Part 5-2: Control Circuit Devices And Switching Elements- Proximity Switches
JIS C 8201-4-3	(2010) Low-voltage switchgear and controlgear -- Part 4-3: Contactors and motor-starters -- AC semiconductor controllers and contactors for non-motor loads
JIS C 8369	(2012) Photoelectric Controls for Public Lighting
JIS C 8462-1	(2012) Boxes and enclosures for electrical accessories for household and similar fixed electrical installations -- Part 1: General requirements
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS Z 2371	(2015) Methods of Salt Spray Testing
JIS Z 8113	(1998) Lighting vocabulary
JIS Z 9110	(2010) General rules of recommended lighting levels
JIS Z 9111	(1988) Lighting for roads

1.2 RELATED REQUIREMENTS

Materials not considered to be luminaires or lighting equipment are specified in Section(s) [33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION] [33 71 01.00 40 OVERHEAD TRANSMISSION AND DISTRIBUTION] [33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION]. Luminaires and accessories installed in interior of buildings are specified in Section [26 51 00 INTERIOR LIGHTING] [26 51 00.00 40 INTERIOR LIGHTING].

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings shall be as defined in JIS Z 8113.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality

Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Photometric Plan; G[, [_____]]

LED Luminaire Warranty;

SD-02 Shop Drawings

Luminaire Drawings

Poles

SD-03 Product Data

[[LED,]Luminaires; G[, [_____]]

] Luminaire Light Sources; G[, [_____]]

Luminaire[Power Supply Units (Drivers)]; G[, [_____]]

Lighting Contactor; G[, [_____]]

Time Switch; G[, [_____]]

Lighting Control Relay Panel; G[, [_____]]

Motion Sensor; G[, [_____]]

Photocell; G[, [_____]]

Concrete Poles; G[, [_____]]

Aluminum Poles; G[, [_____]]

Steel Poles; G[, [_____]]

Fiberglass Poles; G[, [_____]]

Obstruction Marker Luminaires; G[, [_____]]

SD-06 Test Reports

Operating Test

Submit operating test results as stated in paragraph entitled "Field Quality Control."

SD-10 Operation and Maintenance Data

Operational Service

Submit documentation that includes contact information, summary of

procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and/or reuse.

1.5 QUALITY ASSURANCE

1.5.1 Drawing Requirements

1.5.1.1 Luminaire Drawings

Include dimensions, effective projected area (EPA), accessories, and installation and construction details. Photometric data, including zonal lumen data, average and minimum ratio, aiming diagram, and[computerized] candlepower distribution data shall accompany shop drawings.

[1.5.1.2 Poles

Include dimensions, wind load determined in accordance with JIS C 8105-2-3, pole deflection, pole class, and other applicable information.[For concrete poles, include: section and details to indicate quantities and position of prestressing steel, spiral steel, inserts, and through holes; initial prestressing steel tension; and concrete strengths at release and at 28 days.]

]1.5.2 Photometric Plan

For LED luminaires, include computer-generated photometric analysis of the "designed to" values for the "end of useful life" of the luminaire installation using a light loss factor of 0.7. For LED and all other types of luminaires, the submittal shall include the following:

Horizontal illuminance measurements at finished grade, taken at a maximum of every 3050 mm.

Vertical illuminance measurements at 1500 mm above finished grade.

Minimum and maximum lux levels.

Average maintained lux level.

Maximum to minimum ratio for horizontal illuminance only.

1.5.3 Design Data for Luminaires

a. Provide distribution data according to IES classification type as defined in JIS Z 9110.

b. Shielding as defined by JIS Z 9111 or glare rating for the installed position as defined by JIS Z 9110.

c. Provide wind loading calculations for luminaires mounted on poles. Weight and effective projected area (EPA) of luminaires and mounting brackets shall not exceed maximum rating of pole as installed in particular wind zone area.

1.5.4 LED Luminaire - Test Report

Submit test report on manufacturer's standard production model luminaire. Submittal shall include all photometric and electrical measurements, as

well as all other pertinent data per JIS C 8152-2.

1.5.5 LED Light Source - Test Report

Submit report on manufacturer's standard production LED package, array, or module. Submittal shall include:

a. Testing agency, report number, date, type of equipment, and LED light source being tested.

b. All data required by JIS C 8152-3.

1.5.5.1 Test Laboratories

Test laboratories for the JIS C 8152-2 and JIS C 8152-3 test reports shall be:

A manufacturer's in-house lab that meets the following criteria:

1. Manufacturer has been regularly engaged in the design and production of high intensity discharge roadway and area luminaires and the manufacturer's lab has been successfully certifying these fixtures for a minimum of 15 years.

2. Annual equipment calibration including photometer calibration in accordance with applicable stanards.

[1.5.6 Tests for Fiberglass Poles

a. Ultraviolet resistance tests: Perform using a UV-B light source having a 313 nanometer wavelength, operated at 54 degrees C, cycling the light source on for 4 hours and off for 4 hours for a total test period of 1500 hours minimum with the following results:

Fiber exposure:	None
Crazing:	None
Checking:	None
Chalking:	None
Color:	May dull slightly

b. Flexural strength and deflection test: Test loading shall be as a cantilever beam with pole butt as fixed end and a force simulating wind load at the free end.

]1.5.7 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of applicable codes and standards unless more stringent requirements are specified or indicated.

1.5.8 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.8.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if the manufacturer has been regularly engaged in the design and production of high intensity discharge roadway and area luminaires for a minimum of 15 years. Products shall have been in satisfactory commercial or industrial use for 15 years prior to bid opening. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 15-year period.

1.5.8.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 year prior to date of delivery to site shall not be used, unless specified otherwise.

[1.6 DELIVERY, STORAGE, AND HANDLING OF POLES

[1.6.1 Concrete Poles

Do not store poles on ground. Support poles so they are at least 305 mm above ground level and growing vegetation.

][1.6.2 [Fiberglass] [Aluminum] [Steel] Poles

Do not store poles on ground. Support poles so they are at least 305 mm above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

]]1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

[1.7.1 LED Luminaire Warranty

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

a. Provide a written five year on-site replacement warranty for material,

fixture finish, and workmanship. On-site replacement includes transportation, removal, and installation of new products.

1. Finish warranty shall include warranty against failure and against substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

2. Material warranty shall include:

(a) All power supply units (drivers).

(b) Replacement when more than 10 percent of LED sources in any lightbar or subassembly(s) are defective or non-starting.

b. Warranty period must begin on date of beneficial occupancy. Contractor shall provide the Contracting Officer signed warranty certificates prior to final payment.

]1.8 OPERATIONAL SERVICE

Coordinate with manufacturer for [maintenance agreement] [take-back program]. Collect information from the manufacturer about [maintenance agreement] [green lease] options, and submit to Contracting Officer. Services shall reclaim materials for recycling and/or reuse. Services shall not deposit materials in landfills or burn reclaimed materials. Indicate procedures for compliance with regulations governing disposal of mercury. When such a service is not available, local recyclers shall be sought after to reclaim the materials.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be luminaires, equipment or accessories are specified in[Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION,][Section 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION,][and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.] Luminaires and associated equipment and accessories for interior applications are specified in Section 26 51 00 INTERIOR LIGHTING.

2.2 [LED,] LUMINAIRES

JIS C 61000-3-2, JIS C 8154 and JIS C 8155. Provide luminaires as indicated in luminaire schedule and XL plates or details on project plans. Provide luminaires complete with light sources of quantity, type, and wattage indicated. All luminaires of the same type shall be provided by the same manufacturer.

2.2.1 General Requirements

a.[LED luminaire housings shall be die cast or extruded aluminum.][Housings for luminaires other than LED shall be die cast, extruded, or fabricated aluminum. Fabricated aluminum housings shall have all seams and corners internally welded to resist weathering, moisture and dust.]

[b. LED luminaires shall be rated for operation within an ambient temperature range of minus 30 degrees C to[40 degrees C][50 degrees C].

] c. Luminaires shall be listed for wet locations per JIS C 8105-1.[Optical compartment for LED luminaires shall be sealed and rated a minimum of IP65.]

[d. LED luminaires shall produce a minimum efficacy as shown in the following table, tested per JIS C 8152-2. Theoretical models of initial raw LED lumens per watt are not acceptable.

Application	Luminaire Efficacy in Lumens per Watt
Exterior Pole/Arm-Mounted Area and Roadway Luminaires	65
Exterior Pole/Arm-Mounted Decorative Luminaires	65
Exterior Wall-Mounted Area Luminaires	60
Bollards	35
Parking Garage Luminaires	70

] e. Luminaires shall have lighting distribution and field angle classifications as indicated in luminaire schedule on project plans per JIS Z 9110.

f. Housing finish shall be baked-on enamel, anodized, or baked-on powder coat paint. Finish shall be capable of surviving JIS Z 2371 salt fog environment testing for 2500 hours minimum without blistering or peeling.

g. Luminaires shall not exceed the following JIS Z 9110 Glare ratings:

1. Maximum Glare (G) rating shall be determined by lighting zone in which luminaire is placed.

h. Luminaires shall be fully assembled and electrically tested prior to shipment from factory.

i. The finish color shall be as indicated in the luminaire schedule or detail on the project plans.

[j. Luminaire arm bolts shall be 304 stainless steel or zinc-plated steel.

] k. Luminaire lenses shall be constructed of[clear][frosted] tempered glass or UV-resistant acrylic.[Provide polycarbonate vandal-resistant lenses as indicated.]

[l. The wiring compartment on pole-mounted, street and area luminaires must be accessible without the use of hand tools to manipulate small screws, bolts, or hardware.

] m. Incorporate modular electrical connections, and construct luminaires to allow replacement of all or any part of the optics, heat sinks, power supply units, ballasts, surge suppressors and other electrical

components using only a simple tool, such as a manual or cordless electric screwdriver.

n. Luminaires shall have a nameplate bearing the manufacturer's name, address, model number, date of manufacture, and serial number securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.

[o. Roadway and area luminaires shall have an integral tilt adjustment of plus or minus 5 degrees to allow the unit to be leveled in accordance with JIS C 8105-2-3.

] p. Luminaire must pass vibration testing in accordance with JIS C 8105-2-3 and JIS C 8131.

q. All factory electrical connections shall be made using crimp, locking, or latching style connectors. Twist-style wire nuts are not acceptable.

2.2.2 Luminaire Light Sources

[2.2.2.1 LED Light Sources

a. Correlated Color Temperature (CCT) shall be in accordance with JIS C 8155:

[Nominal CCT: 4000 degrees K: 3985 plus or minus 275 degrees K

] b. Color Rendering Index (CRI) shall be:

Greater than or equal to [70] [_____] for 4000 degrees K light sources.

c. Color Consistency:

]2.2.3 Luminaire[Power Supply Units (Drivers)]

[2.2.3.1 LED Power Supply Units (Drivers)

JIS C 8153. LED Power Supply Units (Drivers) shall meet the following requirements:

a. Minimum efficiency shall be 85 percent.

b. Shall be rated to operate between ambient temperatures of minus 30 degrees C and 40 degrees C[50 degrees C].

c. Shall be designed to operate on the voltage system to which they are connected, typically ranging from 120 V to 480 V or 100V to 430V nominal.

d. Operating frequency shall be: 50 or 60 Hz.

e. Power Factor (PF) shall be greater than or equal to 0.90.

f. Total Harmonic Distortion (THD) current shall be less than or equal to 20 percent.

g. Shall be RoHS-compliant.

h. Shall be mounted integral to luminaire. Remote mounting of power supply is not allowed.

[i. Shall be dimmable, and compatible with a standard dimming control circuit of 0 - 10V or other approved dimming system.

] j. Shall be equipped with over-temperature protection circuit that turns light source off until normal operating temperature is achieved.

]2.2.4 LED Luminaire Surge Protection

Provide surge protection integral to luminaire as defined by JIS C 5381-11

[2.3 OBSTRUCTION MARKER LUMINAIRES

Provide obstruction marker luminaires for facilities as required by the FAA and in accordance with Section 26 56 20 AIRFIELD AND HELIPORT LIGHTING AND VISUAL NAVIGATION AIDS.

]2.4 EXTERIOR LUMINAIRE CONTROLS

[Provide a control system interface within each luminaire that is compatible with the energy management or control system used by the utility department in charge of the project area for control of site lighting.]

[2.4.1 Photocell

JIS C 8369. Photocells shall be hermetically sealed,[cadmium sulfide][silicon diode] light sensor type, rated at [_____] watts, [_____] volts, 50/60 Hz with single-pole, [single][double]-throw contacts. Photocell shall be designed to fail to the ON position. Housing shall be constructed of [polycarbonate] [die cast aluminum] [UV stabilized polypropylene], rated to operate within a temperature range of minus 40 to 70 degrees C.[Photocell shall have a 13 mm threaded base for mounting to a junction box or conduit. Provide[fixed][swivel] base type housing.][Photocell shall be twist-lock receptacle type=. Provide with solid brass prongs and voltage markings and color coding on exterior of housing.] Photocell shall turn on at 10-30 lux and turn off at 30 to 150 lux. A time delay shall prevent accidental switching from transient light sources.[Provide a directional lens in front of the cell to prevent fixed light sources from creating a turnoff condition.][Provide photocell with metal oxide varistor (MOV) type surge protection.][Photocell to be designed for 20-year service to match life expectancy of long-life LED fixtures and exceeds 15,000 operations at full load. Provide photocell with zero-cross technology to withstand severe in-rush current and extend relay life.]

][2.4.2 Timeswitch

[Timeswitch shall be electromechanical type with a[24 hour][7 day] [astronomic] dial[that changes on/off settings according to seasonal variations of sunset and sunrise]. Switch shall be powered by an enclosed synchronous motor with a maximum 3 watt operating rating. Timeswitch contacts shall be rated for [40][_____] amps at 120-277 or 100-230 VAC resistive load in a [SPST][DPST][SPDT][DPST][normally open (NO)][

normally closed (NC)] configuration. Switch shall have an automatic spring mechanism to maintain accurate time for up to 16 hours during a power failure.[Provide switch with function that allows automatic control to be skipped on certain selected days of the week.][Provide switch with manual bypass or remote override control.]

][Timeswitch shall be an electronic type with a[24 hour][7 day] [astronomic] programming function [that changes on/off settings according to seasonal variations of sunset and sunrise], providing a total of [56][_____] on/off set points. Digital clock display format shall be[AM/PM 12 hour][24 hour] type. Provide power outage backup for switch utilizing a[capacitor][alkaline batteries][lithium battery] which provides coverage for a minimum of [7 days][3 years][8 years]. Timeswitch shall provide control to [1][2][4][_____] channels or loads. Contacts shall be rated for [30] [_____] amps at 120-277 or 100-230 VAC resistive load in a [SPST][DPST][SPDT][DPST] [normally open (NO)][normally closed (NC)] configuration. [Provide switch with [function that allows automatic control to be skipped on certain selected days of the week][manual bypass or remote override control][daylight savings time automatic adjustment][EEPROM memory module][momentary function for output contacts][ability for photosensor input]].

] Timeswitch shall be housed in a surface-mounted, lockable [indoor][weatherproof][ ] IP rated enclosure constructed of painted steel or plastic polymer conforming to JIS C 8462-1.

][2.4.3 Lighting Contactor

JIS C 8201-4-3. Provide a [mechanically][electrically]-held lighting contactor [housed in a [indoor][weatherproof][ ] IP rated enclosure conforming to JIS C 8462-1]. Contactor shall have [2][4][6][_____] poles, configured as [normally open (NO)][normally closed (NC)]. Contacts shall be rated [600] [_____] volts, [30][_____] amperes for a resistive load. Coil operating voltage shall be [24][105][120][210][240][277][_____] volts. Contactor shall have silver cadmium oxide double-break contacts [and coil clearing contacts for mechanically held contactors] and shall require no arcing contacts. [Provide contactor with hand-off-automatic [on-off] selector switch.] [Provide contactor as specified above along with [disconnect switch][circuit breaker] in integral [indoor][weatherproof][ ] IP rated enclosure with flange-mounted handle to satisfy requirement for a "combination lighting contactor" when specified.]

][2.4.4 Lighting Control Relay Panel

Panel shall consist of a single [indoor][weatherproof][ ] IP rated [flush][surface]-mounted enclosure with two separate interior sections; one for Class 1 (branch circuit) and one for Class 2 (low voltage) wiring. Provide panel with [8][16][32][_____] relays. Panel shall be designed as [a stand alone][an automated control system interface] type. The Class 1 section shall contain the load side of all relays and the incoming branch circuit wiring. The Class 2 section shall contain the control power transformer (24 volt output), relays, relay control modules, and control wiring[, and native BACnet[LONworks] field-programmable application controller for panels connected to the facility automated control system]. Panel enclosure shall be constructed of [16][14] gauge cold-rolled steel with baked-on enamel finish.

Relays shall be [1][2]-pole, rated at 20 amperes [210][300][420][440][480]

VAC with rated life of 120,000 mechanical operations minimum.

Relay control module shall be 24 volt, electronic type and control up to 16 separate relays (16 channel) or programmed groups of relays. Provide with inputs for signals from devices such as photocells, timeclocks, and motion sensors. [Relay control module with integral timeclock function shall be 24 volt, electronic type with LCD display and control up to 8 separate relays (8 channel)].

][2.4.5 Motion Sensor

JIS C 8201-5-2. Provide [passive infrared][microwave][dual technology passive infrared/microwave] type sensors with [270][_____] degree coverage, time delay that can be adjusted from 15 seconds to 15 minutes, and "fail to ON position" default state. Sensors shall be located to achieve coverage of areas as indicated on project plans. Coverage patterns shall be derated as recommended by manufacturer based on mounting height of sensor and any obstructions such as trees. Do not use gross rated coverage in manufacturer's product literature. Sensors installed integral to the luminaire must be provided by the luminaire manufacturer. Sensors shall have an integral light level sensor that does not allow luminaires to operate during daylight hours and shall be designed to operate on a voltage of [105 VAC][210 VAC][120/277 VAC][24 VDC]. [Provide sensors to operate in conjunction with bi-level controllers that lower LED luminaires to a 50 percent output.] Sensor shall be [equipped with a threaded base for mounting to a weatherproof junction box][mounted directly to luminaire].

][2.5 POLES

Provide poles designed for wind loading of [161][_____] km/hr determined in accordance with JIS C 8105-2-3 while supporting luminaires and all other appurtenances indicated. The effective projected areas of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole. Poles shall be[embedded][anchor]-base type designed for use with[underground][overhead] supply conductors.[Poles[, other than wood poles,] shall have oval-shaped handhole having a minimum clear opening of 65 by 130 mm. Handhole cover shall be secured by stainless steel captive screws.][Metal poles shall have an internal grounding connection accessible from the handhole near the bottom of each pole.] Scratched, stained, chipped, or dented poles shall not be installed.

[2.5.1 Concrete Poles

Provide concrete poles conforming to JIS A 5373. Cross-sectional shape shall be[round][or][multi-sided]. Provide poles designed for wind loading of [100][ ] meters per hour determined in accordance with JIS C 8105-2-3 while supporting luminaires and all other appurtenances indicated. The effective projected areas of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole.

2.5.1.1 Steel Reinforcing

Prestressed concrete pole shafts shall be reinforced with steel prestressing members. Design shall provide internal longitudinal loading by either pretensioning or post tensioning of longitudinal reinforcing members.

2.5.1.2 Tensioned Reinforcing

Primary reinforcement steel used for a prestressed concrete pole shaft shall be tensioned between 60 to 70 percent of its ultimate strength. The amount of reinforcement shall be such that when reinforcement is tensioned to 70 percent of its ultimate strength, the total resultant tensile force does not exceed the minimum section compressive strength of the concrete.

2.5.1.3 Coating and Sleeves for Reinforcing Members

Where minimum internal coverage cannot be maintained next to required core openings, such as handhole and wiring inlet, reinforcing shall be protected with a vaporproof noncorrosive sleeve over the length without the 13 mm concrete coverage. Each steel reinforcing member which is to be post-tensioned shall have a nonmigrating slipper coating applied prior to the addition of concrete to ensure uniformity of stress throughout the length of such member.

2.5.1.4 Strength Requirement

As an exception to the requirements of JIS A 5373, poles shall be naturally cured to achieve a 28-day compressive strength of 48.23 MPa. Poles shall not be subjected to severe temperature changes during the curing period.

2.5.1.5 Shaft Preparation

Completed prestressed concrete pole shaft shall have a hard, smooth, nonporous surface that is resistant to soil acids, road salts, and attacks of water and frost, and shall be clean, smooth, and free of surface voids and internal honeycombing. Poles shall not be installed for at least 15 days after manufacture.

][2.5.2 Aluminum Poles

Provide aluminum poles manufactured of corrosion resistant aluminum alloys conforming to JIS C 8105-2-3for Alloy 6063-T6 or Alloy 6005-T5 for wrought alloys and Alloy 356-T4 (3,5) for cast alloys. Poles shall be seamless extruded or spun seamless type with minimum 4.8 mm wall thickness. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Tops of shafts shall be fitted with a round or tapered cover. Base shall be anchor bolt mounted, made of cast aluminum alloy and shall be machined to receive the lower end of shaft. Joint between shaft and base shall be welded. Base cover shall be cast aluminum alloy. Hardware, except anchor bolts, shall be either anodized aluminum alloy or stainless steel.[Aluminum poles and brackets for [walkway][_____] lighting shall have a[uniform satin][dark anodic bronze][_____] finish to match fixtures and shall not be painted.] Manufacturer's standard provision shall be made for protecting the finish during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes.

][2.5.3 Steel Poles

JIS C 8105-2-3. Provide steel poles having minimum 11-gage steel with minimum yield/strength of 331 MPa and[hot-dipped galvanized in accordance with JIS H 8641][iron-oxide primed] factory finish. Provide a pole

grounding connection designed to prevent electrolysis when used with copper ground wire. Pole shall be[direct set][anchor bolt mounted] type. Poles shall have tapered tubular members, either round in cross section or polygonal.[Pole shafts shall be one piece. Poles shall be welded construction with no bolts, rivets, or other means of fastening except as specifically approved.] Pole markings shall be approximately 900 to 1270 mm above grade and shall include manufacturer, year of manufacture, top and bottom diameters, and length.[Base covers for steel poles shall be structural quality hot-rolled carbon steel plate having a minimum yield of 248 MPa.]

][2.5.4 Fiberglass Poles

Designed specifically for supporting luminaires and having factory-formed cable entrance and handhole. Resin color shall be[dark bronze][as indicated][_____], and pigment shall provide uniform coloration throughout entire wall thickness. Finish surface shall be pigmented polyurethane having a minimum dry film thickness of 0.038 mm. Polyurethane may be omitted if the surface layer of the pole is inherently ultraviolet inhibited. Minimum fiberglass content shall be 65 percent with resin and pigment comprising the other 35 percent material content.

]][2.6 BRACKETS AND SUPPORTS

JIS C 8105-2-3, as applicable. Pole brackets shall be not less than 31.75 mm[galvanized steel pipe][aluminum] secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaires provided, and brackets for use with one type of luminaire shall be identical. Brackets for pole-mounted street lights shall correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 7320 mm above street. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with luminaire head.

][2.7 POLE FOUNDATIONS

Anchor bolts shall be steel rod having a minimum yield strength of 344.5 MPa; the top 305 mm of the rod shall be galvanized. Concrete shall be as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

]2.8 EQUIPMENT IDENTIFICATION

2.8.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.8.2 Labels

Provide labeled luminaires in accordance with JIS C 8105-1 requirements. Luminaires shall be clearly marked for operation of specific light sources and ballasts according to proper light source type. The following light source characteristics shall be noted in the format "Use Only _____":

a. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

Markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place.

2.9 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of JIS C 0920 corrosion-resistance test.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, JIS C 0365 and to the requirements specified herein.

[3.1.1 Concrete Poles

Install concrete poles per JIS A 5373. Poles shall be [embedded] [anchor]-base type designed for use with [underground] [overhead] supply conductors. Install according to pole manufacturer's instructions.

][3.1.2 Fiberglass Poles

Install fiberglass poles designed specifically for supporting luminaires and having factory-formed cable entrance and handhole. Install according to pole manufacturer's instructions and applicable standards.

][3.1.3 [Aluminum][Steel] Poles

Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 1.57 rad at the bottom end. Provide ornamental covers to match pole and galvanized nuts and washers for anchor bolts. Concrete for anchor bases, polyvinyl chloride (PVC) conduit ells, and ground rods shall be as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit ell. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.[After installation, paint exposed surfaces of steel poles with two finish coats of[exterior oil paint of a color as indicated][aluminum paint]. Install according to pole manufacturer's instructions. Alterations to poles after fabrication will void manufacturer's warranty and shall not be allowed.]

]3.1.4 Pole Setting

[Depth shall be as indicated.][Poles in straight runs shall be in a straight line. Dig holes large enough to permit the proper use of tampers to the full depth of the hole. Place backfill in the hole in 150 mm maximum layers and thoroughly tamp. Place surplus earth around the pole in a conical shape and pack tightly to drain water away.]

[3.1.5 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations.[Mount switch on or beside each luminaire when switch is provided in cast weatherproof aluminum housing with swivel arm.][Set adjustable window slide for

[_____] lux photocell turn-on.]

]3.1.6 GROUNDING

Ground noncurrent-carrying parts of equipment including[metal poles,] luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.1.7 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.2 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test after 100 hours of burn-in time to show that the equipment operates in accordance with the requirements of this section.

-- End of Section --

SECTION 27 10 00

BUILDING TELECOMMUNICATIONS CABLING SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. Contractor may substitute compatible Japan Industrial Standard (JIS), Japan Architectural Standard Specification (JASS), or Japan Wire Industry Association Standard (JCS) standards for non-Japanese standards, as approved by the Contracting Officer's representative.

JAPAN WIRE INDUSTRY ASSOCIATION STANDARD (JCS)

JCS 5507	(2010) LAN Twisted Pair Cable

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS C 3665-1-1	(2007) Tests on electric and optical fibre cables under fire conditions -- Part 1-1: Test for vertical flame propagation for a single insulated wire or cable -- Apparatus
JIS C 5964-4	(2014) Fiber optic connector interfaces -- Part 4: Type SC connector family (F04 Type)
JIS C 5964-4-100	(2018) Fiber optic connector interfaces -- Part 4-100: Type SC connector family -- Simplified receptacle SC-PC connector interfaces (F16 type)
JIS C 5964-18	(2014) Fiber optic connector interfaces -- Part 18: Type MT-RJ connector family (F19 type)
JIS C 5964-20	(2015) Fiber optic connector interfaces -- Part 20: Type LC connector family
JIS C 6011-1	(2015) Mechanical structures for electronic equipment -- Tests for IEC 60917 and IEC 60297 series -- Part 1: Environmental requirements, test set-up and safety aspects for cabinets, racks, subracks and chassis under indoor conditions
JIS C 6012-3-100	(2015) Mechanical structures for electronic equipment -- Dimensions of mechanical structures of the 482.6 mm (19 in) series -- Part 3-100: Basic dimensions of front panels, subracks, chassis, racks and cabinets

JIS C 6185-2	(2014) Optical time-domain reflectometers (OTDR) -- Part 2: Calibration of OTDR for single mode fibers
JIS C 6185-3	(2014) Optical time-domain reflectometers (OTDR) -- Part 3: Calibration of OTDR for multimode fibers
JIS C 6820	(2018) General rules of optical fibers
JIS C 6850	(2006) General rules of optical fiber cables
JIS C 6870-2	(2006) Indoor optical fiber cables -- Part 2: Sectional specification
JIS C 8435	(2018) Boxes And Box Covers Of Plastic Conduits
JIS C 60364-4-42	(2006) Electrical installations of buildings -- Part 4-42: Protection for safety -- Protection against thermal effects
JIS C 60364-5-54	(2006) Building Electrical Equipment-Part 5-54: Selection Of Electrical Equipment and Contruction-Grounding Equipment, Protective Conductor and Protective Bonding Conductor
JIS C 61300-2-2	(2011) Fiber optic interconnecting devices and passive components -- Basic test and measurement procedures -- Part 2-2: Tests -- Mating durability
JIS K 6911	(2006) Thermosetting plastic general test method
JIS X 5150	(R2016) Information Technology-Generic Cabling for Customer Premises

UNDERWRITERS LABORATORIES (UL)

UL 1666	(2007; Reprint Jun 2012) Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
UL 723	(2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials

1.2 RELATED REQUIREMENTS

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and Section 33 82 00 TELECOMMUNICATIONS, OUTSIDE PLANT (OSP), apply to this section with additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in JIS X 5150, JCS 5507, JIS C 6820, JIS C 6850, and herein.

1.3.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect (MC).)

1.3.2 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect (IC).)

1.3.3 Floor Distributor (FD)

A distributor used to connect horizontal cable and cabling subsystems or equipment. (International expression for horizontal cross-connect (HC).)

1.3.4 Telecommunications Room (TR)

An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling.

1.3.5 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including wireless) including the entrance point at the building wall and continuing to the equipment room.

1.3.6 Equipment Room (ER) (Telecommunications)

An environmentally controlled centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.3.7 Open Cable

Cabling that is not run in a raceway as defined by applicable codes and standards. This refers to cabling that is "open" to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space.

1.3.8 Open Office

A floor space division provided by furniture, moveable partitions, or other means instead of by building walls.

1.3.9 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.4 SYSTEM DESCRIPTION

The building telecommunications cabling and pathway system shall include permanently installed backbone and horizontal cabling, horizontal and backbone pathways, service entrance facilities, work area pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting cabling necessary to transport telephone and data (including LAN) between equipment items in a building. The horizontal system shall be wired in a star topology from the telecommunications work area to the floor distributor or campus distributor at the center or hub of the star. The backbone cabling and pathway system includes intrabuilding and interbuilding interconnecting cabling, pathway, and terminal hardware. The intrabuilding backbone provides connectivity from the floor distributors to the building distributors or to the campus distributor and from the building distributors to the campus distributor as required. The backbone system shall be wired in a star topology with the campus distributor at the center or hub of the star.[The interbuilding backbone system provides connectivity between the campus distributors and is specified in Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP).] Provide telecommunications pathway systems referenced herein as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.[The telecommunications contractor must coordinate with the NMCI/COSC/NGEN contractor concerning access to and configuration of telecommunications spaces. The telecommunications contractor may be required to coordinate work effort within the telecommunications spaces with the NMCI/COSC/NGEN contractor.]

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications drawings; G[, [_____]]

Telecommunications Space Drawings; G[, [_____]]

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

SD-03 Product Data

Telecommunications cabling (backbone and horizontal); G[, [_____]]

Patch panels; G[, [_____]]

Telecommunications outlet/connector assemblies; G[, [_____]]

Equipment support frame; G[, [_____]]

[Connector blocks; G[, [_____]]]

SD-06 Test Reports

Telecommunications cabling testing;

SD-10 Operation and Maintenance Data

Telecommunications cabling and pathway system Data Package 5;

SD-11 Closeout Submittals

Record Documentation;

1.6 QUALITY ASSURANCE

1.6.1 Shop Drawings

In exception to Section 01 33 00 SUBMITTAL PROCEDURES, submitted plan drawings shall be a minimum of 279 by 432 mm in size using a minimum scale of one mm per 100 mm[, except as specified otherwise]. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

1.6.1.1 Telecommunications Drawings

Provide[registered communications distribution designer (RCDD) approved,] drawings in accordance with applicable codes and standards. The identifier for each termination and cable shall appear on the drawings. Drawings shall depict final telecommunications installed wiring system infrastructure. The drawings should provide details required to prove that the distribution system shall properly support connectivity from the EF telecommunications and ER telecommunications, CD's[, BD's], and FD's to the telecommunications work area outlets.[Provide a plastic laminated schematic of the as-installed telecommunications cable system showing cabling, CD's, BD's, FD's, and the EF and ER for telecommunications keyed to floor plans by room number. Mount the laminated schematic in the EF telecommunications space as directed by the Contracting Officer.] The following drawings shall be provided as a minimum:

a. T1 - Layout of complete building per floor - Building Area/Serving Zone Boundaries, Backbone Systems, and Horizontal Pathways. Layout of complete building per floor. The drawing indicates location of building areas, serving zones, vertical backbone diagrams, telecommunications rooms, access points, pathways, grounding system, and other systems that need to be viewed from the complete building perspective.

b. T2 - Serving Zones/Building Area Drawings - Drop Locations and Cable Identification (ID’S). Shows a building area or serving zone. These drawings show drop locations, telecommunications rooms, access points and detail call outs for common equipment rooms and other congested areas.

c. T4 - Typical Detail Drawings - Faceplate Labeling, Firestopping, Americans with Disabilities Act (ADA), Safety, Department of Transportation (DOT). Detailed drawings of symbols and typicals such as faceplate labeling, faceplate types, faceplate population installation procedures, detail racking, and raceways.

1.6.1.2 Telecommunications Space Drawings

Provide T3 drawings that include telecommunications rooms plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and [cabinet][, rack][, backboard][and] wall elevations. Drawings shall show layout of applicable equipment including incoming cable stub or connector blocks, building protector assembly, outgoing cable connector blocks, patch panels and equipment spaces and cabinet/racks. Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation. Drawings may also be an enlargement of a congested area of T1 or T2 drawings.

1.6.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.2.1 Telecommunications Contractor

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years of similar scope and size. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor.

1.6.2.2 Key Personnel

Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel.

In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have a minimum of [3][_____] years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications systems and provide the names and locations of at least two project installations successfully completed using [optical fiber and]copper telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

Indicate that all key persons are currently employed by the telecommunications contractor, or have a commitment to the telecommunications contractor to work on this project. All key persons shall be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer.

Note that only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor's key personnel requires approval from The Contracting Officer.

1.6.2.3 Minimum Manufacturer Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of [3] [_____] years experience in the manufacturing, assembly, and factory testing of components which comply with JIS X 5150, JCS 5507 and JIS C 6820 and JIS C 6850.

1.6.3 Test Plan

Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the components and accessories for each cable type specified, [60][_____] days prior to the proposed test date. Include procedures for certification, validation, and testing.

1.6.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in

these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of applicable codes and standards unless more stringent requirements are specified or indicated.

1.6.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.6.5.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.5.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 year prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 DELIVERY AND STORAGE

Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

1.8 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 0 to 60 degrees C and in the range of 0 to 95 percent relative humidity, noncondensing.

1.9 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.10 MAINTENANCE

1.10.1 Operation and Maintenance Manuals

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications cabling and pathway system, Data Package

5. Submit operations and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein not later than [2] [_____] months prior to the date of beneficial occupancy. In addition to requirements of Data Package 5, include the requirements of paragraphs TELECOMMUNICATIONS DRAWINGS, TELECOMMUNICATIONS SPACE DRAWINGS, and RECORD DOCUMENTATION. Ensure that these drawings and documents depict the as-built configuration.

1.10.2 Record Documentation

Provide T5 drawings including documentation on cables and termination hardware. T5 drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts and cover plate assignments, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided[in hard copy format][on electronic media using Windows based computer cable management software.][A licensed copy of the cable management software including documentation, shall be provided.] Provide the following T5 drawing documentation as a minimum:

a. Cables - A record of installed cable shall be provided. The cable records shall [include only the required data fields][include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility]. Include manufacture date of cable with submittal.

b. Termination Hardware - A record of installed patch panels, cross-connect points, distribution frames, terminating block arrangements and type, and outlets shall be provided. Documentation shall include the required data fields[as a minimum][only].

PART 2 PRODUCTS

2.1 COMPONENTS

Components shall be UL or third party certified. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard. Provide a complete system of telecommunications cabling and pathway components using star topology. Provide support structures and pathways, complete with outlets, cables, connecting hardware and telecommunications cabinets/racks. Cabling and interconnecting hardware and components for telecommunications systems shall be listed or third party independent testing laboratory certified, and shall comply with applicable codes and standards and conform to the requirements specified herein.

2.2 TELECOMMUNICATIONS PATHWAY

Provide telecommunications pathways in accordance with JIS X 5150 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.3 TELECOMMUNICATIONS CABLING

Cabling shall be listed for the application and shall comply with JIS X 5150, JCS 5507, JIS C 6820 and JIS C 6850. Provide a labeling system for cabling as required. Ship cable on reels or in boxes bearing manufacture date for for unshielded twisted pair (UTP) in accordance with JCS 5507[and optical fiber cables in accordance with JIS C 6870-2] for all cable used on this project. Cabling manufactured more than 12 months prior to date of installation shall not be used.

[2.3.1 Backbone Cabling

[2.3.1.1 Backbone Copper

Copper backbone cable shall be solid conductor, 0.2 sqmm, 100 ohm, [100] [_____]-pair, Category 3, UTP, in accordance with JCS 5507, JIS X 5150, JCS 5507 and JCS 5000 series, formed into [25][10] pair binder groups covered with a[gray][____] thermoplastic jacket[and overall metallic shield]. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular length marking intervals in accordance with JCS 5507. Provide plenum (CMP), riser (CMR), or general purpose (CM or CMG)communications rated cabling as required. Substitution of a higher rated cable shall be permitted upon approval prior to installation.

][2.3.1.2 Backbone Optical Fiber

Provide in accordance with JIS C 6870-2, JIS C 6820, JIS C 6850, UL 1666 and JIS C 3665-1-1. Cable shall be imprinted with fiber count, fiber type and aggregate length at regular intervals not to exceed 1 meter.

Provide the number of strands indicated, (but not less than 12 strands between the main telecommunication room and each of the other telecommunication rooms), of single-mode(OS1), tight buffered fiber optic cable.

[Provide tight buffered fiber optic multimode, [50/125-um diameter laser optimized(OM3)][50/125-um diameter(OM2)][62.5/125-um diameter(OM1)] cable as indicated.]

Provide plenum (OFNP), riser (OFNR), or general purpose (OFN or OFNG) rated non-conductive, fiber optic cable as required per application. Substitution of a higher rated cable shall be permitted. The cable cordage jacket, fiber, unit, and group color shall be in accordance with JIS X 5150.

Provide plenum (OFNP) riser (OFNR) , or general purpose (OFN or OFNG) rated non-conductive, fiber optic cable as required per application. Substitution of a higher rated cable shall be permitted . The cable cordage jacket, fiber, unit, and group color shall be in accordance with JIS X 5150.

]]2.3.2 Horizontal Cabling

Provide horizontal cable and performance characteristics in accordance with JIS X 5150.

2.3.2.1 Horizontal Copper

Provide horizontal copper cable, UTP, 100 ohm in accordance with JCS 5507, and JIS X 5150. Provide four each individually twisted pair, minimum size 0.2 sqmm conductors, Category 6, with a[blue][_____] thermoplastic jacket. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) and length marking at regular intervals in accordance with JCS 5507. Provide plenum (CMP), riser (CMR), or general purpose (CM or CMG) communications rated cabling as required per application. Substitution of a higher rated cable shall be permitted . Cables installed in conduit within and under slabs shall be listed and labeled for wet locations. [Provide residential Category 6 cabling as required.]

[2.3.2.2 Horizontal Optical Fiber

Provide optical fiber horizontal cable in accordance with JIS C 6870-2 and JIS C 6820 and JIS C 6850. Cable shall be tight buffered, [multimode, 50/125-um diameter laser optimized, OM3][,][multimode, 50/125-um diameter, OM2][multimode, 62.5.125-um diameter, OM1][single-mode, 8/125-um diameter, OS1]. Cable shall be imprinted with manufacturer, flammability rating and fiber count at regular intervals not to exceed 1 meter.

Provide plenum (OFNP), riser (OFNR), or general purpose (OFN or OFNG) rated non-conductive, fiber optic cable as required per application. Substitution of a higher rated cable shall be permitted. Cables installed in conduit within and under slabs be listed and labeled for wet locations. The cable jacket shall be of single jacket construction with color coding of cordage jacket, fiber, unit, and group in accordance with JIS X 5150.

][2.3.3 Work Area Cabling

2.3.3.1 Work Area Copper

Provide work area copper cable in accordance with JCS 5507, with a[blue,][_____] thermoplastic jacket.

[2.3.3.2 Work Area Optical Fiber

Provide optical work area cable in accordance with JIS C 6820 and JIS C 6850.

]]2.4 TELECOMMUNICATIONS SPACES

Provide connecting hardware and termination equipment in the telecommunications entrance facility[and telecommunication equipment room[s]] to facilitate installation as shown on design drawings for terminating and cross-connecting permanent cabling. Provide telecommunications interconnecting hardware color coding in accordance with [base][facility] standards.

2.4.1 Backboards

Provide void-free, interior grade A-C plywood 19 mm thick[1200 by 2400 mm] [as indicated]. Backboards shall be fire rated by manufacturing process. Fire stamp shall be clearly visible.[Paint applied over fire retardant backboard shall be UL 723 and JIS C 60364-4-42 fire retardant paint.

Provide label including paint manufacturer, date painted, UL listing and name of Installer. When painted, paint label and fire stamp shall be clearly visible.] Backboards shall be provided on a minimum of two adjacent walls in the telecommunication spaces.

[2.4.2 Equipment Support Frame

Provide in accordance with JIS C 6011-1 and JIS C 6012-3-100.

[a. Bracket, wall mounted, 8 gauge aluminum. Provide hinged bracket compatible with [482.6 mm][584 mm] panel mounting.

][b. Racks, floor mounted modular type, [16 gauge steel][or][11 gauge aluminum] construction, minimum, treated to resist corrosion. Provide rack with vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug[and a surge protected power strip with 6 duplex 20 amp receptacles]. Rack shall be compatible with[482.6 mm][584 mm] panel mounting.

][c. Cabinets, freestanding modular type, [16 gauge steel][or][11 gauge aluminum] construction , minimum, treated to resist corrosion. Cabinet shall have removable and lockable side panels, front and rear doors, and have adjustable feet for leveling. Cabinet shall be vented in the roof and rear door. Cabinet shall have cable access in the roof and base and be compatible with[482.6 mm][584 mm] panel mounting. Provide cabinet with grounding bar[,][[rack][roof] mounted 15 cu. m fan with filter][and][a surge protected power strip with 6 duplex 20 amp receptacles].[All cabinets shall be keyed alike.]

][d. Cabinets, wall-mounted modular type, [16 gauge steel][or][11 gauge aluminum] construction , minimum, treated to resist corrosion. Cabinet shall have have lockable front[and rear] door[s], louvered side panels,[7 cu. m [roof][rack] mounted fan,] ground lug, and top and bottom cable access. Cabinet shall be compatible with[482.6 mm][584 mm] panel mounting.[All cabinets shall be keyed alike.][A [duplex AC outlet][surge protected power strip with 6 duplex 20 amp receptacles] shall be provided within the cabinet.]

]][2.4.3 Connector Blocks

Provide insulation displacement connector (IDC) Type 110 for Category 6 systems. Provide blocks for the number of horizontal and backbone cables terminated on the block plus 25 percent spare.

][2.4.4 Cable Guides

Provide cable guides specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on[[482.6][584] mm equipment[racks][cabinets]][and][telecommunications backboards]. Cable guides of ring or bracket type devices[mounted on [rack][cabinet] panels][backboard] for horizontal cable management and individually mounted for vertical cable management. Mount cable guides with screws,[and][or]nuts and lockwashers.

][2.4.5 Patch Panels

Provide ports for the number of horizontal and backbone cables terminated on the panel plus [25][_____] percent spare. Provide pre-connectorized

[optical fiber][and][copper] patch cords for patch panels. Provide patch cords, as complete assemblies, with matching connectors as specified.[Provide fiber optic patch cables with crossover orientation in accordance with JIS C 6820 and JIS C 6850]. Patch cords shall meet minimum performance requirements specified in JIS X 5150, JCS 5507 [and JIS C 6820 and JIS C 6850] for cables, cable length and hardware specified.

2.4.5.1 Modular to 110 Block Patch Panel

Provide in accordance with JIS X 5150 and JCS 5507. Panels shall be third party verified[and shall comply with EIA/TIACategory 6 requirements]. Panel shall be constructed of 2.2 mm minimum aluminum and shall be [cabinet][rack][wall] mounted and compatible with JIS C 6012-3-100 [482.6 mm][584 mm] equipment[cabinet][rack]. Panel shall provide [48][_____] non-keyed, 8-pin modular ports, wired to [T568A][T568B]. Patch panels shall terminate the building cabling on Type 110 IDCs and shall utilize a printed circuit board interface. The rear of each panel shall have incoming cable strain-relief and routing guides. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port.

[2.4.5.2 Fiber Optic Patch Panel

Provide panel for maintenance and cross-connecting of optical fiber cables. Panel shall be constructed of[[16][18] gauge steel][or][11 gauge aluminum] minimum and shall be [cabinet][rack][wall] mounted and compatible with a JIS C 6012-3-100[482.6 mm][584 mm] equipment rack. Each panel shall provide [12][_____] [multimode][single-mode] adapters as [duplex LC in accordance with JIS C 5964-20 with zirconia ceramic alignment sleeves,] [duplex SC in accordance with JIS C 5964-4 and JIS C 5964-4-100 with zirconia ceramic][MT-RJ in accordance with JIS C 5964-18 with thermoplastic][ST in accordance with with metallic] alignment sleeves. Provide dust cover for unused adapters. The rear of each panel shall have a cable management tray a minimum of 203 mm deep with removable cover, incoming cable strain-relief and routing guides. Panels shall have each adapter factory numbered and be equipped with laminated plastic nameplates above each adapter.

]][2.4.6 Optical Fiber Distribution Panel

[Cabinet][Rack][Wall] mounted optical fiber distribution panel (OFDP) shall be constructed in accordance with JIS C 6012-3-100 utilizing[[16][18] gauge steel][or][11 gauge aluminum] minimum. Panel shall be divided into two sections, distribution and user. Distribution section shall have strain relief, routing guides, splice tray and shall be lockable, user section shall have a cover for patch cord protection. Each panel shall provide[[12][_____] multimode][and][[12][_____] single-mode] pigtails and adapters. Provide adapters as [duplex LC with zirconia ceramic] [duplex SC with zirconia ceramic][MT-RJ with thermoplastic][ST with metallic] alignment sleeves. Provide dust covers for adapters. Provide patch cords as specified in the paragraph PATCH PANELS.

]2.5 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

2.5.1 Outlet/Connector Copper

Outlet/connectors shall comply with JIS X 5150 and JCS 5507. UTP outlet/connectors shall be JIS X 5150 listed, non-keyed, 8-pin modular,

constructed of high impact rated thermoplastic housing and shall be third party verified[and shall comply with JCS 5507 Category 6 requirements.] Outlet/connectors provided for UTP cabling shall meet or exceed the requirements for the cable provided. Outlet/connectors shall be terminated using a Type 110 IDC PC board connector, color-coded for both T568A and T568B wiring. Each outlet/connector shall be wired [T568A][or][T568B][as indicated]. UTP outlet/connectors shall comply with JCS 5507 for [200] [_____] mating cycles.[UTP outlet/connectors installed in outdoor or marine environments shall be jell-filled type containing an anti-corrosive, memory retaining compound.]

2.5.2 Optical Fiber Adapters(Couplers)

Provide optical fiber adapters suitable for[duplex LC in accordance with JIS C 5964-20 with zirconia ceramic alignment sleeves,][duplex SC in Accordance with JIS C 5964-4 and JIS C 5964-4-100 with zirconia ceramic alignment sleeves,] [MT-RJ in accordance with JIS C 5964-18 with thermoplastic alignment sleeves,][and][ST with metallic alignment sleeves] as indicated. Provide dust cover for adapters. Optical fiber adapters shall comply with JIS C 61300-2-2 for [500][_____] mating cycles.

2.5.3 Optical Fiber Connectors

Provide in accordance with JIS C 61300-2-2.[Optical fiber connectors shall be[duplex LC in accordance with JIS C 5964-20 with zirconia ceramic alignment sleeves,] [duplex SC in accordance with JIS C 5964-4 and JIS C 5964-4-100 with zirconia ceramic][MT-RJ in accordance with JIS C 5964-18 with thermoplastic][ST in accordance with with metallic] ferrule, epoxyless[crimp style] compatible with[[62.5/125][50/125] multimode][8/125 single-mode] fiber. The connectors shall provide a maximum attenuation of 0.3 dB at[850][1300][1310][1550] nm with less than a 0.2 dB change after 500 mating cycles.]

2.5.4 Cover Plates

Telecommunications cover plates shall comply with JIS C 8435, and JIS X 5150, [JCS 5507], [JIS C 6820 and JIS C 6850]; [flush][or][oversized] design constructed of [high impact thermoplastic material [[ivory][white][brown] in color][to match color of receptacle/switch cover plates specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM]][302 stainless material][or][brass material]. Provide labeling in accordance with the paragraph LABELING in this section.

[2.6 MULTI-USER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

Provide MUTOA(s) in accordance with JIS X 5150.

][2.7 TERMINAL CABINETS

Construct of zinc-coated sheet steel,[915 by 610 by 150 mm deep][as indicated]. Trim shall be fitted with hinged door and locking latch. Doors shall be maximum size openings to box interiors. Boxes shall be provided with 16 mm backboard with two-coat varnish finish. Match trim, hardware, doors, and finishes with panelboards. Provide label and identification systems for telecommunications wiring and components.

]2.8 GROUNDING AND BONDING PRODUCTS

Provide in accordance with JIS C 60364-5-54. Components shall be

identified as required by applicable codes and standards. Provide ground rods, bonding conductors, and grounding busbars as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.9 FIRESTOPPING MATERIAL

Provide as specified in Section 07 84 00 FIRESTOPPING.

2.10 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.11 FIELD FABRICATED NAMEPLATES

JIS K 6911. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 3 mm thick, white with [black] [_____] center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 25 by 65 mm . Lettering shall be a minimum of 6.35 mm high normal block style.

2.12 TESTS, INSPECTIONS, AND VERIFICATIONS

2.12.1 Factory Reel Tests

Provide documentation of the testing and verification actions taken by manufacturer to confirm compliance with JIS X 5150, JCS 5507, JIS C 6820 and JIS C 6850[, JIS C 6185-2 for single mode optical fiber][, and JIS C 6185-3 for multimode optical fiber] cables.

PART 3 EXECUTION

3.1 INSTALLATION

Install telecommunications cabling and pathway systems, including the horizontal and backbone cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with JIS X 5150, JCS 5507, [JIS C 6820 and JIS C 6850,], and UL standards as applicable. Provide cabling in a star topology network.[Provide residential cabling in a star wiring architecture from the distribution device as required.] Pathways and outlet boxes shall be installed as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling.[Cabling shall be run with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.]

3.1.1 Cabling

Install [UTP,][and][optical fiber] telecommunications cabling system as detailed in JIS X 5150, [JCS 5507,] [JIS C 6820 and JIS C 6850, Appendix

A][and applicable codes and standards for residential cabling]. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 110 N pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. For UTP cable, bend radii shall not be less than four times the cable diameter. Cables shall be terminated; no cable shall contain unterminated elements. Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.

[3.1.1.1 Open Cable

Use only where specifically indicated on plans for use in cable trays, or below raised floors. Install in accordance withJIS X 5150, JCS 5507 [[and]JIS C 6820 and JIS C 6850, Appendix A]. Do not exceed cable pull tensions recommended by the manufacturer.[Copper cable not in a wireway or pathway shall be suspended a minimum of [200][_____] mm above ceilings by cable supports no greater than [1.5][_____] m apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 300 mm shall be maintained when such placement cannot be avoided.]

Plenum cable shall be used where open cables are routed through plenum areas. Cable routed exposed under raised floors shall be plenum rated. Plenum cables shall comply with flammability plenum requirements per applicable codes and standards. Install cabling after the flooring system has been installed in raised floor areas.[Cable [1.8][_____] meters long shall be neatly coiled not less than [300][_____] mm in diameter below each feed point in raised floor areas.]

]3.1.1.2 Backbone Cable

a. Copper Backbone Cable. Install intrabuilding backbone copper cable, in indicated pathways, between the campus distributor, located in the telecommunications entrance facility or room, the building distributors and the floor distributors located in telecommunications rooms and telecommunications equipment rooms as indicated on drawings.

b. Optical fiber Backbone Cable. Install intrabuilding backbone optical fiber in indicated pathways. Do not exceed manufacturer's recommended bending radii and pull tension. Prepare cable for pulling by cutting outer jacket 250 mm leaving strength members exposed for approximately 250 mm. Twist strength members together and attach to pulling eye. Vertical cable support intervals shall be in accordance with manufacturer's recommendations.

3.1.1.3 Horizontal Cabling

Install horizontal cabling as indicated on drawings Do not untwist Category 6 UTP cables more than 12 mm from the point of termination to maintain cable geometry. Provide slack cable in the form of a figure eight (not a service loop) on each end of the cable, 3 m in the telecommunications room, and 304 mm in the work area outlet.

3.1.2 Pathway Installations

Provide in accordance with JIS X 5150. Provide building pathway as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

[3.1.3 Service Entrance Conduit, Overhead

Provide service entrance overhead as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEMS.

][3.1.4 Service Entrance Conduit, Underground

Provide service entrance underground as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

]3.1.5 Cable Tray Installation

Install cable tray as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Only [CMP] [and] [OFNP] type cable shall be installed in a plenum.

3.1.6 Work Area Outlets

3.1.6.1 Terminations

Terminate UTP cable in accordance with JIS X 5150, JCS 5507 and wiring configuration as specified.[Terminate fiber optic cables in accordance with JIS C 6820 and JIS C 6850]

3.1.6.2 Cover Plates

As a minimum, each outlet/connector shall be labeled as to its function and a unique number to identify cable link in accordance with the paragraph LABELING in this section.

3.1.6.3 Cables

Unshielded twisted pair and fiber optic cables shall have a minimum of 304 mm of slack cable loosely coiled into the telecommunications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

3.1.6.4 Pull Cords

Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed.

[3.1.6.5 Multi-User Telecommunications Outlet Assembly (MUTOA)

Run horizontal cable in the ceiling or underneath the floor and terminate each cable on a MUTOA in each individual zone. MUTOAs shall not be located in ceiling spaces, or any obstructed area. MUTOAs shall not be installed in furniture unless that unit of furniture is permanently secured to the building structure. MUTOAs shall be located in an open work area so that each furniture cluster is served by at least one MUTOA. The MUTOA shall be limited to serving a maximum of twelve work areas. Maximum work area cable length requirements shall also be taken into account. MUTOAs must be labeled to include the maximum length of work area cables. MUTOA labeling is in addition to the labeling, or other applicable cabling administration standards. Work area cables extending

from the MUTOA to the work area device must also be uniquely identified and labeled.

]3.1.7 Telecommunications Space Termination

Install termination hardware required for [Category 6][and][optical fiber] system. An insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

[3.1.7.1 Connector Blocks

Connector blocks shall be [cabinet][rack][wall] mounted in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Install in accordance with industry standard wire routing guides in accordance with JIS X 5150.

]3.1.7.2 Patch Panels

Patch panels shall be mounted [in equipment [cabinets]][racks][on the plywood backboard] with sufficient ports to accommodate the installed cable plant plus [25][_____] percent spares.

[a. Copper Patch Panel. Copper cable entering a patch panel shall be secured to the panel [with cable ties][as recommended by the manufacturer] to prevent movement of the cable.

][b. Fiber Optic Patch Panel. Fiber optic cable loop shall be [[900][_____] mm in length][provided as recommended by the manufacturer]. The outer jacket of each cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

][3.1.7.3 Equipment Support Frames

Install in accordance with JIS X 5150:

[a. Bracket, wall mounted. Mount bracket to plywood backboard in accordance with manufacturer's recommendations. Mount rack so height of highest panel does not exceed 1980 mm above floor.]

[b. Racks, floor mounted modular type. Permanently anchor rack to the floor in accordance with manufacturer's recommendations.]

[c. Cabinets, freestanding modular type. When cabinets are connected together, remove adjoining side panels for cable routing between cabinets.[Mount rack mounted fan in [roof][base] of cabinet.]]

