

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 (2019; TIA 19-1) 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 6, 2021) 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 STANDARDS ASSOCIATION (JSA)

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
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
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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 standards as indicated herein. Provide valves and fittings with pressure ratings equivalent to the pressure ratings of the pipe. Provide 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 JCPA Z 2010. Bonded coating shall have minimum thickness of 0.1 mm for pipe and 0.08 mm for bends.

2.1.1.1.2 Plastic Piping

2.1.1.2.1 PVC and PVC-O 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 PVC-O Piping

JWWA K 129 plain end or gasket bell end pipe, Pressure Class 165 PVC-O pressure pipe, with ductile iron outside diameter.

2.1.1.2.1.3 Fittings for PVC and PVC-O 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 PVC-O Piping

- a. Push-on joints: Use jointing material as recommended by PVC and PVC-O 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 PVC0 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 O-ring stem seals, except for those valves for which gearing is specified, in which case use conventional packing in place of O-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 restraint.

Provide mechanical joint 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 JCPA 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 PVC0 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 PVC-O 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 manufacturer's 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 JCPA 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 PVC0 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 --