SECTION 211100 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

TIPS:

To view non-printing **Editor's Notes** that provide guidance for editing, click on Masterworks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on Masterworks/Supporting Information.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fire-suppression water-service piping and related components outside the building [**and service entrance piping through floor into the building**] [**and service entrance piping through wall into the building**] and the following:

1. Pipes, fittings, and specialties.
2. Fire-suppression specialty valves.
3. Concrete vaults.
4. Protective enclosures.
5. Alarm devices.

B. Utility-furnished products include water meters that are furnished to the site, ready for installation.

C. Related Requirements:

1. Section 211116 "Facility Fire Hydrants" for AWWA and UL-listed, dry- and wet-barrel fire hydrants.
2. Section 211119 "Fire-Department Connections" for exposed-, flush-, and yard-type, fire-department connections.
3. Section 211200 "Fire-Suppression Standpipes" for fire-suppression standpipes inside the building.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.

2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Fire-Suppression Water-Service Piping: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify [**Architect**] [**Construction Manager**] [**Owner**] no fewer than [**two**] <**Insert number**> days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without [**Architect's**] [**Construction Manager's**] [**Owner's**] written permission.

1.8 WARRANTY

A. Manufacturer's Special Warranty on Domestic Products: Conbraco Industries, Inc. warrants products to be free of defects in workmanship or material for a period of five years. This warranty applies to Apollo brand products with "Made in the USA" markings only. Conbraco will correct such defects by suitable repair or replacement at Conbraco's discretion.

B. Manufacturer's Special Warranty on International Products: APOLLO INTERNATIONAL products will be free of defects in workmanship or material for a period of two years. Conbraco will correct such defects by suitable repair or replacement at Conbraco's discretion.

C. Elkhart Products Corporation warranties our fittings to be free from defects in materials and workmanship for a period of fifty (50) years. The Elkhart Product Corporation Water Heater hoses carry a two (2) year warranty against defects in materials and workmanship. Any fitting which proves to be defective will be replaced or a credit issued, but no incidental labor charges, expenses or damages will be allowed.

D. Manufacturer's Special Warranty on Apollo-Shurjoint Piping Products: The 10 Year Limited Warranty applies to manufacturing defects only and does not cover severe service/temperature applications or wear parts. Apollo-Shurjoint will correct such defects by suitable repair or replacement at Apollo-Shurjoint's discretion.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: [**ASTM B 88, Type K (ASTM B 88M, Type A)**] [**and**] [**ASTM B 88, Type L (ASTM B 88M, Type B)**], water tube, annealed temper.

B. Hard Copper Tube: [**ASTM B 88, Type K (ASTM B 88M, Type A)**] [**and**] [**ASTM B 88, Type L (ASTM B 88M, Type B)**], water tube, drawn temper.

C. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Elkhart Products Corporation, or comparable products by one of the following:

a. NIBCO INC.
b. Lee Brass.
c. <**Insert manufacturer's name**>.

D. Copper, Pressure-Seal Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Viega LLC.
    b. <**Insert manufacturer's name**>.

2. Standard: UL 213.
3. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
4. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Elkhart Products Corporation, or comparable products by one of the following:

    a. NIBCO INC.
    b. Lee Brass.
    c. <**Insert manufacturer's name**>.

F. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Elkhart Products Corporation, or comparable products by one of the following:

    a. NIBCO INC.
    b. <**Insert manufacturer's name**>.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.

C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.

D. Grooved-End, Ductile-Iron Pipe Appurtenances:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo-Shurjoint Piping Products USA Inc.; A505, A507, A512, or comparable products by one of the following.

    a. Star Pipe Products.
    b. Victaulic Company.
    c. <**Insert manufacturer's name**>.

2. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
3. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

E. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

F. Push-on-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.

1. Gaskets: AWWA C111, rubber.

G. Flanges: ASME B16.1, Class 125, cast iron.

2.3 PE PIPE AND FITTINGS

A. PE, Fire-Service Pipe: FM Global approved, with minimum thickness equivalent to [**Class 150**] [**and**] [**Class 200**].

B. Molded PE Fittings: FM Global approved; PE butt-fusion type, made to match PE pipe dimensions and class.

2.4 PVC PIPE AND FITTINGS

A. PVC Pipe: [**AWWA C900**] [**or**] [**UL 1285**], [**Class 150**] [**and**] [**Class 200**], with bell end with gasket, and with spigot end.

B. PVC Fittings: [**AWWA C900**] [**or**] [**UL 1285**], [**Class 150**] [**and**] [**Class 200**], with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.5 FIBERGLASS PIPE AND FITTINGS

A. RTRP: UL 1713, [**Class 150**] [**and**] [**Class 200**], with bell-and-spigot ends for bonded joints. Liner is optional unless otherwise indicated.