[d. Cabinets, wall-mounted modular type. Mount cabinet to plywood backboard in accordance with manufacturer's recommendations. Mount cabinet so height of highest panel does not exceed 1980 mm above floor.]

]3.1.8 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings as specified in Section 07 84 00 FIRESTOPPING.

3.1.9 Grounding and Bonding

Provide in accordance with JIS C 60364-5-54 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.2 LABELING

3.2.1 Labels

Provide labeling in accordance with applicable codes and standards. Handwritten labeling is unacceptable. Stenciled lettering for voice and data circuits shall be provided using[thermal ink transfer process][laser printer] [_____].

3.2.2 Cable

Cables shall be labeled using color labels on both ends with identifiers.

3.2.3 Termination Hardware

Workstation outlets and patch panel connections shall be labeled using color coded labels with identifiers.

3.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.3.1 Painting Backboards

If backboards are required to be painted, then the manufactured fire retardant backboard must be painted with fire retardant paint, so as not to increase flame spread and smoke density and must be appropriately labeled. Label and fire rating stamp must be unpainted.

3.4 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.5 TESTING

3.5.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and performance tests in accordance with JIS X 5150, [JCS 5507], [JIS C 6820 and JIS C 6850]. Test equipment shall conform to JIS X 5150. Perform optical fiber field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

3.5.1.1 Inspection

Visually inspect UTP and optical fiber jacket materials for UL or third party certification markings. Inspect cabling terminations in

telecommunications rooms and at workstations to confirm color code for T568A or T568B pin assignments, and inspect cabling connections to confirm compliance with JIS X 5150, JCS 5507, [JIS C 6820 and JIS C 6850], [and][applicable codes and standardsfor residential cabling]. Visually confirm [Category 6,] marking of outlets, cover plates, outlet/connectors, and patch panels.

3.5.1.2 Verification Tests

UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but prior to being cross-connected.

[[For multimode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with JIS C 6820 and JIS C 6850 and JIS C 6850 and JIS C 6185-3 using[Method A, Optical Power Meter and Light Source][Method B, OTDR] for multimode optical fiber.][For single-mode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with JIS C 6820 and JIS C 6850 and JIS C 6185-2 using[Method A, Optical Power Meter and Light Source][Method B, OTDR] for single-mode optical fiber.] Perform verification acceptance tests.]

3.5.1.3 Performance Tests

Perform testing for each outlet and MUTOA as follows:

[a. Perform Category 6 link tests in accordance with JIS X 5150 and JCS 5507. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.

][. Optical fiber Links. Perform optical fiber end-to-end link tests in accordance with JIS C 6820 and JIS C 6850.

]3.5.1.4 Final Verification Tests

Perform verification tests for UTP[and optical fiber] systems after the complete telecommunications cabling and workstation outlet/connectors are installed.

[a. Voice Tests. These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and DSN telephone call.

][b. Data Tests. These tests assume the Information Technology Staff has a network installed and are available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

] -- End of Section --

SECTION 31 00 00

EARTHWORK

PART 1 GENERAL

1.1 MEASUREMENT PROCEDURES

1.1.1 Excavation

The unit of measurement for excavation and borrow will be the cubic meter, computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. The measurements will include authorized excavation of rock (except for piping trenches that is covered below), authorized excavation of unsatisfactory subgrade soil, and the volume of loose, scattered rocks and boulders collected within the limits of the work; allowance will be made on the same basis for selected backfill ordered as replacement. The measurement will not include the volume of subgrade material or other material that is scarified or plowed and reused in-place, and will not include the volume excavated without authorization or the volume of any material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow pits, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to the taking of elevations and measurements of the undisturbed grade.

1.1.2 Piping Trench Excavation

Measure trench excavation by the number of linear meters along the centerline of the trench and excavate to the depths and widths specified for the particular size of pipe. Replace unstable trench bottoms with a selected granular material. Include the additional width at manholes and similar structures, the furnishing, placing and removal of sheeting and bracing, pumping and bailing, and all incidentals necessary to complete the work required by this section.

1.1.3 Rock Excavation for Trenches

Measure and pay for rock excavation by the number of cubic meters of acceptably excavated rock material. Measure the material in place, but base volume on a maximum 750 mm width for pipes 300 mm in diameter or less, and a maximum width of 400 mm greater than the outside diameter of the pipe for pipes over 300 mm in diameter. Provide the measurement to include all authorized overdepth rock excavation as determined by the Contracting Officer. For manholes and other appurtenances, compute volumes of rock excavation on the basis of 300 mm outside of the wall lines of the structures.

1.1.4 Topsoil Requirements

Separate excavation, hauling, and spreading or piling of topsoil and related miscellaneous operations will be considered subsidiary obligations of the Contractor, covered under the contract unit price for excavation.

1.1.5 Overhaul Requirements

Allow the unit of measurement for overhaul to be the station-meter. The overhaul distance will be the distance in stations between the center of volume of the overhaul material in its original position and the center of volume after placing, minus the free-haul distance in stations. The haul distance will be measured along the shortest route determined by the Contracting Officer as feasible and satisfactory. Do no measure or waste unsatisfactory materials for overhaul where the length of haul for borrow is within the free-haul limits.

1.1.6 Select Granular Material

Measure select granular material in place as the actual cubic meters replacing wet or unstable material in trench bottoms [within the limits shown] [in authorized overdepth areas]. Provide unit prices which include furnishing and placing the granular material, excavation and disposal of unsatisfactory material, and additional requirements for sheeting and bracing, pumping, bailing, cleaning, and other incidentals necessary to complete the work.

1.2 PAYMENT PROCEDURES

Payment will constitute full compensation for all labor, equipment, tools, supplies, and incidentals necessary to complete the work.

1.2.1 Classified Excavation

Classified excavation will be paid for at the contract unit prices per cubic meter for common or rock excavation.

1.2.2 Piping Trench Excavation

Payment for trench excavation will constitute full payment for excavation and backfilling, [including specified overdepth] except in rock or unstable trench bottoms.

1.2.3 Rock Excavation for Trenches

Payment for rock excavation will be made in addition to the price bid for the trench excavation, and will include all necessary drilling and all incidentals necessary to excavate and dispose of the rock. Select granular material, used as backfill replacing rock excavation, will not be paid for separately, but will be included in the unit price for rock excavation.

1.2.4 Unclassified Excavation

Unclassified excavation will be paid for at the contract unit price per cubic meter for unclassified excavation.

1.2.5 Classified Borrow

Classified borrow will be paid for at the contract unit prices per cubic meter for common or rock borrow.

1.2.6 Unclassified Borrow

Unclassified borrow will be paid for at the contract unit price per cubic meter for unclassified borrow.

1.2.7 Authorized Overhaul

The number of station-meters of overhaul to be paid for will be the product of number of cubic meters of overhaul material measured in the original position, multiplied by the overhaul distance measured in stations of 100 meters and will be paid for at the contract unit price per station-meter for overhaul in excess of the free-haul limit as designated in paragraph DEFINITIONS.

1.2.8 Sheeting and Bracing

Sheeting and bracing, when shown or authorized by the Contracting Officer to be left in place, will be paid for as follows: [_____].

1.2.8.1 Timber Sheeting

Timber sheeting will be paid for as the number of board feet of lumber below finish grade measured in place prior to backfilling. Include in the measurement sheeting wasted when cut off between the finished grade and 300 mm below the finished grade.

1.2.8.2 Steel Sheeting and Soldier Piles

Steel sheeting, soldier piles, and steel bracing will be paid for according to the number of pounds of steel calculated. Calculate the steel by multiplying the measured in-place length in meters below finish grade by the unit weight of the section in kg per meter. Obtain unit weight of rolled steel sections from recognized steel manuals. [Included in the measurement sheeting wasted when cut off between the finished grade and a distance of up to [_____] meters below the finished grade.]

1.3 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

c. [Ground water elevations indicated by the boring log were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.] [Ground water elevation is [_____] meters below existing surface elevation.]

d. [Ground water elevation is [_____] meters below existing surface elevation.]

e. [Material character is indicated by the boring logs.]

f. [Hard materials [and rock] [will not] [will] be encountered [in [_____] percent of the excavations] [at [_____] meter below existing surface elevations]].

1.4 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1102	(2014) Method of Test for Sieve Analysis of Aggregates
JIS A 1103	(2014) Method of Test for Amount of Material Passing Test Sieve 75 μm in Aggregates
JIS A 1205	(2009) Test Method for Liquid Limit and Plastic Limit of Soils
JIS A 1210	(2009) Test Method for Soil Compaction Using a Rammer
JIS A 1211	(2009) Test Methods for the California Bearing Ratio (CBR) of Soils in laboratory
JIS A 1214	(2013) Test Method for Soil Density by the Sand Replacement Method
JIS A 1218	(2013) Test Methods for Permeability of Saturated Soils
JIS A 5001	(2008) Crushed Stone for Road Construction
JIS A 5005	(2009) Crushed Stone and Manufactured Sand for Concrete

JAPAN MINISTRY OF THE ENVIRONMENT (MOE)

Notification No.46	(2001) Environmental Quality Standards for Soil Contamination

JAPANESE GEOTECHNICAL SOCIETY (JGS)

JGS 0051	(2000) Method of Classification of Geomaterials for Engineering Purposes
JGS 1614	(2003) Test Method for Soil Density Using Nuclear Gauge

U.S. DEPARTMENT OF DEFENSE HEADQUARTERS, U.S. FORCES JAPAN (USFJ)

JEGS	(2018) Japan Environmental Governing Standards

1.5 DEFINITIONS

1.5.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by JGS 0051 as G,

G-M, G-C, [G-O], [G-V], GM, GC, [GO], [GV], S, S-M, S-C, [S-O], [S-V], SM, SC, [SO], [SV], ML, MH, CL, CH, [OL], [OH], [OV], [VH1], [VH2]. Satisfactory materials for grading comprise stones less than 200 mm, except for fill material for pavements and railroads which comprise stones less than 75 mm in any dimension.

1.5.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.5.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in JGS 0051 as G, G-M, G-C, S, S-M, S-C. Cohesive materials include materials classified as GC, SC, ML, CL, MH, CH. Materials classified as GM, SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with JIS A 1205, JIS A 1102 and JIS A 1103.

1.5.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in JIS A 1210 (Methods C,D,E - non repeating method) abbreviated as a percent of laboratory maximum density (Modified Proctor Test).

1.5.5 Overhaul

Overhaul is the authorized transportation of satisfactory excavation or borrow materials in excess of the free-haul limit of [_____] stations. Overhaul is the product of the quantity of materials hauled beyond the free-haul limit, and the distance such materials are hauled beyond the free-haul limit, expressed in station meters.

1.5.6 Topsoil

Material suitable for topsoils obtained from [offsite areas] [excavations] [areas indicated on the drawings] is defined as: Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than 25 mm diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

1.5.7 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than [_____] mm in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.5.8 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding [0.375] [_____] cubic meter in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling that is performed merely to increase production.

1.5.9 Unstable Material

Unstable materials are too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.5.10 Select Granular Material

1.5.10.1 General Requirements

Select granular material consist of materials classified as [G], [G-M], [G-C], [S], [S-M], [S-C] or [_____] by JGS 0051 where indicated. [The liquid limit of such material must not exceed [35] [_____] percent when tested in accordance with JIS A 1205. The plasticity index must not be greater than [12] [_____] percent when tested in accordance with JIS A 1205, and not more than [35] [_____] percent by weight may be finer than 75 micrometers sieve when tested in accordance with JIS A 1103.] [Provide a minimum coefficient of permeability of [0.01] [_____] mm per second when tested in accordance with JIS A 1218.]

1.5.10.2 California Bearing Ratio Values

[Bearing Ratio: Provide Design CBR ratio in accordance with JIS A 1211 for a laboratory soaking period of not less than 4 days. [Provide [_____] percent maximum expansion.] [Conform the combined material to the following sieve analysis:]]

Sieve Size	Percent Passing by Weight
63 mm	100
4.75 mm	40 - 85
2.00 mm	20 - 80
425 µm	10 - 60
75 µm	5 - 25

1.5.11 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks [_____] mm or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, free the initial backfill material of stones larger than [_____] mm in any

dimension or as recommended by the pipe manufacturer, whichever is smaller.

1.5.12 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than [_____] when tested in accordance with JIS A 1205 or have expansion/swelling ratios equal to or greater than [____] when tested in accordance with JIS A 1211.

1.5.13 Nonfrost Susceptible (NFS) Material

Nonfrost susceptible material are a uniformly graded washed sand with a maximum particle size of [_____] mm and less than 5 percent passing the 0.075 mm size sieve, and with not more than 3 percent by weight finer than 0.02 mm grain size.

1.5.14 Pile Supported Structure

As used herein, a structure where both the foundation and floor slab are pile supported.

1.6 SYSTEM DESCRIPTION

Subsurface soil boring logs are [shown on the drawings] [appended to the SPECIAL CONTRACT REQUIREMENTS]. The subsoil investigation report and samples of materials taken from subsurface investigations may be examined at [_____]. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.6.1 Classification of Excavation

[No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.] [Finish the specified excavation on a classified basis, in accordance with the following designations and classifications.]

1.6.1.1 Common Excavation

Include common excavation with the satisfactory removal and disposal of all materials not classified as rock excavation.

1.6.1.2 Rock Excavation

Submit notification of encountering rock in the project. Include rock excavation with excavating, grading, disposing of material classified as rock, and the satisfactory removal and disposal of boulders 1/2 cubic meter or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling; firmly cemented conglomerate deposits possessing the characteristics of solid rock impossible to remove without systematic drilling; and hard materials (see Definitions). Include the removal of any concrete or masonry structures, except pavements, exceeding 1/2 cubic meter in volume that may be encountered in the work in this classification. If at any time during excavation, including excavation from borrow areas, the Contractor encounters material that may be classified as rock excavation, uncover such material and notify the Contracting Officer. Do not proceed with the excavation of this material until the Contracting Officer has classified the materials as common

excavation or rock excavation and has taken cross sections as required. Failure on the part of the Contractor to uncover such material, notify the Contracting Officer, and allow ample time for classification and cross sectioning of the undisturbed surface of such material will cause the forfeiture of the Contractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Contracting Officer for the areas of work in which such deposits occur.

1.6.2 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.7 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals
Shoring; G[, [_____]]
Dewatering Work Plan; G[, [_____]]

SD-06 Test Reports

Testing

Borrow Site Testing

Within 24 hours of conclusion of physical tests, submit [_____] copies of test results, including calibration curves and results of calibration tests.

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR OFFSITE SOILS

Test offsite soils brought in for use as backfill for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and full Toxicity Characteristic Leaching Procedure (TCLP) including ignitability, corrosivity and reactivity. Perform tests and verify threshold values in accordance with JAPAN Ministry of the Environment Notification No.46 guidelines and JEGS. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Do not bring material onsite until tests have been approved by the Contracting Officer.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

Provide [polyethylene plastic] [and] [metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic] warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 75 mm minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length.

Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes	
Red	Electric
Yellow	Gas, Oil; Dangerous Materials
Orange	Telephone and Other Communications
Blue	Water Systems
Green	Sewer Systems
White	Steam Systems
Gray	Compressed Air

2.2.1 Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.08 mm and a minimum strength of 10.3 MPa lengthwise, and 8.6 MPa crosswise, with a maximum 350 percent elongation.

2.2.2 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.10 mm, and a minimum strength of 10.3 MPa lengthwise and 8.6 MPa crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 920 mm deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.3 DETECTION WIRE FOR NON-METALLIC PIPING

Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

2.4 MATERIAL FOR RIP-RAP

Provide [Bedding material] [Grout] [Filter fabric] and rock conforming to [these requirements] [[_____] local Standard] for construction indicated.

2.4.1 Bedding Material

Provide bedding material consisting of sand, gravel, or crushed rock, well graded, [or poorly graded] with a maximum particle size of 50 mm. Compose material of tough, durable particles. Allow fines passing the 75 micrometers standard sieve with a plasticity index less than six.

2.4.2 Grout

Provide durable grout composed of cement, water, an air-entraining admixture, and sand mixed in proportions of one part portland cement to [two] [_____] parts of sand, sufficient water to produce a workable mixture, and an amount of admixture which will entrain sufficient air, as determined by the Contracting Officer. Mix grout in a concrete mixer. Allow a sufficient mixing time to produce a mixture having a consistency permitting gravity flow into the interstices of the rip-rap with limited spading and brooming.

2.4.3 Rock

Provide rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Provide fragments sized so that no individual fragment exceeds a weight of [68] [_____] kg and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 0.91 kg or less each. Provide rock with a minimum specific gravity of [2.50] [_____]. Do not permit the inclusion of more than trace [1 percent] [_____] quantities of dirt, sand, clay, and rock fines.

2.5 CAPILLARY WATER BARRIER

Provide capillary water barrier of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Conform to JIS A 5005 for fine aggregate grading with a maximum of 3 percent by weight passing JIS A 1103, 75 micrometers sieve, [or] [37.5 mm and no more than 2 percent by weight passing the 4.75 mm size sieve] [or coarse aggregate with "S-x" designation (where x is the maximum nominal gravel size) in accordance with JIS A 5001].

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated or directed, strip topsoil to a depth of [100] [_____] mm. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 50 mm in diameter, and other materials that would interfere with planting and maintenance operations. [Stockpile in locations indicated] [Remove from the site] any surplus of topsoil from excavations and gradings.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose

surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

3.2.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on Drawing Sheet No. [_____]. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a maximum 1 meter from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or other hard foundation material of loose debris and cut to a firm, level, stepped, or serrated surface. Remove loose disintegrated rock and thin strata. Do not disturb the bottom of the excavation when concrete or masonry is to be placed in an excavated area. Do not excavate to the final grade level until just before the concrete or masonry is to be placed. Where pile foundations are to be used, stop the excavation of each pit at an elevation 300 mm above the base of the footing, as specified, before piles are driven. After the pile driving has been completed, remove loose and displaced material and complete excavation, leaving a smooth, solid, undisturbed surface to receive the concrete or masonry.

3.2.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity [and] [or] provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.4 Dewatering

Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. Do not permit French drains, sumps, ditches or trenches within 0.9 m of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Take control measures by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least [_____] m below the working level. [Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly.] [Measure and record performance of dewatering system at same time each day by use of observation wells or piezometers installed in conjunction with the dewatering system.] [Relieve hydrostatic head in previous zones below subgrade elevation in layered soils to prevent uplift.]

3.2.5 Trench Excavation Requirements

Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation manual. Provide vertical trench walls where no manufacturer's printed installation manual is available. Shore trench walls more than [_____] meters high, cut back to a stable slope, or provide with equivalent means of protection for employees who may be exposed to moving ground or cave in. Shore vertical trench walls more than [_____] meters high. Excavate trench walls which are cut back to at least the angle of repose of the soil. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 600 mm plus pipe outside diameter (O.D.) for pipes of less than 600 mm inside diameter, and do not exceed 900 mm plus pipe outside diameter for sizes larger than 600 mm inside diameter. Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures by the Contractor. The Contractor is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Government.

3.2.5.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. Remove stones of [_____] mm or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.2.5.2 Removal of Unyielding Material

Where [overdepth is not indicated and] unyielding material is encountered in the bottom of the trench, remove such material [_____] mm below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.5.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.2.5.4 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures [sufficient to leave at least 300 mm clear between the outer structure surfaces and the face of the excavation or support members.] [of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown.] Clean rock or loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Remove loose disintegrated rock and thin strata. Specify removal of unstable material. When concrete or masonry is to be placed in an excavated area, take special care not to disturb the bottom of the excavation. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.5.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, provide excavation by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

3.2.6 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. [Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company.] [Excavation made with power-driven equipment is not permitted within [600] [_____] mm of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer.] Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.2.7 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Contracting Officer. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of JIS A 1210 maximum density.

3.3 SELECTION OF BORROW MATERIAL

Select borrow material to meet the requirements and conditions of the

particular fill or embankment for which it is to be used. Obtain borrow material from the borrow areas [shown on Drawing Sheet No. [_____]] [within the limits of the project site, selected by the Contractor] [or] [from approved private sources]. Unless otherwise provided in the contract, the Contractor is responsible for obtaining the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling from the owners. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, do not obtain borrow within the limits of the project site without prior written approval. Consider necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon related operations to the borrow excavation.

3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

Notify the Contracting Officer sufficiently in advance of the opening of any excavation or borrow pit or borrow areas to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, excavate borrow pits and other excavation areas providing adequate drainage. Transport overburden and other spoil material to designated spoil areas or otherwise dispose of as directed. Provide neatly trimmed and drained borrow pits after the excavation is completed. Ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.5 SHORING

3.5.1 General Requirements

Submit a Shoring and Sheeting plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheeting as excavations are backfilled, in a manner to prevent caving.

3.5.2 Geotechnical Engineer

Hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer is responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer is responsible for updating the excavation, sheeting and dewatering plans as construction progresses to reflect changing conditions and submit an updated plan if necessary. Submit a monthly written report, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Contracting Officer is responsible for arranging meetings with the Geotechnical Engineer at any time throughout the contract duration.

3.6 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading

area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactory [and unsatisfactory] [and wasted materials] as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.7 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed. [For pile foundations, stop the excavation at an elevation of from 150 to 300 mm above the bottom of the footing before driving piles. After pile driving has been completed, complete the remainder of the excavation to the elevations shown.] Only use excavation methods that will leave the foundation rock in a solid and unshattered condition. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond. Protect shales from slaking and all surfaces from erosion resulting from ponding or water flow.

3.8 GROUND SURFACE PREPARATION

3.8.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 150 mm before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 150 mm, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 300 mm and compact it as specified for the adjacent fill.

3.8.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten material as necessary [to plus or minus [_____] percent of optimum moisture] [to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used].

3.9 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Submit procedure and location for disposal of unused satisfactory material. Submit proposed source of borrow material. Do not waste any satisfactory excavated material without specific written

authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Government-controlled land before disposal of waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.10 BURIED TAPE AND DETECTION WIRE

3.10.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 300 mm below finished grade; under pavements and slabs, bury tape 150 mm below top of subgrade.

3.10.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm above the top of pipe. Extend the wire continuously and unbroken, from manhole to manhole. Terminate the ends of the wire inside the manholes at each end of the pipe, with a minimum of 0.9 m of wire, coiled, remaining accessible in each manhole. Furnish insulated wire over it's entire length. Install wires at manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, terminate the wire in the valve pit at the pump station end of the pipe.

3.11 BACKFILLING AND COMPACTION

Place backfill adjacent to any and all types of structures, in successive horizontal layers of loose materia not more than 200 mm in depth. Compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials in accordance with JIS A 1210, to prevent wedging action or eccentric loading upon or against the structure. Backfill material must be within the range of -2 to +2 percent of optimum moisture content at the time of compaction.

Prepare ground surface on which backfill is to be placed and provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.11.1 Trench Backfill

Backfill trenches to the grade shown. [Backfill the trench to [_____] meters above the top of pipe prior to performing the required pressure tests. Leave the joints and couplings uncovered during the pressure test.] [Do not backfill the trench until all specified tests are performed.]

3.11.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with select granular material or initial backfill material.

3.11.1.2 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 150 mm loose thickness.

3.11.1.3 Bedding and Initial Backfill

[Provide bedding of the type and thickness shown.] Place initial backfill material and compact it with approved tampers to a height of at least 300 mm above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with as shown in design drawings, except as specified herein. Compact backfill to top of pipe to 90 percent of JIS A 1210 maximum density. Provide plastic piping with bedding to spring line of pipe. Provide materials as follows:

3.11.1.3.1 Class I

Angular, 6 to 40 mm, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

3.11.1.3.2 Class II

Coarse sands and gravels with maximum particle size of 40 mm, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types G, G-M, G-C, S, S-M, S-C are included in this class as specified in JGS 0051.

3.11.1.3.3 Sand

Clean, coarse-grained sand classified as [_____] in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL, [gradation [_____] of the [local Standard] or [S], [S-M], [S-C] by JGS 0051 for [bedding] [and] [backfill] [as indicated]].

3.11.1.3.4 Gravel and Crushed Stone

Clean, coarsely graded natural gravel, crushed stone or a combination thereof identified as [_____] in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL, [gradation [_____] of the [DOT] [State Standard]] or having a classification of [G], [G-M], [G-C] in accordance with JGS 0051 for [bedding] [and] [backfill] [as indicated]. [Do not exceed maximum particle size of [75] [_____] mm.]

3.11.1.4 Final Backfill

Fill the remainder of the trench, except for special materials for roadways, railroads and airfields, with satisfactory material. Place backfill material and compact as follows:

3.11.1.4.1 Roadways, Railroads, and Airfields

Place backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction.

3.11.1.4.2 Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas

Deposit backfill in layers of a maximum of 300 mm loose thickness, and compact it to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. [Allow water flooding or jetting methods of compaction for granular noncohesive backfill material. Do not allow water jetting to penetrate the initial backfill.] [Do not permit compaction by water flooding or jetting.] Apply this requirement to all other areas not specifically designated above.

3.11.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed [and the concrete has been allowed to cure for [_____] days], place backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.12 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.12.1 Gas Distribution

Excavate trenches to a depth that will provide a minimum 450 mm of cover in rock excavation and a minimum 600 mm of cover in other excavation.

3.12.2 Water Lines

Excavate trenches to a depth that provides a minimum cover of [_____] meters from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. [For fire protection yard mains or piping, an additional [_____] mm of cover is required.]

3.12.3 Heat Distribution System

Free initial backfill material of stones larger than 6.3 mm in any dimension.

3.12.4 Electrical Distribution System

Provide a minimum cover of 600 mm from the finished grade to direct burial cable and conduit or duct line, unless otherwise indicated.

3.12.5 Sewage Absorption Trenches or Pits

3.12.5.1 Porous Fill

Provide backfill material consisting of clean crushed rock or gravel having a gradation [such that 100 percent passes the 50 mm sieve and zero percent passes the 12.5 mm sieve.] [conforming to the requirements of gradation [4.75 mm] [_____] for coarse aggregate in JIS A 5005.]

3.12.5.2 Cover

[Filter fabric] [Concrete] [or a layer of straw at least 50 mm thick] as

indicated.

3.12.6 Rip-Rap Construction

Construct rip-rap [on bedding material] [on filter fabric] [with grout] [in accordance with [_____] local Standard, paragraph [_____]] in the areas indicated. Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 30 mm.

3.12.6.1 Bedding Placement

Spread [filter fabric] bedding material uniformly to a thickness of at least [75] [_____] mm on prepared subgrade as indicated. [Compaction of bedding is not required. Finish bedding to present even surface free from mounds and windrows.]

3.12.6.2 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above. [For grouted rip-rap, hand-place surface rock with open joints to facilitate grouting and do not fill smaller spaces between surface rock with finer material. Provide at least one "weep hole" through grouted rip-rap for every 4.65 square meters of finished surface. Provide weep holes with columns of bedding material, 100 mm in diameter, extending up to the rip-rap surface without grout.]

3.12.6.3 Grouting

[Prior to grouting, wet rip-rap surfaces. Grout rip-rap in successive longitudinal strips, approximately 3 m in width, commencing at the lowest strip and working up the slope. Distribute grout to place of final deposit and work into place between stones with brooms, spades, trowels, or vibrating equipment. Take precautions to prevent grout from penetrating bedding layer. Protect and cure surface for a minimum of 7 days.]

3.13 EMBANKMENTS

3.13.1 Earth Embankments

Construct earth embankments from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 75 mm. Place the material in successive horizontal layers of loose material not more than 200 mm in depth. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, plow, disk, or otherwise break up each layer; moisten or aerate as necessary; thoroughly mix; and compact to at least 90 percent laboratory maximum density in accordance with JIS A 1210 for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Backfill material must be within the range of -2 to +2 percent of optimum moisture content at the time of compaction, when required.

Compaction requirements for the upper portion of earth embankments forming subgrade for pavements are identical with those requirements specified in paragraph SUBGRADE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.13.2 Rock Embankments

Construct rock embankments from material classified as rock excavation, as defined above, placed in successive horizontal layers of loose material not more than [_____] mm in depth. Do not use pieces of rock larger than [_____] mm in the greatest dimension. Spread each layer of material uniformly, completely saturate, and compact to a minimum density of [_____] kg/cubic meter. Adequately bond each successive layer of material to the material on which it is placed. Finish compaction with vibratory compactors weighing at least [_____] metric tons, heavy rubber-tired rollers weighing at least [_____] metric tons, or steel-wheeled rollers weighing at least [_____] metric tons. [Do not use rock excavation as fill material for the construction of pavements.] [In embankments on which pavements are to be constructed, do not use rock above a point [_____] mm below the surface of the pavement.]

3.14 SUBGRADE PREPARATION

3.14.1 Proof Rolling

Finish proof rolling on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. [After stripping,] proof roll the existing subgrade of the [_____] with six passes of a [dump truck loaded with 6 cubic meters of soil] [13.6 meter tons, pneumatic-tired roller.] Operate the [roller] [truck] in a systematic manner to ensure the number of passes over all areas, and at speeds between 4 to 5.5 km/hour. [When proof rolling, provide one-half of the passes made with the roller in a direction perpendicular to the other passes.] Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Perform proof rolling in the presence of the Contracting Officer. Undercut rutting or pumping of material [as directed by the Contracting Officer] [to a depth of [_____] mm] and replace with [fill and backfill] [select] material. [Prepare bids based on replacing approximately [_____] square meters, with an average depth of [_____] mm at various locations.]

3.14.2 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Excavate rock encountered in the cut section to a depth of 150 mm below finished grade for the subgrade. Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified. [After rolling, the surface of the subgrade for roadways shall not show deviations greater than 13 mm when tested with a 4 m straightedge applied both parallel and at right angles to the centerline of the area.] [After rolling, do not show deviations for the surface of the subgrade for airfields greater than

[_____] mm when tested with a [_____] meter straightedge applied both parallel and at right angles to the centerline of the area.] Do not vary the elevation of the finish subgrade more than 15 mm from the established grade and cross section.

3.14.3 Compaction

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, compact each layer of the embankment to at least [_____] percent of laboratory maximum density.

3.14.3.1 Subgrade for Railroads

Compact subgrade for railroads to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials in accordance with JIS A 1210.

3.14.3.2 Subgrade for Pavements

Compact subgrade for pavements to at least [_____] percentage laboratory maximum density in accordance with JIS A 1210 for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, thoroughly blend, reshape, and compact the top [_____] mm of subgrade.

3.14.3.3 Subgrade for Shoulders

Compact subgrade for shoulders to at least [_____] percentage laboratory maximum density in accordance with JIS A 1210 for the [depth below the surface of shoulder shown] [full depth of the shoulder].

3.14.3.4 Subgrade for Airfield Pavements

Compact top 600 mm below finished pavement or top 300 mm of subgrades, whichever is greater, to [100] [_____] percent of JIS A 1210; compact fill and backfill material to [100] [_____] percent of JIS A 1210.

3.15 SHOULDER CONSTRUCTION

Construct shoulders of satisfactory excavated or borrow material or as otherwise shown or specified.. Submit advanced notice on shoulder construction for rigid pavements. Construct shoulders immediately after adjacent paving is complete. In the case of rigid pavements, do not construct shoulders until permission of the Contracting Officer has been obtained. Compact the entire shoulder area to at least the percentage of maximum density as specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Finish shoulder construction in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. Align the completed shoulders true to grade and shaped to drain in conformity with the cross section shown.

3.16 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross

sections or elevations shown. Provide the degree of finish for graded areas within 30 mm of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.16.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation. Protect and maintain the finished subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved, and in no case place subbase, base, surfacing, pavement, or ballast on a muddy, spongy, or frozen subgrade.

3.16.2 Capillary Water Barrier

Place a capillary water barrier under concrete floor and area-way slabs grade directly on the subgrade and compact with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.16.3 Grading Around Structures

Construct areas within 1.5 m outside of each building and structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.17 PLACING TOPSOIL

On areas to receive topsoil, prepare the compacted subgrade soil to a 50 mm depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of [_____] mm and grade to the elevations and slopes shown. Do not spread topsoil when frozen or excessively wet or dry. Obtain material required for topsoil in excess of that produced by excavation within the grading limits from [offsite areas] [areas indicated].

3.18 TESTING

Perform testing by a Corps validated commercial testing laboratory or the Contractor's validated testing facility. Submit qualifications of the Corps validated commercial testing laboratory or the Contractor's validated testing facilities. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, Corps validated and approved by the Contracting Officer.

a. Determine field in-place density in accordance with [JIS A 1214][JGS 1614] . [When JGS 1614 is used, check the calibration curves and adjust using only the sand cone method as described in JIS A 1214. results in a wet unit weight of soil in determining the moisture content of the soil when using this method. Since JGS 1614 uses equipment that contains radiactive materials, notify the Base

BioEnvironmental and/or Environmental Office and the Contracting Officer if this method is used.

b. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in JGS 1614; check the calibration of both the density and moisture gauges at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer.] When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, remove the material, replace and recompact to meet specification requirements.

c. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.18.1 Fill and Backfill Material Gradation

One test per [_____] cubic meters stockpiled or in-place source material. Determine gradation of fill and backfill material in accordance with [JIS A 1102] [JIS A 1103].

3.18.2 In-Place Densities

a. One test per [_____] square meters, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

b. One test per [_____] square meters, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

c. One test per [_____] linear meters, or fraction thereof, of each lift of embankment or backfill for [roads] [airfields].

d. One test per [_____] linear meters, or fraction thereof, of each lift of embankment or backfill for railroads.

3.18.3 Check Tests on In-Place Densities

If JGS 1614 is used, check in-place densities by JIS A 1214 as follows:

a. One check test per lift for each [_____] square meters, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.

b. One check test per lift for each [_____] square meters, of fill or backfill areas compacted by hand-operated machines.

c. One check test per lift for each [_____] linear meters, or fraction thereof, of embankment or backfill for [roads] [airfields].

d. One check test per lift for each [_____] linear meters, or fraction thereof, of embankment or backfill for railroads.

3.18.4 Moisture Contents

In the stockpile, excavation, or borrow areas, perform tests as required, to meet compaction requirements, per type of material or source of material being placed during stable weather conditions. During unstable weather, perform tests as dictated by local conditions and approved by the Contracting Officer.

3.18.5 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per [_____] cubic meters of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.18.6 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.18.7 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to [[_____], meters above the top of the pipe] [the finished grade surface], inspect the pipe to determine whether significant displacement has occurred. Conduct this inspection in the presence of the Contracting Officer. Inspect pipe sizes larger than 900 mm, while inspecting smaller diameter pipe by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgment of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, replace or repair the defects as directed at no additional cost to the Government.

3.19 DISPOSITION OF SURPLUS MATERIAL

Remove surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber [to a Government disposal area [as indicated][which is located within a haul distance of [_____] km]][from Government property to an approved location] [from Government property and delivered to a licensed/permitted facility or to a location approved by the Contracting Officer.].

-- End of Section --

SECTION 31 21 13

RADON MITIGATION

PART 1 GENERAL

1.1 SUMMARY

Provide all work necessary to reduce and maintain radon concentration levels below [148 Bequerels per cubic meter (Bq/cu m)][4.0 picoCuries per liter (pCi/L)] in various buildings specified herein. Perform mitigation system installation, and perform post-mitigation testing and monitoring for radon.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 210	(2016) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

AMERICAN ASSOCIATION OF RADON SCIENTISTS AND TECHNOLOGISTS (AARST)

ANSI/AARST MALB	(2014) Protocol for Conducting Measurements of Radon and Radon Decay Products in Schools and Large Buildings
ANSI/AARST RMS-LB	(2018) Radon Mitigation Standards for Schools and Large Buildings

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 301	(2016) Specifications for Structural Concrete

ASTM INTERNATIONAL (ASTM)

ASTM B209M	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C475/C475M	(2017) Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
ASTM C514	(2004; R 2020) Standard Specification for Nails for the Application of Gypsum Board
ASTM C645	(2014; E 2015) Nonstructural Steel Framing Members
ASTM C834	(2017) Standard Specification for Latex Sealants

ASTM C840	(2020) Standard Specification for Application and Finishing of Gypsum Board
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C1002	(2020) Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
ASTM C1047	(2019) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
ASTM C1396/C1396M	(2017) Standard Specification for Gypsum Board
ASTM D2665	(2014) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM E2121	(2013) Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings

COMPRESSED GAS ASSOCIATION (CGA)

CGA G-7	(2014) Compressed Air for Human Respiration; 6th Edition

GYPSUM ASSOCIATION (GA)

GA 216	(2010) Application and Finishing of Gypsum Panel Products

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5508	(2019) Nails
JIS A 5538	(2018) Adhesives for Wall and Ceiling Boards
JIS A 5556	(2021) Staples
JIS A 6517	(2020) Steel Furrings for Wall and Ceiling in Buildings
JIS A 6901	(2019) Gypsum Boards
JIS A 6914	(2017) Jointing Materials for Gypsum Plasterboards
JIS B 1112	(2019) Cross-Recessed Head Wood Screws
JIS B 1125	(2020) Self Drilling Tapping Screws

INTERNATIONAL CODE COUNCIL (ICC)

ICC IMC	(2018) International Mechanical Code

MASTER PAINTERS INSTITUTE (MPI)

MPI 50	(2015) Primer Sealer, Latex, Interior
MPI 114	(2012) Latex, Interior, Gloss (MPI GLoss Level 6)
MPI 139	(2016) Latex, Interior, High Performance Architectural, (MPI Gloss Level 3)
MPI 141	(2016) Latex, Interior, High Performance Architectural, Semi-Gloss (MPI Gloss Level 5)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2016) Motors and Generators - Revision 1: 2018; Includes 2021 Updates to Parts 0, 1, 7, 12, 30, and 31

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules	(2013) Standard Grading Rules for Northeastern Lumber

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1378	(1995) Thermoplastic Duct (PVC) Construction Manual, 2nd Edition

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003	(2014) Standard Grading Rules for Southern Pine Lumber

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety -- Safety and Health Requirements Manual

U.S. DEPARTMENT OF THE NAVY

OPNAV M-5090.1	(2014) Environmental Readiness Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 402-R-92-003	(1993) Protocols for Radon and Radon Decay Product Measurements in Homes

EPA 402-R-92-004	(1992) Indoor Radon and Radon Decay Product Measurement Device Protocols
EPA 402-R-92-014	(1993) Radon Measurement in Schools
EPA 402-R-93-078	(1993; R 1994) Radon Mitigation Standards
EPA 625-R-92-016	(1993; Am 1994) Radon Prevention in Design and Construction of Schools and Other Large Buildings
EPA 625-R-93-011	(1993) Radon Reduction Technique for Existing Detached Houses: Technical Guidance for Active Soil Depressurization Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1096	(2017) Ionizing Radiation
29 CFR 1926.59	Hazard Communication
29 CFR 1926.103	Respiratory Protection
42 CFR 84	Approval of Respiratory Protective Devices

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17	(2015) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5	(2017) Western Lumber Grading Rules

1.3 DEFINITIONS

1.3.1 Active Soil Depressurization (ASD)

A family of radon mitigation systems involving mechanically-driven soil depressurization, including sub-slab depressurization (SSD), sub-membrane depressurization (SMD), block wall depressurization (BWD) and crawl space depressurization (CSD).

1.3.2 Contract Documents

Documents furnished to prospective bidders/proposers containing information and specifying criteria and project requirements for diagnostic testing, design, construction and monitoring of multiple radon mitigation systems. The documents include this specification and the drawings listed in and accompanying this specification.

1.3.3 Long Term Radon Detectors

Alpha track, electret ion chamber, or approved equivalent. Devices capable of sensing and recording the presences of radon during a time period of 91 days to 12 months which when analyzed provide a numeric value, measured in [Bq/cu m][pCi/L], for radon concentrations during the time exposed.

1.3.4 Pressure Differential Gauge

A tool used to measure the PFE created by an ASD system. Calibrate the gauge in accordance with national standards and the manufacturer's recommendations. The gauge must be capable of readings to 0.25 Pa water column

1.3.5 Pressure Field Extension (PFE)

The distance that a pressure change, created by drawing soil-gas through a suction point, extends outward in a sub-slab gas permeable layer, under a membrane, behind a solid wall or in a hollow wall.

1.3.6 Qualified Mitigation Professional

Regardless of team composition, a "Qualified Mitigation Professional" for the purposes of this document is defined as: "An individual that has demonstrated a minimum degree of appropriate technical knowledge and skills specific to radon mitigation of schools and large buildings: a) as established in certification requirements of the National Radon Proficiency Program (NRPP) or the National Radon Safety Board (NRSB); and b) as required by statute, state licensure or certification program, where applicable."

1.3.7 Short Term Radon Detectors

Charcoal, electret ion chamber, or approved equivalent. Devices capable of sensing and recording the presences of radon during a time period of 48-hours to 90 days which when analyzed provide a numeric value, measured in [Bq/cu m][pCi/L], for radon concentrations during the time exposed.

1.3.8 Suction Hole

Location at which vacuum is created for sub-slab communication testing.

1.3.9 Suction Point

Vertical standpipe penetrating into the soil gas environment containing radon and serving as the conduit to exhaust radon gas to the atmosphere.

1.3.10 Test Hole

Location at which pressure readings are taken during sub-slab communication testing. Readings are used to evaluate potential effectiveness of a sub-slab depressurization system.

1.4 SYSTEM DESCRIPTION AND REQUIREMENTS

1.4.1 Performance Requirements

Radon mitigation systems must reduce and maintain radon concentration levels below [148 Bq/cu m][4.0 pCi/L] in various buildings specified herein. Test and construct radon mitigation systems in accordance with ANSI/AARST RMS-LB, ANSI/AARST MALB,[ASTM E2121][OPNAV M-5090.1] EPA 402-R-93-078, EPA 402-R-92-003, EPA 402-R-92-004 and as specified herein. Additional guidance for testing and constructing radon mitigation systems is contained in EPA 625-R-92-016 and EPA 625-R-93-011.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Respirators; G[, [_____]]

Radon Mitigation Systems Components

Radon Mitigation Systems Enclosure Components

SD-06 Test Reports

Post Mitigation Testing; G[, [_____]]

SD-07 Certificates

Worker Protection Plan; G[, [_____]]

Medical Certification; G[, [_____]]

Worker Notification; G[, [_____]]

Respiratory Protection Program; G[, [_____]]

Contractor Qualifications; G[, [_____]]

Contractor Experience; G[, [_____]]

Testing Laboratory Certification; G[, [_____]]

Proof Of Current Calibration For Testing Devices; G[, [_____]]

Radon Mitigation System Inspection; G[, [_____]]

SD-08 Manufacturer's Instructions

Radon Mitigation Systems Components

Radon Mitigation Systems Enclosure Components

SD-10 Operation and Maintenance Data

Radon Mitigation Systems, Data Package 2; G[, [_____]]

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

Radon Detector Location Log; G[, [_____]]

Respirator Program Records; G[, [_____]]

1.6 RADON DETECTOR LOCATION LOG

Prepare and provide to the Contracting Officer a Radon Detector Location Log for each building detailing the identity and location of each short term and long term radon detector. Prepare the log using copies of the "Device Placement Log" contained in EPA 402-R-92-014, and provide the appropriate information as line items. In addition to the log, on a copy of the building floor plans, locate and identify each short term and long term detector.

1.7 WORKER HEALTH AND SAFETY

Comply with OSHA, state and local standards or regulations relating to worker safety and occupational radon exposure. Prepare a worker protection plan in accordance with 29 CFR 1910.1096,[OPNAV M-5090.1,][EM 385-1-1,] and EPA 402-R-93-078.

1.7.1 Worker Protection Plan

The worker protection plan must address, at a minimum occupational radon exposure, safe use of all job site equipment including safe practices when using ladders or scaffolding; safe procedures for crawl space work and avoidance of job site hazards; discussion of hantavirus symptoms; fire and life safety issues; confined space access; handling caustic solvents and bonding chemicals; appropriate use of personal protective equipment; respiratory protection program; suspected contaminants such as asbestos, lead paint, mold or other toxins that may exist; safety data sheets (SDS); ventilated work areas as required to reduce occupational radon exposure. Adhere to 29 CFR 1926.59 and provide the Contracting Officer with a copy of the SDS for all materials brought to the site.

1.7.2 Worker Exposure Records

Maintain records of worker exposure to radon sufficient to verify that workers are exposed to less than four working level months (WLM) in any 12-month period.

1.7.3 Medical Certification

Provide a written certification for each worker and supervisor, signed by a licensed physician indicating that the worker and supervisor has met or exceeded all of the medical prerequisites listed herein and in 29 CFR 1910.1096 and 29 CFR 1926.103 as prescribed by law. Submit certificates prior to the start of work.

1.7.4 Worker Notification

Train workers exposed to radon about the hazards of exposure to radon and the need to apply protective measures when working in areas with elevated radon concentrations. Training must comply with 29 CFR 1910.1096. Submit a notification signed by each worker acknowledging they have been properly trained regarding the hazards of radon exposure.

1.8 RESPIRATORY PROTECTION PROGRAM

Establish and implement a respirator program as required by 29 CFR 1910.1096, and 29 CFR 1926.103. Submit a written description of the program to the Contracting Officer. Submit a written program manual

or operating procedure including methods of compliance with regulatory statutes.

1.8.1 Respirator Program Records

Submit records of the respirator program as required by 29 CFR 1926.103, and 29 CFR 1910.1096.

1.8.2 Respirator Fit Testing

Conduct a qualitative or quantitative fit test conforming to 29 CFR 1926.103 for each worker required to wear a respirator, and any authorized visitors who enter a regulated area where respirators are required to be worn. A respirator fit test must be performed prior to initially wearing a respirator and every 12 months thereafter. If physical changes develop that will affect the fit, a new fit test must be performed. Functional fit checks must be performed each time a respirator is put on and in accordance with the manufacturer's recommendation.

1.8.3 Respirator Selection and Use Requirements

Provide respirators, and ensure that they are used as required by 29 CFR 1910.1096, 29 CFR 1926.103 and in accordance with CGA G-7 and the manufacturer's recommendations. Respirators must be approved by the National Institute for Occupational Safety and Health NIOSH, under the provisions of 42 CFR 84, for use in environments containing radon. For air-purifying respirators, the particulate filter must be high-efficiency particulate air (HEPA)/(N-,R-,P-100). The initial respirator selection and the decisions regarding the upgrading or downgrading of respirator type must be made by the Contractor's Designated IH based on the measured or anticipated airborne radon concentrations to be encountered.

1.8.3.1 Respirators

Provide personnel with respiratory protection as indicated in 29 CFR 1926.103. Breathing air must comply with CGA G-7.

1.9 QUALITY ASSURANCE

1.9.1 Contractor Qualifications and Experience

Within 15 days after award, submit written evidence or data demonstrating that the Contractor and one or more subcontractors employed by the Contractor possess the qualifications and experience specified below.

1.9.1.1 Contractor Qualifications

The person responsible for diagnostic testing, construction and on-site supervision, as required by the specifications, must have successfully completed the requirements of and maintaining a current certification issued by either the National Radon Proficiency Program (NRPP) or the National Radon Safety Board (NRSB)as a qualified mitigation professional. Alternatively, in a State with legislation requiring mandatory credentialing for this work, compliance with the State legislation is acceptable. Evidence showing successful completion of the requirements of the NRPP or the NRSB must include copy of current certification document and documentation issued by the State.[Listing in the State of [_____] is required.]

1.9.1.2 Contractor Experience

Submit written evidence demonstrating that the Contractor has successfully designed and installed at least [two] [_____] radon mitigation systems of the same or similar to the type required herein. The Contractor must have [3][5][_____] years of experience installing radon mitigation systems. Experience proof must include but not be limited to:

a. The contract name and number, completion dates of the project and the total cost of the project;

b. The names, telephone numbers and fax number of the facility or installation for whom the radon mitigation system design, construction and testing were performed;

c. The name, telephone number and fax number of a supervisory level point of contact at each facility or installation who has knowledge of the Contractor's performance.

1.9.1.3 Qualified Mitigation Professional

A Qualified Mitigation Professional must be physically present or ensure a responsible person is present during onsite activities and immediately available to direct, instruct and oversee activities of other individuals, mitigation installers and other professionals engaged in installation activities for the mitigation system(s). The qualified mitigation professional must have [3][5][_____] years of experience installing radon mitigation systems.

1.9.2 Testing Laboratory

Submit testing laboratory certification as proof that the testing laboratory performing radon detector analysis has successfully completed the requirements of the National Radon Safety Board (NRSB)or the National Radon Proficiency Program, (NRPP) and is qualified and authorized to perform such analysis. Alternatively, in a State with legislation requiring mandatory credentialing for this work, compliance with the State legislation is acceptable.[Listing in the State of [_____] is required.]

1.9.3 Diagnostic Testing Equipment

Submit proof of current calibration for testing devices used in performing diagnostic testing.

1.9.4 On-Site Supervision

No work at the site will be permitted without the presence of a person possessing the qualifications specified elsewhere in this section, namely certification issued by either the National Radon Proficiency Program, (NRPP) or the National Radon Safety Board (NRSB)as a qualified mitigation professional, or the State equivalent, where applicable.

1.9.5 Preconstruction Conference

Conduct a safety preconstruction conference to discuss the details of the Worker Protection Plan, Accident Prevention Plan (APP) including the AHAs required in specification section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS [_____]. The safety preconstruction conference must include the Contractor and their Qualified Mitigation Professional, Designated IH

and Project Supervisor and the Contracting Officer. Deficiencies in the APP will be discussed. Onsite work must not begin until the APP has been accepted. [_____]

1.10 DELIVERY, STORAGE AND HANDLING

1.10.1 Delivery of Products

Deliver materials to the site in an undamaged condition. Deliver proprietary items in manufacture's original unopened and undamaged containers of packages with manufacture's name and brand and other pertinent data such as specification number, type, and class, date of manufacture. Schedule deliveries of materials to coincide with scheduled installation.

1.10.2 Storage and Handling

Carefully store materials off the ground to provide proper ventilation, drainage and protection against weather and dampness. Protect materials from marring, staining, rust, damage and overload and from contaminants such as grease, oil and dirt. Store materials at temperatures recommended by the manufacturer. Handle material to avoid damage such as chipping and breaking. Replace damaged material.

1.11 PROJECT CONDITIONS

1.11.1 Building Descriptions

[Building No. [_____] is a three story, brick faced (CMU backed), slab-on grade structure with a partial basement on the southeast corner of the building. Concrete slab is approximately [_____] mm thick and the aggregate beneath the concrete slab is approximately [_____] mm thick. Interior partitions are gypsum wallboard on metal studs except where indicated otherwise on the drawings. The roof is flat and covered with single ply rubber membrane. Except for the basement, mechanical rooms and closets, all rooms have suspended acoustical ceilings located approximately 450 mm below the structural floor or roof above. The building will[not] be occupied during the contract period.[Roof penetrations are not permitted and the south elevation must remain unchanged as a result of the work.][Penetrations to the building exterior must be through the roof only. All elevations must remain unchanged as a result of the work.]

]PART 2 PRODUCTS

2.1 RADON MITIGATION SYSTEMS

2.1.1 System Performance

Radon mitigation systems must reduce and maintain radon concentration levels below [148 Bq/cu m][4.0 pCi/L] after activation of the mitigation systems.

2.1.1.1 System Piping

Route radon mitigation systems piping so as not to interfere with the daily operations and functions of the building occupants. Keep visibility of the systems to a minimum. Enclose each radon mitigation system in occupied spaces, however, all operating components must be accessible for maintenance and repair. All spaces must be considered to be occupied

spaces except for mechanical and electrical rooms, warehouses, storerooms, janitor closets, crawl spaces, [_____] and attic spaces. Enclosures are not required for portions of systems installed above suspended acoustical ceilings.

2.1.1.2 System Outlet Location

Mitigation system discharge points must be as specified in ANSI/AARST RMS-LB and EPA 402-R-93-078. Prevent foreign objects from entering the outlet.[Rain caps are not permitted.] Maintain water tight seal through all penetrations to the building exterior.

2.1.1.3 System Failure Warning Monitor

Provide a means to detect and announce each radon mitigation system failure. System failure is defined as:

a. System blockage: foreign debris.

b. Mechanical failure: fan or other mechanical failure.

c. System leakage: pipe breakage or crack.

Provide an audio or visual annunciator device to indicate system failure and locate the annunciator device in an occupied space. Conform to the requirements of ANSI/AARST RMS-LB and EPA 402-R-93-078.

2.1.1.4 Air Cleaners

Do not use air cleaners as a radon reduction method.

2.1.1.5 Ventilation Devices

Do not use devices that solely increase ventilation as a radon reduction method.

2.1.1.6 Back Drafting

Do not allow radon mitigation systems to cause back drafting of building chimneys.

2.1.2 Radon Mitigation Systems Components

Mechanical and electrical materials, fabrication, construction and installation must conform to the following industry standards:

a. Poly(vinyl chloride) (PVC) Piping: ASTM D2665, Schedule 40.

b. In-line Tubular Centrifugal Fans: AMCA 210 and UL listed.

c. Electrical Work: NFPA 70, NEMA MG 1, ANSI/AARST RMS-LB and EPA 402-R-93-078, No. 12 AWG minimum wire size, solid copper installed in EMT or surface metal raceway.

d. Mechanical Work: ICC IMC, SMACNA 1378, ANSI/AARST RMS-LB and EPA 402-R-93-078.

e. Sealants: ASTM C920, polyurethane, Type S, Grade P for horizontal application, Grade NS for vertical application, Class 25, Use T.

f. Crawl space soil-gas retarder membrane must be minimum [40][60] mils thick.

[g. Mock Downspouts and Fittings: Aluminum, ASTM B209M, minimum 0.81 mm thick, color to match existing. Seal seams and joints. Use downspout only on the building exterior above the fan with appropriate round to downspout shape PVC adapter.

]2.2 RADON MITIGATION SYSTEMS ENCLOSURES

[Radon mitigation systems enclosure components, materials, fabrication, construction and installation must conform to the following industry standards:

a. Concrete: ACI 301.

b. Wood Studs and Furring: WWPA G-5, WCLIB 17, SPIB 1003 or NELMA Grading Rules Standard Light Framing, air dried or kiln dried lumber.

c. Metal Studs and Furring: ASTM C645 or JIS A 6517, but not lighter than 25 gage.

d. Gypsum Wallboard Work: ASTM C1396/C1396M or JIS A 5508, JIS A 5538, JIS A 5556, JIS A 6517, JIS A 6901, JIS A 6914, JIS B 1112, JIS B 1125, ASTM C475/C475M, ASTM C514, ASTM C1002, ASTM C1047 or JIS A 5538, JIS A 5556, JIS A 6901, JIS A 6914, JIS B 1112, JIS B 1125, ASTM C840 or JIS A 6901 and GA 216. Wallboard must be minimum [12][15] mm thick.

e. Sealants: ASTM C834.

f. Painting/Coating: MPI 50 and [[MPI 139] [MPI 141][MPI 114]], provide primer, intermediate and top coat. Match existing coating material. Match the adjacent surfaces color.

g. Hardware: Be of the type and size necessary for the project requirements. Sizes, types and spacing of fasteners for manufactured building materials must be as recommended by the product manufacturer. Hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs must be zinc coated.

][Radon mitigation systems enclosure components, materials, fabrication, construction and installation for concrete, wood studs and furring, metal studs and furring, gypsum wallboard, sealants and painting must conform to the requirements specified in the respective specification sections addressing this work contained in the project specification.

]PART 3 EXECUTION

3.1 RADON MITIGATION SYSTEMS INSTALLATION

3.1.1 Furnishings

[Furniture [,(_____)] and equipment will be removed from the area of work by the Government before radon mitigation work begins.

][Furniture [,(_____)] and equipment will remain in the building. Cover and

seal furnishings with 0.15 mm plastic sheet or remove from the work area and store in a location on site approved by the Contracting Officer.

