

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 STANDARDS ASSOCIATION (JSA)

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 Varimeters
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 Synchrosopes
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 1216-1	(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 1283-1	(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	(2020) 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	(2019) High Voltage AC circuit breakers
JIS C 4604	(2017) High Voltage Current-Limiting Fuses
JIS C 4605	(2020) AC Load Break Switches for rated voltage above 1kV up to and including 52 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	(2021) Luminaires - Part 1: General Requirements For Safety
JIS C 8105-2-2	(2017) 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	(2021) Low-Voltage Switchgear and Control Gear - Part 2-1: Circuit-Breakers
JIS C 8201-2-2	(2021) 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; R 2022) Plugs And Receptacles For Domestic And Similar General Use
JIS C 8364	(2008; R 2018) Busways
JIS C 8480	(R2020) 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 H 3140	(2018) Copper Bus Bars
JIS H 8641	(2021) Hot Dip Galvanized Coatings
JIS Z 8721	(1993) Color Specification - Specification According To Their Three Attributes

THE JAPANESE ELECTRIC WIRE & CABLE MAKERS' ASSOCIATION (JCMA)

JCS 1226	(2003) Soft Stranded Wire
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JAPANESE ELECTROTECHNICAL COMMITTEE (JEC)

JEC 2200	(2015) Transformer
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JEC 2300 (1998) Vacuum Circuit Breaker  
JEC 2310 (2003) Disconnecter 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 (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 (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 watt-hour 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. A DS has no fuse and no arc chute.

###### 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 conform 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 1216-1, JIS C 1281 and JIS C 1283-1.

Var-hour meter shall conform to JIS C 1263-1.

[Alternatively, 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 MLIT ESS, MLIT DSKKS, METI, the Technical Standard for Electrical Equipment TSEE, and JEAC 8001.

- 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 25 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 25 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.

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INSERT 7 DRAWINGS  
-- End of Section --