B. RTRF: UL 1713, similar to pipe in material, pressure class, and joining method.

2.6 SPECIAL PIPE FITTINGS

A. Ductile-Iron Flexible Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. EBAA Iron, Inc.
b. Romac Industries, Inc.
c. Star Pipe Products.
d. Zurn Industries, LLC.
e. <**Insert manufacturer's name**>.

2. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
3. Pressure Rating: 250 psig (1725 kPa) minimum.

B. Ductile-Iron Deflection Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. EBAA Iron, Inc.
b. <**Insert manufacturer's name**>.

2. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
3. Pressure Rating: 250 psig (1725 kPa) minimum.

2.7 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Material: [**Linear low-density PE film of 0.008-inch (0.20-mm) minimum thickness**] [**or**] [**high-density, cross-laminated PE film of 0.004-inch (0.10-mm) minimum thickness**].

C. Form: [**Sheet**] [**or**] [**tube**].

D. Color: [**Black**] [**or**] [**natural**] <**Insert color**>.

2.8 JOINING MATERIALS

A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.

B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

2.9 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Cascade Waterworks Mfg. Co.
   b. Dresser, Inc.
   c. Ford Meter Box Company, Inc. (The).
   d. Jay R. Smith Mfg. Co.
   e. JCM Industries, Inc.
   f. Romac Industries, Inc.
   g. Viking Johnson.
   h. <**Insert manufacturer's name**>.

2. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.
3. Standard: AWWA C219.
4. Center-Sleeve Material: [**Manufacturer's standard**] [**Carbon steel**] [**Stainless steel**] [**Ductile iron**] [**Malleable iron**].
5. Gasket Material: Natural or synthetic rubber.
6. Pressure Rating: [**150 psig (1035 kPa)**] [**200 psig (1380 kPa)**] <**Insert value**> minimum.
7. Metal Component Finish: Corrosion-resistant coating or material.

2.10 CORPORATION VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A.Y. McDonald Mfg. Co.
2. Ford Meter Box Company, Inc. (The).
3. Jones, James Company.
4. Master Meter, Inc.
5. Mueller Co.
6. Red Hed Manufacturing Company; a division of Everett J. Prescott, Inc.
7. <**Insert manufacturer's name**>.

B. Corporation Valves: Comply with AWWA C800. Include saddle and valve compatible with tapping machine[**and manifold**].

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.11 CURB VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A.Y. McDonald Mfg. Co.
2. Ford Meter Box Company, Inc. (The).
3. Jones, James Company.
4. Master Meter, Inc.
5. Mueller Co.
6. Red Hed Manufacturing Company; a division of Everett J. Prescott, Inc.
7. <**Insert manufacturer's name**>.

B. Curb Valves: Comply with AWWA C800 for high-pressure, service-line valves. Valve has bronze body, ground-key plug or ball, wide tee head, and inlet and outlet matching service piping material.

C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.

1. Shutoff Rods: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

D. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.12 DETECTOR CHECK VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ames Fire & Waterworks; A WATTS Brand.
2. Badger Meter, Inc.
3. FEBCO; A WATTS Brand.
4. Flomatic Corporation.
5. Globe Fire Sprinkler Corporation.
6. Kennedy Valve Company; a division of McWane, Inc.
7. Mueller Co.
8. Victaulic Company.

9. Viking Corporation.
10. WATTS.
11. Zurn Industries, LLC.
12. <**Insert manufacturer's name**>.

B. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.

C. Standards: UL 312 and FM Global's "Approval Guide."

D. Pressure Rating: 175 psig (1200 kPa).

E. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

2.13 WATER METERS

A. Water meters are furnished by utility company.

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMCO Water Metering Systems.
2. Badger Meter, Inc.
3. Carlon Meter.
4. Hays Fluid Controls.
5. McCrometer, Inc.
6. Mueller Co.
7. Neptune Technology Group Inc.
8. Sensus Metering Systems.
9. <**Insert manufacturer's name**>.

B. Displacement-Type Water Meters:

1. Description: With bronze main case.
2. Standard: AWWA C700.
3. Registration: Flow in [**gallons (liters)**] [**cubic feet (cubic meters)**].

C. Turbine-Type Water Meters:

1. Standard: AWWA C701.
2. Registration: Flow in [**gallons (liters)**] [**cubic feet (cubic meters)**].

D. Compound-Type Water Meters:

1. Standard: AWWA C702.
2. Registration: Flow in [**gallons (liters)**] [**cubic feet (cubic meters)**].

E. Remote Registration System:

1. Description: Utility company's standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C706.
3. Registration: Flow in [**gallons (liters)**] [**cubic feet (cubic meters)**].