]3.1.2 Installation

a. Provide radon mitigation systems as indicated in the approved design drawings, as specified in ANSI/AARST RMS-LB, EPA 402-R-93-078 and as required by the specifications and standards referenced herein for the respective materials using workmen skilled in the trades involved. Install piping plumb and parallel to existing walls, partitions and ceilings as appropriate, slope horizontal runs to drain, and secure in place in a rigid and substantial manner.

b. Seal new and existing floor slab penetrations in accordance with EPA 402-R-93-078 and as specified herein. Prevent entry of soil gas into the building and exhausting of conditioned air via the radon mitigation system. Seal cracks and openings around floor slab penetrations with polyurethane sealant. Provide backer rod or comparable filler material as required. Insure that all penetrations to the building exterior are weathertight.

c. Lay work out in advance. Exercise care where cutting, channeling, chasing or drilling floors, walls, partitions, ceilings or other surfaces as necessary for proper installation, support or anchorage. Patch and repair damage to buildings, piping and equipment using workmen skilled in the trades involved.

d. Coordinate all work with the Contracting Officer.

3.1.3 Supervision

Installation of the radon mitigation systems must be supervised by a qualified mitigation professional.

3.1.4 Electrical Work

NFPA 70, ANSI/AARST RMS-LB and EPA 402-R-93-078, No. 12 AWG minimum wire size, solid copper installed in EMT or surface metal raceway. A source of electric power should be available within [15] [_____] meters of each fan installation. Base bids on providing [15] [_____] meters of wire and conduit or surface metal raceway for each fan.

3.1.5 Mechanical Work

ICC IMC, SMACNA 1378, ANSI/AARST RMS-LB, and EPA 402-R-93-078.

3.1.6 System Identification

Label all components of the radon mitigation systems including, but not limited to, piping (every 3 meters), enclosures, fans, electrical conduit (every 3 meters) and circuit breakers. Labels must read:

Radon Reduction System. Do Not Turn Off.
Public Works Office Phone [_____]

[or as specified by the Contracting Officer.

]3.2 RADON MITIGATION SYSTEM ENCLOSURES INSTALLATION

Provide enclosures as indicated in the approved design drawings and as required by the specifications and standards referenced herein for the respective materials using workmen skilled in the trades involved. Install enclosures plumb, level and parallel to existing walls, partitions and ceilings as appropriate, and secure in place in a rigid and substantial manner.

3.3 POST MITIGATION FUNCTIONAL EVALUATION/INSPECTION

3.3.1 ASD Systems

In conjunction with activating an ASD system, the suction in system piping must be measured and recorded along with at least one PFE measurement that is conducted under closed-building or normal operating conditions. It is recommended that both measurements be made under conditions that reflect normal building operation when significantly occupied and include consideration for worst-case conditions.

3.3.1.1 PFE Measurement

Obtain PFE measurements at more than one point distant from each suction point(s) to verify intended design using a differential pressure gauge capable of reading to 0.25 Pa water column. Record PFE test location and close in a nonpermanent fashion to facilitate any future needs (e.g. diagnosing a system when radon tests do not indicate success in achieving mitigation goals).

3.3.2 Non-ASD Systems

Measurements of airflow volume, pressure and other system parameters that are applicable to the method chosen must be recorded after installation.

3.4 FIELD QUALITY CONTROL

3.4.1 Radon Mitigation System Inspection

Inspect and approve in writing by a qualified mitigation professional each radon mitigation system. Verify compliance with the design, ANSI/AARST MALB, ANSI/AARST RMS-LB and the presence of fire stops. Provide the Radon Mitigation System inspection to the Contracting Officer. Deficiencies identified in the inspection report must be corrected by the Contractor at no additional cost to the Government.

3.4.2 Post Mitigation Testing and Monitoring

Perform post mitigation radon testing in the buildings as specified in ANSI/AARST RMS-LB, EPA 402-R-93-078 and herein.

3.4.2.1 Short Term

Test each radon mitigation system as described below.

a. Test each radon mitigation system for effectiveness no sooner than 24-hours nor later than 15 days after activation of the radon mitigation system. Perform all testing in accordance with ANSI/AARST MALB, ANSI/AARST RMS-LB and all local, state and Federal requirements. Provide short term radon detectors (charcoal, electret

ion chamber or approved equivalent) at the rate of one detector per 186 square meters but not less than one detector per enclosed space, except for closets. On copies of the building floor plans, locate and identify each short term detector and provide short term detector data on copies of the "Device Placement Log" contained in EPA 402-R-92-014.

b. At the end of the testing period, collect the detectors and send the detectors to the testing laboratory for analysis. Provide radon test results of the effectiveness of the mitigation systems not later than 30 days after collecting the detectors. Radon test results must be sent from the testing laboratory directly to the Contracting Officer with one copy to the Contractor. Complete the line item information on the "Device Placement Log."

c. Radon test results above [148 Bq/cu m][4.0 pCi/L] require system redesign and installation modifications as necessary to achieve radon test results below [148 Bq/cu m][4.0 pCi/L]. Submit design modifications to the Government for review and approval. After approval of the design modifications, provide installation modifications to the radon mitigation system and retest for effectiveness. Repeat this short term test procedure until test results below [148 Bq/cu m][4.0 pCi/L] are achieved.

d. System modifications (as-built systems installations) must be reflected in the Contractor's design documents (drawings and design narrative).

3.4.2.2 Long Term

After acceptance of the radon mitigation systems, provide for long term testing (8 to 12 months), see below.

a. Perform all testing in accordance with ANSI/AARST MALB, ANSI/AARST RMS-LB and all local, state and Federal requirements. Provide long term radon detectors (alpha track, electret ion chamber or approved equivalent) at the rate of one detector per 186 square meters but not less than one detector per enclosed space, except for closets. Locate and identify each detector on copies of the building floor plans and in the Radon Detector Location Log. After installing the detectors, furnish the completed detector documentation and mailers to the Contracting Officer.

[b. At the end of the testing period, collect the detectors, request return of the detector documentation and mailers from the Contracting Officer and send the detectors to the testing laboratory for analysis. Radon test results must be sent from the testing laboratory directly to the Contracting Officer with one copy to the Contractor. Complete the line item information in the Radon Detector Location Log.

][c. At the end of the testing period, the Contracting Officer will collect and send the detectors to the testing laboratory for analysis. Radon test results must be sent from the testing laboratory directly to the Contracting Officer with one copy to the Contractor.

] d. Radon test results above [148 Bq/cu m][4.0 pCi/L] require system redesign and installation modifications as necessary to achieve radon test results below [148 Bq/cu m][4.0 pCi/L]. Submit design modifications to the Government for review and approval. After approval of the design modifications, provide installation

modifications to the radon mitigation system and retest for effectiveness. Repeat the short term and long term test procedures specified herein until test results below [148 Bq/cu m][4.0 pCi/L] are achieved.

e. Payment for work required because long term testing results in readings above [148 Bq/cu m][4.0 pCi/L] will be made from the funds identified in the "Schedule of Prices" for the work required under this paragraph and defined under the paragraph POST MITIGATION TESTING - SCHEDULE OF PRICES DATA included herein. Payment of these funds will be made only after the Contracting Officer has received the radon testing results from the testing laboratory and the readings for the long term testing are below [148 Bq/cu m][4.0 pCi/L].

f. Final system modifications (as-built systems installations) must be reflected in the Contractor's design documents (drawings and design narrative).

-- End of Section --

SECTION 31 62 13.20

PRECAST/PRESTRESSED CONCRETE PILES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1108	(2018) Method of Test for Compressive Strength of Concrete
JIS A 1132	(2014) Method of Making and Curing Concrete Specimens
JIS A 5373	(2016) Precast Prestressed Concrete Products
JIS A 7201	(2009) Standard Practice for Execution of Spun Concrete Piles

JAPANESE GEOTECHNICAL SOCIETY (JGS)

JGS 1811	(2002) Method for Static Axial Compressive Load Test of Single Piles
JGS 1813	(2002) Method for Static Axial Tensile Load Test of Single Piles
JGS 1816	(2002) Method for Dynamic Load Test of Single Piles
JGS 1831	(2010) Method for Lateral Load Test of Piles

JAPAN MINISTRY OF THE ENVIRONMENT (MOE)

Notification No.46	(2001) Environmental Quality Standards for Soil Contamination

[1.2 LUMP SUM PAYMENT

Base bids upon providing the number, size, capacity, and length of piles as indicated on the [drawings.] [following Table I:

Table 1

[Location]	Number	Size	[Capacity]	Length (tip to cut-off)

]

The contract price for piling shall include the cost of all necessary equipment, tools, material, labor, and supervision required to: deliver, handle, install, cut-off, dispose of any cut-offs, and meet the applicable contract requirements. The contract price also includes mobilization, pre-drilling, and redriving heaved piles. If, in redriving, it is found that any pile is not of sufficient length to provide the capacity specified, notify the Contracting Officer, who reserves the right to increase or decrease the total length of piles to be furnished and installed by changing the pile locations or elevations, requiring the installation of additional piles, or directing the omission of piles from the requirements shown and specified. Should total number of piles or number of each length vary from that specified as the basis for bidding, an adjustment in the contract price or time for completion, or both, will be made in accordance with the contract documents. Payment for piles will be based on successfully installing piles to both the minimum tip elevation and satisfying the acceptance criteria identified herein. No additional payment will be made for: damaged, rejected, or misplaced piles; withdrawn piles; any portion of a pile remaining above the cut-off elevation; backdriving; cutting off piles; splicing; build-ups; any cut-off length of piles; or other excesses beyond the assumed pile length indicated for which the Contractor is responsible.

1.2.1 Acceptance Criteria

Safe design capacity for piles is [_____] KiloNewtons (KN). Piles shall be driven to a minimum depth of [_____] feet below cut-off elevation, and to such additional depth as required to obtain a bearing capacity of not less than [_____] KN.

The following formulas are presented only as a guide to aid in establishing the controlling penetration per blow, which, together with the minimum depth of penetration will serve to determine the required minimum depth of penetration of each individual pile:

R = (2WH) / (5s plus 0.1)

Where:
R - is the approximate allowable pile load in KN
W - is the weight of the hammer in KN
H - is the height of fall of hammer in m
S - is the average of penetration for the last ten blows in m

][1.3 MEASUREMENT AND PAYMENT

[For unit price bid, see SF 1442, "Solicitation, Offer and Award" and "Schedule of Bid Items."] [Section 00 22 13.00 20 SUPPLEMENTARY INSTRUCTIONS TO OFFERORS.
]
Requirements of FAR 52.211-18 Variation in Estimated Quantity shall not apply to payment for piling. Each pile and test pile acceptably provided will be paid for at the bid unit price per unit length, which price shall include items incidental to furnishing and driving the piles including mobilization and demobilization,[jetting][predrilling][probing], redriving uplifted piles, [an additional 1.5 m in furnished length for any test pile not driven beyond estimated pile length,] and cutting off piles at the cut-off elevation. [The cost for additional length for the test piles shall be included in the total unit price cost for the job.] Payment will be made for job [and test piles] at the bid unit price for the length of pile, from tip to final cut-off, actually provided,

excluding buildups and splices directed by the Contracting Officer to be made. Should the actual cumulative pile length driven (tip to cut-off) vary more than 25 percent from the total pile length specified as a basis for bidding, at the direction of the Contracting Officer, the unit price per unit length will be adjusted in accordance with provisions of FAR 52.236-2 Differing Site Conditions.

1.3.1 Pile Cut-Off

Where the tip to cut-off length is less than that calculated from the results of test pile driving [and load testing], payment for that portion of pile not driven will be made at 75 percent of the bid unit price and no other payment will be made for making the cut-off.

1.3.2 Pile Build-ups

Payment for buildups will be made at 125 percent of the bid unit price.

1.3.3 Pile Splices

Payment for splices, as specified, will be made at 25 times the unit price per 300 mm bid for 250 mm piling, 22 times the unit price per 300 mm bid for 300 mm piling, and 18 times the unit price per 300 mm bid for all other piling.

1.3.4 Pulled Piles

Piles required to be pulled at no fault of the Contractor will be paid for at the bid unit price for furnishing and driving the pile in its original position plus 25 percent of the amount to cover the cost of pulling. Such pulled piles when redriven will be paid for at 25 percent of the bid unit price for the length driven.

[1.3.5 Pile Load Test

Payment for each acceptably provided complete test loading of a single pile will be made at the contract unit price per test, which price shall include furnishing, placing, and removing testing equipment, and placing and removing test loads. At the direction of the Contracting Officer, load tests may be waived at a credit to the Government of the unit price bid therefore.

]][1.4 UNIT PRICES

1.4.1 Furnishing and Delivering Prestressed Concrete Piles

1.4.1.1 Payment

Payment will be made for costs associated with furnishing and delivering the required lengths of permanent prestressed concrete piles, [including H-pile extensions,] which includes costs of furnishing and delivering piles to the work site. No payment will be made for the driving head or lengths of piles exceeding required lengths. No payment will be made for piles damaged during delivery, storage, or handling to the extent that they are rendered unsuitable for the work, in the opinion of the Contracting Officer.

1.4.1.2 Measurement

Furnishing and delivering permanent prestressed concrete piles will be measured for payment by the linear meter of piles required below the cut-off elevation as [determined by the Contracting Officer and furnished to the Contractor] [indicated].

1.4.1.3 Unit of Measure

Unit of measure: linear meter.

1.4.2 Driving Prestressed Concrete Piles

1.4.2.1 Payment

Payment will be made for costs associated with driving permanent prestressed concrete piles, which includes costs of handling, driving, [and splicing of piles,] [performing dynamic testing, interpreting data and submitting reports,] measuring heave, redriving heaved piles, removal of [build-ups] driving heads or cutting off piles at the cut-off elevation and removing from the work site, compiling and submitting pile driving records, backfilling voids around piles, and any other items incidental to driving piles to the required elevation.

1.4.2.2 Measurement

Permanent prestressed concrete piles will be measured for payment for driving on the basis of lengths, to the nearest hundredth of a linear meter, along the axis of each pile acceptably in place below the cut-off elevation shown.

1.4.2.3 Unit of Measure

Unit of measure: linear meter.

1.4.3 Pulled Prestressed Concrete Piles

1.4.3.1 Payment

Payment will be made for costs associated with piles pulled at the direction of the Contracting Officer and found to be undamaged. The cost of furnishing and delivering pulled and undamaged piles will be paid for at the applicable contract unit price for payment item "Furnishing and Delivering Prestressed Concrete Piles". The cost of driving pulled and undamaged piles will be paid for at the applicable contract unit price for payment item "Driving Prestressed Concrete Piles". The cost of pulling pulled and undamaged piles will be paid for at twice the applicable contract unit price for payment item "Driving Prestressed Concrete Piles", which includes backfilling any remaining void. The cost of redriving pulled and undamaged piles will be paid for at the applicable contract unit price for payment item "Driving Prestressed Concrete Piles". No payment will be made for furnishing, delivering, driving, pulling, and disposing of piles, including pile driving points, pulled and found to be damaged and backfilling voids. New piles replacing damaged piles will be paid for at the applicable contract unit price for payment items "Furnishing and Delivering Prestressed Concrete Piles" and "Driving Prestressed Concrete Piles".

1.4.3.2 Measurement

Furnishing and delivering pulled and undamaged permanent prestressed concrete piles will be measured for payment as specified in paragraph UNIT PRICES, subparagraph FURNISH AND DELIVER PRESTRESSED CONCRETE PILES. Pulling undamaged prestressed concrete piles will be measured for payment as specified in paragraph UNIT PRICES, subparagraph DRIVING PRESTRESSED CONCRETE PILES. Redriving pulled undamaged prestressed concrete piles will be measured for payment as specified in paragraph UNIT PRICES, subparagraph DRIVING PRESTRESSED CONCRETE PILES. New piles replacing damaged piles will be measured for payment as specified in paragraph UNIT PRICES, subparagraphs FURNISH AND DELIVER PRESTRESSED CONCRETE PILES and DRIVING PRESTRESSED CONCRETE PILES.

1.4.3.3 Unit of Measure

Unit of measure: linear meter.

1.4.4 [Prestressed Concrete Pile Driving Tests]

1.4.4.1 Payment

Payment will be made for costs associated with furnishing, delivering, driving, pulling, and disposing of driven test piles, [including [pile driving points] [and] [splices]]; conducting pile driving tests; backfilling voids around piles; compiling pile driving test records [; performing dynamic testing; interpreting data; and submitting reports].

1.4.4.2 Measurement

Prestressed concrete pile driving tests will be measured for payment on the basis of the applicable contract unit price per pile driving test.

1.4.4.3 Unit of Measure

Unit of measure: each.

1.4.5 [Prestressed Concrete Piles for Load Tests]

1.4.5.1 Payment

Payment will be made for costs associated with furnishing, delivering, driving, pulling, and disposing of load test piles [including [pile driving points] [and] [splices]]; backfilling voids around piles; compiling pile driving records [; furnishing, fabricating, and mounting of strain rods and protective assembly] [; furnishing, fabricating, and mounting of inclinometer and inclinometer protective assembly] [; performing dynamic testing; interpreting data; and submitting reports]. No additional payment will be made for load test piles incorporated in the permanent work other than as provided.

1.4.5.2 Measurement

Prestressed concrete piles for load tests will be measured for payment on the basis of the applicable contract unit price per load test pile.

1.4.5.3 Unit of Measure

Unit of measure: each.

1.4.6 [Prestressed Concrete Pile Compressive Load Tests]

1.4.6.1 Payment

Payment will be made for costs associated with prestressed concrete pile compressive load tests, including material and labor for fabricating and furnishing load frames; calibrating load cells and hydraulic jacks; furnishing specified test equipment; installing strain rods; placing and removing test loads and test equipment; recording, reducing, and submitting test data; and compiling and submitting pile load test reports. No payment will be made for rejected pile compressive load tests.

1.4.6.2 Measurement

Prestressed concrete pile compressive load tests will be measured for payment on the basis of the applicable contract unit price per load test.

1.4.6.3 Unit of Measure

Unit of measure: each.

1.4.7 [Prestressed Concrete Pile Tensile Load Tests]

1.4.7.1 Payment

Payment will be made for costs associated with prestressed concrete pile tensile load tests, including material and labor for fabricating and furnishing load frames; calibrating load cells and hydraulic jacks; furnishing specified test equipment; installing strain rods; placing and removing test loads and test equipment; recording, reducing, and submitting test data; and compiling and submitting pile load test reports. No payment will be made for rejected pile tensile load tests.

1.4.7.2 Measurement

Prestressed concrete pile tensile load tests will be measured for payment on the basis of the applicable contract unit price per number of tensile load test.

1.4.7.3 Unit of Measure

Unit of measure: each.

1.4.8 [Prestressed Concrete Pile Lateral Load Tests]

1.4.8.1 Payment

Payment will be made for costs associated with prestressed concrete pile lateral load tests, including material and labor for fabricating and furnishing load frames; calibrating load cells and hydraulic jacks; furnishing specified test equipment; installing inclinometers; placing and removing test loads and test equipment; recording, reducing, and submitting test data; and compiling and submitting pile load test reports. No payment will be made for rejected pile lateral load tests.

1.4.8.2 Measurement

Prestressed concrete pile lateral load tests will be measured for payment

on the basis of the applicable contract unit price per lateral load test.

1.4.8.3 Unit of Measure

Unit of measure: each.

1.4.9 [Pulled Load Test Prestressed Concrete Piles]

1.4.9.1 Payment

Payment will be made for costs associated with load test prestressed concrete piles pulled prior to load testing at the direction of the Contracting Officer and found to be undamaged. The cost of furnishing, delivering, driving, and pulling undamaged load test piles will be paid for at the applicable contract unit price for payment item "Prestressed Concrete Piles for Load Tests". The cost of pulling undamaged load test piles the second time after redriving and testing will be paid for at twice the applicable contract unit price for payment item "Driving Prestressed Concrete Piles". The cost of redriving pulled undamaged load test piles will be paid for at the applicable contract unit price for payment item "Driving Prestressed Concrete Piles". No payment will be made for furnishing, delivering, driving, pulling, and disposing of load test piles pulled at the direction of the Contracting Officer and found to be damaged. New load test piles replacing damaged piles will be paid for at the applicable contract unit price for payment item "Prestressed Concrete Piles for Load Tests".

1.4.9.2 Measurement

Pulled undamaged load test prestressed concrete piles will be measured for payment as specified in paragraph UNIT PRICES, subparagraph PRESTRESSED CONCRETE PILES FOR LOAD TESTS. Pulling undamaged load test prestressed concrete piles the second time after redriving and testing will be measured for payment as specified in paragraph UNIT PRICES, subparagraph DRIVING PRESTRESSED CONCRETE PILES. Redriving pulled undamaged prestressed concrete piles will be measured for payment as specified in paragraph UNIT PRICES, subparagraph DRIVING PRESTRESSED CONCRETE PILES. New load test prestressed concrete piles replacing damaged piles will be measured for payment as specified in paragraph UNIT PRICES, subparagraph PRESTRESSED CONCRETE PILES FOR LOAD TESTS.

1.4.9.3 Unit of Measure

Unit of measure: as specified in paragraph UNIT PRICES, subparagraphs DRIVING PRESTRESSED CONCRETE PILES and PRESTRESSED CONCRETE PILES FOR LOAD TESTS, respectfully.

1.4.10 [Prestressed Concrete Pile Splices]

1.4.10.1 Payment

Payment will be made for costs associated with prestressed concrete pile splices, including all plant, labor, and material required to make the splice.

1.4.10.2 Measurement

Prestressed concrete pile splices will be measured for payment on the basis of the applicable contract unit price per pile splice.

1.4.10.3 Unit of Measure

Unit of measure: each.

]1.5 PILE REQUIREMENTS

Provide precast prestressed concrete piles per JIS A 5373. Production of piles shall be in accordance with JIS A 5373. The Contractor's Geotechnical Consultant will determine and list "calculated" tip elevations or driving resistance for each pile[from test pile data]. This information will be given to the Contractor no later than 7 days from receipt of complete test data. Use this list as the basis for ordering the piles. Do not order piles until list is provided by the Contractor's Geotechnical Consultant. [Test piles shall be [1.5] [_____] meter longer than the bid length.]

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Installation Procedures; G[, [_____]]

[Geotechnical Consultant Documentation; G[, [_____]]

][Wave Equation Analysis; G[, [_____]]

] Order List; G[, [_____]]

Precasting manufacturer's quality control procedures; G[, [_____]]

Provide instructions and procedures for the processes of Dynamic Pile Testing, Inspection and Monitoring of piles during installation and testing.

SD-02 Shop Drawings

Piles; G[, [_____]]

SD-03 Product Data

Pile Driving Equipment; G[, [_____]]

Submit descriptions of pile driving equipment, including hammers, power packs, driving helmets, cap blocks, pile cushions, leads, extractors, jetting equipment, and preboring equipment at least 30 days prior to commencement of work.

SD-05 Design Data

Concrete mix design; G[, [_____]]

Submit a concrete mix design before concrete is placed, for each type of concrete used for the piles.

Cement milk mix design; G

SD-06 Test Reports

[Silica Fume[; G][; G, [_____]]]

Concrete Compressive Strength; G[, [_____]]

Cement milk Compressive Strength; G

[Test piles; G[, [_____]]]

[Load tests; G[, [_____]]]

Submit concrete cylinder compressive strength test results. [Submit test pile records] [and] [load test data].

[Dynamic Pile Analysis; G[, [_____]]

Submit a summary report of dynamic test results for test piles within [7][_____] calendar days of completing field work. [For permanent piles, submit a field summary report within one (1) day of testing. Submit a typed report summarizing the results of dynamic testing of permanent piles on a monthly basis.]]

SD-11 Closeout Submittals

Pile records; G[, [_____]]

Submit pile [and test pile] records.[Submit load test data and results.]

1.7 QUALITY ASSURANCE

1.7.1 Piles

Prepare in accordance with JIS A 5373 and JIS A 7201. Indicate placement of reinforcement including tendons. Indicate location of special embedded or attached lifting devices, employment of pick-up points, support points other than pick-up points, and any other methods of pick-up. [Provide certification of a Professional Engineer registered in any jurisdiction of the U. S. or its territories or Japan, that layout and details of reinforcement and tendons conform with that shown on the structural design drawings.]

1.7.2 Quality Control Procedures

Submit the precasting manufacturer's quality control procedures and inspection records established in accordance with JIS A 5373.

1.7.3 Installation Procedures

a. Submit information on the type of equipment proposed to be used, proposed methods of operation, pile driving plan including proposed

sequence of driving, and details of all pile driving equipment and accessories.

[b. Provide details of pile driving equipment and a Wave Equation Analysis of pile drivability for selection of the hammer along with a statement of driving procedures. The Wave Equation Analysis is to be completed by the Contractor's Geotechnical Consultant for each test pile location where different subsurface conditions exist and is to include the following information pertaining to the proposed pile driving equipment:

(1) Complete Pile and Driving Equipment Data Form, (which can be downloaded at: http://www.wbdg.org/FFC/NAVGRAPH/graphtoc.pdf) for each proposed pile hammer and pile type combination.

(2) Copies of computer input and output sheets and graphs showing soil resistance versus blow count as well as maximum tension and compression stresses versus blow count. Analysis shall be run at the estimated tip elevation as well as other required elevations to define maximum stress levels in the pile during driving.

c. Provide detailed procedures for conducting the dynamic pile load test and equipment to be used for conducting the load test. The detailed description shall explain how specific information of pile performance will be evaluated.

][1.7.4 Geotechnical Consultant Documentation

The services of an independent, Registered Professional Geotechnical Engineer, experienced in soil mechanics and Pile Dynamic Analysis, shall be hired by the Contractor to observe test pile installation and job pile installation as specified herein. The Geotechnical Consultant shall be independent of the Contractor and shall have no employee of employer relationship which could constitute a conflict of interest.

]1.7.5 Concrete Mix Design

Certify, using a Government-approved independent commercial testing laboratory, that proportioning of mix is in accordance with JIS A 5373 for specified strength and is based on aggregate data which has been determined by laboratory tests during last twelve months. Submit a complete list of materials including type; brand; source and amount of cement, fly ash, pozzolan, ground slag, and admixtures; and applicable reference specifications. Submit additional data regarding concrete aggregates if the source of aggregate changes. Submittal shall clearly indicate where each mix design will be used when more than one mix design is submitted.

[1.7.6 Load Test Supporting Data

Submit Jack calibration records, a testing arrangement description and diagram, and the proposed loading sequence.

]1.7.7 Silica Fume Manufacturer's Representative

Provide statement that the manufacturer's representative will be present at plant to ensure proper mix, including high range water reducer (HRWR), and batching methods.

1.8 DELIVERY, STORAGE, AND HANDLING

Piles shall be stored, handled, and transported in accordance with JIS A 5373 except as follows. Methods used for handling and storage of piles shall be such that the piles are not subjected to excessive bending stress, cracking, spalling, or other damage.

1.8.1 Damaged Piles

The Contractor shall inspect each pile for sweep and structural damage such as cracking and spalling before transporting them to the project site and immediately prior to placement in the driving leads. Any unusual cracks (cracks other than crazing, surface drying, shrinkage cracks and end cracks) shall be brought to the attention of the Contracting Officer. Piles which are damaged during delivery, storage, or handling to the extent they are rendered unsuitable for the work, in the opinion of the Contracting Officer, shall be rejected and removed from the project site, or may be repaired, if approved, at no cost to the Government.

1.8.1.1 Repairable Cracks

Piles with cracks equal to or greater than 0.15 mm but less than 1.5 mm shall be rejected or repaired. As an alternate to pile rejection, the Contractor may submit a proposal to repair deficient piles, which shall be restored prior to driving to provide its required design capacity, perform its intended function in the structure, and take into consideration long term durability in corrosive environment.

1.8.1.2 Non-Repairable Cracks

Piles with cracks equal to or greater than 1.5 mm shall be rejected.

1.8.2 Pile Sweep

Sweep shall be limited to 3 mm per 3 M over the length of the pile. Piles having excessive sweep shall be rejected.

PART 2 PRODUCTS

2.1 MATERIALS

Materials used for manufacturing precast/prestressed concrete piles shall comply with JIS A 5373.

2.2 CONCRETE MIX DESIGN

Concrete shall have a minimum compressive strength of 80 MPa at 28 days and a maximum size aggregate of [_____] mm. Concrete shall be air entrained with a minimum of 4.5 percent and a maximum of 7.5 percent. Mix shall contain fly ash, ground iron blast furnace slag or silica fume to meet the requirements specified herein to mitigate Alkali-Silica Reactivity (ASR).[For marine exposure, ensure a dense concrete free of shrinkage cracks, with a minimum degree of permeability. The maximum water cement ratio shall be 0.40 .]

2.3 FABRICATION

2.3.1 Formwork

Formwork and dimensional tolerances shall be in accordance with JIS A 5373 , and as specified herein. Provide forms of metal, braced and stiffened against deformation, accurately constructed, watertight, and supported on unyielding casting beds. Forms shall permit movement of pile without damage during release of prestressing force. Form precast dowel holes with galvanized flexible metal conduit. [Inside forms or void tubes not to be grouted may be treated cardboard, plywood, or other material.]

2.3.2 Pretensioning

Pretensioning shall be performed in accordance with JIS A 5373, and as specified herein. Use gage calibrated within last 6 months by a laboratory approved by Contracting Officer. Provide means for measuring elongation of steel to nearest 3 mm. Give tensioning steel a uniform prestress prior to being brought to design prestress. Induce same initial prestress in each unit when several units of prestressing steel in a pile are stretched simultaneously.

2.3.3 Casting

2.3.3.1 Conveying

Convey concrete to formwork in accordance with JIS A 5373, and as specified herein. Clean conveying equipment thoroughly before each run. During placing, make any free vertical drop of the concrete less than 0.91 m. Remove concrete which has segregated in conveying or placing.

2.3.3.2 Placing and Casting

Perform concrete casting within 3 days after pretensioning steel; however, do not deposit concrete in forms until placement of reinforcement and anchorages has been inspected and approved by pile manufacturer's quality control representative. Produce each pile of dense concrete straight with smooth surfaces with reinforcement retained in its proper position during fabrication. Use vibrator with heads smaller than the minimum distance between steel for pretensioning. Make surface of pile ends perpendicular to axis of pile. Chamfer, [a minimum of 19 mm,] [[_____] mm,] [between 19 mm and 31 mm,] ends of piles and corners of square piles.

2.3.4 Curing of Piles

Cure piles using moist or accelerated curing. Curing of piles shall be in accordance with JIS A 5373 except as follows.

2.4 PRODUCT QUALITY CONTROL

Where piling is manufactured in a plant with an established quality control program as attested to by a current certification in the PCI "Certification Program for Quality Control" perform product quality control in accordance with JIS A 5373. Where piling is manufactured by specialists or in plants not currently enrolled in the PCI "Certification Program for Quality Control," set-up a product quality control system in accordance with JIS A 5373 and perform concrete and aggregate quality control testing using an independent commercial testing laboratory approved by the Contracting Officer in accordance with the following.

2.4.1 Aggregate Tests

Aggregate tests shall comply with JIS A 5373.

2.4.2 Slump and Strength Tests

Slump and compressive strength tests shall comply with JIS A 5373.

2.4.3 Changes in Proportions

If, after evaluation of strength test results, compressive strength is less than specified compressive strength, make adjustments in proportions and water content and changes in temperature, moisture, and curing procedures as necessary to secure specified strength. Submit changes in mix design to Contracting Officer in writing.

PART 3 EXECUTION

3.1 PILE DRIVING EQUIPMENT

3.1.1 Pile Hammers

Furnish a hammer capable of developing the indicated ultimate pile capacity considering hammer impact velocity; ram weight; stiffness of hammer and pile cushions; cross section, length, and total weight of pile; and character of subsurface material to be encountered. [Use the same pile hammer, operating at the same rate and in the same manner, as that used for driving test piles.] Obtain required driving energy of hammer, except for diesel hammers, by use of a heavy ram and a short stroke with low impact velocity. At final driving, operate pile hammer in accordance with manufacturer's recommendation for driving either end bearing piles or friction piles. At final driving, operate diesel powered hammers at rate recommended by manufacturer for hard driving. Maintain pressure at steam or air hammer so that: (1) for double-acting hammer, the number of blows per minute during and at completion of driving of a pile is equal approximately to that at which hammer is rated; (2) for single-acting hammer, there is a full upward stroke of the ram; and (3) for differential type hammer, there is a slight rise of hammer base during each upward stroke.

3.1.2 Driving Helmets and Cushion Blocks

3.1.2.1 Driving Helmets or Caps and Pile Cushions

Use a steel driving helmet or cap including a pile cushion between top of pile and driving helmet or cap to prevent impact damage to pile. Use a driving helmet or cap and pile cushion combination capable of protecting pile head, minimizing energy absorption and dissipation, and transmitting hammer energy uniformly over top of pile. Provide driving helmet or cap that fits sufficiently loose around top of pile so that pile may be free to rotate without binding within driving helmet. [During test pile installation, demonstrate to satisfaction of Contracting Officer that equipment to be used on project performs specified function.] Use pile cushion of solid wood or of laminated construction using plywood, softwood or hardwood boards with grain parallel to end of pile. Provide pile cushion with thickness of [_____][75] mm minimum and the thickness shall be increased so as to be suitable for the size and length of pile, character of the sub-surface material to be encountered, hammer

characteristics, and the required driving resistance. Replace pile cushion at the start of driving of each pile and when it becomes highly compressed, charred or burned, or has become spongy or deteriorated in any manner. Show details of driving helmets, capblocks, and pile cushions. Submit 2 weeks prior to [test] pile installation.

3.1.2.2 Hammer Cushion or Capblock

Use a hammer cushion or capblock between driving helmet or cap and hammer ram consisting of [a solid hardwood block with grain parallel to the pile axis and enclosed in a close-fitting steel housing] [aluminum and micarta (or equal) discs stacked alternately in a steel housing or a suitable polymer designed for this specific purpose as indicated by the hammer manufacturer]. Use steel plates at top and bottom of capblock. [Replace wood capblock when it becomes highly compressed, charred or burned or becomes spongy or deteriorated in any manner]. [Replace aluminum, micarta or polymer discs that have become damaged, split or deteriorated in any manner]. [Do not replace wood capblock during final driving of any pile.] Do not use small wood blocks, wood chips, rope or other materials that permit excessive loss of hammer energy.

3.2 PRELIMINARY WORK

[3.2.1 Wave Equation Analysis of Pile Drivability

a. Prior to driving any pile, the Contractor shall submit a pile Wave Equation Analysis, performed by his Geotechnical Consultant, for each size pile and distinct subsurface profile condition. These analyses shall take into account the proposed hammer assembly, pile cap block and cushion characteristics, the pile properties and estimated lengths and the soil properties anticipated to be encountered throughout the installed pile length based on static capacity analysis with consideration of driving gain/loss factors. Only one specific model of pile hammer may be used for each pile type and capacity.

b. The Wave Equation Analysis shall demonstrate that the piles will not be damaged during driving, shall indicate that the driving stresses will be maintained within the limits below and indicate the blow count necessary to achieve the required ultimate static pile capacities.

Allowable Driving Stresses

Steel Piles

Compression - 0.9 fy (MPa)
Tension - 0.9 fy (MPa)

Where fy is yield strength of steel

Concrete

Compression - 0.85f'c minus UPL (MPa)
Tension - (0.25 times (the square root of f'c)) plus UPL (MPa)

f'c is compressive strength of concrete (MPa)
UPL = Unit Prestress after Losses (MPa)
(Obtain values from pile manufacturer)

c. Upon completion of the dynamic and static testing programs outlined in this specification section, a refined Wave Equation Analysis shall be performed taking into consideration the evaluated capacities, gain/loss factors and recommended production pile lengths. Production pile driving criteria shall be developed based on the results of the refined Wave Equation Evaluations.

d. All pile driving equipment furnished by the Contractor shall be subject to the approval of the Contractor's Geotechnical Consultant. Complete the attached pile and driving equipment data form, including hammer information, in full as part of the submittal of the results of the Wave Equation Analyses.

e. The cost of performing the Wave Equation Analyses shall be paid for by the Contractor and included in the base bid.

]3.2.2 Order List

The Contractor shall submit to the Contracting Officer for approval, an itemized list for piles prior to placing the order with the supplier. The list shall indicate the pile lengths required at each location as shown on the plans and the corresponding ordered length of each pile.[Load testing and refined wave equation analysis shall be completed prior to submission of an order list.]

3.2.3 Pile Length Markings

The Contractor shall mark each pile prior to driving with horizontal lines at 1 m intervals, and the number of feet from pile tip at 1 m intervals.

3.3 PILE DRIVING

3.3.1 Driving Piles

Notify Contracting Officer 10 days prior to driving of [test] piles [and load test]. [Foundation excavation shall be stopped at 300 mm above foundation grade before piles are driven. When pile driving is completed, excavation shall be completed to lines and grade shown.]Piles may be driven when the specified 28-day concrete strength has been achieved but not less than 7 days after casting. Drive piles to [or below "calculated"] [indicated] tip elevation [to reach a driving resistance established by the wave equation analyses (WEAP) in accordance with the schedule which the Government Contractor's Geotechnical Consultant will prepare from the test-pile driving data]. During initial driving and until pile tip has penetrated beyond layers of very soft soil [or below bottom of predrilled or prejetted holes], use a reduced driving energy of the hammer as required to prevent pile damage. Refusal criteria shall be established by the Contracting Officer. If a pile fails to reach ["calculated"] [indicated] tip elevation, [or if a pile reaches ["calculated"] tip elevation without reaching required driving resistance,] notify Contracting Officer and perform corrective measures as directed. Provide hearing protection when noise levels exceed 140 dB. Piles or pile sections shall not be handled or moved in any manner that would result in cracking or permanent damage to the concrete or to the grout surrounding the prestressing cables. Piles may be driven without pile guides or leads providing a hammer guide frame is used to keep the pile and hammer in alignment.

3.3.2 Protection of Piles

Take care to avoid damage to piles during handling, placing pile in leads, and during pile driving operations. Support piles laterally during driving, but allow rotation in leads. [Where pile or projecting reinforcement orientation is essential, take precautionary measures to maintain the orientation during driving.][Take special care in supporting battered piles to prevent excessive bending stresses in pile.] Square top of pile to longitudinal axis of pile. Maintain axial alignment of pile hammer with that of the pile. If the Contractor elects to use a pile head with projecting strands or mild steel reinforcement, prevent direct impact forces from being transmitted through the reinforcement, by using a special driving head.

3.3.3 Tolerances in Driving

Drive piles with a variation of not more than 2 percent from vertical for plumb piles or more than 4 percent from required angle for batter piles. Maintain and check axial alignment of pile and leads at all times. If subsurface conditions cause pile drifting beyond allowable axial alignment tolerance, notify Contracting Officer and perform corrective measures as directed. Place butts within 100 mm of location indicated. [Manipulation of piles within specified tolerances [will not be permitted.][will be permitted, to a maximum of 1 1/2-percent of their exposed length above ground surface or mudline.]] In addition to specified tolerances, maintain a location to provide a clear distance of at least 125 mm from butt to edge of pile cap. If clear distance can not be maintained, then notify Contracting Officer. Check each pile for heave. Redrive heaved piles to required point elevation.

3.3.4 Rejected Piles

Piles damaged or impaired for use during handling or driving, mislocated, or driven out of alignment beyond the maximum tolerance shall be withdrawn and replaced by new piles or shall be cut-off and abandoned and new piles driven as directed. Excess cut-off from piles and unacceptable piles shall be removed from the work site. All work in connection with withdrawing and removing rejected piles from the site shall be done at no additional cost to the Government.

3.3.5 Jetting of Piles

Water jets will[not] be permitted.[Jetting [may] [shall] be used to assist driving piles through strata that cannot be penetrated practicably by use of the hammer alone. [Driving shall be restricted to a static weight while water is being injected to prevent inducing tensile stresses in the piles which damage the concrete.] After the penetration of the strata requiring jetting has been accomplished, jetting shall be discontinued and hammer driving shall be resumed.][Discontinue jetting when the pile tip is approximately 1.5 m above the [calculated] [indicated] pile tip elevation. Drive pile the final 1.5 m of penetration.][Adequate measures shall be taken for collecting and disposing of runoff water.][Jetting method and equipment shall be approved by the Contracting Officer prior to commencing jetting operation.] Before starting final driving, firmly seat piles in place by application of a number of reduced energy hammer blows.[Measures, including use of a silt curtain, shall be employed to contain turbid water created by jetting piles.]

3.3.6 Predrilling of Piles

Predrilling to remove soil or other material representing the bulk of the volume of the pile to be driven[will[not] be permitted][shall be provided]. [The diameter of the hole should not exceed two-thirds the width of the pile.][Predrill only to a depth of [_____] meters below cut-off elevation prior to setting piles.][Discontinue drilling when the pile tip is approximately 1.5 m above the [calculated] [indicated] pile tip elevation. Drive pile the final 1.5 m of penetration.]

3.3.7 Splices

[Splicing of piles is not permitted.] [Make splices as indicated. Splices shall be capable of developing the full strength of the member in compression, tension, shear, and bending. Detail drawings of splices and design calculations demonstrating the strength of the splice shall be submitted for approval.

]3.3.8 Build-Ups

Where required, pile section may be extended to cut-off elevation by means of a cast-in-place reinforced concrete build-up or by adding a new pile segment with same properties of the below pile. Make build-up in accordance with JIS A 5373. Construct build-ups made after completion of driving in accordance with detail, "Build-Up Without Driving." Make build-ups to be driven in accordance with detail "Build-Up With Driving." Have details of means for protecting joints by a suitable mortar or epoxy approved by Contracting Officer. Where build-ups are exposed to water, protect cast-in-place section from water during curing period. Concrete in build-up shall have a minimum compressive strength of [_____] MPa. Build-ups will not be permitted on more than [_____] percent of total number of piles. If this percent figure is exceeded, or if in the judgment of the Contracting Officer, the clustered location of build-ups is undesirable, withdraw piles of insufficient length and replace with longer piles. Payment for such withdrawal and replacement will be made as an adjustment to the contract price.

3.3.9 Pile Cut-Off

Cut-off piles with a smooth level cut using pneumatic tools, sawing, or other suitable methods approved by Contracting Officer. Use of explosives for cutting is not permitted. Cut-off sections of piles shall be removed from the site upon completion of the work.

3.4 FIELD QUALITY CONTROL

3.4.1 Test Piles

[Use test piles of type, and drive as specified for piling elsewhere in this section.][Order test piles [_____] meters longer in length than production piles. The additional test pile length shall be driven only at the direction of the Contracting Officer.]The Contractor's Geotechnical Consultant will use test pile data to determine "calculated" pile tip elevation or necessary driving resistance. Drive test piles [at the locations indicated] [in vicinity of soil boring test holes Nos. [_____,] [_____,] and [_____]]. Drive test piles to [indicated tip elevation] [indicated bidding lengths]. Use test piles, if located properly and offering adequate driving resistance in finished work. [Pre-drilling or jetting is permitted only when test piles clearly establish validity of

its use, or as directed by the Contracting Officer.][A pile dynamic analyzer shall be provided and operated as specified in paragraph DYNAMIC PILE ANALYSIS during the driving of each test pile. Modify driving as required based upon recommendation of Contractor's Geotechnical Consultant and approval of the Contracting Officer.

][3.4.2 Dynamic Pile Analysis

The purpose of dynamic testing is to provide supplemental information for evaluating pile hammer performance, driving stresses, and bearing capacities. Dynamic testing shall be conducted during the entire time piles are initially driven or redriven and during pile restrike testing. Use test piles of type as specified elsewhere in this section. Equipment to obtain dynamic measurements, record, reduce and display its data shall be furnished and meet the requirement of JGS 1816. The equipment shall have been calibrated within 12 months thereafter throughout the contract duration. Drive test piles at the locations indicated. The contractor shall employ an independent inspection firm, hereinafter referred to as the "Contractor's Geotechnical Consultant", experienced in the pile driving process, monitoring of test pile installation, and in the use of the Pile Driving Analyzer and its related equipment. Dynamic pile analysis shall be performed as follows:

a. Each dynamic pile analysis shall be performed in two steps. The first step is to check the hammer, pile and soil performance, and to determine the suitability of the proposed hammer for the size, length and type of pile being installed for the soil types encountered as the piles are driven. This initial monitoring shall determine whether pre-augering or jetting is appropriate, efficiency of the hammer relative to specified efficiency, effectiveness of cushion, level of compressive and tensile stress in pile and extent/location of any pile damage caused by the initial driving. With each blow of the pile the information listed below shall be electronically recorded and analyzed by the Pile Driving Analyzer:

(1) Blow number

(2) Blow rate per minute and/or stroke.

(3) Input and reflected values of force and velocity.

(4) Value of upward and downward traveling force wave with time.

(5) Maximum and final transferred energy to pile, hammer system efficiency.

(6) Maximum compressive stress, velocity, acceleration and displacement.

(7) Maximum tensile stress in pile.

(8) Pile structural integrity, damage detection, extent and location.

(9) Bearing capacity of pile by Case method.

If the pile, hammer and soil performance evaluation recommends changes to the hammer stroke, pile cushioning, augering or any other aspect for the pile driving operation these changes shall be

incorporated into production pile driving in an effort to control excessive stresses and pile damage. Test piles damaged or broken during installation shall be replaced, incorporating driving modifications as determined by the Contractor's Geotechnical Consultant and reviewed and approved by the Contracting Officer. This procedure shall be repeated until allowable tensile and compressive stresses are achieved in the pile and/or pile damage is minimized. Selected initial driving records shall be subjected to rigorous computer analysis based on the Case Method for determination of resistance distribution, soil resistance and properties, and estimation of anticipated gain/loss factors.

b. Upon completion of test pile driving the piles shall be allowed to set-up for at least 72 hours. After evaluation of pile, hammer and soil performance by the Contractor's Geotechnical Consultant, the second step of the dynamic pile analysis may proceed. This portion of the evaluation requires striking the set-up piles a minimum of 20-50 times, or as directed by the Contractor's Geotechnical Consultant using the same hammer which was used for the test pile driving and which will be used for production pile driving. The hammer shall be "warmed up" and in optimal readiness prior to restriking, in order to avoid capacity losses during evaluation of restrike data. Maximum hammer energy shall be applied during restrike in order to fully mobilize the soil resistance. However, care should be exercised as to not overstress the pile. In addition to those items listed above, selected restrike driving records (as directed by the Contractor's Geotechnical Consultant are to be subjected to rigorous computer analysis based on the Case method for determination of resistance distribution, soil resistance and properties, and plot of applied load vs. average pile displacement based on the calculated soil properties.

c. Performance Report:

(1) Upon satisfactory completion of each dynamic load test a minimum of three copies of a Pile Performance Report shall be submitted for the Contractor by the Contractor's Geotechnical Consultant. The submittal shall be prepared and sealed by a Professional Engineer registered in any jurisdiction of the U.S. or its territories or Japan and shall be made within three working days of the completion of the dynamic load test.

(2) The report for the Dynamic Pile Analysis shall contain the following information:

(a) Bearing capacity of pile. Information resulting from analysis of a selected restrike blow.

(b) Maximum and final transferred energy, hammer system efficiency during pile installation.

(c) Maximum compressive stress, velocity, acceleration and displacement.

(d) Maximum tensile stress in pile.

(e) Pile structural integrity, damage detection, extent and location.

(f) Blows per minute and blow number.

(g) Input and reflection values of force and velocity, upward and downward traveling force wave with time.

(h) Pile skin friction and toe resistance distribution.

(i) Maximum energy transferred to pile.

(3) The maximum allowable pile design load will be proposed by the Contractor's Geotechnical Consultant based upon the results of a satisfactory pile load test conducted on a pile driven as specified herein and shall include the effects of load transfer to the soil above the foundation stratum.

d. The equipment to be used for dynamic testing of the pile hammer and soil performance and for dynamic load testing of the test pile shall meet the requirements of JGS 1816.

e. All services of the Contractor's Geotechnical Consultant shall be paid for by the Contractor. The Contractor's Geotechnical Consultant shall be available throughout the pile driving operation to consult with the Contracting Officer when required by the Contracting Officer. The cost of changes in the Contractor's procedure, as required by evaluation of the results of the Pile Driving Analysis, shall be at the Contractor's expense.

]3.4.3 Static Load Tests

Perform compressive load tests on [_____] test piles in accordance with JGS 1811 as modified herein. [Allow a minimum of 72 hours following final test pile driving for pile set-up prior to load testing.][Do not use anchor piles.] Provide apparatus for applying vertical loads as required by method, using load from weighted box or platform [or reaction frame attached to sufficient uplift piles to safely take required load] applied to pile by hydraulic jack. Increase load in increments until rapid progressive settlement takes place or until application of total compressive load of [_____] metric tons for compressive load tests . Consider load test satisfactory when [after one hour at full test load gross settlement of pile butt is not greater than gross elastic pile compression plus 4 mm plus one percent of pile tip diameter or width in [_____] mm,] [slope of gross load-settlement curve under full test load does not exceed 1.5 mm per metric ton,] [net settlement after removal of test load does not exceed 19 mm.] Perform load tests at locations[as proposed by the Contractor's Geotechnical Consultant and] as directed by the Contracting Officer. Additional load tests, at Government expense, may be required by the Contracting Officer. Loading, testing, and recording and analysis of data shall be under the direct supervision of a Registered Professional Engineer, registered in the state of project location, and provided and paid for by the Contractor.

3.4.3.1 Safe Design Capacity

The safe design capacity of a test pile as determined from the results of load tests shall be the lesser of the two values computed according to the following:

a. One-half of that load which causes a net settlement after rebound of not more than 0.28 mm per metric ton of total test load.

b. One-half of the load that causes a gross settlement of not more than 25 mm, provided the load settlement curve shows no sign of failure.

[3.4.4 Tensile Load Test

Perform tensile load tests on [_____] test piles in accordance with JGS 1813, as modified [and] in paragraph LOAD TESTS. A tensile load of [_____] kN shall be applied to each tensile load test pile. In performing the tension load test, the ultimate load to be applied shall be one and one-half times the safe tension capacity, and the Standard Loading Procedure shall be employed.

][3.4.5 Lateral Load Test

Perform lateral load tests on [_____] piles in accordance with JGS 1831, as modified [and] in paragraph LOAD TESTS. Lateral load tests shall consist of jacking two piles apart with a hydraulic jack, with one pile serving as the reaction pile for the other. A lateral load of [_____] kN shall be applied to each pair of lateral load test piles. Required movement readings shall be made and recorded for each pile.

]3.4.6 Pile Records

Keep a complete and accurate record of each pile driven. Indicate the pile location, deviations from pile location, cross section shape and dimensions, original length, ground elevation, tip elevation, cut-off elevations, [batter alignment,] number of blows required for each 300 mm of penetration and number of blows for the last 150 mm penetration or fraction thereof [as required] for the "calculated" [driving resistance]. Include in the record the beginning and ending times of each operation during driving of pile, type and size of hammer used, rate of operation, stroke or equivalent stroke for diesel hammer, type of driving helmet, and type and dimension of hammer cushion (capblock) and pile cushion used. Record retap data and unusual occurrences during pile driving such as redriving, heaving, weaving, obstructions, [jetting,] and any driving interruptions. A preprinted pile driving log for recording pile driving data[and pile driving equipment data form], which can be downloaded at: http://www.wbdg.org/FFC/NAVGRAPH/graphtoc.pdf. For piles installed by the Cement-Milk Method, provide the actual grout amount pumped into the predrilled hole on the Pile Record.

[3.5 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01 45 35 SPECIAL INSPECTIONS.

]3.6 PILE INSTALLATION BY PLACING METHODS ("Cement-Milk" Method)

Pile installation by placing methods consists of pre-drilling with earth auger system and filling with cement grout ("cement milk").

If required, use borehole stabilizing liquid during pre-drilling operations. Excavation liquid shall be Bentonite plus cement plus water with following standard mixing quantities

Bentonite (kg)	Cement (kg)	Water (l)
25 - 50	80 - 160	450 - 500

The cement milk compressive strength at 28-Days shall be greater than 20 MPa. The cement milk mix design that can provide the required compressive strength shall be submitted before concrete is placed. Piles shall be open-end piles.

3.6.1 PILE INSTALLATION PROCEDURES

(1) Conduct pre-drilling operations as indicated in drawings.

(2) Earth auger head diameter is approximately pile diameter plus 100 mm.

(3) The electric current of earth auger motor shall be recorded continuously.

(4) Drilling and Pile Erection

(a) Perform drilling in a vertical direction aligned with the pile centerline and prevent soil on the lateral surface of a borehole from collapsing by using soil stabilizing liquid. Do not rotate the earth auger in a reverse direction when it is pulled out.

(b) After the earth auger reaches the specified bearing ground and subsequently cement milk for condensation is injected, pull out the earth auger while injecting perimeter condensation liquid, place a pile into the borehole while being careful of not damaging the lateral surface of the borehole, either applying pressure with the pile equipment or by slightly driving the pile with a hammer.

(c) After placing the pile into the borehole, allow for curing process for approximate 7 days while keeping it as it is aligned with the pile centerline.

(5) Stabilizing Liquid, Cement Milk for Condensation, and Perimeter Condensation Liquid

(a) Use borehole stabilizing liquid for preventing the lateral surface of a borehole from collapsing.

(b) Cement milk for condensation is a cement-grout material that is injected at the pile top zone.

(c) Perimeter condensation liquid is a cement-grout material injected to fill the gap between the pile and the borehole.

(6) Perform supervision tests for cement milk for condensation and perimeter condensation liquid as follows:

(a) The number of samples per test shall be three.

(b) Collect samples as follows: 1) Collect the amount of cement milk for condensation for one test from a grout plant at one time. 2) Collect the amount of perimeter condensation liquid from the cement milk flown over a drilled hole at one time after inserting a pile into it.

(c) Collect samples by using polyethylene bags and make cylindrical samples with the approximate diameter of 50 mm and the approximate height of 100 mm.

(d) Cure samples in accordance with the standard cure method which is in the water curing at 20+2 degrees C specified in JIS A 1132.

(e) Strength test shall be in accordance with JIS A 1108 (Method of Test for Compressive Strength of Concrete).

(f) The compressive strengths of cement milk for condensation and perimeter condensation liquid are those determined on the 28th day of curing. Required compressive strengths are listed below.

Compressive Strength (Unit: N/mm2)

Type	Compressive Strength
Cement Milk for Condensation	20 or greater
Perimeter Condensation Liquid	0.5 or greater

3.6.2 FIELD QUALITY CONTROL

Tests indicated in Section 3.4.2, 3.4.3, 3.4.4 and 3.4.5 may also be applicable to piles installed by the "cement-milk" method.

3.6.3 ENVIRONMENTAL CONSIDERATIONS

The Soil Mixing Contractor shall use cement materials in order to comply with the regulations from the Japanese Ministry of the Environment indicated in Notification No.46 (i.e. limits for Hexavalent Chromium Leachate in Soils) or other applicable local environmental regulations.

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SECTION 32 01 16.71

COLD MILLING ASPHALT PAVING

PART 1 GENERAL

1.1 QUALITY ASSURANCE

1.1.1 Grade

Mill pavement such that the finished surface conforms to the lines, grades, and cross sections indicated. The maximum allowable deviation of the finished milled pavement surfaces from the established plan grade line and elevation will be 6 mm. The deviations from the plan grade line and elevation will not be permitted in areas of pavements where closer conformance with planned grade and elevation is required for the proper functioning of appurtenant structures involved.

1.1.2 Surface Smoothness

The maximum allowable deviation of the finished surfaces from the testing edge in the transverse or longitudinal direction will be 6 mm.

1.1.3 Traffic Control

Provide all necessary traffic controls during milling operations.

1.2 EQUIPMENT, TOOLS, AND MACHINES

Maintain in a satisfactory working condition equipment, tools, and machines used in the performance of the work.

1.2.1 Cold-Milling Machine

Provide a cold-milling machine which is self-propelled, capable of milling the pavement to a specified depth and smoothness and of establishing grade control; with means of controlling transverse slope and dust produced during the pavement milling operation. Machine will have capability of adding water in front of equipment to minimize dust during milling operation. The machine will have the ability to remove the millings or cuttings from the pavement and load them into a truck. The milling machine will not damage any part of the pavement structure that is not to be removed.

1.2.2 Cleaning Equiment

Provide cleaning equipment suitable for removing and cleaning loose material from the pavement surface.

1.2.3 Straightedge

Furnish and maintain at the site, in good condition, one 3.66 meter straightedge or other suitable device for each milling machine, for testing the finished surface. Make straightedge available for Government use. Use straightedges constructed of aluminum or other lightweight metal, with blades of box or box-girder cross section with flat bottom reinforced

to insure rigidity and accuracy. Use straightedges with handles to facilitate movement on the pavement.

1.3 ENVIRONMENTAL REQUIREMENTS

Do not perform milling when there is accumulation of snow or ice on the pavement surface.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 MILLING OPERATION

A minimum of seven days notice is required, prior to start work, for the Contracting Officer to coordinate the milling operation with other activities at the site. Make sufficient passes so that the designated area is milled to the grades and cross sections indicated. Mill the pavement in depth increments that will not damage the pavement below the designated finished grade. If scabbing occurs, the surface will not meet smoothness requirements. Take steps to modify the process as needed to prevent scabbing from occuring. Repair or replace, as directed, items damaged during milling such as manholes, valve boxes, utility lines, pavement that is torn, cracked, gouged, broken, or undercut. Remove the milled material from the pavement and load into trucks.

3.2 GRADE AND SURFACE-SMOOTHNESS TESTING

3.2.1 Grade-Conformance Tests

Test the finished milled surface of the pavement for conformance with the plan-grade requirements and for acceptance by the Contracting Officer by running lines of levels at intervals of 7.5 meters longitudinally and 7.5 meters transversely to determine the elevation of the completed pavement. Correct variations from the designated grade line and elevation in excess of the plan-grade requirements as directed. Skin patching for correcting low areas will not be permitted. Remove and replace the deficient low area. Remove sufficient material to allow at least 25 mm of asphalt concrete to be placed.

3.2.2 Surface-Smoothness Tests

After completion of the final milling, the finished milled surface will be tested by the Government with a straightedge. Other approved devices may be used, provided that when satisfactorily and properly operated, such devices reveal all surface irregularities exceeding the tolerances specified. Correct surface irregularities that depart from the testing edge by more than 6 mm. Skin patching for correcting low areas will not be permitted. Remove and replace the deficient low area. Remove sufficient material to allow at least 25 mm of asphalt concrete to be placed.

3.3 REMOVAL OF MILLED MATERIAL

Stockpile material that is removed as specified and in such a manner to prevent segregation or contamination. Material that is removed will become the property of the Contractor and removed from the site.

-- End of Section --

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SECTION 32 11 20

BASE COURSE FOR RIGID AND SUBBASES FOR FLEXIBLE PAVING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1102	(2014) Method of Test for Sieve Analysis of Aggregates
JIS A 1103	(2014) Method of Test for Amount of Material Passing Test Sieve 75 μm in Aggregates
JIS A 1104	(2006) Methods of Test for Density and Water Absorption of Fine Aggregates
JIS A 1121	(2007) Method of Test for Resistance to Abrasion of Coarse Aggregate by Use of the Los Angeles Machine
JIS A 1201	(2009) Practise for Preparing Disturbed Soil Samples for Soil Testing
JIS A 1205	(2009) Test Method for Liquid Limit and Plastic Limit of Soils
JIS A 1210	(2009) Test Method for Soil Compaction Using a Rammer
JIS A 1214	(2013) Test Method for Soil Density by the Sand Replacement Method
JIS A 5001	(2008) Crushed Stone for Road Construction
JIS Z 8801	(2006) Test Sieves Part 1: Test Sieves of Metal Wire Cloth

JAPANESE GEOTECHNICAL SOCIETY (JGS)

JGS 0051	(2000) Method of Classification of Geomaterials for Engineering Purposes

1.2 DEGREE OF COMPACTION

Degree of compaction required is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in JIS A 1210 abbreviated as a percent of laboratory maximum dry density.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools

SD-06 Test Reports

Initial Tests; G

In-Place Tests; G

1.4 EQUIPMENT, TOOLS, AND MACHINES

All plant, equipment, and tools used in the performance of the work will be subject to approval by the Contracting Officer before the work is started. Maintain all plant, equipment, and tools in satisfactory working condition at all times. Submit a list of proposed equipment, including descriptive data. Use equipment capable of minimizing segregation, producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.5 QUALITY ASSURANCE

Sampling and testing are the responsibility of the Contractor. Perform sampling and testing using a laboratory approved in accordance with Section 01 45 00.00 1001 45 00.00 2001 45 00.00 40 QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. Test the materials to establish compliance with the specified requirements and perform testing at the specified frequency. The Contracting Officer may specify the time and location of the tests. Furnish copies of test results to the Contracting Officer within 24 hours of completion of the tests.

1.5.1 Sampling

Take samples for laboratory testing in conformance with JIS A 1201. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.5.2 Tests

1.5.2.1 Sieve Analysis

Perform sieve analysis in conformance with JIS A 1103 and JIS A 1102 using sieves conforming to JIS Z 8801.

1.5.2.2 Liquid Limit and Plasticity Index

Determine liquid limit and plasticity index in accordance with JIS A 1205.

1.5.2.3 Moisture-Density Determinations

Determine the laboratory maximum dry density and optimum moisture in accordance with paragraph DEGREE OF COMPACTION.

1.5.2.4 Field Density Tests

Measure field density in accordance with JIS A 1214.

1.5.2.5 Wear Test

Perform wear tests on subbase course and or rigid pavement base course material in conformance with JIS A 1121.

1.5.2.6 Weight of Slag

Determine weight per cubic meter of slag in accordance with JIS A 1104.

1.6 ENVIRONMENTAL REQUIREMENTS

Perform construction when the atmospheric temperature is above 2 degrees C. When the temperature falls below 2 degrees C, protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Flexible Paving Subbase Course

Provide aggregates conforming to JIS A 5001, C-30/RC-30 and C-40/RC-40consisting of crushed stone or slag, gravel, shell, sand, or other sound, durable, approved materials processed and blended or naturally combined. Provide aggregates which are free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. The percentage of loss of material retained on the 4.75 mm sieve must not exceed 50 percent after 500 revolutions when tested in accordance with JIS A 1121. Provide aggregate that is reasonably uniform in density and quality. Provide slag that is an air-cooled, blast-furnace product having a dry weight of not less than 1050 kg/cubic meter. Provide aggregates with a maximum size of 37.5 mm for C-40/RC-40 and 31.5 mm for C-30/RC-30 and within the limits specified as follows:

Maximum Allowable Percentage by Weight
Passing Square-Mesh Sieve

Sieve Designation (mm)	C-30 / RC-30	C-40 /RC-40
53.0	----	100
37.5	100	95-100
31.5	95-100	----
26.5	----	----
19	55-85	50-80
13.2	----	----
4.75	15-45	15-40
2.36	5-30	5-25

The portion of any blended component and of the completed course passing the 0.425 mm must be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2.1.2 Rigid Pavement Base Course

Provide aggregates for rigid pavement base course as specified for flexible paving subbase course.

2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

2.2.1 Initial Tests

Perform one of each of the following tests on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements prior to installation. Complete this testing for each source if materials from more than one source are proposed.

a. Sieve Analysis .

b. Liquid limit and plasticity index.

c. Moisture-density relationship.

d. Wear.

e. Weight per cubic meter of Slag.

Submit certified copies of test results for approval not less than 30 days before material is required for the work.

2.2.2 Approval of Material

Tentative approval of material will be based on initial test results.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Provide adequate drainage during the entire period of construction to prevent water from collecting or standing on the working area.

3.2 STOCKPILING MATERIAL

Clear and level storage sites prior to stockpiling of material. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Stockpile aggregates on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Stockpile materials obtained from different sources separately.

3.3 PREPARATION OF UNDERLYING COURSE OR SUBGRADE

Clean the underlying course or subgrade of all foreign substances prior to constructing the subbase or rigid pavement base course. Do not construct subbase or rigid pavement base course on underlying course or subgrade that is frozen. Construct the surface of the underlying course or subgrade to meet specified compaction and surface tolerances. Correct ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the specified requirements set forth herein by loosening and removing soft or unsatisfactory material and adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in JGS 0051, stabilize the surface prior to placement of the overlying course. Stabilize by mixing the overlying course material into the underlying course and compacting by approved methods. Consider the stabilized material as part of the underlying course and meet all requirements of the underlying course. Do not allow traffic or other operations to disturb the finished underlying course and maintain in a satisfactory condition until the overlying course is placed.

3.4 GRADE CONTROL

Provide a finished and completed subbase and rigid pavement base courses conforming to the lines, grades, and cross sections shown. Place line and grade stakes as necessary for control.

3.5 MIXING AND PLACING MATERIALS

Mix and place the materials to obtain uniformity of the material at the water content specified. Make such adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory subbase course.

3.6 LAYER THICKNESS

Compact the completed course to the thickness indicated. No individual layer may be thicker than 150 mm nor be thinner than 75 mm in compacted

thickness. Compact the course(s) to a total thickness that is within 13 mm of the thickness indicated. Where the measured thickness is more than 13 mm deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 13 mm thicker than indicated, the course will be considered as conforming to the specified thickness requirements. The average job thickness will be the average of all thickness measurements taken for the job and must be within 6 mm of the thickness indicated. Measure the total thickness of the course(s) at intervals of one measurement for each 500 square meters of completed course. Measure total thickness using 75 mm diameter test holes penetrating the completed course.

3.7 COMPACTION

Compact each layer of the material, as specified, with approved compaction equipment. Maintain water content during the compaction procedure to within plus or minus 2 percent of optimum water content determined from laboratory tests as specified in this Section. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Slightly vary the length of alternate trips of the roller. Adjust speed of the roller as needed so that displacement of the aggregate does not occur. Compact mixture with hand-operated power tampers in all places not accessible to the rollers. Continue compaction of the subbase until each layer is compacted through the full depth to at least 100 percent of laboratory maximum density. Continue compaction of the rigid base course until each layer is compacted through the full depth to at least 95 percent of laboratory maximum density. Make such adjustments in compacting or finishing procedures as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory subbase and rigid pavement base course. Remove any materials that are found to be unsatisfactory and replace with satisfactory material or rework, as directed, to meet the requirements of this specification.

3.8 PROOF ROLLING

In addition to the compaction specified, proof roll subbase course under a flexible airfield pavement in areas designated on the drawings by application of 30 coverages for Class IV runways, 8 coverages for runways that support fighter aircraft only, and 4 coverages to all other paved areas, of a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 13,600 kg and inflated to a minimum of 862 kPa. A coverage is defined as the application of one tire print over the designated area. In the areas designated, apply proof rolling to the top layer of the completed subbase course. Maintain water content of the top layer of the subbase course as specified in paragraph COMPACTION from start of compaction to completion of proof rolling. Remove any subbase course materials that produce unsatisfactory results by proof rolling and replace with satisfactory materials. Then recompact and proof roll to meet specifications.

3.9 EDGES OF SUBBASE AND RIGID PAVEMENT BASE COURSE

Place approved material along the outer edges of the subbase and rigid pavement base course in sufficient quantity to compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, simultaneously roll and compact at least a 600 mm width of

this shoulder material with the rolling and compacting of each layer of the subbase and rigid pavement base course, as directed.

3.10 FINISHING

Finish the surface of the top layer of rigid pavement base course after final compaction and proof rolling by cutting any overbuild to grade and rolling with a steel-wheeled roller. Do not add thin layers of material to the top layer of rigid pavement base course to meet grade. If the elevation of the top layer of rigid pavement base course is 13 mm or more below grade, scarify the top layer to a depth of at least 75 mm and blend new material in and compact and proof roll to bring to grade. Make adjustments to rolling and finishing procedures as directed by the Contracting Officer to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable rigid pavement base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, scarify the unsatisfactory portion and rework and recompact it or replace as directed.

3.11 SMOOTHNESS TEST

Construct the top layer so that the surface shows no deviations in excess of 10 mm when tested with a 3.00 m straightedge. Take measurements in successive positions parallel to the centerline of the area to be paved. Also take measurements perpendicular to the centerline at 15 meter intervals. Correct deviations exceeding this amount by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.12 FIELD QUALITY CONTROL

3.12.1 In-Place Tests

Perform one of each of the following tests on samples taken from the placed and compacted subbase and rigid pavement base course. Take samples and test at the rates indicated.

a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 500 square meters, or portion thereof, of completed area.

b. Perform sieve analysis on every lift of material placed and at a frequency of one sieve analysis for every 1,000 square meters, or portion thereof, of material placed.

c. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.

d. Measure the thickness of each course at intervals providing at least one measurement for each 500 square meters or part thereof. Measure the thickness using test holes, at least 75 mm in diameter through the course.

3.12.2 Approval of Material

Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and fully compacted course(s).

3.13 TRAFFIC

Do not allow traffic on the completed subbase and rigid pavement base coursefor airfield pavements. For roads, do not allow heavy equipment on the completed rigid pavement base course except when necessary for construction. When it is necessary for heavy equipment to travel on the completed rigid pavement base course, protect the area against marring or damage to the completed work.

3.14 MAINTENANCE

Maintain the completed course in a satisfactory condition until the full pavement section is completed and accepted. Immediately repair any defects and repeat repairs as often as necessary to keep the area intact. Retest any course that was not paved over prior to the onset of winter to verify that it still complies with the requirements of this specification. Rework or replace any area that is damaged as necessary to comply with this specification.

3.15 DISPOSAL OF UNSATISFACTORY MATERIALS

Dispose of any unsuitable materials that have been removed as directed . No additional payments will be made for materials that have to be replaced.

-- End of Section --

SECTION 32 11 23

AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1102	(2014) Method of Test for Sieve Analysis of Aggregates
JIS A 1103	(2014) Method of Test for Amount of Material Passing Test Sieve 75 μm in Aggregates
JIS A 1104	(2006) Methods of Test for Density and Water Absorption of Fine Aggregates
JIS A 1109	(2006) Method of Test for Density and Water Absorption of Fine Aggregates
JIS A 1110	(2006) Methods of Test for Density and Water Absorption of Coarse Aggregates
JIS A 1112	(2012) Method of Test for Washing Analysis of Fresh Concrete
JIS A 1121	(2007) Method of Test for Resistance to Abrasion of Coarse Aggregate by Use of the Los Angeles Machine
JIS A 1201	(2009) Practise for Preparing Disturbed Soil Samples for Soil Testing
JIS A 1205	(2009) Test Method for Liquid Limit and Plastic Limit of Soils
JIS A 1210	(2009) Test Method for Soil Compaction Using a Rammer
JIS A 1214	(2013) Test Method for Soil Density by the Sand Replacement Method
JIS A 5001	(2008) Crushed Stone for Road Construction
JIS Z 8801	(2006) Test Sieves Part 1: Test Sieves of Metal Wire Cloth

JAPANESE GEOTECHNICAL SOCIETY (JGS)

JGS 0051 (2000) Method of Classification of Geomaterials for Engineering Purposes

1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Aggregate Base Course

Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Graded-Crushed Aggregate Base Course

Graded-crushed aggregate (GCA) base course is well graded, crushed, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.3 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in JIS A 1210 abbreviated as a percent of laboratory maximum dry density.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools

SD-06 Test Reports

Initial Tests; G

In-Place Tests; G

1.4 EQUIPMENT, TOOLS, AND MACHINES

All plant, equipment, and tools used in the performance of the work will be subject to approval by the Contracting Officer before the work is started. Maintain all plant, equipment, and tools in satisfactory working condition at all times. Submit a list of proposed equipment, including descriptive data. Use equipment capable of minimizing segregation, producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.5 QUALITY ASSURANCE

Sampling and testing are the responsibility of the Contractor. Perform sampling and testing using a laboratory approved in accordance with Section 01 45 00.00 1001 45 00.00 2001 45 00.00 40 QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. Test the materials to establish compliance with the specified requirements and perform testing at the specified frequency. The Contracting Officer may specify the time and location of the tests. Furnish copies of test results to the Contracting Officer within 24 hours of completion of the tests.

1.5.1 Sampling

Take samples for laboratory testing in conformance with JIS A 1201. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.5.2 Tests

1.5.2.1 Sieve Analysis

Perform sieve analysis in conformance with JIS A 1103 and JIS A 1102 using sieves conforming to JIS Z 8801. .

1.5.2.2 Liquid Limit and Plasticity Index

Determine liquid limit and plasticity index in accordance with JIS A 1205.

1.5.2.3 Moisture-Density Determinations

Determine the laboratory maximum dry density and optimum moisture content in accordance with paragraph DEGREE OF COMPACTION.

1.5.2.4 Field Density Tests

Measure field density in accordance with JIS A 1214.

1.5.2.5 Wear Test

Perform wear tests on ABC and GCA course material in conformance with JIS A 1121.

1.5.2.6 Soundness

Perform soundness tests on GCA in accordance with JIS A 1112.

1.5.2.7 Weight of Slag

Determine weight per cubic meter of slag in accordance with JIS A 1104 on the ABC and GCA course material.

1.6 ENVIRONMENTAL REQUIREMENTS

Perform construction when the atmospheric temperature is above 2 degrees C. When the temperature falls below 2 degrees C, protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

PART 2 PRODUCTS

2.1 AGGREGATES

Provide Aggregate Base Course (ABC) and Graded-Crushed Aggregate (GCA) base course consisting of clean, sound, durable particles of crushed stone, crushed slag, crushed gravel, crushed recycled concrete, angular sand, or other approved material. Provide ABC that is free of lumps of clay, organic matter, and other objectionable materials or coatings. Provide GCA that is free of silt and clay as defined by JGS 0051, organic matter, and other objectionable materials or coatings. The portion retained on the 4.75 mm sieve is known as coarse aggregate; that portion passing the 4.75 mm sieve is known as fine aggregate. Base course shall conform to JIS A 5001, M-30/RM-30 and M-40/RM-40. When the coarse and fine aggregate is supplied form more than one source, provide aggregate from each source that meets the specified requirements.

2.1.1 Coarse Aggregate

Provide coarse aggregates with angular particles of uniform density. Separately stockpile coarse aggregate supplied from more than one source.

a. Crushed Gravel: Provide crushed gravel that has been manufactured by crushing gravels and that meets all the requirements specified below.

b. Crushed Stone: Provide crushed stone consisting of freshly mined quarry rock, meeting all the requirements specified below.

c. Crushed Recycled Concrete: Provide crushed recycled concrete consisting of previously hardened portland cement concrete or other concrete containing pozzolanic binder material. Provide recycled concrete that is free of all reinforcing steel, bituminous concrete surfacing, and any other foreign material and that has been crushed and processed to meet the required gradations for coarse aggregate. Reject recycled concrete aggregate exceeding this value. Provide crushed recycled concrete that meets all other applicable requirements specified below.

d. Crushed Slag: Provide crushed slag that is an air-cooled blast-furnace product having an air dry unit weight of not less than 1120 kg/cubic meter as determined by JIS A 1104, and meets all the requirements specified below.

2.1.1.1 Aggregate Base Course

The percentage of loss of ABC coarse aggregate must not exceed 50 percent when tested in accordance with JIS A 1121.

2.1.1.2 Graded-Crushed Aggregate Base Course

The percentage of loss of GCA coarse aggregate must not exceed 40 percent loss when tested in accordance with JIS A 1121. Provide GCA coarse aggregate that does not exhibit a loss greater than 18 percent weighted average, at five cycles, when tested for soundness in magnesium sulfate, or 12 percent weighted average, at five cycles, when tested in sodium sulfate in accordance with JIS A 1112.

2.1.2 Fine Aggregate

Provide fine aggregates consisting of angular particles of uniform density.

2.1.2.1 Aggregate Base Course

Provide ABC fine aggregate that consists of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

2.1.2.2 Graded-Crushed Aggregate Base Course

Provide GCA fine aggregate consisting of angular particles produced by crushing stone, slag, recycled concrete, or gravel that meets the requirements for wear and soundness specified for GCA coarse aggregate. Produce fine aggregate by crushing only particles larger than 4.75 mm sieve in size. Provide fine aggregate that contains at least 90 percent by weight of particles having two or more freshly fractured faces in the portion passing the 4.75 mm sieve and retained on the 2 mm sieve, and in the portion passing the 2 mm sieve and retained on the 0.425 mm sieve. Manufacture fine aggregate from gravel particles 95 percent of which by weight are retained on the 12.5 mm sieve.

2.1.3 Gradation Requirements

Apply the specified gradation requirements to the completed base course. Provide aggregates that are continuously well graded within the limits specified in TABLE 1. Use sieves that conform to JIS Z 8801.

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation (mm)	M-30 / RM-30	M-40 / RM-40
53.0	----	100
37.5	100	95-100
31.5	95-100	----
26.5	----	----
19.0	60-90	60-90
13.2	----	----
4.75	30-65	30-65
2.36	20-50	20-50
1.18	----	----
0.425	10-30	10-30
0.075	2-10	2-10

NOTE 1: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, test the materials in accordance with JIS A 1110 and JIS A 1109 to determine their specific gravities. Correct the percentages passing the various sieves as directed by the Contracting Officer if the specific gravities vary by more than 10 percent.

2.2 LIQUID LIMIT AND PLASTICITY INDEX

Apply liquid limit and plasticity index requirements to the completed course and to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the 0.425 mm sieve must be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

2.3.1 Initial Tests

Perform one of each of the following tests, on the proposed material prior to commencing construction, to demonstrate that the proposed material meets all specified requirements when furnished. Complete this testing for each source if materials from more than one source are proposed.

a. Sieve Analysis.

b. Liquid limit and plasticity index.

c. Moisture-density relationship.

d. Wear.

e. Soundness.

f. Weight per cubic meter of Slag.

Submit certified copies of test results for approval not less than 30 days before material is required for the work.

2.3.2 Approval of Material

Tentative approval of material will be based on initial test results.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the ABC or GCA is constructed in more than one layer, clean the previously constructed layer of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Provide adequate drainage during the entire period of construction to prevent water from collecting or standing on the working area.

3.2 STOCKPILING MATERIAL

Clear and level storage sites prior to stockpiling of material. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Stockpile aggregates on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Stockpile materials obtained from different sources separately.

3.3 PREPARATION OF UNDERLYING COURSE OR SUBGRADE

Clean the underlying course or subgrade of all foreign substances prior to constructing the base course(s). Do not construct base course(s) on underlying course or subgrade that is frozen. Construct the surface of the underlying course or subgrade to meet specified compaction and surface tolerances. Correct ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the specified requirements set forth herein by loosening and removing soft or unsatisfactory material and adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in JGS 0051, stabilize the surface prior to placement of the base course(s). Stabilize by mixing ABC or GCA into the underlying course and compacting by approved methods. Consider the stabilized material as part of the underlying course and meet all requirements of the underlying course. Do not allow traffic or other operations to disturb the finished underlying course and maintain in a satisfactory condition until the base course is placed.

3.4 GRADE CONTROL

Provide a finished and completed base course conforming to the lines,

grades, and cross sections shown. Place line and grade stakes as necessary for control.

3.5 MIXING AND PLACING MATERIALS

. Make adjustments in mixing procedures or in equipment, as directed, to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory base course meeting all requirements of this specification. Place the mixed material on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. Place the layers so that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one layer, clean the previously constructed layers of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Make adjustments in placing procedures or equipment as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable base course.

3.6 LAYER THICKNESS

Compact the completed base course to the thickness indicated. No individual layer may be thicker than 150 mm nor be thinner than 75 mm in compacted thickness. Compact the base course(s) to a total thickness that is within 13 mm of the thickness indicated. Where the measured thickness is more than 13 mm deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 13 mm thicker than indicated, the course will be considered as conforming to the specified thickness requirements. The average job thickness will be the average of all thickness measurements taken for the job and must be within 6 mm of the thickness indicated. Measure the total thickness of the base course at intervals of one measurement for each 500 square meters of base course. Measure total thickness using 75 mm diameter test holes penetrating the base course.

3.7 COMPACTION

Compact each layer of the base course, as specified, with approved compaction equipment. Maintain water content during the compaction procedure to within plus or minus 2 percent of the optimum water content determined from laboratory tests as specified in this Section. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Slightly vary the length of alternate trips of the roller. Adjust speed of the roller as needed so that displacement of the aggregate does not occur. Compact mixture with hand-operated power tampers in all places not accessible to the rollers. Continue compaction until each layer is compacted through the full depth to at least 100 percent of laboratory maximum density. Make such adjustments in compacting or finishing procedures as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory base course. Remove any materials found to be unsatisfactory and replace with satisfactory material or rework, as directed, to meet the requirements of this specification.

3.8 PROOF ROLLING

In addition to the compaction specified, proof roll base course under a flexible airfield pavement in areas designated on the drawings by application of 30 coverages for Class IV runways, 8 coverages for runways that support fighter aircraft only, and 4 coverages to all other paved areas, of a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 13,600 kg and inflated to a minimum of 862 kPa. A coverage is defined as the application of one tire print over the designated area. In the areas designated, apply proof rolling to the top of the underlying material on which the base course is laid and to the top of each layer of the completed base course. Maintain water content of the underlying material and each layer of the base course as specified in Paragraph COMPACTION from start of compaction to completion of proof rolling of that layer. Remove any base course materials or any underlying materials that produce unsatisfactory results by proof rolling and replace with satisfactory materials. Then recompact and proof roll to meet these specifications.

3.9 EDGES OF BASE COURSE

Place the base course(s) so that the completed section will be a minimum of 600 mm wider, on all sides, than the next layer that will be placed above it. Place approved material along the outer edges of the base course in sufficient quantity to compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, simultaneously roll and compact at least a 600 mm width of this shoulder material with the rolling and compacting of each layer of the base course, as directed.

3.10 FINISHING

Finish the surface of the top layer of base course after final compaction and proof rolling by cutting any overbuild to grade and rolling with a steel-wheeled roller. Do not add thin layers of material to the top layer of base course to meet grade. If the elevation of the top layer of base course is 13 mm or more below grade, scarify the top layer to a depth of at least 75 mm and blend new material in and compact and proof roll to bring to grade. Make adjustments to rolling and finishing procedures as directed by the Contracting Officer to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, scarify the unsatisfactory portion and rework and recompact it or replace as directed.

3.11 SMOOTHNESS TEST

Construct the top layer so that the surface shows no deviations in excess of 10 mm when tested with a 3.00 meter straightedge. Take measurements in successive positions parallel to the centerline of the area to be paved. Also take measurements perpendicular to the centerline at 15 meter intervals. Correct deviations exceeding this amount by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.12 FIELD QUALITY CONTROL

3.12.1 In-Place Tests

Perform each of the following tests on samples taken from the placed and compacted ABC and GCA. Take samples and test at the rates indicated. Perform sampling and testing of recycled concrete aggregate at twice the specified frequency until the material uniformity is established.

a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 250 square meters, or portion thereof, of completed area.

b. Perform sieve analysis on every lift of material placed and at a frequency of one sieve analysis for every 500 square meters, or portion thereof, of material placed.

c. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.

d. Measure the thickness of the base course at intervals providing at least one measurement for each 500 square meters of base course or part thereof. Measure the thickness using test holes, at least 75 mm in diameter through the base course.

3.12.2 Approval of Material

Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and fully compacted course(s).

3.13 TRAFFIC

Do not allow traffic on the completed base course for airfield pavements. For roads, do not allow heavy equipment on the completed base course except when necessary for construction. When it is necessary for heavy equipment to travel on the completed base course, protect the area against marring or damage to the completed work.

3.14 MAINTENANCE

Maintain the base course in a satisfactory condition until the full pavement section is completed and accepted. Immediately repair any defects and repeat repairs as often as necessary to keep the area intact. Retest any base course that was not paved over prior to the onset of winter to verify that it still complies with the requirements of this specification. Rework or replace any area of base course that is damaged as necessary to comply with this specification.

3.15 DISPOSAL OF UNSATISFACTORY MATERIALS

Dispose of any unsuitable materials that have been removed as directed . No additional payments will be made for materials that have to be replaced.

-- End of Section --

SECTION 32 12 13

BITUMINOUS TACK AND PRIME COATS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS K 2208	(2009) Asphalt Emulsion
JIS K 2251	(2003) Crude Petroleum and Petroleum Products - Sampling

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Sampling and Testing; G

1.3 QUALITY ASSURANCE

Certificates of compliance for asphalt materials delivered will be obtained and checked to ensure that specification requirements are met. Tack coat materials will not be diluted. Prime coat materials when emulsions are used can be diluted on site with potable water up to 1 part emulsion to 1 part water.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect the materials delivered to the site for contamination and damage. Unload and store the materials with a minimum of handling.

1.5 EQUIPMENT, TOOLS AND MACHINES

1.5.1 General Requirements

Equipment, tools and machines used in the work are subject to approval. Maintain in a satisfactory working condition at all times. Calibrate equipment such as asphalt distributors, scales, batching equipment, spreaders and similar equipment within 12 months of their use. If the calibration expires during project, recalibrate the equipment before work

can continue.

1.5.2 Bituminous Distributor

Provide a self propelled distributor with pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the surface being sprayed. Design and equip the distributor to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled total liquid rates from 0.14 to 4.5 L/square meter, with a pressure range of 172.4 to 517.1 kPa and with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Include with the distributor equipment a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor will be capable of circulating and agitating the bituminous material during the heating process.

1.5.3 Heating Equipment for Storage Tanks

Use steam, electric, or hot oil heaters for heating the bituminous material. Provide steam heaters consisting of steam coils and equipment for producing steam, so designed that the steam cannot come in contact with the bituminous material. Fix an armored thermometer to the tank with a temperature range from 4.4 to 204.4 degrees C so that the temperature of the bituminous material may be determined at all times.

1.5.4 Power Brooms and Power Blowers

Use power brooms and power blowers suitable for cleaning the surfaces to which the bituminous coat is to be applied.

1.6 ENVIRONMENTAL REQUIREMENTS

Apply bituminous coat only when the surface to receive the bituminous coat is dry. A limited amount of moisture (approximately 0.14 liter/square meter) can be sprayed on the surface of unbound material when prime coat is used to improve coverage and penetration of asphalt material. Apply bituminous coat only when the atmospheric temperature in the shade is 10 degrees C or above and when the temperature has not been below 2 degrees C for the 12 hours prior to application, unless otherwise directed.

PART 2 PRODUCTS

2.1 PRIME COAT

2.1.1 Emulsified Asphalt

Provide emulsified asphalt conforming to JIS K 2208, Type PK-3. . Asphalt emulsion can be diluted up to 1 part water to 1 part emulsion for prime coat use. Do not dilute asphalt emulsion for tack coat use.

2.2 TACK COAT

2.2.1 Emulsified Asphalt

Provide emulsified asphalt conforming to JIS K 2208, Type PK-4. For prime coats the emulsified asphalt can be diluted with up to 1 part emulsion to 1 part water. No dilution is allowed for tack coat applications.

PART 3 EXECUTION

3.1 PREPARATION OF SURFACE

Immediately before applying the bituminous coat, remove all loose material, dirt, clay, or other objectionable material from the surface to be treated by means of a power broom or blower supplemented with hand brooms. Apply treatment only when the surface is dry and clean.

3.2 APPLICATION RATE

The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Contracting Officer.

3.2.1 Tack Coat

Apply bituminous material for the tack coat in quantities of not less than 0.30 L nor more than 0.60 L/square meter of residual asphalt onto the pavement surface as approved by the Contracting Officer. Do not dilute asphalt emulsion when used as a tack coat.

3.2.2 Prime Coat

Apply bituminous material for the prime coat in quantities of not less than 1.0 L nor more than 2.0 L/square meter of residual asphalt for asphalt emulsion up to a 1 to 1 dilution rate or for residual asphalt for cutback asphalt.

3.3 APPLICATION TEMPERATURE

3.3.1 Viscosity Relationship

Apply asphalt at a temperature that will provide a viscosity between 10 and 60 seconds, Saybolt Furol, or between 20 and 120 square mm/sec, kinematic. Furnish the temperature viscosity relation to the Contracting Officer.

3.3.2 Temperature Ranges

The viscosity requirements determine the application temperature to be used. The following is a normal range of application temperatures:

Asphalt Emulsion	
All Grades	20-70 degrees C

3.4 APPLICATION

3.4.1 General

Following preparation and subsequent inspection of the surface, apply the bituminous prime or tack coat with the bituminous distributor at the specified rate with uniform distribution over the surface to be treated. Properly treat all areas and spots, not capable of being sprayed with the distributor, with the hand spray. Until the succeeding layer of pavement is placed, maintain the surface by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, spread clean dry sand to effectively blot up any excess bituminous material. No smoking, fires, or flames other than those from the heaters that are a part of the equipment are permitted within 8 meters of heating, distributing, and transferring operations of cutback materials. Prevent all traffic, except for paving equipment used in constructing the surfacing, from using the underlying material, whether primed or not, until the surfacing is completed. The bituminous coat requirements are described herein.

3.4.2 Prime Coat

The prime coat is required if it will be at least 7 days before the asphalt mixture is constructed on the underlying (base course, etc.) compacted material. The type of liquid asphalt and application rate will be as specified herein. Protect the underlying layer from any damage (water, traffic, etc.) until the surfacing is placed. If the Contractor places the surfacing within seven days, the choice of protection measures or actions to be taken is at the Contractor's option. Repair (recompact or replace) damage to the underlying material caused by lack of, or inadequate, protection by approved methods at no additional cost to the Government. If the Contractor opts to use the prime coat, apply as soon as possible after consolidation of the underlying material. Apply the bituminous material uniformly over the surface to be treated at a pressure range of 172.4 to 517.1 kPa; the rate will be as specified above in paragraph APPLICATION RATE. To obtain uniform application of the prime coat on the surface treated at the junction of previous and subsequent applications, spread building paper on the surface for a sufficient distance back from the ends of each application to start and stop the prime coat on the paper and to ensure that all sprayers will operate at full force on the surface to be treated. Immediately after application remove and destroy the building paper.

3.4.3 Tack Coat

A tack coat should be applied to every bound surface (asphalt or concrete pavement) that is being overlaid with asphalt mixture and at transverse and longitudinal joints. Apply the tack coat when the surface to be treated is clean and dry. Immediately following the preparation of the surface for treatment, apply the bituminous material by means of the bituminous distributor, within the limits of temperature specified herein and at a rate as specified above in paragraph APPLICATION RATE. Apply the bituminous material so that uniform distribution is obtained over the entire surface to be treated. Treat lightly coated areas and spots missed by the distributor by spraying with a hand wand or using other approved method. Following the application of bituminous material, allow the surface to cure without being disturbed for period of time necessary to permit setting of the tack coat. Apply the bituminous tack coat only as far in advance of the placing of the overlying layer as required for that

day's operation. Maintain and protect the treated surface from damage until the succeeding course of pavement is placed.

3.5 CURING PERIOD

Following application of the bituminous material and prior to application of the succeeding layer of asphalt mixture allow the bituminous coat to cure and water or volatiles to evaporate prior to overlaying. Maintain the tacked surface in good condition until the succeeding layer of pavement is placed, by protecting the surface against damage and by repairing and recoating deficient areas. Allow the prime coat to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course. Furnish and spread enough sand to effectively blot up excess bituminous material.

3.6 FIELD QUALITY CONTROL

Obtain certificates of compliance for all asphalt material delivered to the project. Obtain samples of the bituminous material under the supervision of the Contracting Officer. The sample may be retained and tested by the Government at no cost to the Contractor.

3.7 SAMPLING AND TESTING

Furnish certified copies of the manufacturer's test reports indicating temperature viscosity relationship for cutback asphalt or asphalt cement, compliance with applicable specified requirements, not less than 5 days before the material is required in the work.

3.7.1 Sampling

Unless otherwise specified, sample bituminous material in accordance with JIS K 2251.

3.7.2 Calibration Test

Furnish all equipment, materials, and labor necessary to calibrate the bituminous distributor. Calibrate using the approved job material and prior to applying the bituminous coat material to the prepared surface.

3.7.3 Trial Applications

Before applying the spray application of tack or prime coat, apply three lengths of at least 30 meters for the full width of the distributor bar to evaluate the amount of bituminous material that can be satisfactorily applied.

3.7.3.1 Tack Coat Trial Application Rate

Unless otherwise authorized, apply the trial application rate of bituminous tack coat materials in the amount of 0.23 L/square meter. Make other trial applications using various amounts of material as may be deemed necessary.

3.7.3.2 Prime Coat Trial Application Rate

Unless otherwise authorized, apply the trial application rate of bituminous materials in the amount of 0.66 L/square meter. Make other trial applications using various amounts of material as may be deemed

necessary.

3.7.4 Sampling and Testing During Construction

Perform quality control sampling and testing as required in paragraph FIELD QUALITY CONTROL.

3.8 TRAFFIC CONTROLS

Keep traffic off surfaces freshly treated with bituminous material. Provide sufficient warning signs and barricades so that traffic will not travel over freshly treated surfaces.

-- End of Section --

SECTION 32 12 16.16

HOT-MIX ASPHALT (HMA) FOR ROADS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1110	(2006) Methods of Test for Density and Water Absorption of Coarse Aggregates
JIS A 1121	(2007) Method of Test for Resistance to Abrasion of Coarse Aggregate by Use of the Los Angeles Machine
JIS A 1122	(2014) Method of Test for Soundness of Aggregate by Use of Sodium Sulfate
JIS A 1137	(2014) Method of Test for Clay Lumps Contained in Aggregates
JIS A 5001	(2008) Crushed Stone for Road Construction
JIS A 5008	(2008) Limestone Filler for Bituminous Paving Mixtures
JIS K 2207	(2006) Petroleum Asphalts

JAPAN ROAD ASSOCIATION (JRA)

JRA HAP	(2019) Handbook for Asphalt Pavement

1.2 GENERAL REQUIREMENTS

All materials, equipment, and construction procedures of hot-mix asphalt pavement for this project shall be in accordance with the Japan Road Association standards per publication identified in this specification.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mix Design; G

Quality Control; G

Material Acceptance; G

SD-06 Test Reports

Aggregates; G

QC Monitoring

1.4 ENVIRONMENTAL REQUIREMENTS

Do not place the hot-mix asphalt upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 3. The temperature requirements may be waived by the Contracting Officer, if requested; however, meet all other requirements, including compaction.

Table 3. Surface Temperature Limitations of Underlying Course

Mat Thickness, mm	Degrees C
75 or greater	4
Less than 75	7

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Perform the work consisting of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. HMA designed and constructed in accordance with this section shall conform to the lines, grades, thicknesses, and typical cross sections indicated. Construct each course to the depth, section, or elevation required by the drawings and roll, finish, and approve it before the placement of the next course.

2.2 AGGREGATES

Provide aggregates consisting of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The portion of material retained on the 5 mm sieve is coarse aggregate. The portion of material passing the 5 mm sieve and retained on the 0.074 mm sieve is fine aggregate. The portion passing the 0.074 mm sieve is defined as mineral filler. Submit all aggregate test results and samples to the Contracting Officer at least 14 days prior to start of construction.

2.2.1 Coarse Aggregate

Provide coarse aggregate consisting of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances and conforming to JIS A 5001. All individual coarse aggregate sources shall meet the following requirements:

Percent Passing (by Weight)

Sieve Size (mm)	S-20 (20-13 mm)	S-13 (13-5 mm)	S-5 (5-2.5 mm)
25	100	-	-
20	85 - 100	100	-
13	0 - 15	85 - 100	100
5	-	0 - 15	85 - 100
2.5	-	-	0 - 25

a. At least 75 percent by weight of the aggregate shall have two or more fractured faces in accordance with JRA HAP

b. It shall be of uniform quality, clean, hard and durable, and shall not contain deleterious substances over the maximum percent by weight, such as clay or loam (0.25% maximum), soft stone pieces (5.0% maximum), and flat or elongated stone pieces (10.0% maximum) in accordance with JRA HAP.

c. Specific gravity shall be 2.45 or more when tested with JIS A 1110, water absorption shall be 3.0 percent or less when tested with JIS A 1110, and wear shall be not more than 30 percent when tested with JIS A 1121.

d. Soundness of aggregate shall be not more than 12 percent when tested with JIS A 1122.

2.2.2 Fine Aggregate

Fine aggregate shall consist of natural or manufactured sand, and screenings conforming to JIS A 5001, except as modified herein. Fine aggregate shall meet requirements for wear and soundness specified for coarse aggregate. Since screenings may contain deleterious substances, such as silt and clay, it is necessary to perform sufficient examination before use. Clay lumps content shall be less than 0.25% when tested with JIS A 1137. Gradation of fine aggregate shall be as follows:

Sieve Size (mm)	Percent Passing (by Weight)
5	100
2.5	85 - 100
0.6	25 - 55
0.3	15 - 40
0.15	7 - 28

Sieve Size (mm)	Percent Passing (by Weight)
0.074	0 - 20

2.2.3 Mineral Filler

Mineral filler shall be pulverized limestone or igneous rock that is sufficiently dry and free of lumps and meeting the requirements of JIS A 5008. Moisture content shall be less than 1.0 percent, and specific gravity shall be more than 2.60 percent. Gradation of mineral filler shall be as follows:

Sieve Size (mm)	Percent Passing (by Weight)
0.6	100
0.15	Over 90
0.074	Over 70

2.2.4 Composition of Hot-Mix Asphalt Mixture

2.2.4.1 Aggregate Gradation

The combined aggregate gradation shall conform to gradations specified in Table 1 and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grade uniformly from coarse to fine.

Table 1

Total Percent Passing (By Weight)

Sieve Size (mm)	Binder Course (Max. 20 mm)	Wearing Course (Max. 20 mm)	Wearing Course (Max. 13 mm)
25	100	100	-
20	95 - 100	95 - 100	100
13	70 - 90	75 - 90	95 - 100
5	35 - 55	45 - 65	55 -70
2.5	20 - 35	35 - 50	35 -50
0.6	11 - 23	18 - 30	18 - 30

Sieve Size (mm)	Binder Course (Max. 20 mm)	Wearing Course (Max. 20 mm)	Wearing Course (Max. 13 mm)
0.3	5 - 16	10 - 21	10 - 21
0.15	4 - 12	6 - 16	6 - 16
0.074	2 - 7	4 - 8	4 - 8

2.2.4.2 Quantity of Asphalt Cement

Mix asphalt cement with aggregates of corresponding mixes in the following proportions:

Asphalt Cement Percent by Weight of Total Mix	
Binder Course	Wearing Course
4.5 - 6	5 - 7

2.3 ASPHALT CEMENT

Asphalt cement shall conform to JIS K 2207, penetration grade 40-60 (high traffic areas), 60-80 (general traffic conditions), 80-100 (snowy regions), and 100-120 (extremely cold places).

2.4 MIX DESIGN

a. Develop the mix design. The asphalt mix shall be composed of a mixture of well-graded aggregate, mineral filler if required, and asphalt material. The aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF). Submit proposed JMF; do not produce hot-mix asphalt for payment until a JMF has been approved. The hot-mix asphalt shall be designed in accordance with Chapter 5 of the JRA HAP - Handbook for Asphalt Pavement and the criteria shown in Table 2.

2.4.1 JMF Requirements

Submit in writing the job mix formula for approval at least 14 days prior to the start of the test section including as a minimum:

a. Source and proportions, percent by weight, of each ingredient of the mixture.

b. Correct gradation, the percentages passing each size sieve listed in the specification for the mixture to be used, for the aggregate and mineral filler from each separate source and from each different size to be used in the mixture and for the composite mixture.

c. Amount of material passing the JIS 0.074 mm sieve as determined by dry sieving.

d. Number of blows of hammer compaction per side of molded specimen.

e. Temperature viscosity relationship of the asphalt pavement.

f. Stability, flow, percent voids in mineral aggregate, percent air voids, and unit weight.

g. Asphalt absorption by the aggregate.

h. Effective asphalt content as percent by weight of total mix.

i. Temperature of the mixture immediately upon completion of mixing.

j. Asphalt viscosity grade and/or penetration range.

k. Curves for the binder and wearing courses.

2.4.1.1 Marshall Test

Marshall test specimen of hot-mix asphalt mixture shall be prepared in a laboratory to determine the optimum composition of aggregates and the optimum quantity of asphalt cement. Aggregate gradation and asphalt cement content used in the mixtures shall be within the limits specified. Standard value for Marshall test shall be as follows:

Table 2. Mix Design Criteria

Type of Mixture	Binder Course	Wearing Course
Number of Blows (Traffic Classification C or heavier)	75	75
Number of Blows (Traffic Classification B or ligher)	50	50
Percentage of Air Voids (%)	3-7	3-6
Voids Filled with Asphalt (%)	65-85	70-85
Marshall Stability (kgf)	500 or more	750 or more
Flow Value (1/100cm)	20-40	20-40

2.4.2 Adjustments to Field JMF

Keep the Laboratory JMF for each mixture in effect until a new formula is approved in writing by the Contracting Officer. Should a change in sources of any materials be made, perform a new laboratory jmf design and a new JMF approved before the new material is used. The Contractor will be allowed to adjust the Laboratory JMF within the limits specified below

to optimize mix volumetric properties with the approval of the Contracting Officer. Adjustments to the Laboratory JMF shall be applied to the field (plant) established JMF and limited to those values as shown. Adjustments shall be targeted to produce or nearly produce 4 percent voids total mix (VTM).

TABLE 3. Field (Plant) Established JMF Tolerances

Sieves, mm	Adjustments (plus or minus), percent
13	3
5	3
2.5	3
0.074	1
Binder Content	0.4

If adjustments are needed that exceed these limits, develop a new mix design. Tolerances given above may permit the aggregate grading to be outside the limits shown in Table 1; while not desirable, this is acceptable, except for the 0.074 mm sieve, which shall remain within the aggregate grading of Table 1.

2.5 RECYCLED HOT MIX ASPHALT

Recycled HMA shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, and asphalt cement to produce a consistent gradation and asphalt content and properties. When RAP is fed into the plant, the maximum RAP chunk size shall not exceed 50 mm. The amount of RAP shall not exceed 30 percent.

PART 3 EXECUTION

3.1 PREPARATION OF ASPHALT BINDER MATERIAL

Heat the asphalt cement material avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of unmodified asphalts shall be no more than 160 degrees C when added to the aggregates.

3.2 PREPARATION OF MINERAL AGGREGATE

Heat and dry the aggregate for the mixture prior to mixing. No damage shall occur to the aggregates due to the maximum temperature and rate of heating used. The temperature of the aggregate and mineral filler shall not exceed 175 degrees C when the asphalt cement is added. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

3.3 PREPARATION OF HOT-MIX ASPHALT MIXTURE

Accurately weigh or gauge the aggregates and the dry mineral filler and convey into the mixer in the proportionate amounts of each aggregate size

required to meet the job-mix formula. Introduce required amount of asphalt into the mixer at a temperature at which it can be applied uniformly to the aggregate but not to exceed 163 degrees C. In batch mixing, after the aggregates and mineral filler have been introduced into the mixer and mixed for not less than 15 seconds, add asphalt by spraying or other approved methods, and continue mixing for a period of not less than 20 seconds or as much longer as may be required to obtain a homogeneous mixture. The time required to add or spray the asphalt into the mixer will not be added to the total wet-mixing time provided this operation does not exceed 10 seconds and a homogeneous mixture is obtained. The additional mixing time, when required, will be as directed. The temperature of the mixture at the time of discharge shall not exceed 168 degrees C. The temperature of the aggregate and mineral filler in the mixer shall not exceed 177 degrees C when the asphalt is added. When the mixture is prepared in a twin-pugmill mixer, the volume of the aggregates, mineral filler, and asphalt shall not extend above the tips of the mixer blades when the blades are in a vertical position. Overheated and carbonized mixtures, or mixtures that foam or show indication of free moisture, will be rejected. When free moisture is detected in batch mix plant produced mixture, withdraw the aggregates in the hot bins immediately and return to the respective stockpiles.

3.4 PREPARATION OF THE UNDERLYING SURFACE

Immediately before placing the hot mix asphalt, clean the underlying course of dust and debris. Apply a [prime coat] [and/or] [tack coat] in accordance with the contract specifications.

3.4.1 Raising of Existing Manhole, Handhole, Valve Box and Catch Basin

If there are existing manhole, handhole, valve box and catch basins in existing asphalt concrete pavement to be overlaid, those shall be raised up to flush with the finished surface of new hot-mix asphalt pavement before new asphalt concrete is placed. Existing mortar leveling course under the manhole, handhole and valve box shall be replaced with new up to new level to provide a flush setting.

3.5 TESTING LABORATORY

Submit laboratory certification issued by the local prefectural or central government (Japan Ministry of Land, Infrastructure, Transport and Tourism (MLIT)). Use a laboratory to develop the JMF. The Government will inspect the laboratory equipment and test procedures prior to the start of hot mix operations. The laboratory shall maintain a valid certification for the duration of the project. A statement signed by the manager of the laboratory stating that it meets these requirements or clearly listing all deficiencies shall be submitted to the Contracting Officer prior to the start of construction. The statement shall contain as a minimum:

a. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.

b. A listing of equipment to be used in developing the job mix.

c. A copy of the laboratory's quality control system.

3.6 TRANSPORTING AND PLACING

3.6.1 Transporting

Transport the hot-mix asphalt from the mixing plant to the site in clean, tight vehicles. Schedule deliveries so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Provide adequate artificial lighting for night placements. Hauling over freshly placed material will not be permitted until the material has been compacted as specified, and allowed to cool to 60 degrees C. To deliver mix to the paver, use a material transfer vehicle operated to produce continuous forward motion of the paver.

3.6.2 Placing

Place and compact the mix at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. Upon arrival, place the mixture to the full width by an asphalt paver; it shall be struck off in a uniform layer of such depth that, when the work is completed, it will have the required thickness and conform to the grade and contour indicated. Regulate the speed of the paver to eliminate pulling and tearing of the asphalt mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. Place the mixture in consecutive adjacent strips having a minimum width of 3 m. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 300 mm; however, the joint in the surface course shall be at the centerline of the pavement. Transverse joints in one course shall be offset by at least 3 m from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 3 m. On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools.

3.7 COMPACTION OF MIXTURE

After placing, the mixture shall be thoroughly and uniformly compacted by rolling. Compact the surface as soon as possible without causing displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once. Furnish sufficient rollers to handle the output of the plant. Continue rolling until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, keep the wheels properly moistened but excessive water will not be permitted. In areas not accessible to the roller, the mixture shall be thoroughly compacted with hand tampers. Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way defective shall be removed full depth, replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching will not be allowed.

3.8 JOINTS

The formation of joints shall be performed ensuring a continuous bond

between the courses and to obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

3.8.1 Transverse Joints

Do not pass the roller over the unprotected end of the freshly laid mixture, except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing material at the joint. Remove the cutback material from the project. In both methods, all contact surfaces shall be given a light tack coat of asphalt material before placing any fresh mixture against the joint.

3.8.2 Longitudinal Joints

Longitudinal joints which are irregular, damaged, uncompacted, cold (less than 80 degrees C at the time of placing adjacent lanes), or otherwise defective, shall be cut back a maximum of 75 mm from the top of the course with a cutting wheel to expose a clean, sound vertical surface for the full depth of the course. All cutback material shall be removed from the project. All contact surfaces shall be given a light tack coat of asphalt material prior to placing any fresh mixture against the joint. The Contractor will be allowed to use an alternate method if it can be demonstrated that density, smoothness, and texture can be met.

3.9 Finishing at Edge and Limit of Paving

Overlay of new hot-mix asphalt mixture shall be finished evenly in the same thickness indicated. Overlay shall be finished in gentle slope so that the edge of new overlaying pavement shall meet the edge elevation of existing asphalt concrete pavement. And where the drawing indicates "Limit of Paving," overlay shall be finished to provide a smooth transition to existing concrete pavement.

3.10 Compacted Earth Shoulder

Place and compact earth at edges of course for at least 30 cm of the shoulder.

3.11 QUALITY CONTROL

3.11.1 General Quality Control Requirements

Develop and submit an approved Quality Control Plan. Submit aggregate and QC test results. Do not produce hot-mix asphalt for payment until the quality control plan has been approved addressing all elements which affect the quality of the pavement including, but not limited to:

a. Mix Design

b. Aggregate Grading

c. Quality of Materials

d. Stockpile Management

e. Proportioning

f. Mixing and Transportation

g. Mixture Volumetrics

h. Moisture Content of Mixtures

i. Placing and Finishing

j. Joints

k. Compaction

l. Surface Smoothness

3.11.2 Testing Laboratory

Provide a fully equipped asphalt laboratory located at the plant or job site. Laboratory facilities shall be kept clean and all equipment maintained in proper working condition. The Contracting Officer shall be permitted unrestricted access to inspect the Contractor's laboratory facility, to witness quality control activities, and to perform any check testing desired. The Contracting Officer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to adversely affect test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are corrected.

3.11.3 Quality Control Testing

Perform all quality control tests applicable to these specifications in accordance with the testing criteria and frequency requirements as set forth in Chapter 6 of the JRA HAP - Handbook for Asphalt Pavement. Develop a Quality Control Testing Plan as part of a Quality Control Program. The testing program shall include, but shall not be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, stability (, flow , in-place density, grade and smoothness.

3.11.3.1 Additional Testing

Any additional testing, which the Contractor deems necessary to control the process, may be performed at the Contractor's option.

3.11.3.2 QC Monitoring

Submit all QC test results to the Contracting Officer on a daily basis as the tests are performed. The Contracting Officer reserves the right to monitor any of the Contractor's quality control testing and to perform duplicate testing as a check to the Contractor's quality control testing.

3.11.4 Sampling

When directed by the Contracting Officer, sample and test any material which appears inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or deficiencies

corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

3.12 MATERIAL ACCEPTANCE

3.12.1 Grade

The final wearing surface of pavement shall conform to the elevations and cross sections shown and shall vary not more than 15 mm from the plan grade established and approved at site of work. Finished surfaces at juncture with other pavements shall coincide with finished surfaces of abutting pavements. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The grade will be determined by running lines of levels at intervals of 7.6 m, or less, longitudinally and transversely, to determine the elevation of the completed pavement surface. Within 5 working days, after the completion of a particular lot incorporating the final wearing surface, test the final wearing surface of the pavement for conformance with the specified plan grade. Diamond grinding may be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted.

3.12.2 Surface Smoothness

Perform all testing in the presence of the Contracting Officer. Keep detailed notes of the results of the testing and furnish a copy to the Government immediately after each day's testing. Use the profilograph method for all longitudinal testing, except where the runs would be less than 60 m in length and the ends where the straightedge will be used.

3.12.2.1 Smoothness Requirements

3.12.2.1.1 Straightedge Testing

The finished surfaces of the pavements shall have no abrupt change of 6 mm or more, and all pavements shall be within the tolerances of 6 mm in both the longitudinal and transverse directions, when tested with an approved 3 m straightedge.

3.12.2.1.2 Profilograph Testing

The finished surfaces of the pavements shall have no abrupt change of 3 mm or more, and each 0.1 km segment of each pavement lot shall have a Profile Index not greater than 140 mm/km when tested with an approved Japanese construction practice using profilometer. If the extent of the pavement in either direction is less than 60 m, that direction shall be tested by the straightedge method and shall meet requirements specified above.

3.12.2.2 Testing Method

After the final rolling, but not later than 24 hours after placement, test the surface of the pavement in each entire lot in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. Separate testing of individual sublots is not required. If any pavement areas are ground, these areas shall be retested immediately after grinding. Test each lot of the pavement in both a longitudinal and a transverse direction on parallel lines. Set the transverse lines 4.5 m or

less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane for lanes less than 6.1 m wide and at the third points for lanes 6.1 m or wider. Also test other areas having obvious deviations. Longitudinal testing lines shall be continuous across all joints.