F. Remote Registration System:

1. Description: Utility company's standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C707.
3. Registration: Flow in [**gallons (liters)**] [**cubic feet (cubic meters)**].
4. Data-Acquisition Units: Comply with utility company's requirements for type and quantity.
5. Visible Display Units: Comply with utility company's requirements for type and quantity.

2.14 DETECTOR-TYPE WATER METERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Badger Meter, Inc.
2. Mueller Co.
3. Neptune Technology Group Inc.
4. Sensus Metering Systems.
5. <**Insert manufacturer's name**>.

B. AWWA, Detector Check Water Meters:

1. Description: Main line, turbine meter with second meter on bypass.
2. Standard: AWWA C703.
3. Registration: Flow in [**gallons (liters)**] [**cubic feet (cubic meters)**].
4. Pressure Rating: 150 psig (1035 kPa).
5. Bypass Meter: [**AWWA C701, turbine**] [**AWWA C702, compound**]-type, bronze case.

a. Size: At least one-half nominal size of main-line meter.

C. Fire-Protection, Detector Check Water Meters:

1. Description: Main-line turbine meter with strainer and second meter on bypass.
2. Standards: UL's "Fire Protection Equipment Directory" listing and FM Global's "Approval Guide."
3. Registration: Flow in [**gallons (liters)**] [**cubic feet (cubic meters)**].
4. Pressure Rating: 175 psig (1200 kPa) minimum.
5. Bypass Meter: AWWA C701, turbine-type, bronze case.

a. Size: At least NPS 2 (DN 50).

D. Remote Registration System:

1. Description: Utility company's standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C706.
3. Registration: Flow in [**gallons (liters)**] [**cubic feet (cubic meters)**].

E. Remote Registration System:

1. Description: Utility company's standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C707.
3. Registration: Flow in [**gallons (liters)**] [**cubic feet (cubic meters)**].
4. Data-Acquisition Units: Comply with utility company's requirements for type and quantity.
5. Visible Display Units: Comply with utility company's requirements for type and quantity.

2.15 PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo, Conbraco Industries, Inc.; [**36LF**] [**36CLF**] [**36ELF**] [**36HLF**] [**36**] [**36C**] [**36E**] [**36H**] Series, or a comparable product by one of the following:

   a. WATTS.
   b. Zurn Industries, LLC.
   c. <**Insert manufacturer's name**>.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial pressure of 150 psig (1035 kPa).
4. Size: <**Insert NPS (DN)**>.
5. Design Flow Rate: <**Insert gpm (L/s)**>.
6. Design Inlet Pressure: <**Insert psig (kPa)**>.
7. Design Outlet Pressure Setting: <**Insert psig (kPa)**>.
8. Body Material: Bronze[**with chrome-plated finish**] for NPS 2 (DN 50) and smaller; cast iron[**with interior lining complying with AWWA C550 or that is FDA approved**] for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
9. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

B. Water Control Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo, Conbraco Industries, Inc. [**A127**] [**A127LF**] [**A727**] [**A727LF**] Series, or a comparable product by one of the following:

   a. WATTS.

b. Zurn Industries, LLC.
c. <**Insert manufacturer's name**>.

2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.
3. Pressure Rating: Initial pressure of 150 psig (1035 kPa) minimum.
4. Main Valve Body: Cast or ductile iron with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.

a. Size: <**Insert NPS (DN)**>.
b. Pattern: [**Angle**] [**Globe**]-valve design.
c. Trim: Stainless steel.

5. Design Flow Rate: <**Insert gpm (L/s)**>.
6. Design Inlet Pressure: <**Insert psig (kPa)**>.
7. Design Outlet Pressure Setting: <**Insert psig (kPa)**>.
8. End Connections: Threaded for NPS 2 (DN 50) and smaller; [**flanged**] <**Insert type**> for NPS 2-1/2 (DN 65) and larger.

2.16 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo, Conbraco Industries, Inc.; [**4ALF-200**] [**4ANLF-200**] Series for potable-water applications, and [**4A-200**] [**40-200T2S**] Series for applications other than potable water, or comparable products by one of the following:

a. WATTS.
b. Zurn Industries, LLC.
c. <**Insert manufacturer's name**>.