3.12.2.2.1 Straightedge Testing

Hold the straightedge in contact with the surface and move it ahead one-half the length of the straightedge for each successive measurement. Determine the amount of surface irregularity by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points.

3.12.2.2.2 Profilograph Testing

Perform profilograph testing using approved equipment and procedures. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate "must-grind" bumps and the Profile Index for each 0.1 km segment of each pavement lot. Grade breaks on parking lots shall be accommodated by breaking the profile segment into shorter sections and repositioning the blanking band on each segment. The "blanking band" shall be 5 mm wide and the "bump template" shall span 25 mm with an offset of 7.5 mm. Compute the Profile Index for each pass of the profilograph in each 0.1 km segment. The Profile Index for each segment shall be the average of the Profile Indices for each pass in each segment. Furnish a copy of the reduced tapes to the Government at the end of each day's testing.

-- End of Section --

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SECTION 32 15 00

AGGREGATE SURFACING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1102	(2014) Method of Test for Sieve Analysis of Aggregates
JIS A 1103	(2014) Method of Test for Amount of Material Passing Test Sieve 75 μm in Aggregates
JIS A 1121	(2007) Method of Test for Resistance to Abrasion of Coarse Aggregate by Use of the Los Angeles Machine
JIS A 1201	(2009) Practise for Preparing Disturbed Soil Samples for Soil Testing
JIS A 1205	(2009) Test Method for Liquid Limit and Plastic Limit of Soils
JIS A 1210	(2009) Test Method for Soil Compaction Using a Rammer
JIS A 1214	(2013) Test Method for Soil Density by the Sand Replacement Method
JIS A 5001	(2008) Crushed Stone for Road Construction
JIS Z 8801	(2006) Test Sieves Part 1: Test Sieves of Metal Wire Cloth

1.2 DEGREE OF COMPACTION

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in JIS A 1210 abbreviated as a percent of laboratory maximum dry density.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to

Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools;

SD-06 Test Reports

Initial Tests; G
In-Place Tests; G

1.4 EQUIPMENT, TOOLS, AND MACHINES

All plant, equipment, and tools used in the performance of the work will be subject to approval by the Contracting Officer before the work is started. Maintain all plant, equipment, and tools in satisfactory working condition at all times. Submit a list of proposed equipment, including descriptive data. Provide adequate equipment having the capability of minimizing segregation, producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.5 QUALITY ASSURANCE

Sampling and testing are the responsibility of the Contractor. Perform sampling and testing using a laboratory approved in accordance with Section 01 45 00.00 1001 45 00.00 2001 45 00.00 40 QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. Test the materials to establish compliance with the specified requirements and perform testing at the specified frequency. The Contracting Officer may specify the time and location of the tests. Furnish copies of test results to the Contracting Officer within 24 hours of completion of the tests.

1.5.1 Sampling

Take samples for laboratory testing in conformance with JIS A 1201. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.5.2 Testing

1.5.2.1 Sieve Analysis

Perform sieve analysis in conformance with JIS A 1103 and JIS A 1102 using sieves conforming to JIS Z 8801.

1.5.2.2 Liquid Limit and Plasticity Index

Determine liquid limit and plasticity index in accordance with JIS A 1205.

1.5.2.3 Moisture-Density Determinations

Determine the laboratory maximum dry density and optimum moisture content in accordance with paragraph DEGREE OF COMPACTION.

1.5.2.4 Field Density Tests

Measure field density in accordance with JIS A 1214.

1.5.2.5 Wear Test

Perform wear tests on aggregate surface course material in conformance with JIS A 1121.

1.6 ENVIRONMENTAL REQUIREMENTS

Perform construction when the atmospheric temperature is above 2 degrees C. It is the responsibility of the Contractor to protect, by approved method or methods, all areas of surfacing that have not been accepted by the Contracting Officer. Bring surfaces damaged by freeze, rainfall, or other weather conditions to a satisfactory condition.

PART 2 PRODUCTS

2.1 AGGREGATES

Provide aggregates consisting of clean, sound, durable particles of natural gravel, crushed gravel, crushed stone, sand, slag, soil, or other approved materials processed and blended or naturally combined. Provide aggregates free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign materials. The Contractor is responsible for obtaining materials that meet the specification and can be used to meet the grade and smoothness requirements specified herein after all compaction and proof rolling operations have been completed. Aggregates shall conform to JIS A 5001, M-30/RM-30.

2.1.1 Coarse Aggregates

The material retained on the 5 mm sieve is known as coarse aggregate. Use only coarse aggregates that are reasonably uniform in density and quality. Use only coarse aggregate having a percentage of wear not exceeding 50 percent after 500 revolutions as determined by JIS A 1121. The amount of flat and/or elongated particles must not exceed 20 percent. A flat particle is one having a ratio of width to thickness greater than three; an elongated particle is one having a ratio of length to width greater than three. When the coarse aggregate is supplied from more than one source, aggregate from each source must meet the requirements set forth herein.

2.1.2 Fine Aggregates

The material passing the 5 mm sieve is known as fine aggregate. Fine aggregate consists of screenings, sand, soil, or other finely divided mineral matter that is processed or naturally combined with the coarse aggregate.

2.1.3 Gradation Requirements

Gradation requirements specified in TABLE I apply to the completed aggregate surface. It is the responsibility of the Contractor to obtain materials that will meet the gradation requirements after mixing, placing, compacting, and other operations. TABLE I shows permissible gradings for granular material used in aggregate surface roads and airfields. Use sieves conforming to JIS Z 8801.

GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	M-30 / RM-30
37.5	100
31.5	95-100
19.0	60-90
4.75	30-65
2.36	20-50
0.425	10-30
0.075	2-10

2.2 LIQUID LIMIT AND PLASTICITY INDEX

The portion of the completed aggregate surface course passing the 0.425 mm sieve must have a maximum liquid limit of 35 and a plasticity index of 4 to 9.

2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

2.3.1 Initial Tests

Perform one of each of the following tests, on the proposed material prior to commencing construction, to demonstrate that the proposed material meets all specified requirements when furnished. Complete this testing for each source if materials from more than one source are proposed.

a. Sieve Analysis.

b. Liquid limit and plasticity index.

c. Moisture-density relationship.

d. Wear.

Submit certified copies of test results for approval not less than 30 days before material is required for the work.

2.3.2 Approval of Material

Tentative approval of material will be based on initial test results.

PART 3 EXECUTION

3.1 STOCKPILING MATERIAL

Prior to stockpiling the material, clear and level the storage sites. Stockpile all materials, including approved material available from

excavation and grading, in the manner and at the locations designated. Stockpile aggregates in such a manner that will prevent segregation. Stockpile aggregates and binders obtained from different sources separately.

3.2 PREPARATION OF UNDERLYING COURSE SUBGRADE

Clean the underlying course subgrade and shoulders of all foreign substances. Do not construct the surface course on underlying course subgrade that is frozen material. Correct ruts or soft yielding spots in the underlying course subgrade, areas having inadequate compaction and deviations of the surface from the requirements set forth herein by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade and recompacting to density requirements specified in Section 31 00 00 EARTHWORK Section 32 11 20 BASE COURSE FOR RIGID AND SUBBASES FOR FLEXIBLE PAVING. Do not allow traffic or other operations to disturb the completed underlying course subgrade and maintain in a satisfactory condition until the surface course is placed.

3.3 GRADE CONTROL

During construction, maintain the lines and grades including crown and cross slope indicated for the aggregate surface course by means of line and grade stakes placed by the Contractor in accordance with the SPECIAL CONTRACT REQUIREMENTS.

3.4 MIXING AND PLACING MATERIALS

Mix and place the materials to obtain uniformity of the material and a uniform optimum water content for compaction. Make adjustments in mixing, placing procedures, or in equipment to obtain the true grades, to minimize segregation and degradation, to obtain the desired water content, and to ensure a satisfactory surface course.

3.5 LAYER THICKNESS

Place the aggregate material on the underlying course subgrade in layers of uniform thickness. Compact the completed aggregate surface course to the thickness indicated. No individual layer may be thicker than 150 mm nor be thinner than 75 mm in compacted thickness. Compact the aggregate surface course to a total thickness that is within 13 mm of the thickness indicated. Where the measured thickness is more than 13 mm deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 13 mm thicker than indicated, the course will be considered as conforming to the specified thickness requirements. The average job thickness will be the average of all thickness measurements taken for the job and must be within 6 mm of the thickness indicated. Measure the total thickness of the aggregate surface course at intervals of one measurement for each 500 square meters of surface course. Measure total thickness using 75 mm diameter test holes penetrating the aggregate surface course.

3.6 COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in JIS A 1210 abbreviated herein as percent laboratory maximum density. Compact each layer of the aggregate surface

course with approved compaction equipment, as required in the following paragraphs. Maintain the water content during the compaction procedure at optimum or at the percentage specified by the Contracting Officer. Compact the mixture with mechanical tampers in locations not accessible to rollers. Continue compaction until each layer through the full depth is compacted to at least 100 percent of laboratory maximum density. Remove any materials that are found to be unsatisfactory and replace them with satisfactory material or rework them to produce a satisfactory material.

3.7 EDGES OF AGGREGATE SURFACE COURSE

Place approved material along the edges of the aggregate surface course in such quantity as to compact to the thickness of the course being constructed. Simultaneously roll and compact at least 300 mm of shoulder width with the rolling and compacting of each layer of the surface course when the course is being constructed in two or more layers.

3.8 SMOOTHNESS TEST

Construct each layer so that the surface shows no deviations in excess of 10 mm when tested with a 3 m straightedge applied both parallel with and at right angles to the centerline of the area to be paved. Correct deviations exceeding this amount by removing material, replacing with new material, or reworking existing material and compacting, as directed.

3.9 FIELD QUALITY CONTROL

3.9.1 In-Place Tests

Perform each of the following tests on samples taken from the placed and compacted aggregate surface course. Take samples and test at the rates indicated.

a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 250 square meters, or portion thereof, of completed area.

b. Perform sieve analysis on every lift of material placed and at a frequency of one sieve analysis for every 500 square meters, or portion thereof, of material placed.

c. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.

d. Measure the thickness of the aggregate surface course at intervals providing at least one measurement for each 500 square meters of base course or part thereof. Measure the thickness using test holes, at least 75 mm in diameter through the aggregate surface course.

3.9.2 Approval of Material

Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and full coompacted aggregate surface course.

3.10 MAINTENANCE

Maintain the aggregate surface course in a condition that will meet all specification requirements until accepted.

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SECTION 32 16 19

CONCRETE CURBS, GUTTERS AND SIDEWALKS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1101	(2014) Method of Test for Slump of Concrete
JIS A 1115	(2014) Method of Sampling Fresh Concrete
JIS A 1118	(2017) Method of Test for Air Content of Fresh Concrete by Volumetric Method
JIS A 1128	(2014) Method of Test for Air Content of Fresh Concrete by Pressure Method
JIS A 1132	(2014) Method of Making and Curing Concrete Specimens
JIS A 5308	(2014) Ready-Mixed Concrete
JIS A 5371	(2010) Precast Unreinforced Concrete Product
JIS A 5758	(2016) Sealants for Sealing and Glazing in Buildings
JIS G 3112	(2010) Steel Bars for Concrete Reinforcement
JIS G 3551	(2005) Welded Wire Mesh and Rebar Grid
JIS K 6781	(1994) Polyethylene Films for Agriculture

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Concrete; G

SD-06 Test Reports

Field Quality Control

1.3 EQUIPMENT, TOOLS, AND MACHINES

1.3.1 General Requirements

Plant, equipment, machines, and tools used in the work will be subject to approval and must be maintained in a satisfactory working condition at all times. Use equipment capable of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Discontinue using equipment that produces unsatisfactory results. Allow the Contracting Officer access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

1.3.2 Slip Form Equipment

Slip form paver or curb forming machines, will be approved based on trial use on the job and must be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in one pass.

1.4 ENVIRONMENTAL REQUIREMENTS

1.4.1 Placing During Cold Weather

Do not place concrete when the air temperature reaches 5 degrees C and is falling, or is already below that point. Placement may begin when the air temperature reaches 2 degrees C and is rising, or is already above 5 degrees C. Make provisions to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 2 degrees C, placement and protection must be approved in writing. Approval will be contingent upon full conformance with the following provisions. Prepare and protect the underlying material so that it is entirely free of frost when the concrete is deposited. Heat mixing water and aggregates as necessary to result in the temperature of the in-place concrete being between 10 and 30 degrees C. Methods and equipment for heating must be approved. Use only aggregates that are free of ice, snow, and frozen lumps before entering the mixer. Provide covering or other means as needed to maintain the concrete at a temperature of at least 10 degrees C for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

1.4.2 Placing During Warm Weather

The temperature of the concrete as placed must not exceed 30 degrees C except where an approved retarder is used. Cool the mixing water and aggregates as necessary to maintain a satisfactory placing temperature. The placing temperature must not exceed 35 degrees C at any time.

PART 2 PRODUCTS

2.1 CONCRETE

Provide concrete conforming to the applicable requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE , JIS A 5308 except as otherwise specified. Concrete must have a minimum compressive strength of 24 MPa at 28 days. Size of aggregate must not exceed 37.5 mm. Submit copies of certified delivery tickets for all concrete used in the construction.

2.1.1 Air Content

Use concrete mixtures that have an air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

2.1.2 Slump

Use concrete with a slump of 75 mm plus or minus 25 mm for hand placed concrete or 25 mm plus or minus 10 mm for slipformed concrete as determined in accordance with JIS A 1101.

2.1.3 Reinforcement Steel

Use reinforcement bars conforming to JIS G 3112. Use wire mesh reinforcement conforming to JIS G 3551.

2.2 CONCRETE CURING MATERIALS

2.2.1 Impervious Sheet Materials

Use impervious sheet materials conforming to JIS K 6781, type optional, except that polyethylene film, if used, must be white opaque.

2.2.2 White Pigmented Membrane-Forming Curing Compound

Use Japanese manufactured white pigmented membrane-forming curing compound conforming to ASTM C309, Type 2.

2.3 CONCRETE PROTECTION MATERIALS

Use concrete protection materials consisting of a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the Contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

2.4 JOINT FILLER STRIPS

2.4.1 Expansion Joint Filler, Premolded

Unless otherwise indicated, use 10 mm thick Japanese manufactured premolded expansion joint filler conforming to ASTM D1751.

2.5 JOINT SEALANTS

Use Japanese manufactured cold-applied joint sealant conforming to JIS A 5758.

2.6 FORM WORK

Design and construct form work to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Use wood or steel forms that are straight and of sufficient strength to resist springing during depositing and consolidating concrete.

2.6.1 Wood Forms

Use forms that are surfaced plank, 50 mm nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Use forms with a nominal length of 3 m. Radius bends may be formed with 19 mm boards, laminated to the required thickness.

2.6.2 Steel Forms

Use channel-formed sections with a flat top surface and welded braces at each end and at not less than two intermediate points. Use forms with interlocking and self-aligning ends. Provide flexible forms for radius forming, corner forms, form spreaders, and fillers as needed. Use forms with a nominal length of 3 m and that have a minimum of 3 welded stake pockets per form. Use stake pins consisting of solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.6.3 Sidewalk Forms

Use sidewalk forms that are of a height equal to the full depth of the finished sidewalk.

2.6.4 Curb and Gutter Forms

Use curb and gutter outside forms that have a height equal to the full depth of the curb or gutter. Use rigid forms for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 3 m or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 38 mm benders, for the full height of the curb, cleated together. In lieu of inside forms for curbs, a curb "mule" may be used for forming and finishing this surface, provided the results are approved.

2.6.5 Precast Concrete Curb or Precast Concrete Curb and Gutter

Precast concrete curb or precast concrete curb and gutter, where indicated, shall conform to JIS A 5371.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

Construct subgrade to the specified grade and cross section prior to concrete placement.

3.1.1 Sidewalk Subgrade

Place and compact the subgrade in accordance with Section 31 00 00 EARTHWORK . Test the subgrade for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

3.1.2 Curb and Gutter Subgrade

Place and compact the subgrade in accordance with Section 31 00 00 EARTHWORK Section 32 11 23 AGGREGATE BASE COURSES . Test the subgrade for grade and cross section by means of a template extending the full width of the curb and gutter. Use subgrade materials equal in bearing quality to the subgrade under the adjacent pavement.

3.1.3 Maintenance of Subgrade

Maintain subgrade in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade must be in a moist condition when concrete is placed. Prepare and protect subgrade so that it is free from frost when the concrete is deposited.

3.2 FORM SETTING

Set forms to the indicated alignment, grade and dimensions. Hold forms rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 1.2 m. Use additional stakes and braces at corners, deep sections, and radius bends, as required. Use clamps, spreaders, and braces where required to ensure rigidity in the forms. Remove forms in a manner that will not injure the concrete. Do not use bars or heavy tools against the concrete when removing the forms. Promptly and satisfactorily repair concrete found to be defective after form removal. Clean forms and coat with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

3.2.1 Sidewalks

Set forms for sidewalks with the upper edge true to line and grade with an allowable tolerance of 3 mm in any 3 m long section. After forms are set, grade and alignment must be checked with a 3 m straightedge. Sidewalks must have a transverse slope of 20 mm per meter Unless otherwise indicated, construct sidewalks that are located adjacent to curbs with the low side adjacent to the curb. Do not remove side forms less than 12 hours after finishing has been completed.

3.2.2 Curbs and Gutters

Remove forms used along the front of the curb not less than 2 hours nor more than 6 hours after the concrete has been placed. Do not remove forms used along the back of curb until the face and top of the curb have been finished, as specified for concrete finishing. Do not remove gutter forms

while the concrete is sufficiently plastic to slump in any direction.

3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

3.3.1 Formed Sidewalks

Place concrete in the forms in one layer. When consolidated and finished, the sidewalks must be of the thickness indicated. Use a strike-off guided by side forms after concrete has been placed in the forms to bring the surface to proper section to be compacted. Consolidate concrete by tamping and spading or with an approved vibrator. Finish the surface to grade with a strike off.

3.3.2 Concrete Finishing

After straightedging, when most of the water sheen has disappeared, and just before the concrete hardens, finish the surface with a wood or magnesium float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. Produce a scored surface by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

3.3.3 Edge and Joint Finishing

Finish all slab edges, including those at formed joints, with an edger having a radius of 3 mm. Edge transverse joints before brooming. Eliminate the flat surface left by the surface face of the edger with brooming. Clean and solidly fill corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing with a properly proportioned mortar mixture and then finish.

3.3.4 Surface and Thickness Tolerances

Finished surfaces must not vary more than 8 mm from the testing edge of a 3 m straightedge. Permissible deficiency in section thickness will be up to 6 mm.

3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

3.4.1 Formed Curb and Gutter

Place concrete to the required section in a single lift. Consolidate concrete using approved mechanical vibrators. Curve shaped gutters must be finished with a standard curb "mule".

3.4.2 Curb and Gutter Finishing

Approved slipformed curb and gutter machines may be used in lieu of hand placement.

3.4.3 Concrete Finishing

Float and finish exposed surfaces with a smooth wood float until true to grade and section and uniform in texture. Brush floated surfaces with a fine-hair brush using longitudinal strokes. Round the edges of the gutter and top of the curb with an edging tool to a radius of 13 mm. Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Brush the front curb surface, while still wet,

in the same manner as the gutter and curb top. Finish the top surface of gutter and entrance to grade with a wood float.

3.4.4 Joint Finishing

Finish curb edges at formed joints as indicated.

3.4.5 Surface and Thickness Tolerances

Finished surfaces must not vary more than 6 mm from the testing edge of a 3 m straightedge. Permissible deficiency in section thickness will be up to 6 mm.

3.4.6 Precast Concrete Curbs or Precast Concrete Curb and Gutter

Precast concrete curbs or precast concrete curbs and gutters where used shall be installed to line and grade as indicated. Joint width shall be 10 mm. Cement mortar shall be provided to set the curbs and fill the joints. Where only precast concrete curb is used, gutter shall be constructed with cast-in-place concrete. Curbs and gutter shall be accomplished to match existing grade at transition point to existing curbs and gutters.

3.5 SIDEWALK JOINTS

Construct sidewalk joints to divide the surface into rectangular areas. Space transverse contraction joints at a distance equal to the sidewalk width or not to exceed 1.25 times the width, whichever is less, and continuous across the slab. Construct longitudinal contraction joints along the centerline of all sidewalks 3 m or more in width. Construct transverse expansion joints at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, install transverse expansion joints as indicated. Form expansion joints around structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated. Expansion joints are not required between sidewalks and curb that abut the sidewalk longitudinally.

3.5.1 Sidewalk Contraction Joints

Form contraction joints in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness. Unless otherwise approved or indicated, either use a jointer to cut the groove or saw a groove in the hardened concrete with a power-driven saw. Construct sawed joints by sawing a groove in the concrete with a 3 mm blade. Provide an ample supply of saw blades on the jobsite before concrete placement is started. Provide at least one standby sawing unit in good working order at the jobsite at all times during the sawing operations.

3.5.2 Sidewalk Expansion Joints

Form expansion joints using 10 mm joint filler strips. Joint filler in expansion joints surrounding structures and features within the sidewalk may consist of preformed filler material conforming to ASTM D1751. Hold joint filler in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, round joint edges using an edging tool having a radius of 3 mm. Remove any concrete over the joint filler. At the end of the curing period, clean the top of expansion joints and fill with

cold-applied joint sealant. Use joint sealant that is gray or stone in color. Thoroughly clean the joint opening before the sealing material is placed. Do not spill sealing material on exposed surfaces of the concrete. Apply joint sealing material only when the concrete at the joint is surface dry and atmospheric and concrete temperatures are above 10 degrees C. Immediately remove any excess material on exposed surfaces of the concrete and clean the concrete surfaces.

3.5.3 Reinforcement Steel Placement

Accurately and securely fasten reinforcement steel in place with suitable supports and ties before the concrete is placed.

3.6 CURB AND GUTTER JOINTS

Construct curb and gutter joints at right angles to the line of curb and gutter.

3.6.1 Expansion Joints

Form expansion joints by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Construct expansion joints in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement using the same type and thickness of joints as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, provide expansion joints at least 10 mm in width at intervals not less than 10 meters nor greater than 36 meters. Seal expansion joints immediately following curing of the concrete or as soon thereafter as weather conditions permit. Seal expansion joints and the top 25 mm depth of curb and gutter contraction-joints with joint sealant. Thoroughly clean the joint opening before the sealing material is placed. Do not spill sealing material on exposed surfaces of the concrete. Concrete at the joint must be surface dry and atmospheric and concrete temperatures must be above 10 degrees C at the time of application of joint sealing material. Immediately remove excess material on exposed surfaces of the concrete and clean concrete surfaces. Precast concrete curbs will not require expansion joints.

3.7 CURING AND PROTECTION

3.7.1 General Requirements

Protect concrete against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete must be on hand and ready for use before actual concrete placement begins. Protect concrete as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.7.1.1 Mat Method

Cover the entire exposed surface with two or more layers of burlap. Overlap mats at least 150 mm. Thoroughly wet the mat with water prior to placing on concrete surface and keep the mat continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

3.7.1.2 Impervious Sheeting Method

Wet the entire exposed surface with a fine spray of water and then cover with impervious sheeting material. Lay sheets directly on the concrete surface with the light-colored side up and overlapped 300 mm when a continuous sheet is not used. Use sheeting that is not less than 450 mm wider than the concrete surface to be cured. Secure sheeting using heavy wood planks or a bank of moist earth placed along edges and laps in the sheets. Satisfactorily repair or replace sheets that are torn or otherwise damaged during curing. Sheeting must remain on the concrete surface to be cured for not less than 7 days.

3.7.1.3 Membrane Curing Method

Apply a uniform coating of white-pigmented membrane-curing compound to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Coat formed surfaces immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Do not allow concrete surface to dry before application of the membrane. If drying has occurred, moisten the surface of the concrete with a fine spray of water and apply the curing compound as soon as the free water disappears. Apply curing compound in two coats by hand-operated pressure sprayers at a coverage of approximately 5 square meters/L for the total of both coats. Apply the second coat in a direction approximately at right angles to the direction of application of the first coat. The compound must form a uniform, continuous, coherent film that will not check, crack, or peel and must be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, apply an additional coat to the affected areas within 30 minutes. Respray concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied by the method and at the coverage specified above. Respray areas where the curing compound is damaged by subsequent construction operations within the curing period. Take precautions necessary to ensure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. Tightly seal the top of the joint opening and the joint groove at exposed edges before the concrete in the region of the joint is resprayed with curing compound. Use a method used for sealing the joint groove that prevents loss of moisture from the joint during the entire specified curing period. Provide approved standby facilities for curing concrete pavement at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Adequately protect concrete surfaces to which membrane-curing compounds have been applied during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from other possible damage to the continuity of the membrane.

3.7.2 Backfilling

After curing, remove debris and backfill, grade, and compact the area adjoining the concrete to conform to the surrounding area in accordance with lines and grades indicated.

3.7.3 Protection

Protect completed concrete from damage until accepted. Repair damaged concrete and clean concrete discolored during construction. Remove and

reconstruct concrete that is damaged for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Dispose of removed material as directed.

3.7.4 Protective Coating

Apply a protective coating of linseed oil mixture to the exposed-to-view concrete surface after the curing period, if concrete will be exposed to de-icing chemicals within 6 weeks after placement. Moist cure concrete to receive a protective coating.

3.7.4.1 Application

Complete curing and backfilling operation prior to applying two coats of protective coating. Concrete must be surface dry and clean before each application. Spray apply at a rate of not more than 11 square meters/L for first application and not more than 15.5 square meters/L for second application, except that the number of applications and coverage for each application for commercially prepared mixture must be in accordance with the manufacturer's instructions. Protect coated surfaces from vehicular and pedestrian traffic until dry.

3.7.4.2 Precautions

Do not heat protective coating by direct application of flame or electrical heaters and protect the coating from exposure to open flame, sparks, and fire adjacent to open containers or applicators. Do not apply material at ambient or material temperatures lower than 10 degrees C.

3.8 FIELD QUALITY CONTROL

Submit copies of all test reports within 24 hours of completion of the test.

3.8.1 General Requirements

Perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, take the action and submit reports as required below, and additional tests to ensure that the requirements of these specifications are met.

3.8.2 Concrete Testing

3.8.2.1 Strength Testing

Take concrete samples in accordance with JIS A 1115 not less than once a day nor less than once for every 190 cubic meters of concrete placed. Mold cylinders in accordance with JIS A 1132 for strength testing by an approved laboratory. Each strength test result must be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 4 MPa.

3.8.2.2 Air Content

Determine air content in accordance with JIS A 1118, or JIS A 1128. Use JIS A 1128 with concretes and mortars made with relatively dense natural aggregates. Make two tests for air content on randomly selected batches of each class of concrete placed during each shift. Make additional tests when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. Notify the placing forman if results are out of tolerance. The placing foreman must take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

3.8.2.3 Slump Test

Perform two slump tests on randomly selected batches of each class of concrete for every 190 cubic meters, or fraction thereof, of concrete placed during each shift. Perform additional tests when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

3.8.3 Thickness Evaluation

Determine the anticipated thickness of the concrete prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, construct the subgrade true to grade prior to concrete placement. The thickness will be determined by measuring each edge of the completed slab.

3.8.4 Surface Evaluation

Provide finished surfaces for each category of the completed work that are uniform in color and free of blemishes and form or tool marks.

3.9 SURFACE DEFICIENCIES AND CORRECTIONS

3.9.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 6 mm the deficient section will be removed, between regularly scheduled joints, and replaced.

3.9.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, reduce high areas either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete must not exceed 5 percent of the area of any integral slab, and the depth of grinding must not exceed 6 mm. Remove and replace pavement areas requiring grade or surface smoothness corrections in excess of the limits specified.

3.9.3 Appearance

Exposed surfaces of the finished work will be inspected by the Contracting Officer and deficiencies in appearance will be identified. Remove and

replace areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work.

-- End of Section --

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5308	(2014) Ready-Mixed Concrete
JIS A 5540	(2008) Turnbuckle for Building
JIS B 1180	(2014) Hexagon Head Bolts and Hexagon Head Screws
JIS B 1181	(2014) Hexagon Nuts and Hexagon Thin Nuts
JIS B 1256	(2008) Plain Washers
JIS G 3101	(2017) Rolled Steels for General Structure (Amendment 1)
JIS G 3444	(2016) Carbon Steel Tubes for General Structure
JIS G 3532	(2011) Low Carbon Steel Wires
JIS G 3533	(2008) Barbed Wires
JIS G 3552	(2011) Chain Link Wire Netting
JIS H 8641	(2007) Hot Dip Galvanized Coatings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fence Assembly; G

Location of Gate, Corner, End, and Pull Posts; G

Gate Assembly; G

Gate Hardware and Accessories; G

Erection/Installation Drawings; G

SD-03 Product Data

Fence Assembly; G

Gate Assembly; G

Gate Hardware and Accessories; G

Zinc Coating; G

PVC Coating; G

Fabric; G

Stretcher Bars; G

Barbed Wire; G

Precast Concrete Posts; G

Padlocks; G

Turnbuckles; G

Truss Rod; G

Tension Wires; G

Wire Ties; G

Concrete; G

SD-07 Certificates

Certificates of Compliance

SD-08 Manufacturer's Instructions

Fence Assembly

Gate Assembly

Hardware Assembly

Accessories

SD-11 Closeout Submittals

Recycled Material Content

1.3 QUALITY CONTROL

1.3.1 Certificates of Compliance

Submit certificates of compliance in accordance with the applicable

reference standards and descriptions of this section for the following:

a. Zinc coating

b. PVC coating

c. Fabric

d. Stretcher bars

e. Gate hardware and accessories

f. Concrete

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide fencing and gate materials, as specified.
Submit reports of listing chain-link fencing and accessories regarding weight in grams for zinc coating, thickness of PVC coating.

Submit manufacturer's catalog data for complete fence assembly, gate assembly, hardware assembly and accessories. Provide chain link fence on concrete posts for Okinawa Area and chain link fence on pipe posts for all other regions in Japan.

2.2 COMPONENTS FOR CHAIN LINK FENCE AND GATE

2.2.1 Fabric

Fabric for fence and gates shall be galvanized steel chain link wire netting conforming to JIS G 3552 No. 8, 50 mm standard wire mesh.

2.2.2 Posts , Rails and Braces

2.2.2.1 Fence Posts for Okinawa Area

Shall be the commercial precast concrete posts of the type and size as indicated.

2.2.2.2 Fence Posts for Other Regions in Japan

Shall be carbon steel pipe conforming to JIS G 3444, size and thickness as indicated, and galvanized.

2.2.2.3 Fence Rails and Braces, and Pipe Connectors

Shall be carbon steel pipe conforming to JIS G 3444, size and thickness as indicated, and galvanized.

2.2.3 Structural Steel Bars, Plates and Shapes

Shall be JIS G 3101, SS 400, galvanized.

2.2.4 Barbed Wire

Shall be JIS G 3533, #12-gage, two-wire strand, a pitch of 102 mm, 4-pointed barbs and 2 to 7 twists.

2.2.5 Fastening Accessories

Shall be galvanized steel and shall be manufacturer's standard product.

2.2.6 Stretcher Bars

Provide bars that have one-piece lengths equal to the full height of the fabric with a minimum cross section of 5 by 20 millimeter or of size as recommended by the fence manufacturer and conforming to JIS G 3101.

2.2.7 Stretcher Bar Bands

Provide bar bands for securing stretcher bars to posts that are steel, wrought iron, or malleable iron spaced not over 381 millimeter on center or of size as recommended by the fence manufacturer. Bands may also be used in conjunction with special fittings for securing rails to posts. Provide bands with projecting edges chamfered or eased.

2.2.8 Post Tops

Provide tops that are steel, wrought iron, or malleable iron designed as a weathertight closure cap. Provide one cap for each post, unless equal protection is provided by a combination post-cap and wire supporting arm. Provide caps with an opening to permit through passage of the top rail.

2.2.9 Gate Posts

Shall be carbon steel pipe conforming to JIS G 3444, size and thickness as indicated, and galvanized.

2.2.10 Gates

2.2.10.1 Gate Assembly

Shape and size of the gate frame shall be as indicated. Framing and bracing members shall be of steel pipe specified herein.

2.2.10.2 Gate Leaves

For gate leaves, more than 2.44 m wide, provide intermediate members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 2.44 m wide shall have truss rods or intermediate braces. Provide intermediate braces on all gate frames with an electro-mechanical lock. Attach fabric to the gate frame by method standard with the manufacturer except that welding will not be permitted.

2.2.10.3 Gate Hardware And Accessories

Submit manufacturer's catalog data. Furnish and install latches, hinges, stops, keepers, rollers, and other hardware items as required for the

operation of the gate and shall be zinc-coated steel having weight of zinc-coating not less than HDZ 40B, JIS H 8641. Gate latches shall be fork or plunger bar type. Arrange latches for padlocking so that the padlock will be accessible from both sides of the gate. Provide stops for holding the gates in the open position. For high security applications, each end member of gate frames shall be extended sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence.

2.2.10.4 Turnbuckles for Gates

JIS A 5540, galvanized, size as indicated.

2.2.10.5 Truss Rod

Shall be JIS G 3101, 10 mm diameter, welded to fence post where indicated.

2.2.10.6 Tension Wires

Provide galvanized, coiled spring wire conforming to JIS G 3532 SWM-G3. Provide Zinc coating that weighs not less than 370 gram per square meter.

2.2.11 Wire Ties

Provide 2.3 millimeter galvanized steel wire conforming to JIS G 3532 for tying fabric to line posts,spaced 300 millimeter on center. For tying fabric to rails and braces, space wire ties 600 millimeter on center. For tying fabric to tension wire, space 2.7 millimeter hog rings 600 millimeter on center.

Manufacturer's standard procedure will be accepted if of equal strength and durability.

Provide wire ties constructed of the same material as the fencing fabric. Provide accessories with polyvinyl (PVC) coatings when PVC-coated fence fabric is required.

2.2.12 Bolts, Nuts and Washers

Steel conforming to JIS B 1180, JIS B 1181, JIS B 1256 respectively.

2.2.13 Padlocks

Provide Japanese manufactured padlocks with keys and chain in conformance with the appropriate specification of the installation agency having jurisdiction.

2.3 OTHER MATERIALS

2.3.1 Zinc Coating

Hot dip galvanization shall be in conformance with JIS H 8641.

2.3.2 Cast-in-Place Concrete for Fence and Gate Posts

Shall be of size as indicated. Concrete in conformance with JIS A 5308 and shall be a minimum compressive strength of 18 MPa at 28 days.

2.3.3 Grout

Provide grout of proportions one part portland cement to three parts clean, well-graded sand and a minimum amount of water to produce a workable mix.

2.4 GROUNDING

Ground the chain link fence and gates as indicated on drawings.

PART 3 EXECUTION

Submit manufacturer's erection/installation drawings and instructions that detail proper assembly and materials in the design for fence, gate, hardware and accessories.

3.1 PREPARATION

Ensure final grading and established elevations are complete prior to commencing fence installation.

3.1.1 Clearing and Grading

Clear fence line of trees, brush, and other obstacles to install fencing . Establish a graded, compacted fence line prior to fencing installation.

3.2 INSTALLATION

3.2.1 Security

Install new chain link fencing, remove existing fencing, and perform related work to provide continuous security for facility. Schedule and fully coordinate work with Contracting Officer and cognizant Security Officer.

3.2.2 Fence Installation

Install fence on prepared surfaces to line and grade indicated. Install fence in accordance with fence manufacturer's written installation instructions except as modified herein.

3.2.2.1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 3.048 m on center. Provide gate posts spaced as necessary for size of gate openings. Do not exceed 152.4 m on straight runs between braced posts. Provide corner or pull posts, with bracing in both directions, for changes in direction of 0.26 rad or more, or for abrupt changes in grade. Submit drawings showing location of gate, corner, end, and pull posts.

3.2.2.2 Top and Bottom Tension Wire

Install top and bottom tension wires before installing chain-link fabric, and pull wires taut. Place top and bottom tension wires within 203 mm of respective fabric line.

3.2.3 Excavation

Provide excavations for post footings which are drilled holes in virgin or compacted soil, of minimum sizes as indicated.

Space footings for line posts 3048 millimeter on center maximum and at closer intervals when indicated, with bottoms of the holes approximately 75 millimeter below the bottoms of the posts. Set bottom of each post not less than 915 millimeter below finished grade when in firm, undisturbed soil. Set posts deeper, as required, in soft and problem soils and for heavy, lateral loads.

Remove excavated soil from Government property.

When solid rock is encountered near the surface, drill into the rock at least 305 millimeter for line posts and at least 457 millimeter for end, pull, corner, and gate posts. Drill holes at least 25.4 millimeter greater in diameter than the largest dimension of the placed post.

If solid rock is below the soil overburden, drill to the full depth required except that penetration into rock need not exceed the minimum depths specified above.

3.2.4 Setting Posts

Remove loose and foreign materials from holes and moisten the soil prior to placing concrete.

Provide tops of footings that are trowel finished and sloped or domed to shed water away from posts. Set hold-open devices, sleeves, and other accessories in concrete.

Keep exposed concrete moist for at least 7 calendar days after placement or cured with a membrane curing material, as approved.

Grout all posts set into sleeved holes in concrete with an approved grouting material.

Maintain vertical alignment of posts in concrete construction until concrete has set.

3.2.4.1 Earth and Bedrock

Provide concrete bases of dimensions indicated on the manufactures installation drawings, except in bedrock. Compact concrete to eliminate voids, and finish to a dome shape. In bedrock, set posts with a minimum of 25.4 mm of grout around each post. Work grout into hole to eliminate voids, and finish to a dome shape.

3.2.4.2 Concrete Slabs and Walls

Set posts into zinc-coated sleeves, set in concrete slab or wall, to a minimum depth of 305 mm. Fill sleeve joint with lead, nonshrink grout, or other approved material. Set posts for support of removable fence sections into sleeves that provide a tight sliding joint and hold posts aligned and plumb without use of lead or setting material.

3.2.4.3 Bracing

Brace gate, corner, end, and pull posts to nearest post with a horizontal brace used as a compression member, placed at least 305 mm below top of fence, and two diagonal tension rods.

a. Tolerances

Provide posts that are straight and plumb within a vertical tolerance of 6.35 millimeter after the fabric has been stretched. Provide fencing and gates that are true to line with no more than 12.7 millimeter deviation from the established centerline between line posts. Repair defects as directed.

3.2.5 Concrete Strength

Provide concrete that has attained at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than 7 calendar days after placement, before rails, tension wire, or fabric are installed. Do not stretch fabric and wires or hang gates until the concrete has attained its full design strength.

Take samples and test concrete to determine strength as specified.

3.2.6 Supporting Arms (only for Security Chain Link Fence and Gates)

It is the Contractor's option to choose the following type of supporting arms; type (1) or type (2). Type (1): Supporting arm shall be top part of fence and gate post, which shall be one length, seamless pipe through post to arm. Type (2): If the selected manufacturer's standard product uses the sectional type supporting arms, that shall be designed to accomodate the top rail. Install supporting arms as recommended by the manufacturer. In addition to manufacturer's standard connections, securely anchor supporting arms to posts to prevent easy removal with hand tools.

3.2.7 Top Rails

Provide top rails that run continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by the fencing manufacturer.

3.2.8 Brace Assembly

Provide bracing assemblies at end and gate posts and at both sides of corner and pull posts, with the horizontal brace located at midheight of the fabric.

Install brace assemblies so posts are plumb when the diagonal rod is under proper tension.

Provide two complete brace assemblies at corner and pull posts where required for stiffness and as indicated.

3.2.9 Tension Wire Installation

Install tension wire by weaving them through the fabric and tying them to each post with not less than 3.9 millimeter galvanized wire or by securing the wire to the fabric with 3.5 millimeter ties or clips spaced 610 millimeter on center.

3.2.10 Fabric Installation

Provide fabric in single lengths between stretch bars with bottom barbs placed approximately 38 millimeter above the ground line. Pull fabric taut and tied to posts, rails, and tension wire with wire ties and bands.

Install fabric on the security side of fence, unless otherwise directed.

Ensure fabric remains under tension after the pulling force is released.

3.2.11 Stretcher Bar Installation

Thread stretcher bars through or clamped to fabric 102 millimeter on center and secured to posts with metal bands spaced 381 millimeter on center.

3.2.12 Barbed Wire (only for Security Chain Link Fence and Gate)

Install barbed wire on supporting arms above fence posts. Extend each end member of gate frames sufficiently above top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence. Pull each strand taut and securely fasten each strand to each supporting arm and extend member. The method of securing wires shall be as follows: twist tie barbed wire to arm using wire which has been looped through a hole in the supporting arm. Other methods of securing barbed wire are acceptable provided they are equally secure, and are approved in advance by the Contracting Officer.

3.2.13 Gate Installation

Install gates plumb, level, and secure, with full opening without interference. Install ground set items in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricated where necessary.

3.2.14 Tie Wires

Provide tie wires that are U-shaped to the pipe diameters to which attached. Twist ends of tie wires not less than two full turns and bent so as not to present a hazard.

3.2.15 Fasteners

Install nuts for tension bands and hardware on the side of the fence opposite the fabric side. Peen ends of bolts to prevent removal of nuts.

3.2.16 Zinc-Coating Repair

Clean and repair galvanized surfaces damaged by welding or abrasion, and cut ends of fabric, or other cut sections with specified galvanizing repair material applied in strict conformance with the manufacturer's printed instructions.

3.2.17 Accessories Installation

3.2.17.1 Post Caps

Install post caps as recommended by the manufacturer.

3.2.17.2 Padlocks

Provide padlocks for gate openings and provide chains that are securely attached to gate or gate posts. Provide padlocks keyed alike, and provide two keys for each padlock.

3.2.18 Grounding

Ground all fences crossed by overhead power lines in excess of 600 volts, and all electrical equipment attached to the fence. Ground fences on each side of all gates, at each corner, at the closest approach to each building located within 15 m of the fence, and where the fence alignment changes more than 15 degrees. Grounding locations can not exceed 198 m. Bond each gate panel with a flexible bond strap to its gate post. Ground fences crossed by power lines of 600 volts or more at or near the point of crossing and at distances not exceeding 45 m on each side of crossing. Provide ground conductor consisting of No. 6 AWG solid copper wire. Provide copper-clad steel rod grounding electrodes 19 mm by 3.05 m long. Drive electrodes into the earth so that the top of the electrode is at least 152 mm below the grade. Where driving is impracticable, bury electrodes a minimum of 305 mm deep and radially from the fence, with top of the electrode not less than 610 mm or more than 2.4 m from the fence. Clamp ground conductor to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. Total resistance of the fence to ground cannot exceed 25 ohms.

3.3 CLOSEOUT ACTIVITIES

Remove waste fencing materials and other debris from the work site.

Submit manufacturer's data indicating percentage of recycled material content in protective fence materials, including chain link fence, fabric, and gates to verify affirmative procurement compliance.

3.4 RESTORATION

The Contractor shall restore all damaged and disturbed areas caused by this project work to match existing condition as directed.

3.4.1 Surface Course Restoration

Concrete and/or asphalt concrete surface course which has been damaged and disturbed to accomplish this project shall be restored to match existing condition with new concrete and/or new asphalt concrete, including crushed stone base course.

3.4.2 Turf Restoration

Sodded area which has been damaged and disturbed to accomplish this project shall be restored to match existing condition by reusing existing sod or new sod. Water thoroughly immediately after replanting.

-- End of Section --

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	(2016; ERTA 2016) Standard for the Installation of Private Fire Service Mains and Their Appurtenances

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-600-01	(2016; with Change 1) Fire Protection Engineering for Facilities

UNDERWRITERS LABORATORIES (UL)

UL 246	(2011; Reprint Dec 2018) UL Standard for Safety Hydrants for Fire-Protection Service
UL 262	(2004; Reprint Oct 2011) Gate Valves for Fire-Protection Service
UL 312	(2010; Reprint Mar 2018) UL Standard for Safety Check Valves for Fire-Protection Service
UL 789	(2004; Reprint May 2017) UL Standard for Safety Indicator Posts for Fire-Protection Service

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5308	(2014) Ready-Mixed Concrete
JIS A 5314	(2014) Mortar Lining for Ductile Iron Pipes
JIS B 1171	(2015) Cup Head Square Neck Bolts (Amendment 1)
JIS B 1180	(2014) Hexagon Head Bolts and Hexagon Head Screws
JIS B 1181	(2014) Hexagon Nuts and Hexagon Thin Nuts
JIS B 2011	(2013) Bronze, Gate, Globe, Angle, and Check Valves (Amendment 2)
JIS B 2031	(2015) Gray Cast Iron Valves (Amendment 1)

JIS B 2404	(2018) Dimensions of Gaskets for Use with Pipe Flanges
JIS B 7552	(2011) Procedures for Calibration and Testing for Liquid Flowmeter
JIS B 8570-1	(2013) Meters for Cold Water and Hot Water - Part 1: General Specifications
JIS G 5526	(2014) Ductile Iron Pipes
JIS G 5527	(2014) Ductile Iron Fittings
JIS K 1102	(2000) Liquid Chlorine for Industrial Use - Determination of the Chlorine Content.
JIS K 6353	(2011) Rubber Goods for Water Works
JIS K 6742	(2016) Unplasticized poly (vinyl chloride) (PVC-U) pipes for water supply
JIS K 6743	(2016) Unplasticized Poly (Vinyl Chloride) (PVC-U) Pipe Fittings for Water Supply
JIS K 6762	(2012) Double Wall Polyethylene Pipes for Water Supply
JIS S 3200-1	(1997) Equipment for Water Supply Use - Test methods of Hydrostatic Pressure
JIS S 3200-4	(1997) Equipment for Water Supply Use - Test Method of Prevention from Back Current

JAPAN WATER WORKS ASSOCIATION (JWWA)

JWWA B 116	(2012) Polyethylene Pipe Metal Fittings for Water Supply
JWWA B 120	(2017) Soft Seal Gate Valve for Water Supply
JWWA B 122	(2013) Ductile Cast Iron Gate Valve for Water Supply
JWWA B 129	(2013) Backflow Prevention Valve for Water Supply
JWWA B 137	(2013) Water Supply Rapid Air Valve
JWWA B 138	(2013) Water Supply Butterfly Valve
JWWA G 113	(2010) Ductile Iron Pipes for Water Works
JWWA K 129	(2019) Rubber Ring-Shaped Rigid Polyvinyl Chloride Pipe for Water Supply
JWWA K 130	(2019) Rubber Ring-Shaped Rigid Polyvinyl Chloride Pipe Joint for Water Supply

JWWA K 144	(2017) Polyethylene Pipe for Water Distribution
JWWA K 145	(2017) Polyethylene Pipe Fitting for Water Distribution
JWWA K 156	(2015) Rubber Material for Water Supply Facilities
JWWA K 158	(2017) Polyethylene Sleeve for Ductile Cast Iron Pipe for Water Supply

JAPAN DUCTILE IRON PIPE ASSOCIATION (JDPA)

JDPA T 01	(2017) Ductile Iron Pipe Laying Standard Manual
JDPA Z 2010	(2009) Synthetic Resin Coating for Ductile Iron Pipes and Fittings

JAPAN CAST IRON COVER & WASTE FITTING ASSOCIATION (JCW)

JCW-104	(2012) Valve Box

1.2 DEFINITIONS

1.2.1 Water Transmission Mains

Water transmission mains include water piping having diameters greater than 350 mm, specific materials, methods of joining and any appurtenances deemed necessary for a satisfactory system.

1.2.2 Water Mains

Water mains include water piping having diameters 100 through 350 mm, specific materials, methods of joining and any appurtenances deemed necessary for a satisfactory system.

1.2.3 Water Service Lines

Water service lines include water piping from a water main to a building service at a point approximately 1.5 m from building or the point indicated on the drawings, specific materials, methods of joining and any appurtenances deemed necessary for a satisfactory system.

1.2.4 Additional Definitions

For additional definitions refer to the definitions in the applicable referenced standard.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in

accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fire Hydrants;

Meters;

Backflow Preventer;

Disinfection Procedures; G

SD-06 Test Reports

Backflow Preventer Tests; G

Bacteriological Samples; G

Hydrostatic Sewer Test; G

Leakage Test; G

Hydrostatic Test; G

SD-07 Certificates

Fire Hydrants

Backflow Certificate

SD-08 Manufacturer's Instructions

Ductile Iron Piping

PVC Piping

PVCO Piping

Polyethylene (PE) Pipe

PVC Piping For Service Lines

1.4 QUALITY CONTROL

1.4.1 Regulatory Requirements

Comply with NFPA 24 for materials, installation, and testing of fire main piping and components.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling and in accordance with manufacturer's instructions. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of

direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves, fire hydrants, and other accessories free of dirt and debris.

1.5.2 Handling

Handle pipe, fittings, valves, fire hydrants, and other accessories in accordance with manufacturer's instructions and in a manner to ensure delivery to the trench in sound undamaged condition. Avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place other material, hooks, or pipe inside a pipe or fitting after the coating has been applied. Inspect the pipe for defects before installation. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. Clean the interior of pipe and accessories of foreign matter before being lowered into the trench and keep them clean during laying operations by plugging. Replace defective material without additional expense to the Government. Store rubber gaskets, not immediately installed, under cover or out of direct sunlight.

PART 2 PRODUCTS

2.1 MATERIALS

Provide all materials in accordance with JIS, JWWA and other approved Japanese commercial products as indicated herein. Provide valves and fittings with pressure ratings equivalent to the pressure ratings of the pipe. Provide Japanese manufactured materials and components for fire protection service meeting the requirements of NFPA 24 and related UL standards.

2.1.1 Pipe, Fittings, Joints And Couplings

Submit manufacturer's standard drawings or catalog cuts, except submit both drawings and cuts for push-on [and rubber-gasketed bell-and-spigot] joints. Include information concerning gaskets with submittal for joints and couplings.

2.1.1.1 Ductile-Iron Piping

2.1.1.1.1 Pipe and Fittings

Pipe, except flanged pipe, JIS G 5526 or JWWA G 113, Pressure Class [_____] Thickness Class [_____]. Flanged pipe, JIS G 5527. Fittings, JIS G 5527 or JWWA G 113; fittings with push-on joint ends are to meet the same requirements as fittings with mechanical-joint ends, except for the factory modified bell design. Provide fittings with pressure ratings equivalent to that of the pipe. Provide compatible pipe ends and fittings for the specified joints. Provide cement-mortar lining, JIS A 5314 , twice the standard thickness on pipe and fittings.

2.1.1.1.2 Joints and Jointing Material

Provide push-on joints or mechanical joints for pipe and fittings unless otherwise indicated. Provide mechanical joints where indicated. Provide flanged joints where indicated. Provide mechanically coupled type joints using a sleeve-type mechanical coupling where indicated. Provide insulating joints where indicated. Sleeve-type mechanical couplings in

lieu of push-on joints are acceptable, subject to the limitations specified in the paragraph SLEEVE-TYPE MECHANICAL COUPLINGS.

a. Push-On Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly as recommended in JWWA K 156.

b. Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets as recommended in JWWA K 156.

c. Flanged Joints: Bolts, nuts, and gaskets for flanged connections compatible with JIS G 5527 or JWWA G 113 joints. Provide JIS G 5527 ductile iron flanges. Provide epoxy coated steel set screw flanges. Gasket and lubricants for set screw flanges, in accordance with mechanical-joint gaskets conforming to JWWA K 156 or JIS B 2404.

d. Insulating Joints: Designed to prevent metal-to-metal contact at the joint between adjacent sections of piping. Provide flanged type joint with insulating gasket, insulating bolt sleeves, and insulating washers. Provide full face dielectric type gaskets, for JIS G 5527 fittings. Bolts and nuts, for JIS G 5527 fittings.

e. Sleeve-Type Mechanical Coupled Joints: As specified in the paragraph SLEEVE-TYPE MECHANICAL COUPLINGS.

2.1.1.1.3 Pipe, Joint, Valve, and Fitting Coatings

Provide epoxy resin bonded coating meeting the requirements of JDPA Z 2010. Bonded coating shall have minimum thickness of 0.1 mm for pipe and 0.08 mm for bends.

2.1.1.2 Plastic Piping

2.1.1.2.1 PVC and PVCO Piping

2.1.1.2.1.1 PVC Piping

JWWA K 129 or JIS K 6742 plain end or gasket bell end pipe, with a minimum Pressure Class 150 (DR27.5) with ductile iron outside diameter.

2.1.1.2.1.2 PVCO Piping

JWWA K 129 plain end or gasket bell end pipe, Pressure Class 165 PVCO pressure pipe, with ductile iron outside diameter.

2.1.1.2.1.3 Fittings for PVC and PVCO Pipe

Fittings shall be the same material as the pipe with elastomeric gaskets, in conformance with JWWA K 130 or JIS K 6742.

2.1.1.2.1.4 Joints and Jointing Material for PVC and PVCO Piping

a. Push-on joints: Use jointing material as recommended by PVC and PVCO pipe manufacturers between pipes, pipes and metal fittings, valves, and other accessories or compression-type joints/mechanical joints. Provide each joint connection with an elastomeric gasket compatible for the bell or coupling used. Gaskets for push-on joints and compression-type joints/mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories, JIS K 6353 for push-on joints and mechanical joints.

b. Mechanical Joint: Use mechanically coupled joints having a sleeve-type mechanical coupling, as specified in the paragraph SLEEVE-TYPE MECHANICAL COUPLINGS, as an optional jointing method for plain-end PVC pipe, subject to the limitations specified for mechanically coupled joints using a sleeve-type mechanical coupling as specified for compression-type joints. Provide jointing material in conformance with PVC and PVCO pipe manufacturer's recommendation between pipe and sleeve-type mechanical couplings.

2.1.1.2.2 PVC Piping for Service Lines

2.1.1.2.2.1 Pipe and Fittings

Provide JIS K 6742 pipes and JIS K 6743 fittings.

2.1.1.2.2.2 Joints and Connections

Fittings may be joined by the solvent-cement method or threading.

2.1.1.2.2.3 Solvent Joining

Provide solvent joints per pipe manufacturer's recommendation.

2.1.1.2.3 Polyethylene (PE) Pipe

JWWA K 144 or JIS K 6762 with a minimum Pressure Class 200 (DR11) with ductile iron outside diameter.

2.1.1.2.3.1 Fittings For PE Pipe

JWWA K 145 or JWWA B 116.

2.1.1.2.3.2 Joints and Jointing Materials

Mechanical Joint: JWWA K 156 Mechanical joint adapter and gaskets for mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories.

2.1.1.3 Piping Beneath Railroad Right-of-Way

Piping passing under the right-of-way of a commercial railroad is to conform to the specifications for pipelines conveying nonflammable substances. Provide ductile-iron pipe in lieu of cast-iron pipe. Ductile-iron railroad crossing casing pipe is to conform to and have strength computed in accordance with JIS G 5526.

2.1.2 Valves

Provide a JWWA compliant protective interior coating for all valves whose interiors are exposed to sea water or salt water, or where there is a serious corrosion problem other than galvanic corrosion for water having a pH range from 4 to 9.

2.1.2.1 Gate Valves 80 mm Size and Larger on Buried Piping

a. JWWA B 120 or JWWA B 122: nonrising stem type with double-disc gate and mechanical-joint ends or push-on joint ends compatible for the

adjoining pipe

b. JWWA B 120 or JWWA B 122: nonrising stem type with mechanical-joint ends or resilient-seated gate valves 80 to 300 mm in size

c. JWWA compliant locally manufactured gate valve meeting the requirements of UL 262 for pipe protection service: inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 1200 kPa, and have mechanical-joint ends or push-on joint ends as appropriate for the pipe to which it is joined.

Match materials for gate valves meeting UL 262 to the reference standards specified in JWWA B 120 or JWWA B 122. Gate valves open by counterclockwise rotation of the valve stem. Stuffing boxes have 0-ring stem seals, except for those valves for which gearing is specified, in which case use conventional packing in place of 0-ring seal. Stuffing boxes are bolted and constructed so as to permit easy removal of parts for repair. Use gate valves with special ends for connection to sleeve-type mechanical coupling in lieu of mechanical-joint ends and push-on joint ends. Provide valve ends and gaskets for connection to sleeve-type mechanical couplings that conform to the requirements specified respectively for the joint or coupling. Provide JWWA B 122 _____ mm gate valves with gearing and indicator. Where an indicator post are shown, provide an indicator post flange for JWWA B 122 or locally manufactured gate valves conforming to the requirements of UL 262. Provide all valves from one manufacturer.

2.1.2.2 Gate Valves 75 mm Size and Larger in Valve Pit(s) and Aboveground Locations

a. JWWA B 120 or JWWA B 122 or JIS B 2031: nonrising stem type with double-disc gates and flanged ends

b. JWWA B 120 or JWWA B 122 or JIS B 2031: nonrising stem type with flanged ends

c. JWWA B 120 or JWWA B 122 or JIS B 2031 or JWWA compliant locally manufactured gate valve meeting the requirements of UL 262 for fire protection service: inside-screw type, with double-disc or split-wedge type gate and flanged ends, and designed for a hydraulic working pressure of 1200 kPa

Match materials for gate valves meeting UL 262 to the reference standards specified in JWWA B 120 or JWWA B 122 or JIS B 2031. Provide gate valves with handwheels that open by counterclockwise rotation of the valve stem. Bolt and construct stuffing boxes so as to permit easy removal of parts for repair. Provide all valves from one manufacturer.

2.1.2.3 Check Valves

Provide a JWWA compliant protective interior coating for all valves whose interiors are exposed to sea water or salt water, or where there is a serious corrosion problem other than galvanic corrosion for water having a pH range from 4 to 9.

a. JWWA B 129 or JIS B 2031: Iron or steel body and cover and flanged ends

b. JWWA compliant locally manufactured check valve meeting the requirements of UL 312 for fire protection service: Cast iron or steel body and cover, flanged ends, and designed for a minimum working pressure of 1000 kPa.

Materials for check valves meeting UL 312 are to match the reference standards specified in JWWA B 129. Provide check valves with a clear port opening. Provide all check valves from one manufacturer.

2.1.2.4 Rubber-Seated Butterfly Valves

Provide rubber-seated butterfly valves and wafer type valves that match the performance requirements of JWWA B 138. Wafer type valves not meeting laying length requirements are acceptable if supplied and installed with a spacer, providing the specified laying length. Meet all tests required by JWWA B 138. Flanged-end valves are required in a pit. Provide a union or sleeve-type coupling in the pit to permit removal. Direct-bury mechanical-end valves 80 through 250 mm in diameter. Provide a valve box, means for manual operation, and an adjacent pipe joint to facilitate valve removal. Provide valve operators that restrict closing to a rate requiring approximately 60 seconds, from fully open to fully closed.

2.1.2.5 Pressure Reducing Valves

Maintain a constant downstream pressure regardless of fluctuations in demand. Using pressure reducing valves capable of providing 1720 kPa operating pressure on the inlet side, with outlet pressure set for 340 kPa. Provide hydraulically-operated, pilot controlled, globe or angle type valves that are capable of being actuated either by diaphragm or piston. Provide diaphragm-operated, adjustable, spring-loaded type pilot controls made of lead-free bronze with stainless steel working parts, designed to permit flow when controlling pressure exceeds the spring setting. Construct the bodies of bronze, cast iron or cast steel with lead-free bronze trim; the valve stem of stainless steel; the seat of lead-free bronze; and the valve discs and diaphragms of synthetic rubber. Provide flanged ends.

2.1.2.6 Air Release, Air/Vacuum, and Combination Air Valves

Provide JWWA B 137 air release , air vacuum and combination air valves that release air and prevent the formation of a vacuum. Provide valves with an iron body, lead-free bronze trim and stainless steel float that automatically releases air when the lines are being filled with water and admits air into the line when water is being withdrawn in excess of the inflow.

2.1.2.7 Water Service Valves

2.1.2.7.1 Gate Valves Smaller than 75 mm in Size on Buried Piping

Gate valves smaller than 75 mm size on Buried Piping JIS B 2011, Class 150, solid wedge, nonrising stem, with flanged or threaded end connections, a union on one side of the valve, and a handwheel operator.

2.1.2.7.2 Gate Valves Smaller Than 75 mm Size in Valve Pits

JIS B 2011, Class 150, solid wedge, inside screw, rising stem. Provide valves with flanged or threaded end connections, a union on one side of

the valve, and a handwheel operator.

2.1.2.7.3 Check Valves Smaller than 50 mm in Size

Provide check valves with a minimum working pressure of 1000 kPa or as indicated with a clear waterway equal to the full nominal diameter of the valve. Valves open to permit flow when inlet pressure is greater than the discharge pressure, and close tightly to prevent return flow when discharge pressure exceeds inlet pressure. Cast the size of the valve, working pressure, manufacturer's name, initials, or trademark on the body of each valve.

Provide valves for screwed fittings, made of lead-free bronze and in conformance with JIS B 2011, Class 150, Types compatible for the application.

2.1.2.8 Indicator Post

Provide upright gate valve with indicator post conforming to JWWA compliant local commercial products meeting the requirements of UL 789 and NFPA 24. Construct indicator post body of cast iron, ductile iron or a combination of both, bronze operating nut, cast iron locking wrench with open and shut target window.

2.1.2.9 Valve Boxes

Provide a valve box for each gate valve on buried piping, except where indicator post is shown. Construct adjustable valve boxes manufactured from cast iron of a size compatible for the valve on which it is used. Provide cast iron valve boxes conforming to JCW-104. Coat the cast-iron box with a heavy coat of bituminous paint. Provide a round head. Cast the word "WATER" on the lid. The minimum diameter of the shaft of the box is 135 mm or as indicated.

2.1.2.10 Valve Pits

Construct the valve pits at locations indicated or as required above and in accordance with the details shown.

2.1.3 Blowoff Valve Assemblies

Provide blowoff valve assemblies complete with all pipe, fittings, valve, valve box, riser box and lid, riser extension, discharge fitting and other materials required to connect to the water main. Provide blow off valve assemblies 100 mm or larger conforming to JWWA compliant local commercial products.

2.1.4 Fire Hydrants

2.1.4.1 Fire Hydrants

Provide fire hydrants where indicated. Paint fire hydrants with at least one coat of primer and two coats of enamel paint. Paint barrel and bonnet colors in accordance with UFC 3-600-01. Stencil fire hydrant number and main size on the fire hydrant barrel using black stencil paint.

Provide a JWWA compliant protective epoxy interior coating on those portions of the fire hydrant continuously in contact with sea water or salt water.

2.1.4.1.1 Dry-Barrel Type and Wet-Barrel Type Fire Hydrants

Provide Dry-barrel type fire hydrants conforming to JWWA compliant local commercial product of aboveground fire hydrants and meeting the requirements of UL 246, "Base Valve" with 150 mm inlet, 135 mm valve opening, one 115 mm pumper connection, and two 65 mm hose connections. Provide Wet-barrel type fire hydrants conforming to JWWA compliant local commercial product of aboveground fire hydrants and meeting the requirements of UL 246, "Wet Barrel" with 150 mm inlet, one 115 mm pumper connection, and two 65 mm hose connections. Individually valve pumper connection and hose connections with independent nozzle gate valves. The locally manufactured and JWWA compliant commercial product of fire hydrants shall be compatible with the 115 mm pumper and two 65 mm hose connection and shall be of the type as applicable to U.S. military construction projects in Japan.

Provide mechanical-joint or push-on joint end inlet , except where flanged end is indicated. Provide fire hydrants with breakable features . Provide fire hydrant with special couplings joining upper and lower sections of fire hydrant barrel and upper and lower sections of fire hydrant stem that break from a force imposed by a moving vehicle.

2.1.5 Meters

Submit certificates certifying all required and recommended tests set forth in the referenced standard and JIS B 8570-1 have been performed and comply with all applicable requirements of the referenced standard and JIS B 8570-1 within the past three years. Include certification that each meter has been tested for accuracy of registration and that each meter complies with the accuracy and capacity requirements of the referenced standard when tested in accordance with JIS B 7552.

Include a register with all meters whether they are or are not connected to a remote reading system.

2.1.5.1 Propeller Type Meters

Provide Advanced Metering Infrastructure (AMI) and Direct Digital Communication (DDC) compatible meter for waterworks of sizes 50mm to 1800mm, conforming to JWWA compliant local commercial products. Flow tubes or main cases constructed of cast iron or fabricated steel with JWWA compliant protective coating.

2.1.5.2 Displacement Type Meters

Provide Advanced Metering Infrastructure (AMI) and Direct Digital Communication (DDC) compatible meter for waterworks of sizes 50 mm or smaller, conforming to JWWA compliant local commercial products. Pressure casings constructed of copper alloy containing not less than 75 percent copper. Provide registers with non-breakable covers and straight-reading registers. Provide non-breakable covers of copper alloy containing not less than 75 percent copper. For meter sizes 13mm through 25 mm provide frost-protection-type design.

2.1.5.3 Compound Type Meters

Provide Advanced Metering Infrastructure (AMI) and Direct Digital Communication (DDC) compatible meter with strainers for waterworks of

sizes 50 mm through 200 mm, conforming to JWWA compliant local commercial products. Main casing constructed of cast iron or fabricated steel with JWWA compliant protective coating. Equip with tapped bosses near the outlet for field testing purposes.

2.1.5.4 Register

Provide open straight-reading register supplied by the meter manufacturer. Equip register with cubic meters readings. Use encoder type remote register designed in accordance with JWWA compliant local commercial product of water meter.

2.1.5.5 Strainers

Provide strainer recommended and supplied by the local meter manufacturer. Provide strainer of the same material as the meter body (i.e., bronze, ductile, or stainless).

2.1.5.6 Meter Connections

Provide connections compatible with the type of pipe and conditions encountered.

2.1.5.7 Advanced Metering Infrastructure

The Government will supply an Advanced Metering Infrastructure (AMI) compatible water meter(s) for the Contractor to install and connect to the existing AMI Data Acquisition System (DAS). Use the existing Government laptop computers to configure the meter using existing software loaded on the computer. Modifications to existing software on the computer or the addition of software to the computer is not allowed. The Contractor must ensure that the meter(s) transmit the metered data to the DAS. The current meters being used by [_____] are: [_____].

2.1.5.8 Direct Digital Control System Interface

Provide all meters with the capability of providing pulse output to the DDC system.

2.1.5.9 Meter Setter

For water meter 50 mm or greater, provide a by-pass assembly with the valve located outside the vault. Provide valve box for valve located outside of vault.

2.1.5.10 Meter Boxes Vaults

Provide meter boxes vaults of sufficient size to completely enclose the meter and shutoff valve or service stop and in accordance with the details shown on the drawings. Provide a meter boxes or vaults with a height equal to the distance from invert of the service line to finished grade at the meter location.

2.1.5.10.1 Cast Iron

Provide cast iron meter box and lid. Provide a round lid with precast holes for remote electronic meter reading modules having the word "WATER" cast on the top surface.

2.1.5.10.2 Meter Boxes Vaults

2.1.5.10.2.1 Vault Access Door

Provide a single-leaf or double-leaf cast-in aluminum or painted steel diamond-plate access door with the following dimensions:

Width: [_____] mm

Length: [_____] mm

Include stainless steel spring or pneumatic lift assist, type 316 stainless steel slam locking latch, automatic hold-open arm with a red release handle, and flush mounted retractable lifting handle. Door must have a minimum load rating 6,800 kg load.

2.1.5.10.2.2 Fittings

Provide flanged fittings for pipe 75 mm and larger.

2.1.5.10.2.3 Vault Valves

Provide ball or outside screw and yoke (OS&Y) or butterfly valves in meter vault.

2.1.6 Backflow Preventers

Provide a JWWA compliant local commercial product reduced pressure principle type backflow preventer meeting the following requirements:

a. Size: [_____]

b. Maximum Rated Flow: [_____]

c. Allowable Pressure Loss: [_____]

d. Flanged cast iron, mounted gate valve

e. Strainer of the same material as the backflow preventer

The particular make, model, and size of backflow preventers to be installed must be included in the latest edition of the List of Approved Backflow Prevention Assemblies and be accompanied by a backflow certificate . Select materials for piping, strainers, and valves used in assembly installation that are galvanically compatible. Materials joined, connected, or otherwise in contact are to have no greater than 0.25 V difference on the Anodic Index, unless separated by a dielectric type union or fitting.

2.1.6.1 Backflow Preventer Enclosure

Provide an insulated enclosure where freezing temperature are possible.

2.1.7 Disinfection

Chlorinating materials are to conform to: Chlorine, Liquid: JIS K 1102; Hypochlorite, Calcium and Sodium: Approved local commercial product.

2.2 ACCESSORIES

2.2.1 Pipe Restraint

2.2.1.1 Thrust Blocks

Use JIS A 5308 concrete having a minimum compressive strength of 18 MPa at 28 days.

2.2.1.2 Joint Restraint

Provide restrained joints in accordance with NFPA 24, Chapter 10 and in accordance with applicable JWWA standard test method for joint restrain.

Provide mechanical joint restraint restraint devices with gripper wedges incorporated into a follower gland and specifically designed for the pipe material and meeting the requirements of JIS G 5527 or metal harness fabricated by the pipe manufacturer.

2.2.2 Protective Enclosures

Provide Freeze-Protection Enclosures that are insulated and designed to protect aboveground water piping, equipment, or specialties from freezing and damage.

[2.2.3 Tapping Sleeves

Provide cast gray, ductile, malleable iron or stainless steel, split-sleeve type tapping sleeves of the sizes indicated for connection to existing main with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Utilize similar metals for bolts, nuts, and washers to minimize the possibility of galvanic corrosion. Provide dielectric gaskets where dissimilar metals adjoin. Provide a tapping sleeve assembly with a maximum working pressure of 1000 kPa. Provide bolts with square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, utilize an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pre-torqued to 67.8 Newton meters.

]2.2.4 Sleeve-Type Mechanical Couplings

Use couplings to join plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling consists of one middle ring flared or beveled at each end to provide a gasket seat; two follower rings; two resilient tapered rubber gaskets; and bolts and nuts to draw the follower rings toward each other to compress the gaskets. Provide true circular middle ring and the follower rings sections free from irregularities, flat spots, and surface defects; provide for confinement and compression of the gaskets. For ductile iron and PVC pipe, the middle ring is cast-iron; and the follower rings are malleable or ductile iron. Use gaskets for resistance to set after installation and to meet the requirements specified for gaskets for mechanical joint in JIS B 2404. Provide track-head type bolts JIS B 1180, with nuts,JIS B 1181; or round-head square-neck type bolts, JIS B 1171 with hex nuts JIS B 1181. Provide 16 mm diameter bolts. Shape bolt holes in follower rings to hold

fast to the necks of the bolts used. Do not use mechanically coupled joints using a sleeve-type mechanical coupling as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint. Provide a tight flexible joint with mechanical couplings under reasonable conditions, such as pipe movements caused by expansion, contraction, slight settling or shifting in the ground, minor variations in trench gradients, and traffic vibrations. Match coupling strength to that of the adjoining pipeline.

2.2.5 Insulating Joints

Provide a rubber-gasketed insulating joint or dielectric coupling between pipe of dissimilar metals which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.2.6 Bonded Joints

For all ferrous pipe, provide a metallic bond at each joint, including joints made with flexible couplings, caulking, or rubber gaskets, of ferrous metallic piping to effect continuous conductivity. Provide Size 1/0 copper conductor thermal weld type bond wire designed for direct burial and shaped to stand clear of the joint.

2.2.7 Dielectric Fittings

Install dielectric fittings between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains to prevent metal-to-metal contact of dissimilar metallic piping elements and compatible with the indicated working pressure.

2.2.8 Tracer Wire for Nonmetallic Piping

Provide a continuous bare copper or aluminum wire not less than 2.5 mm in diameter in sufficient length over each separate run of nonmetallic pipe.

2.2.9 Water Service Line Appurtenances

2.2.9.1 Corporation Stops

Ground key type; lead-free bronze, compatible with the working pressure of the system and solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops, coupling nut for connection to flared copper tubing.

2.2.9.2 Curb or Service Stops

Ground key, round way, inverted key type; made of lead-free bronze, and compatible with the working pressure of the system. Provide compatible ends for connection to the service piping. Cast an arrow into body of the curb or service stop indicating direction of flow.

2.2.9.3 Service Clamps

Provide single or double flattened strap type service clamps used for repairing damaged cast-iron, steel or PVC pipe with a pressure rating not less than that of the pipe being repaired. Provide clamps with a galvanized malleable-iron body with cadmium plated straps and nuts and a rubber gasket cemented to the body.

2.2.9.4 Goosenecks

Manufacture goosenecks from Type K copper tubing; provide joint ends for goosenecks compatible with connecting to corporation stop and service line. Where multiple gooseneck connections are required for an individual service, connect goosenecks to the service line through a compatible lead-free brass or bronze branch connection; the total clear area of the branches to be at least equal to the clear area of the service line.

2.2.9.5 Curb Boxes

Provide a curb box for each curb or service stop manufactured from cast iron, size capable of containing the stop where it is used. Provide a round head. Cast the word "WATER" on the lid. Factory coat the box with a heavy coat of bituminous paint.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Connections to Existing System

Perform all connections to the existing water system in the presence of the Contracting Officer.

3.1.2 Operation of Existing Valves

Do not operate valves within or directly connected to the existing water system unless expressly directed to do so by the Contracting Officer.

3.1.3 Earthwork

Perform earthwork operations in accordance with Section 31 00 00 EARTHWORK.

3.2 INSTALLATION

Install all materials in accordance with the applicable reference standard, manufacturers instructions and as indicated herein.

3.2.1 Piping

3.2.1.1 General Requirements

Install pipe, fittings, joints and couplings in accordance with the applicable referenced standard, the manufacturer's instructions and as specified herein.

3.2.1.1.1 Termination of Water Lines

Terminate the work covered by this section at a point approximately 1.5 m from the building, unless otherwise indicated.

Do not lay water lines in the same trench with gas lines, fuel lines, electric wiring, or any other utility. Do not install copper tubing in the same trench with ferrous piping materials. Where nonferrous metallic pipe (i.e., copper tubing) crosses any ferrous piping, provide a minimum vertical separation of 300 mm between pipes.

3.2.1.1.2 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Under no circumstances is it permissible to drop or dump pipe, fittings, valves, or other water line material into trenches. Cut pipe cleanly, squarely, and accurately to the length established at the site and work into place without springing or forcing. Replace a pipe or fitting that does not allow sufficient space for installation of jointing material. Blocking or wedging between bells and spigots is not permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at the design elevation and grade. Secure firm, uniform support. Wood support blocking is not permitted. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports for fastening work into place. Make provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been assembled. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation.[Provide a minimum of 760 mm depth of cover over top of pipe under non-traffic areas and minimum of 900 mm under traffic areas.]

3.2.1.1.3 Tracer Wire

Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.2.1.1.4 Connections to Existing Water Lines

Make connections to existing water lines after coordination with the facility and with a minimum interruption of service on the existing line. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped and as indicated.

3.2.1.1.5 Sewer Manholes

No water piping is to pass through or come in contact with any part of a sewer manhole.

3.2.1.1.6 Water Piping Parallel With Sewer Piping

Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer than 3.0 m, horizontally, from any sewer line.

a. Normal Conditions: Lay water piping at least 3.0 m horizontally from sewer or sewer manhole whenever possible. Measure the distance from outside edge to outside edge of pipe or outside edge of manhole. When local conditions prevent horizontal separation install water piping in a separate trench with the bottom of the water piping at least 450 mm above the top of the sewer piping.

b. Unusual Conditions: When local conditions prevent vertical separation,

construct sewer piping of JWWA compliant ductile iron water piping and perform hydrostatic sewer test, without leakage, prior to backfilling. When local conditions prevent vertical separation, test the sewer manhole in place to ensure watertight construction.

3.2.1.1.7 Water Piping Crossing Sewer Piping

Provide at least 450 mm above the top (crown) of the sewer piping and the bottom (invert) of the water piping whenever possible. Measure the distance edge-to-edge. Where water lines cross under gravity sewer lines, construct sewer line of JWWA compliant ductile iron water piping with rubber-gasketed joints and no joint located within 3 m horizontally, of the crossing. Lay water lines which cross sewer force mains and inverted siphons at least 600 mm above these sewer lines; when joints in the sewer line are closer than 900 mm horizontally from the water line relay the sewer line to ensure no joint closer than 900 mm.

a. Normal Conditions: Provide a separation of at least 450 mm between the bottom of the water piping and the top of the sewer piping in cases where water piping crosses above sewer piping.

b. Unusual Conditions: When local conditions prevent a vertical separation described above, construct sewer piping passing over or under water piping of JWWA compliant ductile iron water piping and perform hydrostatic sewer test, without leakage, prior to backfilling. Construct sewer crossing with a minimum 6.1 m length of the JWWA compliant ductile iron water piping, centered at the point of the crossing so that joints are equidistant and as far as possible from the water piping. Protect water piping passing under sewer piping by providing a vertical separation of at least 450 mm between the bottom of the sewer piping and the top of the water piping; adequate structural support for the sewer piping to prevent excessive deflection of the joints and the settling on or damage to the water piping.

3.2.1.1.8 Penetrations

Provide ductile-iron or Schedule 40 steel wall sleeves for pipe passing through walls of valve pits and structures. Fill annular space between walls and sleeves with rich cement mortar. Fill annular space between pipe and sleeves with mastic.

3.2.1.1.9 Flanged Pipe

Only install flanged pipe aboveground or with the flanges in valve pits.

3.2.1.2 Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS and with the requirements of JDPA T 01 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

a. Jointing: Make push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of pipe manufacturer for joint assembly. Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of of pipe manufacturer for joint assembly . Make flanged

joints with the gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When flanged pipe or fitting has dimensions that do not allow the making of a flanged joint as specified, replace it. Use set screw flanges to make flanged joints where conditions prevent the use of full-length flanged pipe and assemble in accordance with the recommendations of the set screw flange manufacturer. During installation of set screw gasket provide for confinement and compression of gasket when joint to adjoining flange is made. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer. Make insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves are to be full size for the bolt holes. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

b. Allowable Deflection: Follow ductile iron pipe manufacturer's recommendation for the maximum allowable deflection. If the alignment requires deflection in excess of the above limitations, provide special bends or a sufficient number of shorter lengths of pipe to achieve angular deflections within the limit set forth.

c. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene film, in conformance with JWWA K 158.

3.2.1.3 PVC and PVCO Water Main Pipe

Unless otherwise specified, install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS for laying of pipe, joining PVC pipe to fittings and accessories, setting of fire hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance per pipe manufacturer's installation instructions.

a. Jointing: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use a lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections; assemble push-on joints for connection to fittings, valves, and other accessories; make compression-type joints/mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel; assemble joints made with sleeve-type mechanical couplings , all in accordance with pipe manufacturer's installation instructions.

b. Joint Offset: Construct joint offset . Do not exceed the minimum longitudinal bending as recommended by pipe manufacturer.

c. Fittings: Install in accordance with PVC and PVCO pipe manufacturer's installation standards.

3.2.1.4 Polyethylene (PE) Piping

Install PE pipes in accordance with pipe manufacturer's installation instruction.

3.2.1.5 Plastic Service Piping

Install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS and with the applicable requirements, pipe manufacturer's installation instructions , unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with pipe manufacturer's installation instructions.

3.2.1.5.1 Jointing

Make solvent-cemented joints for PVC piping using the solvent cement previously specified for this material; assemble joints in accordance with pipe manufacturer's installation instructions. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.2.1.5.2 Plastic Pipe Connections to Appurtenances

Connect plastic service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

3.2.1.6 Fire Protection Service Lines for Sprinkler Supplies

Connect water service lines used to supply building sprinkler systems for fire protection to the water main in accordance with NFPA 24.

3.2.1.7 Water Service Piping

3.2.1.7.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 1.5 m from the building line at the points indicated; close such water service lines with plugs or caps.

3.2.1.7.2 Water Service Line Connections to Water Mains

Connect water service lines to the main by a corporation stop and gooseneck and install a service stop below the frostline. Connect water service lines to ductile-iron water mains in accordance with pipe manufacturer's installation instructions for service taps. Connect water service lines to PVC water mains in accordance with pipe manufacturer's installation instructions.

3.2.2 Railroad Right-of-Way

Install piping passing under the right-of-way of a commercial railroad in accordance with the specifications for pipelines conveying nonflammable substances . For PVC water main pipe, also install in accordance with the

recommendations of pipe manufacturer for installation of casings.

3.2.3 Meters

Install meters and meter boxes vaults at the locations shown on the drawings. Center meters in the boxes vaults to allow for reading and ease of removal or maintenance. Set top of box or vault at finished grade.

3.2.4 Backflow Preventers

Install backflow preventers of type, size, and capacity indicated a minimum of 300 mm and a maximum of 900 mm above concrete base. Include valves and test cocks. Install according to the manufacturers requirements and the requirements of plumbing and health department and authorities having jurisdiction. Support NPS 63 mm and larger backflow preventers, valves, and piping near floor with 300 mm minimum air gap, and on concrete piers or steel pipe supports. Do not install backflow preventers that have a relief drain in vault or in other spaces subject to flooding. Do not install by-pass piping around backflow preventers.

3.2.4.1 Backflow Preventer Enclosure

Install a level concrete base with top of concrete surface approximately 50 mm above grade. Install protective enclosure over valve and equipment. Anchor protective enclosure to concrete base.

3.2.5 Disinfection

Disinfection of systems supplying non-potable water is not required.

Prior to disinfection, provide disinfection procedures, proposed neutralization and disposal methods of waste water from disinfection as part of the disinfection submittal. Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with the applicable JWWA standards. Ensure a free chlorine residual of not less than 10 mg/L after 24 hour holding period and prior to performing bacteriological tests.

3.2.6 Flushing

Perform bacteriological tests prior to flushing. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 to 0.5 mg/L, the residual chlorine content of the distribution system, or acceptable for domestic use. Use neutralizing chemicals as recommended by JWWA standards.

3.2.7 Pipe Restraint

3.2.7.1 Concrete Thrust Blocks

Install concrete thrust blocks where indicated.

3.2.7.2 Restrained Joints

Install restrained joints in accordance with the manufacturer's instructions or NFPA 24 where indicated. For metal harness use tie rods and clamps as shown in NFPA 24. Provide metal harness fabricated by the pipe manufacturer and furnished with the pipe.

3.2.8 Valves

3.2.8.1 Gate Valves

Install gate valves in accordance with the requirements for valve-and-fitting installation and with the recommendations of the gate valve manufacturer. Install gate valves on PVC and PVCO water mains in accordance with the recommendations of the gate valve manufacturer. Make and assemble joints to gate valves as specified for making and assembling the same type joints between pipe and fittings.

3.2.8.2 Check Valves

Install check valves in accordance with the applicable requirements for valve-and-fitting installation , except as otherwise indicated. Make and assemble joints to check valves as specified for making and assembling the same type joints between pipe and fittings.

3.2.8.3 Air Release, Air/Vacuum, and Combination Air Valves

Install pressure vacuum assemblies of type, size, and capacity indicated. Include valves and test cocks. Install according to the requirements of plumbing and health department and authorities having jurisdiction. Do not install pressure vacuum breaker assemblies in vault or other space subject to flooding.

3.2.9 Blowoff Valve Assemblies

Install blowoff valve assemblies as indicated on the drawings or in accordance with the manufactures recommendations. Install discharge fitting on the end of riser pipe to direct the flow of water so as to minimize damage to surrounding areas.

3.2.10 Fire Hydrants

Install fire hydrants in accordance with NFPA 24 and with the requirements of JDPA T 01 for pipe installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Provide metal harness as specified under pipe anchorage requirements for the respective pipeline material to which fire hydrant is attached. Install fire hydrants with the 115 mm connections facing the adjacent paved surface. If there are two paved adjacent surfaces, install fire hydrants with the 115 mm connection facing the paved surface where the connecting main is located.

3.3 FIELD QUALITY CONTROL

3.3.1 Tests

Notify the Contracting Officer a minimum of five days in advance of hydrostatic testing. Coordinate the proposed method for disposal of waste water from hydrostatic testing. Perform field tests, and provide labor, equipment, and incidentals required for testing, except that water needed for field tests will be furnished as set forth in paragraph AVAILABILITY AND USE OF UTILITY SERVICES in Section 01 50 00 TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS. Provide documentation that all items of work have been constructed in accordance with the Contract documents.

3.3.1.1 Hydrostatic Test

Test the water system in accordance with the applicable JWWA standards. Where water mains provide fire service, test in accordance with the special testing requirements given in the paragraph SPECIAL TESTING REQUIREMENTS FOR FIRE SERVICE. Test ductile-iron water mains in accordance with the requirements of JIS S 3200-1 for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical-joints or push-on joints is not to exceed the amounts given in pipe manufacturer's installation instructions. No leakage will be allowed at joints made by any other methods. Test PVC and PVCO plastic water systems made with PVC pipe for pressure and leakage tests. The amount of leakage on pipelines made of PVC water main pipe is not to exceed the amounts given in pipe manufacturer's installation instructions, except that at joints made with sleeve-type mechanical couplings, no leakage will be allowed. Test water service lines for hydrostatic testing. No leakage will be allowed at copper pipe joints, copper tubing joints (soldered, compression type, brazed), plastic pipe joints, flanged joints, and screwed joints. Do not backfill utility trench or begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 7 days after placing of the concrete.

3.3.1.2 Hydrostatic Sewer Test

The hydrostatic pressure sewer test will be performed in accordance with the applicable JWWA standard for the piping material with a minimum test pressure of 200 kPa.

3.3.1.3 Leakage Test

For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

For PE perform leak testing in accordance with the applicable JWWA standards.

3.3.1.4 Bacteriological Testing

Perform bacteriological tests in accordance with the applicable JWWA standards. Analyze samples by a certified laboratory, and submit the results of the bacteriological samples.

3.3.1.5 Backflow Preventer Tests

After installation conduct Backflow Preventer Tests and provide test reports verifying that the installation meets the JIS S 3200-4 or applicable JWWA testing standards.

3.3.1.6 Special Testing Requirements for Fire Service

Test water mains and water service lines providing fire service or water and fire service in accordance with NFPA 24. The additional water added to the system must not exceed the limits given in NFPA 24

3.3.1.7 Tracer Wire Continuity Test

Test tracer wire for continuity after service connections have been completed and prior to final pavement or restoration. Verify that tracer

wire is locatable with electronic utility locating equipment. Repair breaks or separations and re-test for continuity.

3.4 SYSTEM STARTUP

Water mains and appurtenances must be completely installed, disinfected, flushed, and satisfactory bacteriological sample results received prior to permanent connections being made to the active distribution system. Obtain approval by the Contracting Officer prior to the new water piping being placed into service.

3.5 CLEANUP

Upon completion of the installation of water lines and appurtenances, remove all debris and surplus materials resulting from the work.

-- End of Section --

SECTION 33 30 00

SANITARY SEWERAGE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5001	(2008) Crushed Stone for Road Construction
JIS A 5005	(2009) Crushed Stone and Manufactured Sand for Concrete
JIS A 5308	(2014) Ready-Mixed Concrete
JIS A 5314	(2014) Mortar Lining for Ductile Iron Pipes
JIS A 5372	(2016) Precast Reinforced Concrete Products
JIS A 5506	(2008) Manhole Covers for Sewerage Works
JIS B 1171	(2015) Cup Head Square Neck Bolts (Amendment 1)
JIS B 1180	(2014) Hexagon Head Bolts and Hexagon Head Screws
JIS B 1181	(2014) Hexagon Nuts and Hexagon Thin Nuts
JIS B 2404	(2018) Dimensions of Gaskets for Use with Pipe Flanges
JIS G 3101	(2017) Rolled Steels for General Structure (Amendment 1)
JIS G 5526	(2014) Ductile Iron Pipes
JIS G 5527	(2014) Ductile Iron Fittings
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS K 0102	(2019) Testing Methods for Industrial Wastewater (Amendment 1)
JIS K 6353	(2011) Rubber Goods for Water Works
JIS K 6739	(2016) Unplasticized Poly (Vinyl Chloride) (PVC-U) Pipe Fittings for Drain
JIS K 6741	(2016) Unplasticized Poly (Vinyl Chloride)

	(PVC-U) Pipes
JIS K 6742	(2016) Unplasticized poly (vinyl chloride) (PVC-U) pipes for water supply
JIS K 6743	(2016) Unplasticized Poly (Vinyl Chloride) (PVC-U) Pipe Fittings for Water Supply
JIS R 5210	(2009) Portland Cement

JAPAN WATER WORKS ASSOCIATION (JWWA)

JWWA K 158	(2017) Polyethylene Sleeve for Ductile Cast Iron Pipe for Water Supply

JAPAN SEWAGE WORKS ASSOCIATION (JSWAS)

JSWAS K-1	(2010) Rigid PVC Pipe for Sewer

THE SOCIETY OF HEATING, AIR-CONDITIONING AND SANITARY ENGINEERS OF JAPAN STANDARD (SHASE-S)

SHASE-S 209	(2009) Manhole Cover

JAPAN DUCTILE IRON PIPE ASSOCIATION (JDPA)

JDPA Z 2010	(2009) Synthetic Resin Coating for Ductile Iron Pipes and Fittings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings; G

SD-03 Product Data

Pressure Pipe; G

Sewage Treatment Tanks; G

SD-06 Test Reports

Hydrostatic Sewer Test

Infiltration Tests or Exfiltration Tests

Tests For Pressure Lines; G

Deflection Testing

SD-07 Certificates

Gaskets

Pre-Installation Inspection Request; G

Post-Installation Inspection; G

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.3.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.3.1.2 Cement, Aggregate, and Reinforcement

As specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

1.3.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench. Store solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe in accordance with the manufacturer's recommendation and discard those materials if the storage period exceeds the recommended shelf life. Discard solvents in use when the recommended pot life is exceeded.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Sanitary Sewer Gravity Pipeline

Provide mains and laterals of concrete pipe or polyvinyl chloride (PVC) plastic pipe. Provide building connections of polyvinyl chloride (PVC) plastic pipe. Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 1.5 m outside of building walls.

2.1.2 Sanitary Sewer Pressure Lines

Provide pressure lines of ductile iron pressure pipe or polyvinyl chloride (PVC) plastic pressure pipe.

2.2 MATERIALS

Provide materials conforming to the respective specifications and other requirements specified below. Submit manufacturer's product specification,standard drawings or catalog cuts.

2.2.1 Gravity Pipe

2.2.1.1 Concrete Gravity Sewer Piping

2.2.1.1.1 Concrete Gravity Pipe

Provide reinforced concrete pipe conforming to JIS A 5372, external pressure type, Class 1 or Class 2, Type B.

2.2.1.1.2 Jointing Materials for Concrete Gravity Piping

Provide gaskets and pipe ends for rubber gasket joint conforming to JIS K 6353. Use gaskets suitable for use with sewage.

Submit certificates of compliance stating that the fittings or gaskets used for waste drains or lines are oil resistant.

2.2.1.2 PVC Gravity Sewer Piping

2.2.1.2.1 Pipe and Fittings

a. Pipe:JIS K 6741, Class VP or VU.

b. Fittings:JIS K 6739

2.2.1.2.2 Joints and Jointing Material

Jointing Materials: Rubber gasket conforming to JIS K 6353. Gaskets shall be suitable for use in sewerage.

2.2.1.2.3 PVC Branch Pipe Connectors

Shall be standard product compatible with the PVC plastic pipe and conforming to JSWAS K-1 and JIS K 6739. Adhesive materials shall be as per branch pipe manufacturer's recommendation.

2.2.2 Pressure Pipe

2.2.2.1 Ductile Iron Pressure Piping

2.2.2.1.1 Ductile Iron Pressure Pipe and Fittings

Provide mechanical joint or flanged ductile-iron pipe conforming to JIS G 5526. Provide fittings conforming to JIS G 5527. Use fittings which have a pressure rating at least equivalent to that of the pipe. Pipe and fittings are to have interior cement-mortar lining conforming to JIS A 5314 and exterior pipe coating conforming to JDPA Z 2010.

2.2.2.1.2 Ductile Iron Pressure Joints and Jointing Materials

a. Joints, general: Use mechanical joints for pipe and fittings. Use flanged joints where indicated. Joints made with sleeve-type mechanical coupling may be used in lieu of push-on joint.

b. Mechanical joints: Gaskets are to conform to JIS B 2404.

c. Flanged joints: Provide bolts, nuts, and gaskets for flanged connections compatible with JIS G 5527 joints.

d. Joints made with sleeve-type mechanical couplings: Provide bolts conforming to the tensile requirements of JIS B 1180 with nuts conforming to the tensile requirements of JIS B 1181 or round-head square-neck type bolts conforming to JIS B 1171 with hex nuts conforming to JIS B 1181.

2.2.2.2 PVC Pressure Pipe and Associated Fittings

2.2.2.2.1 Pipe and Fittings

Pipe, couplings and fittings are to be manufactured of materials conforming to JIS K 6742 and fittings conforming to JIS K 6743.

2.2.2.2.2 Solvent Cement Joint

Provide solvent cement joint per pipe manufacturer's recommendation.

2.2.3 Piping Beneath Railroad Right-of-Way

Where pipeline passes under the right-of-way of a commercial railroad, piping is to conform to the specifications for pipelines conveying nonflammable substances. For casing pipe provide ductile-iron pipe in lieu of cast-iron soil pipe. Ductile-iron pipe is to conform to and have strength computed in accordance with JIS G 5526.

2.2.4 Portland Cement

Portland cement shall conform to JIS R 5210.

2.2.5 Portland Cement Concrete

Provide portland cement concrete conforming to JIS A 5308, compressive strength of 24 MPa at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement is to have a compressive strength of 18 MPa minimum at 28 days. Protect concrete in place from freezing and moisture loss for 7 days.

2.2.6 Precast Concrete Manholes

Approved commercial products as shown on drawings and conforming to JIS A 5372. Joints between precast concrete manhole sections shall be made with flexible watertight, rubber-type gaskets per manhole manufacturer's standards.

2.2.7 Invert Mortar

Mortar for forming manhole inverts shall be composed of cement, sand and water mixed in proportion of 1 part cement to 2 parts of sand, sufficient water to produce a workable mixture. Mortar shall be used in the work within one hour after mixing.

2.2.8 Gaskets and Connectors

Resilient connectors for making joints between manhole and pipes entering manhole are to conform to pipe manufacturer's standards.

2.2.9 Sewage Treatment Tanks

Shall be three functions of primary, secondary, and final sewage treatment and shall meet the requirements of biochemical oxygen demand (BOD) value as indicated by testing in accordance with JIS K 0102.

2.2.10 Frames And Covers for Manholes

Shall be local manufacturer's standard product conforming to SHASE-S 209, and shall be of cast iron per JIS A 5506. Size, configuration and loading capacity shall be as indicated on drawings. A letter "S" shall be stamped or cast into covers.

2.2.11 Manhole Steps

Materials shall conform to JIS G 3101, Type SS400, galvanized, and of the size and configuration as shown on drawing. Manhole steps are not required in manholes and inlets less than 1.2 m deep.

2.2.12 Manhole Ladders

Provide a steel ladder conforming to JIS G 3101 where the depth of a manhole exceeds 3.6 m. The ladder is not to be less than 406 mm in width, with 19 mm diameter rungs spaced 305 mm apart. The two stringers are to be a minimum 10 mm thick and 51 mm wide. Galvanize ladders and inserts after fabrication in conformance with JIS H 8641.

2.2.13 Miscellaneous Items

2.2.13.1 Warning Tape

Provide in accordance with requirements as specified in Section 31 00 00 EARTHWORK

2.2.13.2 Sand Fill

Fill around PVC drainage pipes shall be cleaned sand conforming to JIS A 5005.

2.2.13.3 Gravel Base Course

Crushed stone for base course at concrete structures shall be crusher run conforming to JIS A 5001, RC-40.

2.2.13.4 Surface Cleanouts

Surface cleanout shall have cast iron cover and fitting adaptable for connection to the lower PVC pipe. Traffic loading capacity shall be as required for the manhole covers located within the same ground surface condition.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Installation Drawings

Submit Installation Drawings showing complete detail, both plan and side view details with proper layout and elevations.

3.2 INSTALLATION

Backfill after inspection by the Contracting Officer. Before, during, and after installation, protect plastic pipe and fittings from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer.

3.2.1 Connections to Existing Lines

Obtain approval from the Contracting Officer before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line.

3.2.2 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

3.2.2.1 Location

Terminate the work covered by this section at a point approximately 1.5 m from the building, unless otherwise indicated. Install pressure sewer lines beneath water lines only, with the top of the sewer line being at least 0.60 m below bottom of water line. When these separation distances can not be met, contact the Contracting Officer for direction.

3.2.2.1.1 Sanitary Piping Installation Parallel with Water Line

3.2.2.1.1.1 Normal Conditions

Install sanitary piping or manholes at least 3 m horizontally from a water line whenever possible. Measure the distance from edge-to-edge.

3.2.2.1.1.2 Unusual Conditions

When local conditions prevent a horizontal separation of 3 m, the sanitary piping or manhole may be laid closer to a water line provided that:

a. The top (crown) of the sanitary piping is to be at least 450 mm below the bottom (invert) of the water main.

b. Where this vertical separation cannot be obtained, construct the sanitary piping with JWWA-approved ductile iron water pipe pressure and conduct a hydrostatic sewer testwithout leakage prior to backfilling.

c. The sewer manhole is to be of watertight construction and tested in place.

3.2.2.1.2 Installation of Sanitary Piping Crossing a Water Line

3.2.2.1.2.1 Normal Conditions

Lay sanitary sewer piping by crossing under water lines to provide a separation of at least 450 mm between the top of the sanitary piping and the bottom of the water line whenever possible.

3.2.2.1.2.2 Unusual Conditions

When local conditions prevent a vertical separation described above, use the following construction:

a. Construct sanitary piping passing over or under water lines with JWWA-approved ductile iron water pressure piping and conduct a hydrostatic sewer test without leakage prior to backfilling.

b. Protect sanitary piping passing over water lines by providing:

(1) A vertical separation of at least 450 mm between the bottom of the sanitary piping and the top of the water line.

(2) Adequate structural support for the sanitary piping to prevent excessive deflection of the joints and the settling on and breaking of the water line.

(3) That the length, minimum 6.1 m, of the sanitary piping be centered at the point of the crossing so that joints are equidistant and as far as possible from the water line.

3.2.2.1.3 Sanitary Sewer Manholes

No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.2.2.2 Earthwork

Perform earthwork operations in accordance with Section 31 00 00 EARTHWORK 31 23 00.00 20 EXCAVATION AND FILL.

3.2.2.3 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell or groove ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 7.50 m apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose. Construct branch connections by use of regular fittings or with matching branch pipe connectors from the same pipe manufacturer.

3.2.3 Special Requirements

3.2.3.1 Installation of Concrete Gravity Sewer Piping

Make joints with the gaskets specified for concrete gravity sewer pipe joints. Clean and dry surfaces receiving lubricants, cements, or adhesives. Affix gaskets to pipe not more than 24 hours prior to the installation of the pipe. Protect gaskets from sun, blowing dust, and other deleterious agents at all times. Before installation of the pipe, inspect gaskets and remove and replace loose or improperly affixed gaskets. Align each pipe section with the previously installed pipe section, and pull the joint together. If, while pulling the joint, the gasket becomes loose and can be seen through the exterior joint recess when the pipe is pulled up to within 25 mm of closure, remove the pipe and remake the joint.

3.2.3.2 Installation of Ductile-Iron Pressure Lines

a. Make mechanical-joints with the gaskets, glands, bolts, and nuts specified for this type joint. Make flanged joints with gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight, taking care to avoid undue strain on flanges, fittings, and other accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When flanged pipe or fittings have dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions.

b. Exterior protection: Completely wrap buried ductile iron pipelines with 8 mil (minimum) polyethylene sheet in conformance with JWWA K 158.

c. Pipe anchorage: Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to JIS A 5308 having a minimum compressive strength of 18 MPa at 28 days.

3.2.3.3 Installation of PVC Piping

Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.2.3.4 Installation of PVC Pressure Pipe

3.2.3.4.1 Pipe

Make push-on joints with elastomeric gasket . For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel. For push-on joint connections to fittings, use cut spigot end of pipe off square, marked to match the manufacturer's insertion line and beveled to match factory supplied bevel. . Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of the pipe manufacturer for laying the pipe. Assemble push-on joints for connection to fittings in accordance with the requirements of the pipe manufacturer for joining PVC pipe to fittings and accessories.

3.2.3.4.2 Pipe Anchorage

Provide concrete thrust blocks (reaction backing) for pipe anchorage. Size and position thrust blocks as indicated. Use concrete conforming to JIS A 5308 having a minimum compressive strength of 18 MPa at 28 days.

3.2.3.5 Pipeline Installation Beneath Railroad Right-of-Way

Where pipeline passes under the right-of-way of a commercial railroad, install piping in accordance with the specifications for pipelines conveying nonflammable substances.

3.2.4 Concrete Work

Cast-in-place concrete is included in Section 03 30 00 CAST-IN-PLACE CONCRETE. Support the pipe on a concrete cradle, or encased in concrete where indicated or directed.

3.2.5 Manhole Construction

Construct base slab of cast-in-place concrete or use precast concrete base sections. Make inverts in cast-in-place concrete and precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. For cast-in-place concrete construction, either pour bottom slabs and walls integrally or key and bond walls to bottom slab. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Perform cast-in-place concrete work in accordance with the requirements specified under paragraph entitled "Concrete Work" of this section. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

3.2.6 Miscellaneous Construction and Installation

3.2.6.1 Connecting to Existing Manholes

Connect pipe to existing manholes such that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. Center the connection on the manhole. Holes for the new pipe are be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cut the manhole in a manner that will cause the least damage to the walls.

3.2.6.2 Metal Work

3.2.6.2.1 Workmanship and Finish

Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

3.2.6.2.2 Field Painting

After installation, clean cast-iron frames, covers, gratings, and steps not buried in concrete to bare metal, remove mortar, rust, grease, dirt, and other deleterious materials and apply a coat of bituminous paint. Do not paint surfaces subject to abrasion.

3.2.7 Installations of Wye Branches and Branch Connectors

Install wye branches and branch connectorsin an existing sewer using a method which does not damage the integrity of the existing sewer. Do not cutinto piping for connections except when approved by the Contracting Officer. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, support on a concrete cradle as directed by the Contracting Officer. Provide and install concrete required because of conditions resulting from faulty construction methods or negligence without any additional cost to the Government. Do not damage the existing sewer when installing wye branches in an existing sewer.

3.2.8 Construction of Sewage Treatment Tanks

Construct sewage tank in accordance with approved drawings and manufacturer's catalog data.

3.3 FIELD QUALITY CONTROL

The Contracting Officer will conduct field inspections and witness field tests specified in this section. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.3.1 Tests

Perform field tests and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished as set forth in Section [_____].

3.3.1.1 Hydrostatic Sewer Test

When unusual conflicts are encountered between sanitary sewer and waterlines a hydrostatic pressure sewer test will be performed in accordance with the applicable JWWA standard for the piping material with a minimum test pressure of 200 kPa.

3.3.1.2 Leakage Tests for Nonpressure Lines

Test lines for leakage by either infiltration tests or exfiltration tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. When the water table is 60 cm or more above top of pipe at upper end of pipeline section to be tested, measure infiltration using a suitable weir or other acceptable device. When the water table is less than 60 cm above top of pipe at upper end of pipeline section to be tested, make exfiltration test by filling the line to be tested with water so that the head will be at least 1.2 m above top of pipe at upper end of pipeline section being tested. Allow filled pipeline to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, reestablish the head and measure amount of water needed to maintain this water level during a 2-hour test period. Amount of leakage, as measured by either infiltration or exfiltration test shall not exceed one liter per cm of diameter per hour per 100 m of pipeline. When leakage exceeds the amount specified, make satisfactory correction and retest pipeline section in the same manner as previously specified. Correct all visible leaks regardless of leakage test results.

3.3.1.3 Tests for Pressure Lines

Test pressure lines in accordance with the applicable standards as recommended by pipe manufacturer's installation manual for the respective pressure pipes specified in this specification. For hydrostatic pressure test, use a hydrostatic pressure 345 kPa in excess of the maximum working pressure of the system, but not less than 690 kPa, holding the pressure for a period of not less than one hour. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

3.3.1.4 Deflection Testing

Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads. Deflection of pipe in the installed pipeline under external loads is not to exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection measuring device.

3.3.1.4.1 Pull-Through Device

This device is to be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Space circular sections on the shaft so that the distance from external faces of front and back sections will equal or exceed the diameter of the circular section. Pull-through device may also be of a design recommended by the pipe manufacturer, provided the device meets the applicable requirements specified in this paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections are to conform to the following:

a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.

b. Homogeneous material throughout, is to have a density greater than 1.0 as related to water at 4 degrees C, and a surface Brinell hardness of not less than 150.

c. Center bored and through-bolted with a 6 mm minimum diameter steel shaft having a yield strength of not less than 483 MPa, with eyes or loops at each end for attaching pulling cables.

d. Suitably Back each eye or loop with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

3.3.1.4.2 Deflection Measuring Device

Sensitive to 1.0 percent of the diameter of the pipe being tested and be accurate to 1.0 percent of the indicated dimension. Prior approval is required for the deflection measuring device.

3.3.1.4.3 Pull-Through Device Procedure

Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.

3.3.1.4.4 Deflection measuring device procedure

Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe which has excessive deflection and completely retest in same manner and under same conditions.

3.3.2 Field Tests for Cast-In-Place Concrete

Field testing requirements are covered in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.3.3 Inspection

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; the light must show a practically full circle of light through the pipeline when viewed from the adjoining end of line.

3.3.3.1 Pre-Installation Inspection

Prior to connecting the new service, perform pre-installation inspection after trenching and layout is complete. Submit pre-installation inspection request for field support at least 14 days in advance. The Installation's Utilities Field Support personnel will perform the pre-installation inspection.

3.3.3.2 Post-Installation Inspection

Perform a post-installation inspection after connection has been made and before the connection is buried. Submit post-installation inspection request for field support at least 14 days in advance. The Installation's Utilities Field Support personnel will perform the post-connection inspection.

-- End of Section --

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 1210	(2009) Test Method for Soil Compaction Using a Rammer
JIS A 1214	(2013) Test Method for Soil Density by the Sand Replacement Method
JIS A 5001	(2008) Crushed Stone for Road Construction
JIS A 5005	(2009) Crushed Stone and Manufactured Sand for Concrete
JIS A 5308	(2014) Ready-Mixed Concrete
JIS A 5372	(2016) Precast Reinforced Concrete Products
JIS A 5506	(2008) Manhole Covers for Sewerage Works
JIS G 3101	(2017) Rolled Steels for General Structure (Amendment 1)
JIS H 8641	(2007) Hot Dip Galvanized Coatings
JIS K 6353	(2011) Rubber Goods for Water Works
JIS K 6739	(2016) Unplasticized Poly (Vinyl Chloride) (PVC-U) Pipe Fittings for Drain
JIS K 6741	(2016) Unplasticized Poly (Vinyl Chloride) (PVC-U) Pipes
JIS K 6761	(2017) Polyethylene Pipes for General Purposes
JIS L 1908	(2000) Geotextile Test Method

JAPAN SEWAGE WORKS ASSOCIATION (JSWAS)

JSWAS K-1	(2010) Rigid PVC Pipe for Sewer

THE SOCIETY OF HEATING, AIR-CONDITIONING AND SANITARY ENGINEERS OF JAPAN STANDARD (SHASE-S)

SHASE-S 209 (2009) Manhole Cover

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Crushed Stone for Perforated Pipes

Geotextile Filter Fabric for Perforated Pipes

Leakage Test; G

Determination of Density

Post-Installation Inspection Report; G

SD-08 Manufacturer's Instructions

Placing Pipe

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

Provide reinforced concrete pipe conforming to JIS A 5372, external pressure type, Class 1 or 2, Type B. Provide gaskets and pipe ends for rubber gasket joint conforming to JIS K 6353. Use gaskets suitable for use with sewage.

2.1.2 Precast Concrete Pipe-Type Gutter

Japanese manufactured precast concrete product that comes in standard length of 2 m. Locally known as DO pipe or acceptable alternative, and to be used along curb lines to function as gutter with water conveyance underneath. Shall be of the cross section shown on drawing and panels are supplied both with grating and without grating. Traffic loading capacity shall be 25 tons. Jointing materials shall be in accordance with manufacturer's standards.

2.1.3 Precast Concrete Pipe Culvert Type Ditch

Japanese manufactured precast concrete product that comes in standard length of 2 m. Locally known as DO pipe or acceptable alternative, and to be used for below grade construction in place of PVC pipe whenever the sand fill layer above the PVC pipe is less than 300 mm. Shall be of the cross section shown on drawing and to be installed where specified on drainage plans. Traffic loading capacity shall be 25 tons. Jointing materials shall be in accordance with manufacturer's standards.

2.1.4 Polyvinyl Chloride (PVC) Pipe

a. PVC plastic pipe shall be in conformance with JIS K 6741, Type VP or VU.

b. Fitting for PVC plastic pipe shall be in conformance with JIS K 6739.

c. Jointing material for PVC plastic pipe shall be in conformance with PVC pipe manufacturer's recommendation.

d. PVC branch pipe connectors shall be standard product compatible with the PVC plastic pipe and conforming to JSWAS K-1 and JIS K 6739. Adhesive materials shall be per branch pipe manufacturer's recommendation.

2.1.5 Polyethylene (PE) Pipe

a. Polyethylene pipe shall be in conformance with JIS K 6761.

b. Jointing material shall conform with polyethylene pipe manufacturer's recommendation.

2.2 PERFORATED PIPING

2.2.1 Polyvinyl Chloride (PVC) Pipe

a. Perforated PVC plastic pipe shall be in conformance with JIS K 6741,Type VP or VU.

b. Fitting for perforated PVC plastic pipe shall be in conformance with JIS K 6739.

c. Jointing material for perforated PVC plastic pipe shall be in conformance with PVC pipe manufacturer's recommendation.

2.2.2 Polyethylene (PE) Pipe

a. Flexible perforated polyethylene pipe shall be in conformance with JIS K 6761.

b. Jointing material shall conform with polyethylene pipe manufacturer's recommendation.

2.3 OTHER DRAINAGE CONVEYANCE MATERIALS

2.3.1 Precast Concrete Free Gradient Ditch

Manufactured precast concrete product that comes in standard length of 2 m, and to be used as an interceptor trench along curb lines. Typically of inverted U shaped with the flat top functioning as gutter surface with grated inlets while the bottom is open and filled with plain concrete to obtain the desired gradient of the water conveyance underneath. Shall be of the varying cross sections as shown on drawing. Traffic loading capacity shall be 25 tons. Jointing materials shall be in accordance with manufacturer's standards.

2.3.2 Precast Concrete U-Ditch

Manufactured precast concrete product conforming to JIS A 5372. Comes in 600 mm panel length and shall be of the cross section shown on drawing. Ditch shall be non-traffic type and with or without cover where specified on drawing.

2.3.3 Cast-in-Place Concrete Trench

A reinforced concrete trench of varying cross sections as shown on drawing. Concrete in conformance with JIS A 5308 shall be 24 MPa and shall have frame and grating.