2. Standard: [**ASSE 1013**] [**or**] [**AWWA C511**].
3. Operation: Continuous-pressure applications.
4. Pressure Loss: [**12 psig (83 kPa)**] <**Insert value**> maximum, through middle one-third of flow range.
5. Size: <**Insert NPS (DN)**>.
6. Design Flow Rate: <**Insert gpm (L/s)**>.
7. Selected Unit Flow Range Limits: <**Insert gpm (L/s)**>.
8. Pressure Loss at Design Flow Rate: <**Insert psig (kPa)**> for NPS 2 (DN 50) and smaller; <**Insert psig (kPa)**> for NPS 2-1/2 (DN 65) and larger.
9. Body Material: Bronze for NPS 2 (DN 50) and smaller; [**cast iron with interior lining complying with AWWA C550 or that is FDA approved**] [**steel with interior lining complying with AWWA C550 or that is FDA approved**] [**stainless steel**] for NPS 2-1/2 (DN 65) and larger.
10. End Connections: Threaded for NPS 2 (DN 50) and smaller; [**flanged**] <**Insert type**> for NPS 2-1/2 (DN 65) and larger.
11. Configuration: Designed for [**horizontal, straight through**] [**vertical inlet, horizontal center section, and vertical outlet**] [**vertical**] <**Insert configuration**> flow.

12. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

B. Double-Check, Backflow-Prevention Assemblies:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo, Conbraco Industries, Inc.; [**4ALF-100**] [**4ANLF-100**] [**4SG-LF**] [**4A-100**] [**4SG-100**] [**4S-100**] Series, or a comparable product by one of the following:

    a. WATTS.
    b. Zurn Industries, LLC.
    c. <**Insert manufacturer's name**>.

2. Standard: [**ASSE 1015**] [**or**] [**AWWA C510**].
3. Operation: Continuous-pressure applications unless otherwise indicated.
4. Pressure Loss: [**5 psig (35 kPa)**] <**Insert value**> maximum, through middle one-third of flow range.
5. Size: <**Insert NPS (DN)**>.
6. Design Flow Rate: <**Insert gpm (L/s)**>.
7. Selected Unit Flow Range Limits: <**Insert gpm (L/s)**>.
8. Pressure Loss at Design Flow Rate: <**Insert psig (kPa)**> for NPS 2 (DN 50) and smaller; <**Insert psig (kPa)**> for NPS 2-1/2 (DN 65) and larger.
9. Body Material: Bronze for NPS 2 (DN 50) and smaller; [**cast iron with interior lining complying with AWWA C550 or that is FDA approved**] [**steel with interior lining complying with AWWA C550 or that is FDA approved**] [**stainless steel**] for NPS 2-1/2 (DN 65) and larger.
10. End Connections: Threaded for NPS 2 (DN 50) and smaller; [**flanged**] <**Insert type**> for NPS 2-1/2 (DN 65) and larger.
11. Configuration: Designed for [**horizontal, straight through**] <**Insert configuration**> flow.
12. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

C. Reduced-Pressure-Detector, Fire-Protection Backflow Preventer Assemblies:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo, Conbraco Industries, Inc.; [**4ALF-700**] [**4ANLF-700**] Series, or a comparable product by one of the following:

    a. Ames Fire & Waterworks; A WATTS Brand.
    b. Zurn Industries, LLC.
    c. <**Insert manufacturer's name**>.

2. Standards: ASSE 1047 and UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
3. Operation: Continuous-pressure applications.

4. Pressure Loss: [**12 psig (83 kPa)**] <**Insert value**> maximum, through middle one-third of flow range.
5. Size: <**Insert NPS (DN)**>.
6. Design Flow Rate: <**Insert gpm (L/s)**>.
7. Selected Unit Flow Range Limits: <**Insert gpm (L/s)**>.
8. Pressure Loss at Design Flow Rate: <**Insert psig (kPa)**>.
9. Body Material: [**Cast iron with interior lining complying with AWWA C550 or that is FDA approved**] [**Steel with interior lining complying with AWWA C550 or that is FDA approved**] [**Stainless steel**].
10. End Connections: Flanged.
11. Configuration: Designed for [**horizontal, straight through**] [**vertical inlet, horizontal center section, and vertical outlet**] [**vertical**] <**Insert configuration**> flow.
12. Accessories:

    a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
    c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

D. Double-Check, Detector-Assembly Backflow Preventers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo, Conbraco Industries, Inc.; [**4ALF-600**] [**4ANLF-600**] [**4SG-600**] [**4S-600**] Series, or comparable product by one of the following:

    a. Ames Fire & Waterworks; A WATTS Brand.
    b. Zurn Industries, LLC.
    c. <**Insert manufacturer's name**>.

2. Standards: ASSE 1048 and UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
3. Operation: Continuous-pressure applications.
4. Pressure Loss: [**5 psig (35 kPa)**] <**Insert value**> maximum, through middle one-third of flow range.
5. Size: <**Insert NPS (DN)**>.
6. Design Flow Rate: <**Insert gpm (L/s)**>.
7. Selected Unit Flow Range Limits: <**Insert gpm (L/s)**>.
8. Pressure Loss at Design Flow Rate: <**Insert psig (kPa)**>.
9. Body Material: [**Cast iron with interior lining complying with AWWA C550 or that is FDA approved**] [**Steel with interior lining complying with AWWA C550 or that is FDA approved**] [**Stainless steel**].
10. End Connections: Flanged.
11. Configuration: Designed for [**horizontal, straight through**] [**vertical inlet, horizontal center section, and vertical outlet**] [**vertical**] <**Insert configuration**> flow.
12. Accessories:

    a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
    b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

E. Backflow Preventer Test Kits:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Apollo, Conbraco Industries, Inc.; 40-200-TK Series, or a comparable product by one of the following:

a. WATTS.
b. Zurn Industries, LLC.
c. <**Insert manufacturer's name**>.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.17 WATER METER BOXES

A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" on cover; and with slotted, open-bottom base section of length to fit over service piping.

1. Option: Base section may be cast-iron, PVC, clay, or other pipe.

B. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" on top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

C. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" on cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches (6 800 kg minimum over 254 by 254 mm) square.

2.18 CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857, and made according to ASTM C 858.

B. Ladder: ASTM A 36/A 36M, steel ladder; or PE-encased steel steps.

C. Manhole: ASTM A 48/A 48M, Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.

1. Dimension: 24-inch (610-mm) minimum diameter unless otherwise indicated.

D. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron traffic frame and cover.

1. Dimension: 24-inch (610-mm) minimum diameter unless otherwise indicated.

E. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.19 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AquaShield.
b. BF Products Inc.
c. DekoRRa Products LLC.
d. Dunco Manufacturing, Inc.
e. G&C Enclosures.
f. Hot Box: Hubbell Power Systems, Inc.
g. HydroCowl, Inc.
h. Piedmont Well Covers, Inc.
i. WATTS.
j. <**Insert manufacturer's name**>.

2. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F (4 deg C) when external temperatures reach as low as minus 34 deg F (minus 36 deg C).
3. Standard: ASSE 1060.
4. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
5. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.

a. Housing: Reinforced[-**aluminum**] [**or**] [-**fiberglass**] <**Insert housing**> construction.

1) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
2) Drain opening for units with drain connection.
3) Access doors with locking devices.
4) Insulation inside housing.
5) Anchoring devices for attaching housing to concrete base.

b. Electric heating cable or heater with self-limiting temperature control.

B. Weather-Resistant Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AquaShield.
b. BF Products Inc.
c. DekoRRa Products LLC.
d. Dunco Manufacturing, Inc.
e. G&C Enclosures.
f. Hot Box: Hubbell Power Systems, Inc.
g. HydroCowl, Inc.

h. Piedmont Well Covers, Inc.
i. WATTS.
j. <**Insert manufacturer's name**>.

2. Description: Uninsulated enclosure designed to protect aboveground water piping, equipment, or specialties from weather and damage.
3. Standard: ASSE 1060.
4. Class III: For equipment or devices other than pressure or atmospheric vacuum breakers.
5. Class III-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.

a. Housing: Reinforced[**-aluminum**] [**or**] [**-fiberglass**] <**Insert housing**> construction.

1) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
2) Drain opening for units with drain connection.
3) Access doors with locking devices.
4) Anchoring devices for attaching housing to concrete base.

C. Expanded-Metal Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Backflow Prevention Device InnClosures, Inc.
b. BF Products Inc.
c. Cross Brothers Inc.
d. GuardShack Enclosures.
e. Le Meur Welding & Manufacturing Co.
f. V.I.T. Products, Inc.
g. <**Insert manufacturer's name**>.

2. Description: Enclosure designed to protect aboveground water piping, equipment, or specialties from damage.
3. Material: ASTM F 1267, expanded-metal side and top panels, of weight and with reinforcement of same metal at edges as required for rigidity.
4. Type: [**I, expanded**] [**II, expanded and flattened**].
5. Class: [**1, uncoated carbon steel**] [**2, hot-dip, zinc-coated carbon steel**] [**3, corrosion-resistant steel**].
6. Finish: Manufacturer's enamel paint.
7. Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
8. Locking device.
9. Lugs or devices for securing enclosure to base.
10. Enclosure Bases: [**4-inch- (100-mm-)**] [**6-inch- (150-mm-)**] minimum thickness precast concrete, of dimensions required to extend at least 6 inches (150 mm) beyond edges of enclosure housings. Include openings for piping.

2.20 ALARM DEVICES

A. General: UL 753 and FM Global's "Approval Guide" listing, of types and sizes to mate and match piping and equipment.

B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig (1725-kPa) working pressure; designed for horizontal or vertical installation; with two single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.

C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with excavating, trenching, and backfilling requirements in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Water-Main Connection: Arrange with water utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 (DN 50) and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company's standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.

4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.

F. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

1. Install encasement for tubing according to ASTM A 674 or AWWA C105.

G. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install encasement for piping according to ASTM A 674 or AWWA C105.