2.4 MISCELLANEOUS MATERIALS

2.4.1 Concrete

Reinforced concrete drainage structures shall use concrete with compressive strength of 24 MPa.

2.4.2 Leveling Mortar

Mortar for setting precast concrete pipe type gutter and culvert pipe ditch (both locally known as DO pipe) shall composed of cement, sand and water mixed in proportion of 1 part cement to 3 parts of sand, sufficient

water to produce a workable mixture. Mortar shall be used in the work within one hour after mixing.2.4.3 Leveling Concrete and Concrete Fill

Plain concrete to be used where specified on drainage drawing details shall have a compressive strength of 18 MPa.

2.4.4 Precast Reinforced Concrete Manholes

Approved commercial products as shown on drawings and conforming to JIS A 5372. Joints between precast concrete manhole sections shall be made with flexible watertight, rubber-type gaskets per manhole manufacturer's standards.

2.4.5 Frames, Covers And Grating

2.4.5.1 Manhole Frames and Covers

Shall be Japanese manufacturer's standard product conforming to SHASE-S 209, and shall be of cast iron per JIS A 5506. Size, configuration and loading capacity shall be as indicated on drawings. A letter "D" shall be stamped or cast into covers.

2.4.5.2 Ditch and Inlet Frame and Grating

Shall be Japanese manufacturer's standard product of steel materials and of the size, shape, grating pattern, and loading capacity as indicated on drawings. Grating shall be finished with factory-zinc-coated in accordance with JIS H 8641, and frame shall be finished with factory-bake coated.

2.4.6 Sand Fill And Leveling Sand

Fill around PVC drainage pipes and for setting non-traffic type precast U-ditch shall be cleaned sand conforming to JIS A 5005.

2.4.7 Crushed Stone For Perforated Pipes

Granular aggregates for use in perforated pipes shall be single-sized crushed stone S-20 (#5) of size 13 mm to 20 mm and conforming to JIS A 5001.

2.4.8 Gravel Base Course

Crushed stone for base course at concrete structures shall be crusher run conforming to JIS A 5001, RC-40.

2.4.9 Flap Gates

Flap Gates shall be medium or heavy-duty with circular or rectangular opening and double-hinged. Top pivot points shall be adjustable. The seat shall be one-piece cast iron with a raised section around the perimeter of the waterway opening to provide the seating face. The seating face of the seat shall be cast iron or stainless steel. The cover shall be one-piece cast iron with necessary reinforcing rib, lifting eye for manual operation, and bosses to provide a pivot point connection with the links. The seating face of the cover shall be cast iron or stainless steel. Links or hinge arms shall be cast or ductile iron. Holes of pivot points shall be bronze bushed. All fasteners shall be either galvanized steel, bronze or stainless steel.

2.5 STEEL LADDER

Steel ladder conforming to JIS G 3101 shall be provided where the depth of the storm drainage structure exceeds 3.66 m. These ladders shall be not less than 406 mm in width, with 19 mm diameter rungs spaced 305 mm apart. The two stringers shall be a minimum 10 mm thick and 63 mm wide. Ladders and inserts shall be galvanized after fabrication in conformance with JIS H 8641.

2.5.1 Manhole Steps

Materials shall conform to JIS G 3101, Type SS 400, galvanized, and of the size and configuration as shown on drawing. Manhole steps are not required in manholes and inlets less than 1.2 m deep.

2.6 RESILIENT CONNECTORS

Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to pipe manufacturer's standards.

2.7 GEOTEXTILE FILTER FABRIC FOR PERFORATED PIPES

Submit certification from the manufacturers attesting that the filter fabric meets specification requirements. Provide geotextile that is a nonwoven pervious sheet of polymeric material conforming to JIS L 1908.

2.8 Warning Tape

Provide in accordance with requirements as specified in Section 31 00 00 EARTHWORK.

2.9 Cleanouts

Cleanouts installed at vertical PVC downspouts shall use the standard Y-fitting with the compatible PVC cleanout cover conforming to JIS K 6739. Surface cleanout at paved and turfed areas shall be cast iron cover and fitting adaptable for connection to the lower PVC pipe. Traffic loading capacity for surface cleanout shall be as required for manhole covers located within the same ground surface condition.

2.10 EROSION CONTROL RIP RAP

Provide non-erodible rock not exceeding 375 mm in its greatest dimension and choked with sufficient small rocks to provide a dense mass with a minimum thickness of [200 mm] [as indicated].

PART 3 EXECUTION

3.1 INSTALLATION OF PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 00 00 EARTHWORK, 31 23 00.00 20 EXCAVATION AND FILL and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 500 mm to permit

satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing, where required, shall be placed within the trench width as specified, without any overexcavation. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 200 mm or 13 mm for each meter of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Section 31 00 00 EARTHWORK 31 23 00.00 20 EXCAVATION AND FILL .

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe Requirements

Concrete pipe shall be bedded with sand material minimum 200 mm in depth in trenches with soil foundation. Depth of sand bedding in trenches with rock foundation shall be 13 mm in depth per 300 mm of depth of fill, minimum depth of bedding shall be 200 mm up to maximum depth of 600 mm. Where concrete pipes are laid in deep trenches or where traffic loads are expected, the entire pipe line length shall be supported uniformly by concrete foundation or cradle.

3.2.2 Precast, Concrete Pipe Type Gutter/Ditch and Free-Gradient Ditch

These type of Precast drainage materials shall be laid using leveling mortar over a concrete foundation base.

3.2.3 Precast Concrete U-Ditch

Use leveling sand for non-traffic areas and leveling mortar over concrete foundation for traffic areas.

3.2.4 Plastic Pipe

Use clean sand for bedding, haunching and initial backfill for PVC and PE pipes. Minimum depth of bedding shall be 200 mm

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed 4.5 percent of the average inside diamater of pipe.

3.3.1 Concrete and Plastic Pipes

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe pointing in the direction of the flow.

3.3.2 Precast Concrete Pipe Type Gutter/Ditch, Free Gradient Ditch and U-Ditch

Lay the drainage materials in conformance with product manufacturer's instructions.

3.3.3 Multiple Culverts

Where multiple lines of pipe are installed, adjacent sides of pipe shall be at least half the nominal pipe diameter or 1 meter apart, whichever is less.

3.4 JOINTING

3.4.1 Concrete Pipes and Other Precast Concrete Drainage Conveyance Materials.

3.4.1.1 Flexible Watertight Joints

Gaskets and jointing materials shall be as recommended by the particular manufacturer. Cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.

3.4.2 Plastic Piping

Install pipes and fittings per pipe manufacturer's installation manual.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete, precast reinforced concrete, precast concrete segmental blocks complete with frames and covers or gratings; and with fixed galvanized steel ladders or manhole steps where indicated. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors in conformance with pipe manufacturer.

3.5.2 Walls and Headwalls

Construction shall be as indicated.

3.6 Metal Steps

Individual metal steps shall be adequately anchored to precast manhole walls per manhole or metal step manufacturer's installation standards.

3.7 STEEL LADDER INSTALLATION

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 1.83 m vertically, and shall be installed to provide at least 152 mm of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

3.8 BACKFILLING

3.8.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded clean sand shall be placed along both sides of pipe in layers not exceeding 150 mm in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 300 mm above the top of the pipe. The remainder of the trench shall be backfilled with select material from excavation or borrow and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 150 mm. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.8.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 150 mm in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 300 mm above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 4 m, whichever is less. After the backfill has reached at least 300 mm above

the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 150 mm. Use sand material for this entire region of backfill for flexible and concrete pipe installations.

3.8.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.8.4 Compaction

3.8.4.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.8.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.

b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.

c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.9 FIELD PAINTING

3.9.1 Cast-Iron Covers and Frames

After installation, clean cast-iron, not buried in masonry or concrete, of mortar, rust, grease, dirt, and other deleterious materials to bare metal and apply a coat of bituminous paint.

3.10 FIELD QUALITY CONTROL

3.10.1 Tests

Testing is the responsibility of the Contractor. Perform all testing and

retesting at no additional cost to the Government.

3.10.1.1 Leakage Test

Lines shall be tested for leakage by exfiltration tests prior to completing backfill. Prior to exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 600 mm or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 600 mm is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be reestablished. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by the exfiltration test shall not exceed 9 mL per mm in diameter per 100 meters of pipeline per hour.

3.10.1.2 Determination Of Density

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance withJIS A 1210 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with JIS A 1214.

3.10.1.3 Deflection Testing

Conduct deflection test no sooner than 30 days after completion of final backfill and compaction testing. Clean or flush all lines prior to testing. Perform a deflection test on entire length of installed flexible pipeline upon completion of work adjacent to and over the pipeline, including backfilling, placement of fill, grading, paving, placement of concrete, and any other superimposed loads. Deflection of pipe in the installed pipeline under external loads shall not exceed limits in paragraph PLACING PIPE above as percent of the average inside diameter of pipe. Use a laser profiler or mandrel to determine if allowable deflection has been exceeded.

3.10.1.3.1 Laser Profiler

Inspect pipe interior with laser profiling equipment. Utilize low barrel distortion video equipment for pipe sizes 1.22 m or less. Use a camera with suitable lighting to allow a clear picture of the entire periphery of the pipe interior. Center the camera in the pipe both vertically and horizontally. The camera must be able to pan and tilt to a 90 degree angle with the axis of the pipe rotating 360 degrees. Use equipment to move the camera through the pipe that will not obstruct the camera's view or interfere with proper documentation of the pipe's condition. The video image shall be clear, focused, and relatively free from roll static or other image distortion qualities that would prevent the reviewer from

evaluating the condition of the pipe. For initial post installation inspections for pipe sizes larger than 1.22 m, a visual inspection shall be completed of the pipe interior.

3.10.1.3.2 Mandrel

Pass the mandrel through each run of pipe by pulling it by hand. If deflection readings in excess of the allowable deflection of average inside diameter of pipe are obtained, stop and begin test from the opposite direction. The mandrel must meet the Pipe Manufacture's recommendations and the following requirements. Provide a Mandrel that is rigid, nonadjustable, has a minimum of 9 fins, pulling rings at each end, and is engraved with the nominal pipe size and mandrel outside diameter. The mandrel must be 4.5 percent less than the certified-actual pipe diameter for Plastic Pipe. The Government will verify the outside diameter(OD)of the Contractor provided mandrel through the use of Contractor provided proving rings.

3.10.2 Inspection

3.10.2.1 Post-Installation Inspection

Visually inspect each segment of concrete pipe for alignment, settlement, joint separations, soil migration through the joint, cracks, buckling, bulging and deflection. An engineer must evaluate all defects to determine if any remediation or repair is required.

3.10.2.1.1 Concrete

Cracks with a width greater than 0.25 mm. An engineer must evaluate all pipes with cracks with a width greater than 0.25 mm but less than 2.5 mm to determine if any remediation or repair is required.

3.10.2.1.2 Flexible Pipe

Check each flexible pipe (PE, PVC)for rips, tears, joint separations, soil migration through the joint, cracks, localized bucking, bulges, settlement and alignment.

3.10.2.1.3 Post-Installation Inspection Report

The deflection results and final post installation inspection report must include: a copy of all video taken, pipe location identification, equipment used for inspection, inspector name, deviation from design, grade, deviation from line, deflection and deformation of flexible pipe, inspector notes, condition of joints, condition of pipe wall (e.g. distress, cracking, wall damage dents, bulges, creases, tears, holes, etc.).

3.10.3 Repair Of Defects

3.10.3.1 Leakage Test

When leakage exceeds the maximum amount specified, correct source of excess leakage by replacing damaged pipe and gaskets and retest.

3.10.3.2 Deflection Testing

When deflection readings are in excess of the allowable deflection of

average inside diameter of pipe are obtained, remove pipe which has excessive deflection and replace with new pipe. Retest 30 days after completing backfill, leakage testing and compaction testing.

3.10.3.3 Inspection

Replace pipe or repair defects indicated in the Post-Installation Inspection Report.

3.10.3.3.1 Concrete

Replace pipes having cracks with a width greater than 2.5 mm.

3.10.3.3.2 Flexible Pipe

Replace pipes having cracks or splits.

3.11 PROTECTION

Protect storm drainage piping and adjacent areas from superimposed and external loads during construction.

3.12 WARRANTY PERIOD

Pipe segments found to have defects during the warranty period must be replaced with new pipe and retested.

-- End of Section --

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SECTION 33 71 02

UNDERGROUND ELECTRICAL DISTRIBUTION

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. Contractor may substitute compatible Japan Industrial Standard (JIS), Ministry of Land, Infrastructure and Transport (MLIT), Japan Electrical Safety Inspection Associations or Japan Power Cable Accessories Association (JCAA) standards for non-Japanese standards, as approved by the Contracting Officer's representative.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

JAPANESE ELECTROTECHNICAL COMMITTEE (JEC)

JEC 3408	(2015) High voltage test of extra high voltage (11 kV to 500 kV) cross-linked polyethylene cable and connections

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS A 5506	(2008) Manhole Covers for Sewerage Works
JIS A 5372	(2016) Precast Reinforced Concrete Products
JIS C 0365	(2007) Protection Against Electric Shock - Common Aspects for Installation and Equipment
JIS C 2336	(2012) Pressure-sensitive polyvinyl chloride tapes for electrical purposes
JIS C 2338	(2012) Polyester adhesive tape for electrical insulation
JIS C 2805	(2010) Crimp terminal for copper wire
JIS C 2806	(2003) Bare crimping sleeve for copper wire
JIS C 2810	(1995) General rules on non-separable type wire connectors for interior wiring
JIS C 3101	(1994) Hard-drawn copper wires for electrical purposes
JIS C 3102	(1984) Annealed Copper Wires for Electrical Purposes

JIS C 3105	(1994) Hard-drawn copper stranded conductors
JIS C 3108	(2016) Hard-drawn aluminium wires for electric purposes
JIS C 3109	(1994) Hard-drawn aluminium stranded conductors
JIS C 3341	(2000) Polyvinyl chloride insulated drop service wires
JIS C 3362	(2009) 600 V Cross-linked polyethylene insulated cables
JIS C 3367	(2008) Power cables with extruded insulation and their accessories for rated voltages from 1 kV up to 30 kV -- Cables for rated voltages of 0.6/1 kV
JIS C 3605	(R2002) 600 V Polyethylene Insulated Cables, Type CV
JIS C 3606	(R2003) High-Voltage Cross-Linked Polyethylene Insulated Cables, Type CV or CE
JIS C 3612	(2002) 600V Flame Retardant Polyethylene Insulated Wires
JIS C 3653	(2004) Installation methods of power cables buried ground
JIS C 8305	(2019) Rigid Steel Conduits
JIS C 8330	(1999) Fittings for rigid metal conduits
JIS C 8340	(1999)Boxes And Box Covers For Rigid Metal Conduits
JIS C 8350	(1999) Fittings for pliable metal conduits
JIS C 8380	(1993) Plastic coated steel pipes for cable-ways
JIS C 8430	(2019) Unplasticized polyvinyl chloride (PVC-U) conduits
JIS C 8432	(2019) Fittings of unplasticized polyvinyl chloride (PVC-U) conduits
JIS C 60364-5-54	(2006) Building Electrical Equipment-Part 5-54: Selection Of Electrical Equipment and Contruction-Grounding Equipment, Protective Conductor and Protective Bonding Conductor
JIS C 60364-6	(2010) Low-voltage electrical installations -- Part 6: Verification

JIS C 60695-2-4-0	(1995) Fire hazard testing Part 2: Test methods -- Section 4/sheet 0: Diffusion type and premixed type flame test methods
JIS K 6741	(2016) Unplasticized Poly (Vinyl Chloride) (PVC-U) Pipes
JIS K 6743	(2016) Unplasticized Poly (Vinyl Chloride) (PVC-U) Pipe Fittings for Water Supply

JAPAN ELECTRICAL SAFETY INSPECTION ASSOCIATIONS

Denki Hoan Kyoukai	Japan Standard for Acceptance Testing and Inspections

JAPAN POWER CABLE ACCESSORIES ASSOCIATION STANDARDS (JCAA)

JCAA A 202	(1989) Indoor / outdoor termination connection for 3300V cross-linked polyethylene insulated power cable
JCAA A 203	(1992) Straight connection for 3300V cross-linked polyethylene insulated power cable
JCAA A 302	(1992) Indoor termination connection for 6600V cross-linked polyethylene insulated power cable
JCAA A 303	(1992) Outdoor termination connection for 6600V cross-linked polyethylene insulated power cable
JCAA A 305	(1992) Straight connection for 6600 V cross-linked polyethylene insulated power cable
JCAA A 501	(1988) Indoor termination connection for 22kV 33kV cross-linked polyethylene insulated power cable
JCAA A 502	(1988) Outdoor termination connection for 22kV 33kV cross-linked polyethylene insulated power cable
JCAA A 503	(1988) Straight connection for 22kV and 33kV cross-linked polyethylene insulated power cable

JAPAN WIRE INDUSTRY ASSOCIATION STANDARD (JCS)

JCS 0168-4	(2010) Calculation of allowable current for power cables under 33 kV- Part 4: Allowable current for 22 kV, 33 kV crosslinked polyethylene cables
JCS 0501	(2014) Allowable current calculation for power cables above 66kV

JCS 4516	(2010) 3300V Cross-Linked Polyethylene Cable
JCS 1226	(2003) Soft Stranded Wire

MINISTRY OF LAND, INFRASTRUCTURE, TRANSPORT AND TOURISM, GOVERNMENT OF JAPAN (MLIT)

MLIT DSKKS	Denki Setsubi Kouji Kanri Shishin (DSKKS) Electrical Construction Supervision Guidelines
MLIT ESS	(2019) MLIT Electrical Standard Specification (ESS)

THE SOCIETY OF HEATING, AIR-CONDITIONING AND SANITARY ENGINEERS OF JAPAN (SHASE)

SHASE-S 209	(2009) Manhole Cover

UNDERWRITERS LABORATORIES (UL)

UL 94	(2013; Reprint Sep 2017) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

[1.2 SYSTEM DESCRIPTION

Items provided under this section must be specifically suitable for the following service conditions. Seismic details must [conform to UFC 3-310-04, "Seismic Design for Buildings" and Sections 13 48 00 [SEISMIC] BRACING FOR MISCELLANEOUS EQUIPMENT and 26 05 48.00 10 SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT] [be as indicated].

a. Fungus Control [_____]

b. Altitude [_____] m.

c. Ambient Temperature [_____] degrees C.

d. Frequency [_____]

e. Ventilation [_____]

f. Seismic Parameters [_____]

g. Humidity Control [_____]

h. Corrosive Areas [_____]

i. [_____]

]1.3 RELATED REQUIREMENTS

Section 26 08 00 APPARATUS INSPECTION AND TESTING applies to this section, with the additions and modifications specified herein.

1.4 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined.

b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

c. Japan voltage range categories are defined as follows:
Low Voltage (Voltages less than 1kV)
High Voltage (Voltages 1kV thru 7kV)
Extra High Voltage (Voltages over 7kV)

d. In the text of this section, "[High][Extra-High] voltage cable splices," and "[High][Extra-High] voltage cable joints" are used interchangeably and have the same meaning.

[d. Underground structures subject to aircraft loading are indicated on the drawings.

]1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Precast underground structures; G[, [_____]]

SD-03 Product Data

[High][Extra-High] voltage cable; G[, [_____]]

[High][Extra-High] voltage cable joints; G[, [_____]]

[High][Extra-High] voltage cable terminations; G[, [_____]]

[Live end caps; G[, [_____]]

] Precast concrete structures; G[, [_____]]

Sealing Material

Pulling-In Irons

Manhole frames and covers; G[, [_____]]

Handhole frames and covers; G[, [_____]]

[Frames and Covers for Airfield Facilities; G[, [_____]]

][Ductile Iron Frames and Covers for Airfield Facilities; G[, [_____]]

] Composite/fiberglass handholes; G[, [_____]]

Cable supports (racks, arms and insulators); G[, [_____]]

[Protective Devices and Coordination Study; G[, [_____]]

][The study must be submitted with protective device equipment submittals. No time extension or similar contract modifications will be granted for work arising out of the requirements for this study. Approval of protective devices proposed must be based on recommendations of this study. The Government must not be held responsible for any changes to equipment, device ratings, settings, or additional labor for installation of equipment or devices ordered or procured prior to approval of the study.

] SD-06 Test Reports

Field Acceptance Checks and Tests;

1.6 QUALITY ASSURANCE

1.6.1 Precast Underground Structures

Submittal required for each type used. Provide calculations and drawings for precast manholes and handholes bearing the seal of a registered professional engineer including:

a. Material description (i.e., f'c and Fy)

b. Manufacturer's printed assembly and installation instructions

c. Design calculations

d. Reinforcing shop drawings in accordance with Manufacturer's recommendations.

e. Plans and elevations showing opening and pulling-in iron locations and details

1.6.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of IEEE C2 and JIS C 0365 unless more stringent requirements are specified or indicated.

1.6.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year

period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.6.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable, unless specified otherwise.

PART 2 PRODUCTS

2.1 CONDUIT, DUCTS, AND FITTINGS

2.1.1 Rigid Metal Conduit or Type G

JIS C 8305, Type G. Diameter of conduit shall be as indicated.

2.1.1.1 Rigid Metallic Conduit, PVC Coated or Type G; LL or LT

JIS C 8380, Type G; LL or LT.

2.1.2 Intermediate Metal Conduit or Type C

JIS C 8305, Type C.

2.1.2.1 Intermediate Metal Conduit, PVC Coated or Type C; LL or LT

JIS C 8380, Type C; LL or LT.

2.1.3 Plastic Conduit or Unplasticized Polyvinyl Chloride for Direct Burial and Riser Applications

[As indicated] [JIS C 3653, Type FEP] [or] JIS C 8430 for Type HIVE conduit of diameter of less than 100mm and JIS K 6741 for Type HIVP conduit diameter or 100mm and larger.

2.1.4 Plastic Duct or Unplasticized Polyvinyl Chloride for Concrete Encasement

Provide[as indicated][or JIS C 8430 for Type VE conduit of diameter of less than 100mm and JIS K 6741 for Type VP conduit diameter or 100mm and larger].

2.1.5 Innerduct

Provide corrugated [or solid wall] polyethylene (PE) or PVC innerducts, or fabric-mesh innerducts, with pullwire. Size as indicated.

2.1.6 Duct Sealant

UL 94 and JIS C 60695-2-4-0. Provide high-expansion urethane foam duct sealant that expands and hardens to form a closed, chemically and water resistant, rigid structure. Sealant must be compatible with common cable and wire jackets and capable of adhering to metals, plastics and concrete. Sealant must be capable of curing in temperature ranges of 2 degrees C to 35 degrees C. Cured sealant must withstand temperature ranges of -29 degrees C to 93 degrees C without loss of function.

2.1.7 Fittings

2.1.7.1 Metal Fittings

JIS C 8330 and JIS C 8350.

2.1.7.2 PVC or Unplasticized Polyvinyl Chloride Conduit Fittings

[JIS C 8432 for diameters less than 100mm][JIS K 6743 for diameters 100mm or larger].

[2.1.7.3 Outlet Boxes for Steel Conduit

Outlet boxes for use with rigid or flexible steel conduit must be cast-metal cadmium or zinc-coated if of ferrous metal with gasketed closures and must conform to JIS C 8340.

]2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors must be rated 600 volts and conform to the requirements of applicable codes and standards, including listing requirements[, or in accordance with JIS C 3362 or JIS C 3367]. Wires and cables manufactured more than [24][12] months prior to date of delivery to the site are not acceptable. Service entrance conductors must conform to JIS C 3341.

2.2.1 Conductor Types

Cable and duct sizes indicated are for copper conductors and [THHN/THWN][EM-IE][EM-CE] unless otherwise noted. Conductors 5.5 sqmm and smaller must be solid. Conductors 8 sqmm and larger must be stranded.[Conductors 14 sqmm and smaller must be copper. Conductors 22 sqmm and larger may be either copper or aluminum, at the Contractor's option. Do not substitute aluminum for copper if the equivalent aluminum conductor size would exceed 250 sqmm. When the Contractor chooses to use aluminum for conductors 22 sqmm and larger, the Contractor must: increase the conductor size to have the same ampacity as the copper size indicated; increase the conduit and pull box sizes to accommodate the larger size aluminum conductors in accordance with applicable codes and standards; ensure that the pulling tension rating of the aluminum conductor is sufficient; relocate equipment, modify equipment terminations, resize equipment, and resolve to the satisfaction of the Contracting Officer problems that are direct results of the use of aluminum conductors in lieu of copper.][All conductors must be copper.]

2.2.2 Conductor Material

Unless specified or indicated otherwise or required, wires in conduit, other than service entrance, must be 600-volt,conforming to [Type EM-IE

conforming to JIS C 3612][or][Type EM-CE, EM-CET or EM-ECEQ conforming to JIS C 3605]. Copper conductors must be annealed copper complying with JCS 1226 and JIS C 3102 and JIS C 3105.[Aluminum conductors must be Type AA-8000 aluminum conductors complying with JIS C 3108 and JIS C 3109, and must be of an aluminum alloy listed or labeled by UL as "component aluminum-wire stock (conductor material). Type 1350 is not acceptable. Intermixing of copper and aluminum conductors in the same raceway is not permitted.]

[2.2.3 Jackets

Multiconductor cables must have an overall PVC outer jacket.

][2.2.4 Direct Buried

Single-conductor [and multi-conductor]cables must be of a type identified for direct burial.

][2.2.5 In Duct

Cables must be single-conductor cable.[Cables in factory-installed, coilable-plastic-duct assemblies where extra physical protection is required.]

]2.2.6 Cable Marking

Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Identify each cable by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole, junction box, and each terminal. Each tag must contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Conductors must be color coded. Provide conductor identification within each enclosure where a tap, splice, or termination is made. Conductor identification must be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves,or colored electrical tape. Control circuit terminations must be properly identified. Color must be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals must be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems must be as follows:

a. Three-phase - Primary

(1) Phase A - red

(2) Phase B - white

(3) Phase C - blue

b. Three-phase - Secondary

(1) Phase A - red

(2) Phase B - black

(3) Phase C - blue

c. 480/277 volt, three phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

d. Single phase: Black and red

[d. On three-phase, four-wire delta system, high leg must be orange, as required.

]2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Must provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors.

a. For use with copper conductors: JIS C 2805, JIS C 2806 and JIS C 2810.

[b. For use with aluminum conductors: JIS C 2805, JIS C 2806 and JIS C 2810. For connecting aluminum to copper, connectors must be the circumferentially compressed, metallurgically bonded type.

]2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water.

2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material applied in accordance with the manufacturer's written instructions.

2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation must not require heat or flame, or any additional materials such as covering or adhesive. It must be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

2.5 [HIGH][EXTRA-HIGH] VOLTAGE CABLE

Cable (conductor) sizes are designated bymillimeters (mm) and square milimeters (sqmm). Conductor and conduit sizes indicated are for copper conductors unless otherwise noted. Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout cable length. Wires and cables manufactured more than [24][12] months prior to date of delivery to the site are not acceptable. Provide single conductor type cables unless otherwise indicated.

2.5.1 Cable Configuration

Provide [Type CVT, conforming to JCS 4516 for 3.3kV][Type EM-CET, conforming to JIS C 3606 for 6.6kV][or][Type EM-CET, conforming to JCS 0168-4 for 22kV and 33kV][Type CV-CVT, conforming to JCS 0501 for 66kV and 77kV].[concentric neutral underground distribution cable][metallic armored cables, consisting of three-conductor, multi-conductor cables, with insulation and shielding, as specified, using [a galvanized steel][an aluminum] interlocked tape armor and thermoplastic jacket]. Provide cables manufactured for use in[duct][or][direct burial] applications[as indicated]. Cable must be rated [3.3kV][5 kV][6.6kV][15 kV][22kV][25 kV][28 kV][33kV][35 kV][66kV][77kV][as indicated] with [[100][133] percent insulation level][[ ] insulation resistance].

2.5.2 Conductor Material

Provide concentric-lay-stranded, Class B[compact round] conductors. Provide[aluminum alloy conductors complying with JIS C 3108 and JIS C 3109][aluminum alloy cables, 3/4 hard minimum for regular concentric and compressed stranding or for compacted stranding][soft drawn copper cables complying with JCS 1226 and JIS C 3102 and JIS C 3105 for regular concentric and compressed stranding or JIS C 3606 for compact stranding].

2.5.3 Insulation

Provide [ethylene-propylene-rubber (EPR) insulation][tree-retardant cross-linked thermosetting polyethylene (XLP) insulation].

2.5.4 Shielding

Cables rated for 2 kV and above must have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper[tape][or][wire] shield for each phase.

2.5.5 Neutrals

[Neutral conductors must be [copper][aluminum], employing the same insulation and jacket materials as phase conductors, except that a 600-volt insulation rating is acceptable.][Concentric neutrals conductors must be copper, having a combined ampacity [equal to][1/3 of] the phase conductor ampacity rating.][For high impedance grounded neutral systems, the neutral conductors from the neutral point of the transformer or generator to the connection point at the impedance must utilize [copper][aluminum] conductors, employing the same insulation level and construction as the phase conductors.

]2.5.6 Jackets

Provide cables with a [PVC][_____] jacket.[Direct buried cables must be rated for direct burial.][Provide type UD cables with an overall jacket.] [Provide PVC jackets with a separator that prevents contact with underlying semiconducting insulating shield.]

2.6 [HIGH][EXTRA-HIGH] VOLTAGE CABLE TERMINATIONS

Provide indoor terminator/outdoor terminations with skirts. [JCAA A 202 for 3.3kV][JCAA A 302 and JCAA A 303 for 6.6kV][JCAA A 501 and JCAA A 502 for 22kV and 33kV][JEC 3408 for 66kV and 77kV]; of the molded elastomer,

prestretched elastomer, or heat-shrinkable elastomer. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations, where required, must be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, or armor. Terminations must be provided in a kit, including: skirts, stress control terminator, ground clamp, connectors, lugs, and complete instructions for assembly and installation. Terminations must be the product of one manufacturer, suitable for the type, diameter, insulation class and level, and materials of the cable terminated. Do not use separate parts of copper or copper alloy in contact with aluminum alloy parts in the construction or installation of the terminator.

2.6.1 Cold-Shrink Type

Terminator must be a one-piece design, utilizing the manufacturer's latest technology, where high-dielectric constant (capacitive) stress control is integrated within a skirted insulator made of silicone rubber. Termination must not require heat or flame for installation. Termination kit must contain all necessary materials (except for the lugs). Termination must be designed for installation in low or highly contaminated indoor and outdoor locations and must resist ultraviolet rays and oxidative decomposition.

2.6.2 Heat Shrinkable Type

Terminator must consist of a uniform cross section heat shrinkable polymeric construction stress relief tubing and environmentally sealed outer covering that is nontracking, resists heavy atmospheric contaminants, ultra violet rays and oxidative decomposition. Provide heat shrinkable sheds or skirts of the same material. Termination must be designed for installation in low or highly contaminated indoor or outdoor locations.

[2.6.3 Separable Insulated Connector Type

Provide connector with steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material. Provide connectors of the loadbreak or deadbreak type as indicated, of suitable construction for the application and the type of cable connected, and that include cable shield adaptors. Provide external clamping points and test points. Separable connectors must not be used in manholes/handholes.

[a. 200 Ampere loadbreak connector ratings: Voltage: [15 kV, 95 kV BIL][25 kV, 125 kV BIL][35 kV, 150 kV BIL]. Short time rating: 10,000 rms symmetrical amperes.
]
[b. 600 Ampere deadbreak connector ratings: Voltage: [15 kV, 95 kV BIL][25 kV, 125 kV BIL][35 kV, 150 kV BIL]. Short time rating: 25,000 rms symmetrical amperes.[Connectors must have 200 ampere bushing interface[for surge arresters][as indicated].]
]
[c. Provide[[one][_____] set[s] of three grounding elbows][and][[one][_____] set[s] of three feed-thru inserts]. Deliver [grounding elbows][and][feed-thru inserts] to the Contracting Officer.
]

[d. Install one set of faulted circuit indicators on the test points of each set of separable insulated connectors. Indicators must be self powered; with automatic trip with mechanical flag indication upon overcurrent followed by loss of system voltage, and automatic reset upon restoration of system voltage. Indicators must be compact, sealed corrosion resistant construction with provision for hotstick installation and operation.

]]2.7 [HIGH][EXTRA-HIGH] VOLTAGE CABLE JOINTS

Provide joints (splices) in accordance with [JCAA A 203 for 3.3kV][JCAA A 305 for 6.6kV][JCAA A 503 for 22kV and 33 kV][JEC 3408 for 66kV and 77kV] suitable for the rated voltage, insulation level, insulation type, and construction of the cable. Joints must be certified by the manufacturer for waterproof, submersible applications. Upon request, supply manufacturer's design qualification test report in accordance with [JCAA A 203 for 3.3kV][JCAA A 305 for 6.6kV][JCAA A 503 for 22kV and 33 kV][JEC 3408 for 66kV and 77kV]. Connectors for joint must be tin-plated electrolytic copper, having ends tapered and having center stops to equalize cable insertion.

2.7.1 Heat-Shrinkable Joint

Consists of a uniform cross-section heat-shrinkable polymeric construction with a linear stress relief system, a high dielectric strength insulating material, and an integrally bonded outer conductor layer for shielding. Replace original cable jacket with a heavy-wall heat-shrinkable sleeve with hot-melt adhesive coating.

2.7.2 Cold-Shrink Rubber-Type Joint

Joint must be of a cold shrink design that does not require any heat source for its installation. Splice insulation and jacket must be of a one-piece factory formed cold shrink sleeve made of black EPDM rubber. Splice must be packaged three splices per kit, including complete installation instructions.

2.8 TELECOMMUNICATIONS CABLING

Provide telecommunications cabling in accordance with Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP).

[2.9 LIVE END CAPS

Provide live end caps using a "kit" including a heat-shrinkable tube and a high dielectric strength, polymeric plug overlapping the conductor. End cap must conform to applicable portions of [JCAA A 202 for 3.3kV][JCAA A 302 and JCAA A 303 for 6.6kV][JCAA A 501 and JCAA A 502 for 22kV and 33kV][JEC 3408 for 66kV and 77kV].

]2.10 TAPE

2.10.1 Insulating Tape

JIS C 2336 and JIS C 2338, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.10.2 Buried Warning and Identification Tape

Provide detectable tape in accordance with Section [31 23 00.00 20 EXCAVATION AND FILL][31 00 00 EARTHWORK].

2.10.3 Fireproofing Tape

Provide tape composed of a flexible, conformable, unsupported intumescent elastomer. Tape must be not less than 0.762 mm thick, noncorrosive to cable sheath, self-extinguishing, noncombustible, adhesive-free, and must not deteriorate when subjected to oil, water, gases, salt water, sewage, and fungus.

2.11 PULL ROPE

Plastic or flat pull line (bull line) having a minimum tensile strength of 890 N.

2.12 GROUNDING AND BONDING

2.12.1 Driven Ground Rods

Provide [copper-clad steel ground rods conforming to JIS C 60364-5-54][solid copper ground rods conforming to JIS C 60364-5-54][solid stainless steel ground rods] not less than [19 mm] in diameter by [3.1 m] in length. Sectional type rods may be used for rods 6 meters or longer.

2.12.2 Grounding Conductors

Stranded-bare copper conductors must conform to JIS C 3105 soft-drawn unless otherwise indicated. Solid-bare copper conductors must conform to JIS C 3101 for sizes 8 sqmm and smaller. Insulated conductors must be of the same material as phase conductors and green color-coded, except that conductors must be rated no more than 600 volts. Aluminum is not acceptable.

2.13 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE. In addition, provide concrete for encasement of underground ducts with 20 MPa minimum 28-day compressive strength. Concrete associated with electrical work for other than encasement of underground ducts must be 30 MPa minimum 28-day compressive strength unless specified otherwise.

2.14 UNDERGROUND STRUCTURES

Provide precast concrete underground structures or standard type cast-in-place manhole types as indicated, conforming to JIS A 5372. Top, walls, and bottom must consist of reinforced concrete. Walls and bottom must be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers must fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings must be free from warp and blow holes that may impair strength or appearance. Exposed metal must have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack

arms and insulators, must be adequate to accommodate the cable.

2.14.1 Cast-In-Place Concrete Structures

Concrete must conform to Section 03 30 00 CAST-IN-PLACE CONCRETE.[Construct walls on a footing of cast-in-place concrete except that precast concrete base sections may be used for precast concrete manhole risers.][Concrete block must conform to Section 04 20 00, MASONRY.][Concrete block is not allowed in areas subject to aircraft loading.]

2.14.2 Precast Concrete Structures, Risers and Tops

Precast concrete underground structures may be provided in lieu of cast-in-place subject to the requirements specified below. Precast units must be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

2.14.2.1 General

Precast concrete structures must have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures must have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction must be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work must have a 28-day compressive strength of not less than 30 MPa. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures must be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

2.14.2.2 Design for Precast Structures

In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

a. Angle of Internal Friction (phi) = 0.523 rad

b. Unit Weight of Soil (Dry) = 1760 kg/m^3, (Saturated) = 2080 kg/m^3

c. Coefficient of Lateral Earth Pressure (Ka) = 0.33

d. Ground Water Level = 915 mm below ground elevation

e. Vertical design loads must include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads must consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load must be for H20 highway loading.

f. Horizontal design loads must include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of

vertical design loads, including impact, must be considered, along with a pulling-in iron design load of 26,700 N.

g. Each structural component must be designed for the load combination and positioning resulting in the maximum shear and moment for thatparticular component.

h. Design must also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

2.14.2.3 Construction

Structure top, bottom, and wall must be of a uniform thickness of not less than 150 mm. Thin-walled knock-out panels for designed or future duct bank entrances are not permitted. Provide quantity, size, and location of duct bank entrance windows as directed, and cast completely open by the precaster. Size of windows must exceed the nominal duct bank envelope dimensions by at least 305 mm vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows must be a minimum of 150 mm from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 13 bars around window openings. Provide drain sumps a minimum of 305 mm in diameter and 100 mm deep for precast structures.

2.14.2.4 Joints

Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

2.14.3 Manhole Frames and Covers

Provide cast iron frames and covers for manholes conforming to SHASE-S 209 and JIS A 5506. Cast the words "ELECTRIC" or "TELECOMMUNICATIONS" in the top face of power and telecommunications manhole covers, respectively.

2.14.4 Handhole Frames and Covers

Frames and covers of steel must be welded by qualified welders in accordance with standard commercial practice. Steel covers must be rolled-steel floor plate having an approved antislip surface. Hinges must be of [stainless steel with bronze hinge pin] [wrought steel], 125 by 125 mm by approximately 4.75 mm thick, without screw holes, and must be for full surface application by fillet welding. Hinges must have nonremovable pins and five knuckles. The surfaces of plates under hinges must be true after the removal of raised antislip surface, by grinding or other approved method.

[2.14.5 Frames and Covers for Airfield Facilities

Fabricate frames and covers for airfield use of standard commercial grade steel welded by qualified welders. Covers must be of rolled steel floor plate having an approved anti-slip surface. Steel frames and covers must be hot dipped galvanized after fabrication.

][2.14.6 Ductile Iron Frames and Covers for Airfield Facilities

At the contractor's option, ductile iron covers and frames designed for a minimum proof load of 45,000 kg may be provided in lieu of the steel frames and covers indicated. Covers must be of the same material as the frames (i.e. ductile iron frame with ductile iron cover, galvanized steel frame with galvanized steel cover). Perform proof loading in accordance with applicable codes and standards. Proof loads must be physically stamped into the cover. Provide the Contracting Officer copies of previous proof load test results performed on the same frames and covers as proposed for this contract. Modify the top of the structure to accept the ductile iron structure in lieu of the steel structure indicated. The finished structure must be level and non-rocking, with the top flush with the surrounding pavement.

]2.14.7 Brick for Manhole Collar

Provide sewer and manhole brick as required per applicable codes and standards.

2.14.8 Composite/Fiberglass Handholes and Covers

Provide handholes and covers of polymer concrete, reinforced with heavy weave fiberglass with a design load (Tier rating) appropriate for or greater than the intended use. All covers are required to have the Tier level rating embossed on the surface and this rating must not exceed the design load of the box.

2.15 CABLE SUPPORTS (RACKS, ARMS, AND INSULATORS)

The metal portion of racks and arms must be zinc-coated after fabrication.

2.15.1 Cable Rack Stanchions

The wall bracket or stanchion must be 100 mm by approximately 38 mm by 4.76 mm channel steel, or 100 mm by approximately 25 mm glass-reinforced nylon with recessed bolt mounting holes, 1220 mm long (minimum) in manholes. Slots for mounting cable rack arms must be spaced at 200 mm intervals.

2.15.2 Rack Arms

Cable rack arms must be steel or malleable iron or glass reinforced nylon and must be of the removable type. Rack arm length must be a minimum of 200 mm and a maximum of 305 mm.

2.15.3 Insulators

Insulators for metal rack arms must be dry-process glazed porcelain. Insulators are not required for nylon arms.

2.16 CABLE TAGS IN MANHOLES

Provide tags for each power cable located in manholes. The tags must be polyethylene. Do not provide handwritten letters. The first position on the power cable tag must denote the voltage. The second through sixth positions on the tag must identify the circuit. The next to last position must denote the phase of the circuit and include the Greek "phi" symbol. The last position must denote the cable size. As an example, a tag could have the following designation: "11.5 NAS 1-8(Phase A)500," denoting that the tagged cable is on the 11.5kV system circuit number NAS 1-8, underground, Phase A, sized at 500 kcmil.

2.16.1 Polyethylene Cable Tags

Provide tags of polyethylene that have an average tensile strength of 22.4 MPa; and that are 2 millimeter thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 77 degrees C. Provide 1.3 mm (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties must have a minimum loop tensile strength of 778.75 N. The cable tags must have black block letters, numbers, and symbols 25 mm high on a yellow background. Letters, numbers, and symbols must not fall off or change positions regardless of the cable tags' orientation.

2.17 [HIGH][EXTRA-HIGH] VOLTAGE ABOVE GROUND CABLE TERMINATING CABINETS

Cable terminating cabinets must be hook-stick operable, deadfront construction. Provide cabinets with [200 A. loadbreak junctions and elbow-type separable loadbreak connectors, cable parking stands, and grounding lugs][600 A. dead-break junctions and elbow-type separable dead-break connectors, cable parking stands, and grounding lugs]. Provide cable terminating equipment [as indicated].

Ratings at [50][60] Hz must be:

Nominal voltage (kV)	[_____]
Rated maximum voltage (kV)	[[3.3][6.6][15][22][25
Rated continuous current (A)	[[200][600]]
One-second short-time current-carrying capacity (kA)	[_____]
BIL (kV)	[_____]

2.18 LOW VOLTAGE ABOVE GROUND TERMINATION PEDESTAL

Provide copolymer polypropylene, low voltage above ground termination pedestal manufactured through an injection molding process. Pedestals must resist fertilizers, salt air environments and ultra-violet radiation. Pedestal top must be imprinted with a "WARNING" and "ELECTRIC" identification. Pedestal must contain [three][four] lay-in six port connectors. Connectors must be dual rated for aluminum or copper, and

capable of terminating conductors ranging from [5.5 sqmm to 250 sqmm]. Protect each connector with a clear, hard lexan (plastic) cover. Pedestal must be provided with rust-free material and stainless steel hardware. Pedestal must be lockable.

2.19 PROTECTIVE DEVICES AND COORDINATION

Provide protective devices and coordination as specified in Section 26 28 01.00 10 COORDINATED POWER SYSTEM PROTECTION.

2.20 SOURCE QUALITY CONTROL

2.20.1 Arc-Proofing Test for Cable Fireproofing Tape

Manufacturer must test one sample assembly consisting of a straight lead tube 305 mm long with a 65.5 mm outside diameter, and a 3.175 mm thick wall, and covered with one-half lap layer of arc and fireproofing tape per manufacturer's instructions. The arc and fireproofing tape must withstand extreme temperature of a high-current fault arc 13,000 degrees K for 70 cycles as determined by using an argon directed plasma jet capable of constantly producing and maintaining an arc temperature of 13,000 degrees K. Temperature (13,000 degrees K) of the ignited arc between the cathode and anode must be obtained from a dc power source of 305 (plus or minus 5) amperes and 20 (plus or minus 1) volts. The arc must be directed toward the sample assembly accurately positioned 5 (plus or minus 1) millimeters downstream in the plasma from the anode orifice by fixed flow rate of argon gas (0.18 g per second). Each sample assembly must be tested at three unrelated points. Start time for tests must be taken from recorded peak current when the specimen is exposed to the full test temperature. Surface heat on the specimen prior to that time must be minimal. The end point is established when the plasma or conductive arc penetrates the protective tape and strikes the lead tube. Submittals for arc-proofing tape must indicate that the test has been performed and passed by the manufacturer.

2.20.2 [HIGH][EXTRA-HIGH] Voltage Cable Qualification and Production Tests

Results of qualification and production tests as applicable for each type of [high][extra-high] voltage cable.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of applicable codes and standards and IEEE C2. In addition to these requirements, install telecommunications in accordance with MLIT ESS.

3.2 CABLE INSPECTION

Inspect each cable reel for correct storage positions, signs of physical damage, and broken end seals prior to installation. If end seal is broken, remove moisture from cable prior to installation in accordance with the cable manufacturer's recommendations.

[3.3 CABLE INSTALLATION PLAN AND PROCEDURE

Obtain from the manufacturer an installation manual or set of instructions

which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature limits for installation, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, maximum allowable pulling tension, and maximum allowable sidewall bearing pressure. [Prepare a checklist of significant requirements][Perform pulling calculations and prepare a pulling plan] and submit along with the manufacturer's instructions in accordance with SUBMITTALS. Install cable strictly in accordance with the cable manufacturer's recommendations and the approved installation plan.

[Calculations and pulling plan must include:

a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.

b. List of cable installation equipment.

c. Lubricant manufacturer's application instructions.

d. Procedure for resealing cable ends to prevent moisture from entering cable.

e. Cable pulling tension calculations of all cable pulls.

f. Cable percentage conduit fill.

g. Cable sidewall bearing pressure.

h. Cable minimum bend radius and minimum diameter of pulling wheels used.

i. Cable jam ratio.

j. Maximum allowable pulling tension on each different type and size of conductor.

k. Maximum allowable pulling tension on pulling device.

]]3.4 UNDERGROUND FEEDERS SUPPLYING BUILDINGS

Terminate underground feeders supplying building at a point 1525 mm outside the building and projections thereof, except that conductors must be continuous to the terminating point indicated. Coordinate connections of the feeders to the service entrance equipment with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide [PVC, Type EPC-40][IMC][RGS][Type G][Type FEP][Type VP][Type VE][Type HIVP][Type HIVE] conduit from the supply equipment to a point 1525 mm outside the building and projections thereof. Protect ends of underground conduit with plastic plugs until connections are made.

[Encase the underground portion of the conduit in a concrete envelope and bury as specified for underground duct with concrete encasement.

]3.5 UNDERGROUND STRUCTURE CONSTRUCTION

Provide standard type cast-in-place construction as specified herein and as indicated, or precast construction as specified herein. Horizontal concrete surfaces of floors must have a smooth trowel finish. Cure concrete by applying two coats of white pigmented membrane forming-curing

compound in strict accordance with the manufacturer's printed instructions, except that precast concrete may be steam cured. Curing compound must conform to manufacturer's recommendations. Locate duct entrances and windows in the center of end walls (shorter) and near the corners of sidewalls (longer) to facilitate cable racking and splicing. Covers for underground structures must fit the frames without undue play. Steel and iron must be formed to shape and size with sharp lines and angles. Castings must be free from warp and blow holes that may impair strength or appearance. Exposed metal must have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Manhole locations, as indicated, are approximate. Coordinate exact manhole locations with other utilities and finished grading and paving.

3.5.1 Cast-In-Place Concrete Structures

[Construct walls on a footing of cast-in-place concrete except that precast concrete base sections may be used for precast concrete manhole risers.][Provide concrete block conforming to Section 04 20 00 MASONRY.][Concrete block is not allowed in areas subject to aircraft loading.]

3.5.2 Precast Concrete Construction

Set commercial precast structures on 150 mm of level, 90 percent compacted granular fill, 19 mm to 25 mm size, extending 305 mm beyond the structure on each side. Compact granular fill by a minimum of four passes with a plate type vibrator. Installation must additionally conform to the manufacturer's instructions.

3.5.3 Pulling-In Irons

Provide steel bars bent as indicated, and cast in the walls and floors. Alternatively, pipe sleeves may be precast into the walls and floors where required to accept U-bolts or other types of pulling-in devices possessing the strengths and clearances stated herein. The final installation of pulling-in devices must be made permanent. Cover and seal exterior projections of thru-wall type pulling-in devices with an appropriate protective coating. In the floor the irons must be a minimum of 150 mm from the edge of the sump, and in the walls the irons must be located within 150 mm of the projected center of the duct bank pattern or precast window in the opposite wall. However, the pulling-in iron must not be located within 150 mm of an adjacent interior surface, or duct or precast window located within the same wall as the iron. If a pulling-in iron cannot be located directly opposite the corresponding duct bank or precast window due to this clearance limitation, locate the iron directly above or below the projected center of the duct bank pattern or precast window the minimum distance required to preserve the 150 mm clearance previously stated. In the case of directly opposing precast windows, pulling-in irons consisting of a 915 mm length of No. 5 reinforcing bar, formed into a hairpin, may be cast-in-place within the precast windows simultaneously with the end of the corresponding duct bank envelope. Irons installed in this manner must be positioned directly in line with, or when not possible, directly above or below the projected center of the duct bank pattern entering the opposite wall, while maintaining a minimum clear distance of 75 mm from any edge of the cast-in-place duct bank envelope or any individual duct. Pulling-in irons must have a clear projection into the structure of approximately 100 mm and must be designed to withstand a

minimum pulling-in load of 26,700 N. Irons must be hot-dipped galvanized after fabrication.

3.5.4 Cable Racks, Arms and Insulators

Cable racks, arms and insulators must be sufficient to accommodate the cables. Space racks in power manholes not more than 915 mm apart, and provide each manhole wall with a minimum of two racks. Space racks in signal manholes not more than 420 mm apart with the end rack being no further than 305 mm from the adjacent wall. Methods of anchoring cable racks must be as follows:

a. Provide a 15 mm diameter by 125 mm long anchor bolt with 75 mm foot cast in structure wall with 50 mm protrusion of threaded portion of bolt into structure. Provide 15 mm steel square head nut on each anchor bolt. Coat threads of anchor bolts with suitable coating immediately prior to installing nuts.

b. Provide concrete channel insert with a minimum load rating of 1192 kg per meter. Insert channel must be steel of the same length as "vertical rack channel;" channel insert must be cast flush in structure wall. Provide 15 mm steel nuts in channel insert to receive 15 mm diameter by 75 mm long steel, square head anchor bolts.

c. Provide concrete "spot insert" at each anchor bolt location, cast flush in structure wall. Each insert must have minimum 365 kg load rating. Provide 15 mm diameter by 75 mm long steel, square head anchor bolt at each anchor point. Coat threads of anchor bolts with suitable coating immediately prior to installing bolts.

3.5.5 Field Painting

Cast-iron frames and covers not buried in concrete or masonry must be cleaned of mortar, rust, grease, dirt and other deleterious materials, and given a coat of bituminous paint.

[3.6 DIRECT BURIAL CABLE SYSTEM

Cables must be buried directly in the earth below the frostline [as indicated][to the requirements of IEEE C2 and JIS C 0365, whichever is more stringent].

3.6.1 Trenching

Excavate trenches for direct-burial cables to provide a minimum cable cover of 610 mm below finished grade for power conductors operated at 600 volts or less, and 765 mm below finished grade for over 600 volts in accordance with IEEE C2 and JIS C 0365. When rock is encountered, remove to a depth of at least 75 mm below the cable and fill the space with sand or clean earth free from particles larger than 6 mm. Bottoms of trenches must be smooth and free of stones and sharp objects. Where materials in bottoms of trenches are other than sand, a 75 mm 3 inch layer of sand must be laid first and compacted to approximate densities of surrounding firm soil. Trenches must be not less than [150][200] mm wide, and must be in straight lines between cable markers.[Cable plows must not be used.] Bends in trenches must have a radius [of not less than 915 mm][consistent with the cable manufacturer's published minimum cable bending radius for the cable installed].

3.6.2 Cable Installation

Unreel cables along the sides of or in trenches and carefully place on sand or earth bottoms. Pulling cables into direct-burial trenches from a fixed reel position is not permitted, except as required to pull cables through conduits under paving or railroad tracks.

Where two or more cables are laid parallel in the same trench, space cables laterally at not less than 75 mm apart, except that communication cable must be separated from power cable by a minimum distance of 305 mm.

Where direct-burial cables cross under roads or other paving exceeding 1.5 m in width, such cables must be installed in[concrete-encased] ducts. Where direct-burial cables cross under railroad tracks, such cables must be installed in [reinforced concrete-encased ducts][ducts installed through rigid galvanized steel sleeves]. Ducts must extend at least 1.5 m beyond each edge of any paving and at least 1.5 m beyond each side of any railroad tracks. Cables may be pulled into duct from a fixed reel where suitable rollers are provided in the trench. Where direct burial cable transitions to duct-enclosed cable, direct-burial cables must be centered in duct entrances, and a waterproof nonhardening mastic compound must be used to facilitate such centering. If paving or railroad tracks are in place where cables are to be installed, coated rigid steel conduits driven under the paving or railroad tracks may be used in lieu of concrete-encased ducts. Prevent damage to conduit coatings by providing ferrous pipe jackets or by predrilling. Where cuts are made in any paving, the paving and subbase must be restored to their original condition. Where cable is placed in duct(e.g. under paved areas, roads, or railroads), slope ducts to drain.

3.6.3 Splicing

Provide cables in one piece without splices between connections except where the distance exceeds the lengths in which cables are manufactured.[Where splices are required, provide splices designed and rated for direct burial.][Where splices are required, install splices only in maintenance manholes/handholes or cabinets/pedestals.]

3.6.4 Bends

Bends in cables must have an inner radius not less than those specified for the type of cable, per manufacturer's recommendation.

3.6.5 Horizontal Slack

Leave approximately 915 mm of horizontal slack in the ground on each end of cable runs, on each side of connection boxes, and at points where connections are brought above ground. Where cable is brought above ground, leave additional slack to make necessary connections.[Enclose splices in lead-sheathed or armored cables in split-type cast-iron splice boxes; after completion of the connection, fill with insulating filler compound and tightly clamp the box.]

3.6.6 Identification Slabs[or Markers]

Provide a slab at each change of direction of cable, over the ends of ducts or conduits which are installed under paved areas and roadways[, over the ends of ducts or conduits stubbed out for future use][, and over each splice]. Identification slabs must be of concrete, approximately 500

mm square by 150 mm thick and must be set flat in the ground so that top surface projects not less than 20 mm, nor more than 30 mm above ground. Concrete must have a compressive strength of not less than 20 MPa and have a smooth troweled finish on exposed surface. Inscribe an identifying legend such as "electric cable," "telephone cable," "splice," or other applicable designation on the top surface of the slab before concrete hardens. Inscribe circuit identification symbols on slabs as indicated. Letters or figures must be approximately 50 mm high and grooves must be approximately 6 mm in width and depth. Install slabs so that the side nearest the inscription on top must include an arrow indicating the side nearest the cable. Provide color, type and depth of warning tape as specified in Section [31 23 00.00 20 EXCAVATION AND FILL][31 00 00 EARTHWORK].