H. Install PE pipe according to ASTM D 2774 and ASTM F 645.

I. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

J. Install fiberglass AWWA pipe according to AWWA M45.

K. Bury piping with depth of cover over top at least [**30 inches (750 mm)**] <**Insert dimension**>, with top at least [**12 inches (300 mm)**] <**Insert dimension**> below level of maximum frost penetration, and according to the following:

1. Under Driveways: With at least [**36 inches (910 mm)**] <**Insert dimension**> of cover over top.
2. Under Railroad Tracks: With at least [**48 inches (1220 mm)**] <**Insert dimension**> of cover over top.
3. In Loose Gravelly Soil and Rock: With at least [**12 inches (300 mm)**] <**Insert dimension**> of additional cover.

L. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

M. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.

1. Terminate fire-suppression water-service piping within the building at the [**floor slab**] [**wall**] until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.

N. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

O. Comply with requirements for fire-suppression water-service piping inside the building in the following Sections:

1. Section 211200 "Fire-Suppression Standpipes"
2. Section 211313 "Wet-Pipe Sprinkler Systems
3. Section 211316 "Dry-Pipe Sprinkler Systems"

P. Comply with requirements in Section 221116 "Domestic Water Piping" for potable-water piping inside the building.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in tubing NPS 2 (DN 50) and smaller.

C. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

D. Ream ends of tubes and remove burrs.

E. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.

F. Copper-Tubing, Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

G. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.

H. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

I. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.

J. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.

K. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

L. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139.

M. Fiberglass Piping Bonded Joints: Use adhesive and procedure recommended by piping manufacturer.

N. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

O. Do not use flanges or unions for underground piping.

3.4 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.
7. <**Insert devices**>.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL-Listed or FM Global-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.

F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.[**Install full-size valved bypass.**]

H. Support valves and piping, not direct buried, on concrete piers. Comply with requirements for concrete piers in [**Section 033000 "Cast-in-Place Concrete."**] [**Section 033053 "Miscellaneous Cast-in-Place Concrete."**]

3.6 DETECTOR CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

C. Support detector check valves and piping on concrete piers. Comply with requirements for concrete piers in [**Section 033000 "Cast-in-Place Concrete."**] [**Section 033053 "Miscellaneous Cast-in-Place Concrete."**]

3.7 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Water Meters: Install [**displacement**] [**turbine**]-type water meters NPS 2 (DN 50) and smaller in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets, and include valved bypass around meters unless prohibited by authorities having jurisdiction.

C. Water Meters: Install [**compound**] [**turbine**]-type water meters NPS 3 (DN 80) and larger in meter vaults. Include shutoff valves on water meter inlets and outlets, and include valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

D. Water Meters: Install detector-type water meters in meter vault according to AWWA M6. Include shutoff valves on water meter inlets and outlets, and include full-size valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

E. Support water meters and piping NPS 3 (DN 80) and larger on concrete piers. Comply with requirements for concrete piers in [**Section 033000 "Cast-in-Place Concrete."**] [**Section 033053 "Miscellaneous Cast-in-Place Concrete."**]

3.8 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.9 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 (DN 65) and larger backflow preventers and piping on concrete piers. Comply with requirements for concrete piers in [**Section 033000 "Cast-in-Place Concrete."**] [**Section 033053 "Miscellaneous Cast-in-Place Concrete."**]

3.10 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top [**2 inches (50 mm)**] <**Insert dimension**> above surface.

3.11 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C 891.

3.12 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately [**2 inches (50 mm)**] <**Insert dimension**> above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.13 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire-department connection to mains.

B. Install protective pipe bollards [**on two sides of**] [**on three sides of**] <**Insert arrangement**> each freestanding fire-department connection. Pipe bollards are specified in Section 055000 "Metal Fabrications."

3.14 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

B. Supervisory Switches: Supervise valves in open position.

1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

C. Locking and Sealing: Secure unsupervised valves as follows:

1. Valves: Install chain and padlock on open OS&Y gate valve.

2. Post Indicators: Install padlock on wrench on indicator post.

D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

F. Connect alarm devices to building's fire-alarm system. Wiring and fire-alarm devices are specified in [**Section 284621.11 "Addressable Fire-Alarm Systems."**] [**Section 284621.13 "Conventional Fire-Alarm Systems."**]

3.15 CONNECTIONS

A. Connect fire-suppression water-service piping to [**utility water main**] [**existing water main**] <**Insert piping system**>. Use [**tapping sleeve and tapping valve**] [**service clamp and corporation valve**] <**Insert method**>.

B. Connect fire-suppression water-service piping to interior fire-suppression piping.

C. Connect waste piping from concrete vault drains to [**sanitary sewerage system. Comply with requirements in Section 221313 "Facility Sanitary Sewers" for connection to sanitary sewer**] [**storm-drainage system. Comply with requirements in Section 334100 "Storm Utility Drainage Piping" for connection to storm sewer**].

3.16 FIELD QUALITY CONTROL

A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.

B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig (zero kPa). Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

D. Prepare test and inspection reports.

3.17 IDENTIFICATION

A. Install continuous underground[**detectable**] warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic fire-suppression water-service piping or fire-suppression water-service piping with electrically insulated fittings, on main electrical meter panel. Comply with requirements for identifying devices in Section 220553 "Identification for Plumbing Piping and Equipment."

3.18 CLEANING

A. Clean[**and disinfect**] fire-suppression water-service piping as follows:

1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging[**and disinfecting**] procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow it to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow it to stand for three hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging[**and disinfecting**] activities.

3.19 PIPING SCHEDULE

A. Underground fire-suppression water-service piping [**NPS 2 (DN 50) and smaller**] <**Insert pipe size range**> shall be[**one of**] the following:

1. [**Hard**] [**Soft**] copper tube, [**ASTM B 88, Type K (ASTM B 88M, Type A)**] [**ASTM B 88, Type L (ASTM B 88M, Type B)**]; [**wrought-copper, solder-joint fittings; and brazed**] [**copper, pressure-seal fittings; and pressure-sealed**] joints.
2. NPS 2 (DN 50) PE, [**Class 150**] [**Class 200**], fire-service pipe; molded PE fittings; and heat-fusion joints.

B. Underground fire-suppression water-service piping NPS 3 (DN 80) shall be[**one of**] the following:

1. [**Hard**] [**Soft**] copper tube, [**ASTM B 88, Type K (ASTM B 88M, Type A)**] [**ASTM B 88, Type L (ASTM B 88M, Type B)**]; [**wrought-copper, solder-joint fittings; and brazed**] [**copper, pressure-seal fittings; and pressure-sealed**] joints.

2. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
3. Mechanical-joint, ductile-iron pipe; mechanical-joint, [**ductile- or gray-iron, standard-pattern**] [**or**] [**ductile-iron, compact-pattern**] fittings; glands, gaskets, and bolts; and gasketed joints.
4. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and gasketed joints.
5. PE, [**Class 150**] [**Class 200**], fire-service pipe; molded PE fittings; and heat-fusion joints.

C. Underground fire-suppression water-service piping NPS 4 (DN 100) shall be[**one of**] the following:

1. [**Hard**] [**Soft**] copper tube, [**ASTM B 88, Type K (ASTM B 88M, Type A)**] [**ASTM B 88, Type L (ASTM B 88M, Type B)**]; [**wrought-copper, solder-joint fittings; and brazed**] [**copper, pressure-seal fittings; and pressure-sealed**] joints.
2. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
3. Mechanical-joint, ductile-iron pipe; mechanical-joint, [**ductile- or gray-iron, standard-pattern**] [**or**] [**ductile-iron, compact-pattern**] fittings; glands, gaskets, and bolts; and gasketed joints.
4. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and gasketed joints.
5. PE, [**Class 150**] [**Class 200**], fire-service pipe; molded PE fittings; and heat-fusion joints.
6. PVC, [**Class 150**] [**Class 200**] pipe listed for fire-protection service; PVC fittings of same class as pipe; and gasketed joints.
7. Fiberglass, RTRP, [**Class 150**] [**Class 200**]; RTRF; and bonded joints.

D. Underground fire-suppression water-service piping [**NPS 6 to NPS 12 (DN 150 to DN 300)**] <**Insert pipe size range**> shall be[**one of**] the following:

1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
2. Mechanical-joint, ductile-iron pipe; mechanical-joint, [**ductile- or gray-iron, standard-pattern**] [**or**] [**ductile-iron, compact-pattern**] fittings; glands, gaskets, and bolts; and gasketed joints.
3. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and gasketed joints.
4. PE, [**Class 150**] [**Class 200**], fire-service pipe; molded PE fittings; and heat-fusion joints.
5. PVC, [**Class 150**] [**Class 200**] pipe listed for fire-protection service; PVC fittings of same class as pipe; and gasketed joints.
6. Fiberglass, RTRP, [**Class 150**] [**Class 200**]; RTRF; and bonded joints.

E. [**Aboveground**] [**and**] [**vault**] fire-suppression water-service piping [**NPS 2 (DN 50) and smaller**] <**Insert pipe size range**> shall be hard copper tube, [**ASTM B 88, Type K (ASTM B 88M, Type A)**] [**ASTM B 88, Type L (ASTM B 88M, Type B)**]; [**wrought- or cast-copper-alloy, solder-joint fittings; and brazed**] [**copper, pressure-seal fittings; and pressure-sealed**] joints.