]3.7 UNDERGROUND CONDUIT AND DUCT SYSTEMS

3.7.1 Requirements

Run conduit in straight lines except where a change of direction is necessary. Provide numbers and sizes of ducts as indicated. Provide a 100 sqmm bare copper grounding conductor for [high][extra-high]-voltage distribution duct banks as indicated in drawings. Bond grounding conductor to ground rings (loops) in all manholes and to ground rings (loops) at all equipment slabs (pads). Route grounding conductor into manholes with the duct bank (sleeving is not required). Ducts must have a continuous slope downward toward underground structures and away from buildings, laid with a minimum slope of [75 mm][100 mm] per 30 m. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Provide ducts with end bells whenever duct lines terminate in structures.

Perform changes in ductbank direction as follows:

a. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable.

b. The minimum manufactured bend radius must be 450 mm for ducts of less than 80 mm diameter, and 900 mm for ducts 80 mm or greater in diameter.

c. As an exception to the bend radius required above, provide field manufactured longsweep bends having a minimum radius of 7.6 m for a change of direction of more than 5 degrees, either horizontally or vertically, using a combination of curved and straight sections. Maximum manufactured curved sections: 30 degrees.

3.7.2 Treatment

Ducts must be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers must be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer must be used whenever an existing duct is connected to a duct of different material or shape. Ducts must be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts must be thoroughly cleaned before being laid. Plastic ducts must be stored on a flat surface and protected from the direct rays of the sun.

3.7.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes 75 mm and larger, draw a flexible testing mandrel approximately 305 mm long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than 75 mm, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

3.7.4 Jacking and Drilling Under Roads and Structures

Conduits to be installed under existing paved areas which are not to be disturbed, and under roads and railroad tracks, must be zinc-coated, rigid steel, jacked into place. Where ducts are jacked under existing pavement, rigid steel conduit must be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 15 m in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks must be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 1.2 m on centers. [Hydraulic jet method must not be used.]

[3.7.5 Galvanized Conduit Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations must be PVC coated and must extend from at least 50 mm within the concrete to the first coupling or fitting outside the concrete (minimum of 150 mm from penetration).

]3.7.6 Multiple Conduits

Separate multiple conduits by a minimum distance of 75 mm[, except that light and power conduits must be separated from control, signal, and telephone conduits by a minimum distance of [300] mm]. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly must consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 3050 mm of conduit assembly.

3.7.7 Conduit Plugs and Pull Rope

New conduit indicated as being unused or empty must be provided with plugs on each end. Plugs must contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 915 mm of slack at each end of unused or empty conduits.

3.7.8 Conduit and Duct Without Concrete Encasement

Depths to top of the conduit must be not less than 610 mm below finished grade. Provide not less than 75 mm clearance from the conduit to each side of the trench. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 75 mm, fill and tamp level with original bottom with sand or

earth free from particles, that would be retained on a 6.25 mm sieve. The first 150 mm layer of backfill cover must be sand compacted as previously specified. The rest of the excavation must be backfilled and compacted in 75 to 150 mm layers. Provide color, type and depth of warning tape as specified in Section [31 23 00.00 20 EXCAVATION AND FILL][31 00 00 EARTHWORK].

3.7.8.1 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 75 mm concrete cover around ducts. Concrete encasement must extend at least 1525 mm beyond the edges of paved areas and roads, and 3660 mm beyond the rails on each side of railroad tracks. Depths to top of the concrete envelope must be not less than 610 mm below finished grade[, and under railroad tracks not less than 1270 mm below the top of the rails].

[3.7.8.2 Directional Boring

HDPE conduits must be installed below the frostline and as specified herein.

[For distribution voltages greater than 1000 volts and less than 34,500 volts, depths to the top of the conduit must not be less than 1220 mm in pavement-covered areas and not less than 3050 mm in non-pavement-covered areas.][For distribution voltages less than 1000 volts, depths to the top of the conduit must not be less than 1220 mm in pavement- or non-pavement-covered areas.][For branch circuit wiring less than 600 volts, depths to the top of the conduit must not be less than 610 mm in pavement- or non-pavement-covered areas.]

]3.7.9 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Depths to top of the concrete envelope must be not less than 450 mm below finished grade[, except under roads and pavement, concrete envelope must be not less than 610 mm below finished grade][, and under railroad tracks not less than 1270 mm below the top of the rails]. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank must be rectangular in cross-section and must provide at least 75 mm of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 75 mm. Before pouring concrete, anchor duct bank assemblies to prevent the assemblies from floating during concrete pouring. Anchoring must be done by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly.[Provide steel reinforcing in the concrete envelope as indicated.][Provide color, type and depth of warning tape as specified in Section [31 00 00 EARTHWORK][31 23 00.00 20 EXCAVATION AND FILL.]]

3.7.9.1 Connections to Manholes

Duct bank envelopes connecting to underground structures must be flared to have enlarged cross-section at the manhole entrance to provide additional shear strength. Dimensions of the flared cross-section must be larger than the corresponding manhole opening dimensions by no less than 300 mm in each direction. Perimeter of the duct bank opening in the underground structure must be flared toward the inside or keyed to provide a positive interlock between the duct bank and the wall of the structure. Use vibrators when this portion of the encasement is poured to assure a seal

between the envelope and the wall of the structure.

3.7.9.2 Connections to Existing Underground Structures

For duct bank connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and [extend into][bend out to tie into the reinforcing of] the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

3.7.9.3 Connections to Existing Concrete Pads

For duct bank connections to concrete pads, break an opening in the pad out to the dimensions required and preserve steel in pad. Cut the steel and [extend into][bend out to tie into the reinforcing of] the duct bank envelope. Chip out the opening in the pad to form a key for the duct bank envelope.

3.7.9.4 Connections to Existing Ducts

Where connections to existing duct banks are indicated, excavate the banks to the maximum depth necessary. Cut off the banks and remove loose concrete from the conduits before new concrete-encased ducts are installed. Provide a reinforced concrete collar, poured monolithically with the new duct bank, to take the shear at the joint of the duct banks.[Remove existing cables which constitute interference with the work.][Abandon in place those no longer used ducts and cables which do not interfere with the work.]

3.7.9.5 Partially Completed Duct Banks

During construction wherever a construction joint is necessary in a duct bank, prevent debris such as mud, and, and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of 610 mm back into the envelope and a minimum of 610 mm beyond the end of the envelope. Provide one No. 13 bar in each corner, 75 mm from the edge of the envelope. Secure corner bars with two No. 10 ties, spaced approximately 305 mm apart. Restrain reinforcing assembly from moving during concrete pouring.

[3.7.9.6 Removal of Ducts

Where duct lines are removed from existing underground structures, close the openings to waterproof the structure. Chip out the wall opening to provide a key for the new section of wall.

]3.7.10 Duct Sealing

Seal all electrical penetrations for radon mitigation, maintaining integrity of the vapor barrier, and to prevent infiltration of air, insects, and vermin.

3.8 CABLE PULLING

[Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables.]Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation. Use

flexible cable feeds to convey cables through manhole opening and into duct runs. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into switches, transformers, switchgear, switchboards, and other enclosures. Cable with[tape][or][wire] shield must have a bending radius not less than 12 times the overall diameter of the completed cable. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.8.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables.

3.9 CABLES IN UNDERGROUND STRUCTURES

Do not install cables utilizing the shortest path between penetrations, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space open for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure.

3.9.1 Cable Tag Installation

Install cable tags in each manhole as specified, including each splice. Tag wire and cable provided by this contract. Install cable tags over the fireproofing, if any, and locate the tags so that they are clearly visible without disturbing any cabling or wiring in the manholes.

3.10 CONDUCTORS INSTALLED IN PARALLEL

Conductors must be grouped such that each conduit of a parallel run contains 1 Phase A conductor, 1 Phase B conductor, 1 Phase C conductor, and 1 neutral conductor.

3.11 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing material has completely set.[Make splices in underground distribution systems only in accessible locations such as manholes, handholes, or aboveground termination pedestals.]

[3.11.1 Terminating Aluminum Conductors

a. Use particular care in making up joints and terminations. Remove surface oxides by cleaning with a wire brush or emery cloth. Apply joint compound to conductors, and use UL-listed solid aluminum connectors for connecting aluminum conductors. When connecting aluminum to copper conductors, use connectors specifically designed for this purpose.

b. Terminate aluminum conductors to copper bus either by: (1) in line

splicing a copper pigtail to the aluminum conductor (copper pigtail must have a ampacity at least that of the aluminum conductor); or (2) using a circumferential compression type, aluminum bodied terminal lug UL listed for AL/CU and steel Belleville spring washers, flat washers, bolts, and nuts. Belleville spring washers must be cadmium-plated hardened steel. Install the Belleville spring washers with the crown up toward the nut or bolt head, with the concave side of the Belleville bearing on a heavy-duty, wide series flat washer of larger diameter than the Belleville. Tighten nuts sufficient to flatten Belleville and leave in that position. Lubricate hardware with joint compound prior to making connection. Wire brush and apply joint compound to conductor prior to inserting in lug.

c. Terminate aluminum conductors to aluminum bus by using all-aluminum nuts, bolts, washers, and lugs. Wire brush and apply inhibiting compound to conductor prior to inserting in lug. Lubricate hardware with joint compound prior to making connection; if bus contact surface is unplated, scratch-brush and coat with joint compound (without grit).

]3.12 [HIGH][EXTRA-HIGH] VOLTAGE CABLE TERMINATIONS

Make terminations in accordance with the written instruction of the termination kit manufacturer.

3.13 [HIGH][EXTRA-HIGH] VOLTAGE CABLE JOINTS

Provide power cable joints (splices) suitable for continuous immersion in water. Make joints only in accessible locations in manholes or handholes by using materials and methods in accordance with the written instructions of the joint kit manufacturer.

3.13.1 Joints in Shielded Cables

Cover the joined area with metallic tape, or material like the original cable shield and connect it to the cable shield on each side of the splice. Provide a bare copper ground connection brought out in a watertight manner and grounded to the manhole grounding loop as part of the splice installation. Ground conductors, connections, and rods must be as specified elsewhere in this section. Wire must be trained to the sides of the enclosure to prevent interference with the working area.

[3.13.2 Joints in Armored Cables

Armored cable joints must be enclosed in compound-filled, cast-iron or alloy splice boxes equipped with stuffing boxes and armor clamps of a suitable type and size for the cable being installed.

]3.14 CABLE END CAPS

Cable ends must be sealed at all times with coated heat shrinkable end caps. Cables ends must be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps must remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

[3.15 LIVE END CAPS

Provide live end caps for single conductor [high][extra-high] voltage cables where indicated.

]3.16 FIREPROOFING OF CABLES IN UNDERGROUND STRUCTURES

Fireproof (arc proof) wire and cables which will carry current at 2200 volts or more in underground structures.

3.16.1 Fireproofing Tape

Tightly wrap strips of fireproofing tape around each cable spirally in half-lapped wrapping. Install tape in accordance with manufacturer's instructions.

[3.16.2 Tape-Wrap

Tape-wrap metallic-sheathed or metallic armored cables without a nonmetallic protective covering over the sheath or armor prior to application of fireproofing. Wrap must be in the form of two tightly applied half-lapped layers of a pressure-sensitive 0.254 mm thick plastic tape, and must extend not less than 25 mm into the duct. Even out irregularities of the cable, such as at splices, with insulation putty before applying tape.

]3.17 GROUNDING SYSTEMS

IEEE C2 and JIS C 0365, except provide grounding systems with a resistance to solid earth ground not exceeding [25][_____] ohms.

3.17.1 Grounding Electrodes

Provide cone pointed driven ground rods driven full depth plus[150 mm][300 mm], installed to provide an earth ground of the appropriate value for the particular equipment being grounded.
If the specified ground resistance is not met, an additional ground rod must be provided (placed not less than 1830 mm from the first rod). Should the resultant (combined) resistance exceed the specified resistance, measured not less than 48 hours after rainfall, notify the Contracting Officer immediately.

3.17.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies must be as recommended by the manufacturer. An embossing die code or other standard method must provide visible indication that a connector has been adequately compressed on the ground wire.

3.17.3 Grounding Conductors

Provide bare grounding conductors, except where installed in conduit with associated phase conductors. Ground cable sheaths, cable shields, conduit, and equipment with 14 sqmm. Ground other noncurrent-carrying metal parts and equipment frames of metal-enclosed equipment. Ground metallic frames and covers of handholes and pull boxes with a braided, copper ground strap with equivalent ampacity of 14 sqmm.[Provide direct connections to the grounding conductor with 600 v insulated, full-size conductor for each grounded neutral of each feeder circuit, which is spliced within the manhole.]

3.17.4 Ground Cable Crossing Expansion Joints

Protect ground cables crossing expansion joints or similar separations in structures and pavements by use of approved devices or methods of installation which provide the necessary slack in the cable across the joint to permit movement. Use stranded or other approved flexible copper cable across such separations.

3.17.5 Manhole Grounding

Loop a 100 sqmm grounding conductor around the interior perimeter, approximately 305 mm above finished floor. Secure the conductor to the manhole walls at intervals not exceeding 914 mm. Connect the conductor to the manhole grounding electrode with 100 sqmm conductor. Connect all incoming 100 sqmm grounding conductors to the ground loop adjacent to the point of entry into the manhole. Bond the ground loop to all cable shields, metal cable racks, and other metal equipment with a minimum 14 sqmm conductor.

[3.17.6 Fence Grounding

[Provide grounding for fences as indicated.][Provide grounding for fences with a ground rod at each fixed gate post and at each corner post.] Drive ground rods until the top is 305 mm below grade. Attach a 22 sqmm copper conductor, by exothermic weld to the ground rods and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 305 mm of fence mesh and fasten by two approved bronze compression fittings, one to bond wire to post and the other to bond wire to fence. Each gate section must be bonded to its gatepost by a 3 by 25 mm flexible braided copper strap and ground post clamps. Clamps must be of the anti-electrolysis type.

][3.17.7 Metal Splice Case Grounding

Metal splice cases for [high][extra-high]-voltage direct-burial cable must be grounded by connection to a driven ground rod located within 600 mm of each splice box using a grounding electrode conductor having a current-carrying capacity of at least 20 percent of the individual phase conductors in the associated splice box, but not less than 14 sqmm.

]3.18 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with Section [31 23 00.00 20 EXCAVATION AND FILL][31 00 00 EARTHWORK].

3.18.1 Reconditioning of Surfaces

3.18.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct [or direct burial cable]. Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.[Provide work in accordance with Section 32 92 19 SEEDING and Section 32 93 00 EXTERIOR PLANTS.]

3.18.1.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists [, restore such surface treatment or pavement the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces.][Make repairs as specified in Section [32 13 13.06 PORTLAND CEMENT CONCRETE PAVEMENT FOR ROADS AND SITE FACILITIES][_____].]

3.19 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.19.1 Concrete Slabs (Pads) for Equipment

Unless otherwise indicated, the slab must be at least 200 mm thick, reinforced with a 150 mm by 150 mm - MW19 by MW19 (6 by 6 - W2.9 by W2.9) mesh, placed uniformly 100 mm from the top of the slab. Slab must be placed on a 150 mm thick, well-compacted gravel base. Top of concrete slab must be approximately 100 mm above finished grade with gradual slope for drainage. Edges above grade must have 15 mm chamfer. Slab must be of adequate size to project at least 200 mm beyond the equipment.

Stub up conduits, with bushings, 50 mm into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

[3.19.2 Sealing

When the installation is complete, seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals must be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

]3.20 FIELD QUALITY CONTROL

3.20.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with Denki Hoan Kyoukai and MLIT DSKKS.

3.20.1.1 [High][Extra-High] Voltage Cables

Perform tests after installation of cable, splices, and terminators and before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

(1) Inspect exposed cable sections for physical damage.

(2) Verify that cable is supplied and connected in accordance with contract plans and specifications.

(3) Inspect for proper shield grounding, cable support, and cable termination.

(4) Verify that cable bends are not less than ICEA or manufacturer's minimum allowable bending radius.

(5) Inspect for proper fireproofing.

(6) Visually inspect jacket and insulation condition.

(7) Inspect for proper phase identification and arrangement.

b. Electrical Tests

(1) Perform a shield continuity test on each power cable by ohmmeter method. Record ohmic value, resistance values in excess of 10 ohms per 1000 feet of cable must be investigated and justified.

(2) Perform acceptance test on new cables before the new cables are connected to existing cables and placed into service, including terminations and joints. Perform maintenance test on complete cable system after the new cables are connected to existing cables and placed into service, including existing cable, terminations, and joints. Tests must be very low frequency (VLF) alternating voltage withstand tests. VLF test frequency must be 0.05 Hz minimum for a duration of 60 minutes using a sinusoidal waveform. Test voltages must be as follows:

CABLE RATING	AC TEST VOLTAGE for ACCEPTANCE TESTING
3.3kV	9kV (peak)
5 kV	10kV rms(peak)
6.6 kV	17kV rms(peak)
8 kV	13kV rms(peak)
15 kV	20kV rms(peak)
22 kV	44kV rms(peak)

CABLE RATING AC TEST VOLTAGE for ACCEPTANCE TESTING	
25 kV	31kV rms(peak)
33 kV	63kV (peak)
35 kV	44kV rms(peak)
66 kV	85kV (peak)
77 kV	95kV (peak)

CABLE RATING AC TEST VOLTAGE for MAINTENANCE TESTING	
3.3kV	Per manufacturer requirements.
5 kV	7kV rms(peak)
6.6 kV	Per manufacturer requirements.
8 kV	10kV rms(peak)
15 kV	16kV rms(peak)
22 kV	Per manufacturer requirements.
25 kV	23kV rms(peak)
33 kV	Per manufacturer requirements.
35 kV	33kV rms(peak)
66 kV	Per manufacturer requirements.
77 kV	Per manufacturer requirements.

(3) In lieu of the acceptance testing required in item (2), High Voltage Direct Current (HVDC) test is an alternative acceptance test on newly installed cables. Maximum applied DC test voltage shall be determined in consultation with the manufacturer of the cable and cable accessories for the type of cable being tested. The maximum test voltage to be maintained for 10 minutes. After reaching the maximum test voltage, the current magnitude should be recorded at least twice: once at approximately 2 min and again at the end of the test period (10 min) Contractor shall submit test procedure and standard use as reference for testing to the government for review and approval.

3.20.1.2 Low Voltage Cables, 600-Volt

Perform tests after installation of cable, splices and terminations and before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

(1) Inspect exposed cable sections for physical damage.

(2) Verify that cable is supplied and connected in accordance with contract plans and specifications.

(3) Verify tightness of accessible bolted electrical connections.

(4) Inspect compression-applied connectors for correct cable match and indentation.

(5) Visually inspect jacket and insulation condition.

(6) Inspect for proper phase identification and arrangement.

b. Electrical Tests

(1) Perform insulation resistance tests on wiring 14 sqmm and larger diameter using instrument which applies voltage of approximately 1000 volts dc for one minute.

(2) Perform continuity tests to insure correct cable connection.

3.20.1.3 Grounding System

a. Visual and mechanical inspection

Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

Perform ground-impedance measurements utilizing the fall-of-potential method in accordance with JIS C 60364-6. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument must be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test. Provide site diagram indicating location of test probes with associated distances, and provide a plot of resistance vs. distance.

3.20.2 Follow-Up Verification

Upon completion of acceptance checks and tests, show by demonstration in service that circuits and devices are in good operating condition and

properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer must be given 5 working days advance notice of the dates and times of checking and testing.

.... -- End of Section --

SECTION 33 82 00

TELECOMMUNICATIONS OUTSIDE PLANT (OSP)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Contractor may substitute compatible Japan Industrial Standard (JIS) or Japan Wire Industry Association Standard (JCS) standards for non-Japanese standards, as approved by the Contracting Officer's representative.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

JAPANESE INDUSTRIAL STANDARDS (JIS)

JIS C 0365	(2007) Protection Against Electric Shock - Common Aspects for Installation and Equipment
JIS C 2336	(2012) Pressure-sensitive polyvinyl chloride tapes for electrical purposes
JIS C 2338	(2012) Polyester adhesive tape for electrical insulation
JIS C 3101	(1994) Hard-drawn copper wires for electrical purposes
JIS C 3105	(1994) Hard-drawn copper stranded conductors
JIS C 3307	(2000) 600 V Polyvinyl chloride insulated wires
JIS C 3401	(2002) Control Cables
JIS C 6188	(1999) Test methods of measuring optical attenuators
JIS C 6189	(2004) Test methods of optical return loss meters
JIS C 6823	(2010) Measuring methods for attenuation of optical fibers
JIS C 6824	(2009) Test methods for bandwidth of multimode optical fibers
JIS C 6835	(2017) Silica glass single-mode optical fibers

JIS C 6837	(2015) All Plastic Multimode Optical Fibers
JIS C 6850	(2006) General rules of optical fiber cables
JIS C 6870-3	(2006) Outdoor optical fiber cables-Part 3: Sectional specification
JIS C 6870-3-10	(2011) Optical fiber cables-Part 3-10: Outdoor cables-Family specification for duct, directly buried and lashed aerial optical telecommunications cables
JIS C 60364-5-54	(2006) Building Electrical Equipment-Part 5-54: Selection Of Electrical Equipment and Contruction-Grounding Equipment, Protective Conductor and Protective Bonding Conductor
JIS X 5150	(R2016) Information Technology-Generic Cabling for Customer Premises
JIS X 5151	(2018) Information technology -- Implementation and operation of customer premises cabling -- Part 3: Testing of optical fibre cabling

JAPAN WIRE INDUSTRY ASSOCIATION STANDARD (JCS)

JCS 5503	(2011) Flame retardant polyolefin sheath LAN twisted pair cable
JCS 5507	(2010) LAN Twisted Pair Cable

1.2 RELATED REQUIREMENTS

[Section 27 10 00, BUILDING TELECOMMUNICATIONS CABLING SYSTEM,][Section 33 71 01, OVERHEAD TRANSMISSION AND DISTRIBUTION, and[Section 33 71 02, UNDERGROUND ELECTRICAL DISTRIBUTION] apply to this section with additions and modifications specified herein.

]1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in JIS X 5150, JCS 5507, JIS C 6850 and herein.

1.3.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect - (MC).)

1.3.2 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space.

1.3.3 Entrance Room (ER) (Telecommunications)

A centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.3.4 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect - (IC).)

1.3.5 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.4 SYSTEM DESCRIPTION

The telecommunications outside plant consists of cable, conduit, manholes, poles, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, interconnecting hardware, terminating cables, lightning and surge protection modules at the entrance facility. The work consists of providing, testing and making operational cabling, interconnecting hardware and lightning and surge protection necessary to form a complete outside plant telecommunications system for continuous use.[The telecommunications contractor must coordinate with the NMCI contractor concerning layout and configuration of the EF telecommunications and OSP. The telecommunications contractor may be required to coordinate work effort for access to the EF telecommunications and OSP with the NMCI contractor.]

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for information only.][for Contractor Quality Control approval.] When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications Outside Plant; G[, [_____]]

Telecommunications Entrance Facility Drawings; G[, [_____]]

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

SD-03 Product Data

Wire and cable; G[, [_____]]

Cable splices, and connectors; G[, [_____]]

Closures; G[, [_____]]

Building protector assemblies; G[, [_____]]

Protector modules; G[, [_____]]

Cross-connect terminal cabinets; G[, [_____]]

SD-06 Test Reports

Pre-installation tests;

Acceptance tests;

SD-10 Operation and Maintenance Data

Telecommunications Outside plant (OSP), Data Package 5;

Commercial off-the-shelf manuals shall be provided for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications outside plant (OSP). Submit operations and maintenance data in accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA and as specified herein not later than[2][_____] months prior to the date of beneficial occupancy. In addition to requirements of Data package 5, include the requirements of paragraphs TELECOMMUNICATIONS OUTSIDE PLANT SHOP DRAWINGS and TELECOMMUNICATIONS ENTRANCE FACILITY DRAWINGS.

SD-11 Closeout Submittals

Record Documentation;

In addition to other requirements, provide in accordance with paragraph RECORD DOCUMENTATION.

1.6 QUALITY ASSURANCE

1.6.1 Shop Drawings

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

1.6.1.1 Telecommunications Outside Plant Shop Drawings

Provide Outside Plant Design in accordance with JIS C 6870-3 and JIS C 6870-3-10 for aerial system design, and for underground system design. Provide T0 shop drawings that show the physical and logical connections from the perspective of an entire campus, such as actual building locations, exterior pathways and campus backbone cabling on plan view drawings, major system nodes, and related connections on the logical system drawings. Drawings shall include wiring and schematic diagrams for

fiber optic and copper cabling and splices, copper conductor gauge and pair count, fiber pair count and type, pathway duct and innerduct arrangement, associated construction materials, and any details required to demonstrate that cable system has been coordinated and will properly support the switching and transmission system identified in specification and drawings.[Provide Registered Communications Distribution Designer (RCDD) approved drawings of the telecommunications outside plant.][Update existing telecommunication Outside Plant T0 drawings to include information modified, deleted or added as a result of this installation.] The telecommunications outside plant (OSP) shop drawings shall be included in the operation and maintenance manuals.

1.6.1.2 Telecommunications Entrance Facility Drawings

[Provide T3 drawings for EF Telecommunications that include telecommunications entrance facility plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and[cabinet][, rack][, backboard][and] wall elevations. Drawings shall show layout of applicable equipment including incoming cable stub or connector blocks, building protector assembly, outgoing cable connector blocks, patch panels and equipment spaces and cabinet/racks. Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation. Drawings may also be an enlargement of a congested area of T1 or T2 drawings.][Provide T3 drawings for EF Telecommunications as specified in the paragraph TELECOMMUNICATIONS SPACE DRAWINGS of Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS.] The telecommunications entrance facility shop drawings shall be included in the operation and maintenance manuals.

1.6.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, the supervisor (if different from the installer), and the cable splicing and terminating personnel. A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.3 Outside Plant Test Plan

Prepare and provide a complete and detailed test plan for field tests of the outside plant including a complete list of test equipment for the[copper conductor][and][optical fiber] cables, components, and accessories for approval by the Contracting Officer. Include a cut-over plan with procedures and schedules for relocation of facility station numbers without interrupting service to any active location. Submit the plan at least[30][_____] days prior to tests for Contracting Officer approval. Provide outside plant testing and performance measurement criteria in accordance with JIS X 5150 and JIS X 5151. Include procedures for certification, validation, and testing that includes fiber optic link performance criteria.

1.6.4 Standard Products

Provide materials and equipment that are standard products of

manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and shall be the manufacturer's latest standard design that has been in satisfactory commercial or industrial use for at least[2][1] year[s] prior to bid opening. The[2][1]-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the[2][1]-year period. Products supplied shall be specifically designed and manufactured for use with outside plant telecommunications systems. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.6.4.1 Alternative Qualifications

Products having less than a[2][1]-year field service record will be acceptable if a certified record of satisfactory field operation for not less than[6000][3000] hours, exclusive of the manufacturers' factory or laboratory tests, is provided.

1.6.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.6.5 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of applicable codes and standards unless more stringent requirements are specified or indicated.

1.6.5.1 Independent Testing Organization Certificate

In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.7 DELIVERY, STORAGE, AND HANDLING

Ship cable on reels in [152][305][_____] meter length with a minimum overage of 10 percent. Radius of the reel drum shall not be smaller than the minimum bend radius of the cable. Wind cable on the reel so that unwinding can be done without kinking the cable. Two meters of cable at both ends of the cable shall be accessible for testing. Attach permanent label on each reel showing length, cable identification number, cable size, cable type, and date of manufacture. Provide water resistant label and the indelible writing on the labels. Apply end seals to each end of the cables to prevent moisture from entering the cable. Reels with cable shall be suitable for outside storage conditions when temperature ranges

from minus 40 degrees C to plus 65 degrees C, with relative humidity from 0 to 100 percent. Equipment, other than cable, delivered and placed in storage shall be stored with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants in accordance with manufacturer's requirements.

1.8 MAINTENANCE

1.8.1 Record Documentation

Provide the activity responsible for telecommunications system maintenance and administration a single complete and accurate set of record documentation for the entire telecommunications system with respect to this project.

[Provide T5 drawings including documentation on cables and termination hardware. T5 drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided[in hard copy format][on electronic media using Windows based computer cable management software.][A licensed copy of the cable management software including documentation, shall be provided.][Update existing record documentation to reflect campus distribution T0 drawings and T3 drawing schedule information modified, deleted or added as a result of this installation.] Provide the following T5 drawing documentation as a minimum:

a. Cables - A record of installed cable shall be provided. The cable records shall [include only the required data fields][include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility]. Include manufacture date of cable with submittal.

b. Termination Hardware - Provide a record of installed patch panels, cross-connect points, campus distributor and terminating block arrangements and type. Documentation shall include [only]the required data fields[as a minimum].

][Provide record documentation as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

]## 1.9 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Products supplied shall be specifically designed and manufactured for use with outside plant telecommunications systems.

2.2 TELECOMMUNICATIONS ENTRANCE FACILITY

2.2.1 Building Protector Assemblies

Provide self-contained[5 pin][screw type] unit supplied with a field cable stub factory connected to protector socket blocks to terminate and accept protector modules for [_____] pairs of outside cable. Building protector assembly shall have interconnecting hardware for connection to interior cabling at full capacity. Provide manufacturers instructions for building protector assembly installation. Provide copper cable interconnecting hardware as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.2.2 Protector Modules

Provide [three][two]-electrode gas tube or solid state type[5 pin][screw type] rated for the application. Provide gas tube protection modules [heavy duty, A>10kA, B>400, C>65A][maximum duty, A>20kA, B>1000, C>200A] where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current. The gas modules shall shunt high voltage to ground, fail short, and be equipped with an external spark gap and heat coils. Provide the number of surge protection modules equal to the number of pairs of exterior cable of the building protector assembly.

2.2.3 Fiber Optic Terminations

Provide fiber optic cable terminations as specified in 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Aerial Cable Closures

Provide cable closure assembly consisting of a frame with clamps, a lift-off polyethylene cover, cable nozzles, and drop wire rings. Closure shall be suitable for use on Figure 8 cables. Closures shall be free breathing and suitable for housing[straight-through type][branch type][of the type indicated] splices of non-pressurized communications cables and shall be sized as indicated. The closure shall be constructed with ultraviolet resistant PVC.

2.3.1.2 Underground Cable Closures

a. Aboveground: Provide aboveground closures constructed of[not less than 14 gauge steel][ultraviolet resistant PVC] and acceptable for[pole][stake] mounting. Closures shall be sized and contain a marker as indicated. Covers shall be secured to prevent unauthorized entry.

b. Direct burial: Provide buried closure suitable for enclosing a straight, butt, and branch splice in a container into which can be poured an encapsulating compound. Closure shall have adequate strength to protect the splice and maintain cable shield electrical continuity in the buried environment. Encapsulating compound shall be reenterable and shall not alter the chemical stability of the closure. Provide filled splice cases.

c. In vault or manhole: Provide underground closure suitable to house a straight, butt, and branch splice in a protective housing into which can be poured an encapsulating compound. Closure shall be of suitable thermoplastic, thermoset, or stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Encapsulating compound shall be reenterable and shall not alter the chemical stability of the closure. Provide filled splice cases.

2.3.2 Fiber Optic Closures

2.3.2.1 Aerial

Provide aerial closure that is free breathing and suitable for housing splice organizer of non -pressurized cables. Closure shall be constructed from heavy PVC with ultraviolet resistance.

2.3.2.2 Direct Burial

Provide buried closure suitable to house splice organizer in protective housing into which can be poured an encapsulating compound. Closure shall have adequate strength to protect the splice and maintain cable shield electrical continuity, when metallic, in buried environment. Encapsulating compound shall be reenterable and shall not alter chemical stability of the closure.

2.3.2.3 In Vault or Manhole

Provide underground closure suitable to house splice organizer in a protective housing into which can be poured an encapsulating compound. Closure shall be of thermoplastic, thermoset, or stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Encapsulating compound shall be reenterable and shall not alter the chemical stability of the closure.

2.4 PAD MOUNTED CROSS-CONNECT TERMINAL CABINETS

Provide in accordance with the following:

a. Constructed of 14 gauge steel or [_____].

b. Equipped with a double set of hinged doors with closed-cell foam weatherstripping. Doors shall be locked and contain a marker as indicated.

c. Equipped with spool spindle bracket, mounting frames, binding post log,[and] jumpering instruction label[, and load coil mounting provisions].

d. Complete with cross connect modules to terminate number of pairs as indicated.

e. Sized as indicated.

2.5 CABLE SPLICES, AND CONNECTORS

2.5.1 Copper Cable Splices

Provide[multipair,[foldback][in-line]][single pair,[in-line][butt][box tap]] splices of a moisture resistant,[two][three][_____]-wire [insulation displacement] connector held rigidly in place to assure maximum continuity. Cables greater than 25 pairs shall be spliced using multipair splicing connectors, which accommodate 25 pairs of conductors at a time. Provide correct connector size to accommodate the cable gauge of the supplied cable.

[2.5.2 Copper Cable Splice Connector

Provide splice connectors with a polycarbonate body and cap and a tin-plated brass contact element. Connector shall accommodate 0.65 to 0.4 mm solid wire with a maximum insulation diameter of 1.65 mm. Fill connector with sealant grease to make a moisture resistant connection.

][2.5.3 Fiber Optic Cable Splices

Provide fiber optic cable splices and splicing materials for[fusion][mechanical] methods at locations shown on the construction drawings. The splice insertion loss shall be 0.3 dB maximum when measured in accordance with JIS C 6823 using an Optical Time Domain Reflectometer (OTDR). Splices shall be designed for a return loss of 40.0 db max for single mode fiber when tested in accordance with JIS C 6189. Physically protect each fiber optic splice by a splice kit specially designed for the splice.

][2.5.4 Fiber Optic Splice Organizer

Provide splice organizer suitable for housing fiber optic splices in a neat and orderly fashion. Splice organizer shall allow for a minimum of 1 m of fiber for each fiber within the cable to be neatly stored without kinks or twists. Splice organizer shall accommodate individual strain relief for each splice and allow for future maintenance or modification, without damage to the cable or splices. Provide splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors in a splice organizer kit.

]2.5.5 Shield Connectors

Provide connectors with a stable, low-impedance electrical connection between the cable shield and the bonding conductor.

2.6 CONDUIT

Provide conduit as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.7 PLASTIC INSULATING TAPE

JIS C 2336 or JIS C 2338.

2.8 WIRE AND CABLE

2.8.1 Copper Conductor Cable

Solid copper conductors, covered with an extruded solid insulating

compound. Insulated conductors shall be twisted into pairs which are then stranded or oscillated to form a cylindrical core. For special high frequency applications, the cable core shall be separated into compartments. Cable shall be completed by the application of a suitable core wrapping material, a corrugated copper or plastic coated aluminum shield, and an overall extruded jacket. Telecommunications contractor shall verify distances between splice points prior to ordering cable in specific cut lengths. Gauge of conductor shall determine the range of numbers of pairs specified; 19 gauge (6 to 400 pairs), 22 gauge (6 to 1200 pairs), 24 gauge (6 to 2100 pairs), and 26 gauge (6 to 3000 pairs). Copper conductor shall conform to the following:

2.8.1.1 Underground

Provide filled cable meeting the requirements of applicable codes and standards.

2.8.1.2 Aerial

Provide filled cable meeting the requirements of JCS 5503.

2.8.1.3 Screen

Provide screen-compartmental core cable filled cable [ ][as indicated].

2.8.2 Fiber Optic Cable

Provide[single-mode, 8/125-um, 0.10 aperture 1310 nm fiber optic cable in accordance with JIS C 6835][single-mode, 8/125-um, 0.10 aperture 1550 nm fiber optic cable in accordance with JIS C 6835][and][multimode 62.5/125-um, 0.275 aperture fiber optic cable in accordance with JIS C 6837][multimode 50/125-um, 0.275 aperture fiber optic cableJIS C 6837], JIS C 6870-3 and JIS C 6870-3-10 including any special requirements made necessary by a specialized design. Provide[12][____] optical fibers[as indicated]. Fiber optic cable shall be specifically designed for outside use with loose buffer construction. Provide fiber optic color code in accordance with JIS C 6870-3-10.

2.8.2.1 Strength Members

Provide[central][non-central],[non-metallic][metallic] strength members with sufficient tensile strength for installation and residual rated loads to meet the applicable performance requirements in accordance with JIS C 6870-3 and JIS C 6870-3-10. The strength member is included to serve as a cable core foundation to reduce strain on the fibers, and shall not serve as a pulling strength member.

[2.8.2.2 Shielding or Other Metallic Covering

Provide[copper, copper alloy or copper and steel laminate][copper and stainless steel, coated stainless steel or bare low carbon steel][bare aluminum or coated aluminum],[single][dual] tape covering or shield in accordance with JIS C 6870-3 and JIS C 6870-3-10.

]2.8.2.3 Performance Requirements

Provide fiber optic cable with optical and mechanical performance requirements in accordance with JIS C 6870-3 and JIS C 6870-3-10.

2.8.3 Grounding and Bonding Conductors

Provide grounding and bonding conductors in accordance with JIS C 60364-5-54, IEEE C2 and JIS C 0365. Solid bare copper wire meeting the requirements of JIS C 3101 for sizes 8 sqmm and smaller and stranded bare copper wire meeting the requirements of JIS C 3105, for sizes 14 sqmm and larger. Insulated conductors shall have 600-volt, Type TW insulation meeting the requirements of JIS C 3307 and JIS C 3401.

2.9 T-SPAN LINE TREATMENT REPEATERS

Provide as indicated. Repeaters shall be pedestal mounted with non-pressurized housings, sized as indicated.

2.10 POLES AND HARDWARE

Provide poles and hardware as specified in Section 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION.

2.11 CABLE TAGS IN MANHOLES, HANDHOLES, AND VAULTS

Provide tags for each telecommunications cable or wire located in manholes, handholes, and vaults. Cable tags shall be[stainless steel][or][polyethylene] and labeled[as indicated]. Handwritten labeling is unacceptable.

[2.11.1 Stainless Steel

Provide stainless steel, cable tags 41.25 mm in diameter 1.58 mm thick minimum, and circular in shape. Tags shall be die stamped with numbers, letters, and symbols not less than 6.35 mm high and approximately 0.38 mm deep in normal block style.

][2.11.2 Polyethylene Cable Tags

Provide tags of polyethylene that have an average tensile strength of 22.4 MPa; and that are two millimeter thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 77 degrees C. Provide 1.3 mm (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties shall have a minimum loop tensile strength of 778.75 N. The cable tags shall have black block letters, numbers, and symbols 25 mm high on a yellow background. Letters, numbers, and symbols shall not fall off or change positions regardless of the cable tags' orientation.

]2.12 BURIED WARNING AND IDENTIFICATION TAPE

Provide fiber optic media marking and protection. Provide color, type and depth of tape as specified in paragraph BURIED WARNING AND IDENTIFICATION TAPE in Section 31 00 00, EARTHWORK.

2.13 GROUNDING BRAID

Provide grounding braid that provides low electrical impedance connections for dependable shield bonding. Braid shall be made from flat tin-plated copper.

2.14 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.15 FIELD FABRICATED NAMEPLATES

Provide laminated plastic nameplates in accordance with JIS K 6911 for each patch panel, protector assembly, rack, cabinet and other equipment or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 3 mm thick, white with[black][_____] center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be 25 by 65 mm. Lettering shall be a minimum of 6.35 mm high normal block style.

2.16 TESTS, INSPECTIONS, AND VERIFICATIONS

2.16.1 Factory Reel Test Data

Test 100 percent OTDR test of FO media at the factory in accordance with JIS X 5150 and JIS C 6850. Use JIS C 6823 for single mode fiber and for multi mode fiber measurements. Calibrate OTDR to show anomalies of 0.2 dB minimum. Enhanced performance filled OSP copper cables, referred to as Broadband Outside Plant (BBOSP). Enhanced performance air core OSP copper cables shall meet the requirements of JCS 5503. Submit test reports, including manufacture date for each cable reel and receive approval before delivery of cable to the project site.

PART 3 EXECUTION

3.1 INSTALLATION

Install all system components and appurtenances in accordance with manufacturer's instructions IEEE C2, JIS C 0365 and as indicated. Provide all necessary interconnections, services, and adjustments required for a complete and operable telecommunications system.

3.1.1 Contractor Damage

Promptly repair indicated utility lines or systems damaged during site preparation and construction. Damages to lines or systems not indicated, which are caused by Contractor operations, shall be treated as "Changes" under the terms of the Contract Clauses. When Contractor is advised in writing of the location of a nonindicated line or system, such notice shall provide that portion of the line or system with "indicated" status in determining liability for damages. In every event, immediately notify the Contracting Officer of damage.

3.1.2 Cable Inspection and Repair

Handle cable and wire provided in the construction of this project with care. Inspect cable reels for cuts, nicks or other damage. Damaged cable shall be replaced or repaired to the satisfaction of the Contracting Officer. Reel wraps shall remain intact on the reel until the cable is ready for placement.

3.1.3 Direct Burial System

Installation shall be in accordance with JIS C 6870-3 and JIS C 6870-3-10. Under railroad tracks, paved areas, and roadways install cable in conduit encased in concrete. Slope ducts to drain. Excavate trenches by hand or mechanical trenching equipment. Provide a minimum cable cover of 610 mm below finished grade. Trenches shall be not less than 155 mm wide and in straight lines between cable markers. Do not use cable plows. Bends in trenches shall have a radius of not less than [915][_____] mm. Where two or more cables are laid parallel in the same trench, space laterally at least 78 mm apart. When rock is encountered, remove it to a depth of at least 78 mm below the cable and fill the space with sand or clean earth free from particles larger than 6 mm. Do not unreel and pull cables into the trench from one end. Cable may be unreeled on grade and lifted into position. Provide color, type and depth of warning tape as specified in paragraph BURIED WARNING AND IDENTIFICATION TAPE in Section 31 00 00 EARTHWORK.

3.1.3.1 Cable Placement

a. Separate cables crossing other cables or metal piping from the other cables or pipe by not less than [78][_____] mm of well tamped earth. Do not install circuits for communications under or above traffic signal loops.

b. Cables shall be in one piece without splices between connections except where the distance exceeds the lengths in which the cable is furnished.

c. Avoid bends in cables of small radii and twists that might cause damage. Do not bend cable and wire in a radius less than 10 times the outside diameter of the cable or wire.

d. Leave a horizontal slack of approximately 915 mm in the ground on each end of cable runs, on each side of connection boxes, and at points where connections are brought aboveground. Where cable is brought aboveground, leave additional slack to make necessary connections.

3.1.3.2 Identification Slabs [Markers]

Provide a marker at each change of direction of the cable, over the ends of ducts or conduits which are installed under paved areas and roadways and over each splice. Identification markers shall be of concrete, approximately 508 mm square by 155 mm thick.

3.1.3.3 Backfill for Rocky Soil

When placing cable in a trench in rocky soil, the cable shall be cushioned by a fill of sand or selected soil at least 53 mm thick on the floor of the trench before placing the cable or wire. The backfill for at least 103 mm above the wire or cable shall be free from stones, rocks, or other hard or sharp materials which might damage the cable or wire. If the buried cable is placed less than 610 mm in depth[, a protective cover of[metal][concrete] shall be used].

3.1.4 Cable Protection

Provide direct burial cable protection in accordance with applicable codes

and standards and as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Galvanized conduits which penetrate concrete (slabs, pavement, and walls) shall be PVC coated and shall extend from the first coupling or fitting outside either side of the concrete minimum of 155 mm per 305 mm burial depth beyond the edge of the surface where cable protection is required; all conduits shall be sealed on each end. Where additional protection is required, cable may be placed in galvanized iron pipe (GIP) sized on a maximum fill of 40 percent of cross-sectional area, or in concrete encased 103 mm PVC pipe. Conduit may be installed by jacking or trenching. Trenches shall be backfilled with earth and mechanically tamped at 155 mm lift so that the earth is restored to the same density, grade and vegetation as adjacent undisturbed material.

3.1.4.1 Cable End Caps

Cable ends shall be sealed at all times with coated heat shrinkable end caps. Cables ends shall be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps shall remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

3.1.5 Underground Duct

Provide underground duct and connections to existing[manholes,][handholes,][concrete pads,][and][existing ducts] as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION with any additional requirements as specified herein.

3.1.6 Reconditioning of Surfaces

Provide reconditioning of surfaces as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.1.7 Penetrations

Caulk and seal cable access penetrations in walls, ceilings and other parts of the building. Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.8 Cable Pulling

Test duct lines with a mandrel and swab out to remove foreign material before the pulling of cables. Avoid damage to cables in setting up pulling apparatus or in placing tools or hardware. Do not step on cables when entering or leaving the manhole. Do not place cables in ducts other than those shown without prior written approval of the Contracting Officer. Roll cable reels in the direction indicated by the arrows painted on the reel flanges. Set up cable reels on the same side of the manhole as the conduit section in which the cable is to be placed. Level the reel and bring into proper alignment with the conduit section so that the cable pays off from the top of the reel in a long smooth bend into the duct without twisting. Under no circumstances shall the cable be paid off from the bottom of a reel. Check the equipment set up prior to beginning the cable pulling to avoid an interruption once pulling has started. Use a cable feeder guide of suitable dimensions between cable reel and face of duct to protect cable and guide cable into the duct as it is paid off the

reel. As cable is paid off the reel, lubricate and inspect cable for sheath defects. When defects are noticed, stop pulling operations and notify the Contracting Officer to determine required corrective action. Cable pulling shall also be stopped when reel binds or does not pay off freely. Rectify cause of binding before resuming pulling operations. Provide cable lubricants recommended by the cable manufacturer. Avoid bends in cables of small radii and twists that might cause damage. Do not bend cable and wire in a radius less than 10 times the outside diameter of the cable or wire.

3.1.8.1 Cable Tensions

Obtain from the cable manufacturer and provide to the Contracting Officer, the maximum allowable pulling tension. This tension shall not be exceeded.

3.1.8.2 Pulling Eyes

Equip cables 32 mm in diameter and larger with cable manufacturer's factory installed pulling-in eyes. Provide cables with diameter smaller than 32 mm with heat shrinkable type end caps or seals on cable ends when using cable pulling grips. Rings to prevent grip from slipping shall not be beaten into the cable sheath. Use a swivel of 19 mm links between pulling-in eyes or grips and pulling strand.

3.1.8.3 Installation of Cables in Manholes, Handholes, and Vaults

Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. [Provide a minimum of 15 meter maintenance loop for all cables at maintenance hole feeding building entrance facilities.] Form cables to closely parallel walls, not to interfere with duct entrances, and support cables on brackets and cable insulators at a maximum of 1220 mm. In existing manholes, handholes, and vaults where new ducts are to be terminated, or where new cables are to be installed, modify the existing installation of cables, cable supports, and grounding as required with cables arranged and supported as specified for new cables. Identify each cable with corrosion-resistant embossed metal tags.

3.1.9 Aerial Cable Installation

Pole installation shall be as specified in Section 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION. Where physical obstructions make it necessary to pull distribution wire along the line from a stationary reel, use cable stringing blocks to support wire during placing and tensioning operations. Do not place ladders, cable coils, and other equipment on or against the distribution wire. Wire shall be sagged in accordance with the data shown. Protect cable installed outside of building less than 2.5 meters above finished grade against physical damage.

3.1.9.1 Figure 8 Distribution Wire

Perform spiraling of the wire within 24 hours of the tensioning operation. Perform spiraling operations at alternate poles with the approximate length of the spiral being 4575 mm. Do not remove insulation from support members except at bonding and grounding points and at points where ends of support members are terminated in splicing and dead-end devices. Ground support wire at poles to the pole ground.

3.1.9.2 Suspension Strand

Place suspension strand as indicated. Tension in accordance with the data indicated. When tensioning strand, loosen cable suspension clamps enough to allow free movement of the strand. Place suspension strand on the road side of the pole line. In tangent construction, point the lip of the suspension strand clamp toward the pole. At angles in the line, point the suspension strand clamp lip away from the load. In level construction place the suspension strand clamp in such a manner that it will hold the strand below the through-bolt. At points where there is an up-pull on the strand, place clamp so that it will support strand above the through-bolt. Make suspension strand electrically continuous throughout its entire length, bond to other bare cables suspension strands and connect to pole ground at each pole.

3.1.9.3 Aerial Cable

Keep cable ends sealed at all times using cable end caps. Take cable from reel only as it is placed. During placing operations, do not bend cables in a radius less than 10 times the outside diameter of cable. Place temporary supports sufficiently close together and properly tension the cable where necessary to prevent excessive bending. In those instances where spiraling of cabling is involved, accomplish mounting of enclosures for purposes of loading, splicing, and distribution after the spiraling operation has been completed.

3.1.10 Cable Splicing

3.1.10.1 Copper Conductor Splices

Perform splicing in accordance with manufacturer's requirements except that direct buried splices and twisted and soldered splices are not allowed. Exception does not apply for pairs assigned for carrier application.

3.1.10.2 Fiber Optic Splices

Fiber optic splicing shall be in accordance with manufacturer's recommendation and shall exhibit an insertion loss[not greater than 0.2 dB for fusion splices][not greater than 0.4 db for mechanical splices].

3.1.11 Surge Protection

All cables and conductors, except fiber optic cable, which serve as communication lines through off-premise lines, shall have surge protection installed at each end.

3.1.12 Grounding

Provide grounding and bonding in accordance with JIS C 60364-5-54 and IEEE C2 and JIS C 0365. Ground exposed noncurrent carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals.

3.1.12.1 Telecommunications Master Ground Bar (TMGB)

The TMGB is the hub of the basic telecommunications grounding system providing a common point of connection for ground from outside cable, CD, and equipment. Establish a TMGB for connection point for cable stub shields to connector blocks and CD protector assemblies as specified in

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.1.12.2 Incoming Cable Shields

Shields shall not be bonded across the splice to the cable stubs. Ground shields of incoming cables in the EF Telecommunications to the TMGB.

3.1.12.3 Campus Distributor Grounding

a. Protection assemblies: Mount CD protector assemblies directly[on the telecommunications backboard][in the telecommunications [rack][cabinet]]. Connect assemblies mounted on each vertical frame with No. 6 AWG copper conductor to provide a low resistance path to TMGB.

[b. TMGB connection: Connect TMGB to TGB with copper conductor with a total resistance of less than 0.01 ohms.

][3.1.13 Cut-Over

All necessary transfers and cut-overs, shall be accomplished by the telecommunications contractor.

]3.2 LABELING

3.2.1 Labels

Provide labeling for new cabling and termination hardware located within the facility. Handwritten labeling is unacceptable. Stenciled lettering for cable and termination hardware shall be provided using[thermal ink transfer process][laser printer][_____].

3.2.2 Cable Tag Installation

Install cable tags for each telecommunications cable or wire located in manholes, handholes, and vaults including each splice.[Tag only new wire and cable provided by this contract.][Tag new wire and cable provided under this contract and existing wire and cable which are indicated to have splices and terminations provided by this contract.] The labeling of telecommunications cable tag identifiers shall be[as indicated].[Tag legend shall be as indicated.] Do not provide handwritten letters. Install cable tags so that they are clearly visible without disturbing any cabling or wiring in the manholes, handholes, and vaults.

3.2.3 Termination Hardware

Label patch panels, distribution panels, connector blocks and protection modules using color coded labels with identifiers.

3.3 FIELD APPLIED PAINTING

[Provide ferrous metallic enclosure finishes in accordance with the following procedures. Ensure that surfaces are dry and clean when the coating is applied. Coat joints and crevices. Prior to assembly, paint surfaces which will be concealed or inaccessible after assembly. Apply primer and finish coat in accordance with the manufacturer's recommendations.][Provide ferrous metallic enclosure finishes as specified in Section 09 90 00 PAINTS AND COATINGS.]

[3.3.1 Cleaning

Clean surfaces as required per applicable codes and standards.

][3.3.2 Priming

Prime with a two component polyamide epoxy primer which has a bisphenol-A base, a minimum of 60 percent solids by volume, and an ability to build up a minimum dry film thickness on a vertical surface of 0.127 mm. Apply in two coats to a total dry film thickness of 0.127 to 0.2 mm.

][3.3.3 Finish Coat

Finish with a two component urethane consisting of saturated polyester polyol resin mixed with aliphatic isocyanate which has a minimum of 50 percent solids by volume. Apply to a minimum dry film thickness of 0.05 to 0.076 mm. Color shall be the manufacturer's standard.

]3.4 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.5 FIELD QUALITY CONTROL

Provide the Contracting Officer[10][_____] working days notice prior to[each][_____] test. Provide labor, equipment, and incidentals required for testing. Correct defective material and workmanship disclosed as the results of the tests. Furnish a signed copy of the test results to the Contracting Officer within 3 working days after the tests for each segment of construction are completed. Perform testing as construction progresses and do not wait until all construction is complete before starting field tests.

3.5.1 Pre-Installation Tests

Perform the following tests on cable at the job site before it is removed from the cable reel. For cables with factory installed pulling eyes, these tests shall be performed at the factory and certified test results shall accompany the cable.

3.5.1.1 Cable Capacitance

Perform capacitance tests on at least 10 percent of the pairs within a cable to determine if cable capacitance is within the limits specified.

3.5.1.2 Loop Resistance

Perform DC-loop resistance on at least 10 percent of the pairs within a cable to determine if DC-loop resistance is within the manufacturer's calculated resistance.

3.5.1.3 Pre-Installation Test Results

Provide results of pre-installation tests to the Contracting Officer at least[5][_____] working days before installation is to start. Results shall indicate reel number of the cable, manufacturer, size of cable, pairs tested, and recorded readings. When pre-installation tests indicate

that cable does not meet specifications, remove cable from the job site.

3.5.2 Acceptance Tests

Perform acceptance testing in accordance with JIS X 5150 and JIS X 5151 and as further specified in this section. Provide personnel, equipment, instrumentation, and supplies necessary to perform required testing. Notification of any planned testing shall be given to the Contracting Officer at least[14][_____] days prior to any test unless specified otherwise. Testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. Test plans shall define the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested. Provide test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be tabulated on a pair by pair or strand by strand basis.

3.5.2.1 Copper Conductor Cable

Perform the following acceptance tests in accordance with JIS C 6870-3 and JIS C 6870-3-10:

a. Wire map (pin to pin continuity)

b. Continuity to remote end

c. Crossed pairs

d. Reversed pairs

e. Split pairs

f. Shorts between two or more conductors

3.5.2.2 Fiber Optic Cable

Test fiber optic cable and as further specified in this section. Two optical tests shall be performed on all optical fibers: Optical Time Domain Reflectometry (OTDR) Test, and Attenuation Test. In addition, a Bandwidth Test shall be performed on all multimode optical fibers. These tests shall be performed on the completed end-to-end spans which include the near-end pre-connectorized single fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single fiber cable assembly.

a. OTDR Test: The OTDR test shall be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings or improper splices for the cable span under test. Hard copy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber,[20][____] m minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature. Conduct OTDR test and provide calculation or interpretation of results

in accordance with JIS C 6823 for single-mode fiber and for multimode fiber. Splice losses shall not exceed 0.3 db.

b. Attenuation Test: End-to-end attenuation measurements shall be made on all fibers, in both directions, using a[850][1300][1310][1550] nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met in accordance with[JIS C 6188 for multimode][and][JIS C 6823 for single-mode] fiber optic cables. The measurement method shall be in accordance with JIS C 6823. Attenuation losses shall not exceed 0.5 db/km at 1310 nm and 1550 nm for single-mode fiber. Attenuation losses shall not exceed 5.0 db/km at 850 nm and 1.5 db/km at 1300 nm for multimode fiber.

c. Bandwidth Test: The end-to-end bandwidth of all multimode fiber span links shall be measured by the frequency domain method. The bandwidth shall be measured in both directions on all fibers. The bandwidth measurements shall be in accordance with JIS C 6824.

3.5.3 Soil Density Tests

[a. Determine soil-density relationships for compaction of backfill material.

][b. Determine soil-density relationships as specified for soil tests in Section 31 00 00 EARTHWORK.

] -- End of Section --

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