F. [**Aboveground**] [**and**] [**vault**] fire-suppression water-service piping [**NPS 3 and NPS 4 (DN 80 and DN 100)**] <**Insert pipe size range**> shall be[**one of**] the following:

1. Hard copper tube, [**ASTM B 88, Type K (ASTM B 88M, Type A)**] [**ASTM B 88, Type L (ASTM B 88M, Type B)**]; [**wrought-copper, solder-joint fittings; and brazed**] [**copper, pressure-seal fittings; and pressure-sealed**] joints.
2. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.

G. [**Aboveground**] [**and**] [**vault**] fire-suppression water-service piping [**NPS 5 to NPS 12 (DN 125 to DN 300)**] <**Insert pipe size range**> shall be grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.

H. Underslab fire-suppression water-service piping [**NPS 2 (DN 50) and smaller**] <**Insert pipe size range**> shall be [**hard**] [**soft**] copper tube, [**ASTM B 88, Type K (ASTM B 88M, Type A)**] [**ASTM B 88, Type L (ASTM B 88M, Type B)**]; [**wrought-copper, solder-joint fittings; and brazed**] [**copper, pressure-seal fittings; and pressure-sealed**] joints.

I. Underslab fire-suppression water-service piping [**NPS 3 and NPS 4 (DN 80 and DN 100)**] <**Insert pipe size range**> shall be[**one of**] the following:

1. [**Hard**] [**Soft**] copper tube, [**ASTM B 88, Type K (ASTM B 88M, Type A)**] [**ASTM B 88, Type L (ASTM B 88M, Type B)**]; [**wrought-copper, solder-joint fittings; and brazed**] [**copper, pressure-seal fittings; and pressure-sealed**] joints.
2. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
3. Mechanical-joint, ductile-iron pipe; mechanical-joint, [**ductile- or gray-iron, standard-pattern**] [**or**] [**ductile-iron, compact-pattern**] fittings; glands, gaskets, and bolts; and restrained, gasketed joints.
4. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and restrained, gasketed joints.

J. Underslab fire-suppression water-service piping [**NPS 6 to NPS 12 (DN 150 to DN 300)**] <**Insert pipe size range**> shall be[**one of**] the following:

1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
2. Mechanical-joint, ductile-iron pipe; mechanical-joint, [**ductile- or gray-iron, standard-pattern**] [**or**] [**ductile-iron, compact-pattern**] fittings; glands, gaskets, and bolts; and restrained, gasketed joints.
3. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and restrained, gasketed joints.

3.20 VALVE SCHEDULE

A. Underground fire-suppression water-service shutoff valves NPS 2 (DN 50) and smaller shall be corporation valves or curb valves with ends compatible with piping.

B. Meter box fire-suppression water-service shutoff valves NPS 2 (DN 50) and smaller shall be meter valves.

C. Vault fire-suppression water-service shutoff valves NPS 2 (DN 50) and smaller shall be [**Class 125, MSS, bronze, nonrising stem**] [**or**] [**UL-listed or FM Global-approved, OS&Y, bronze,**] gate valves.

D. Underground fire-suppression water-service shutoff valves NPS 3 (DN 80) and larger shall be[**one of**] the following:

1. 200-psig (1380-kPa), AWWA, iron, nonrising-stem, [**metal**] [**resilient**]-seated gate valves.
2. 250-psig (1725-kPa), AWWA, iron, nonrising-stem, resilient-seated gate valves.
3. [**175-psig (1200-kPa)**] [**250-psig (1725-kPa)**], UL-listed or FM Global-approved, iron, nonrising-stem gate valves.

E. Indicator-post underground fire-suppression water-service valves NPS 3 (DN 80) and larger shall be [**175-psig (1200-kPa)**] [**250-psig (1725-kPa)**], UL-listed or FM Global-approved, iron, nonrising-stem gate valves with indicator-post flange.

F. Standard-pressure, [**aboveground**] [**and**] [**vault**] fire-suppression water-service shutoff valves NPS 3 (DN 80) and larger shall be[**one of**] the following:

1. 200-psig (1380-kPa), AWWA, iron, OS&Y, [**metal**] [**resilient**]-seated gate valves.
2. 250-psig (1725-kPa), AWWA, iron, OS&Y, resilient-seated gate valves.
3. [**175-psig (1200-kPa)**] [**250-psig (1725-kPa)**], UL-listed or FM Global-approved, iron, OS&Y gate valves.
4. [**AWWA**] [**or**] [**UL-listed or FM Global-approved**] butterfly valves.

G. Fire-suppression water-service check valves NPS 3 (DN 80) and larger shall be[**one of**] the following:

1. [**AWWA**] [**or**] [**UL-listed or FM Global-approved**] check valves.
2. UL-listed or FM Global-approved detector check valves.

END OF SECTION 211100