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SECTION 221113 - FACILITY WATER DISTRIBUTION PIPING

TIPS:

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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. This Section includes water-distribution piping and related components outside the building for [water service] [fire-service mains] [combined water service and fire-service mains].
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 DEFINITIONS

- A. EPDM: Ethylene propylene diene terpolymer rubber.
- B. LLDPE: Linear, low-density polyethylene plastic.

- C. PA: Polyamide (nylon) plastic.
- D. PE: Polyethylene plastic.
- E. PEX: Cross-Linked Polyethylene
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.
- H. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
- I. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
 - 1. Wiring Diagrams: Power, signal, and control wiring for alarms.

1.5 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 test reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals. Include technical data sheets, product instructions, and design calculation reports.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer to maintain ISO 9001 or NSF International and IAPMO R&T quality control programs.
- B. Installer Qualifications:
 - 1. Press-Connect Joining Procedure for Copper and Stainless Steel Tubing: Qualify operators according to training provided by Viega; Plumbing and Heating Systems.
 - 2. Press-Connect Joining Procedure for Steel Piping. Qualify operators according to training provided by Viega; Plumbing and Heating Systems.

- C. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- D. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- G. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- H. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- I. NSF Compliance:
 - 1. Comply with NSF 14 for plastic potable-water-service piping. [**Include marking "NSF-pw" on piping.**]
 - 2. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.8 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.

1.9 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: 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 water-distribution service without [Architect's] [Construction Manager's] [Owner's] written permission.

1.10 COORDINATION

- A. Coordinate connection to water main with utility company.

1.11 WARRANTY

- A. Special Limited Warranty: Viega LLC warrants to wholesalers, and licensed plumbing and mechanical contractors in the United States and Canada, that its fittings, when properly installed in nonindustrial and non-marine applications and under normal conditions of use, will be free of failure from manufacturing defect for the following component warranty periods:
 - 1. Warranty Period for ProPress Fittings: 50 years from date of Substantial Completion.
 - 2. Warranty Period for ProPress Valves: Two years from date of Substantial Completion.
 - 3. Warranty Period for PEX Tubing: 25 years from date of Substantial Completion.
 - 4. Warranty Period of PEX Metal or Polymer Fittings: 25 years from date of Substantial Completion.
 - 5. Warranty Period for Viega ManaBloc, Minibloc or Polymer Manifolds: 10 years from date of Substantial Completion.
 - 6. Warranty Period for PEX Valves: Two years from date of Substantial Completion.

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.

1. 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.
 2. Copper, Press-Connect Fittings:
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide Viega LLC; ProPress or comparable product by one of the following:
 - 1) NIBCO
 - 2) Apollo Xpress
 - 3) Parker
 - 4) <Insert manufacturer's name>.
 - b. **NPS 1-1/4 (DN 35)** and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
- 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.
1. 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.
 2. Copper, Press-Connect Fittings:
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide Viega LLC; ProPress or comparable product by one of the following:
 - 1) NIBCO
 - 2) Apollo Xpress
 - 3) Parker
 - 4) <Insert manufacturer's name>.
 - b. **NPS 2 (DN 54)** and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - c. **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)**: Wrought-copper fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
 3. Press Ends: Unpressed fitting identification feature to the fitting wall.
 4. Sealing Element: EPDM.
- C. Cast Copper Alloy Pipe Flanges with Press-connect Fittings.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Viega LLC; ProPress Copper or comparable product by one of the following:
 - a. NIBCO, INC.
 - b. <Insert manufacturer's name>.
 2. Flanges: ASME B 16.24, Class 150, powder coated steel plate; two-piece design.
 3. **NPS 2-1/2 thru NPS 4 (DN 65 to DN 100)** Fittings: Stainless-steel grip ring and EPDM O-ring seal in each end.

4. Housing: Copper or bronze.
 5. Press Ends: Unpressed fitting identification feature to the fitting wall.
 6. Sealing Element: EPDM.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint or press-connect end. Furnish Class 150 flanges if required to match piping.
- E. 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.

2.2 STAINLESS-STEEL PIPING

- A. Potable-water piping and components shall comply with NSF 61 Annex G.
- B. Stainless-Steel Pipe: ASTM A 312/A 312M, Schedule 5S.
- C. Stainless-Steel Pipe Fittings: ASTM A 815/A 815M, stainless steel; **NPS 1/2 – NPS 4 (DN 15 to DN 100)** fittings.

2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 2. Gaskets: AWWA C111, rubber.
- C. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
1. Grooved-End, Ductile-Iron Pipe Appurtenances:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Anvil International.
 - 2) Grinell.
 - 3) Smith-Cooper International.
 - 4) Victaulic Company.
 - 5) **<Insert manufacturer's name>**.

- b. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
 - c. 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.
- D. Flanges: ASME 16.1, Class 125, cast iron.
- E. Flanges: ASME B16.24 and ANSI/ASME 16.5, Class 150, cast copper alloy.

2.4 PE PIPE AND FITTINGS

- A. PE, ASTM Pipe: ASTM D 2239, SDR No. 5.3, 7, or 9; with PE compound number required to give pressure rating not less than [**160 psig (1100 kPa)**] [**200 psig (1380 kPa)**].
- 1. Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated male insert ends matching inside of pipe. Include bands or crimp rings.
 - 2. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.
- B. PE, AWWA Pipe: AWWA C906, DR No. 7.3, 9, or 9.3; with PE compound number required to give pressure rating not less than [**160 psig (1100 kPa)**] [**200 psig (1380 kPa)**].
- 1. PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than [**160 psig (1100 kPa)**] [**200 psig (1380 kPa)**].
- C. PE, Fire-Service Pipe: ASTM F 714, AWWA C906, or equivalent for PE water pipe; FMG approved, with minimum thickness equivalent to FMG [**Class 150**] [**and**] [**Class 200**].
- 1. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

2.5 PEX TUBE AND FITTINGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Viega LLC; ViegaPEX Ultra or comparable product by one of the following:
- 1. Heat Innovations, Inc.
 - 2. Slant/Fin Corporation.
 - 3. **<Insert manufacturer's name>**.
- B. Tube Material:
- 1. Tubing: Silane cross-linked high density polyethylene per ASTM F 876/F 877 and CSA B 137.5.
 - 2. Certified to NSF 14 and 61.
 - 3. UV Protection: 6 months.
 - 4. Chlorine resistance rating of 5 per ASTM F876 when tested to ASTM F2023.
 - 5. Certified to UL 263 ULC S101 for floor and wall assemblies.

6. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 and ULC S102.2 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency (Refer to PEX manufacturer listing for installation limitations).
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
7. Bronze Fittings: PEX Press Fittings manufactured from UNS [C83600] [C87700] [C87710] copper alloy, meeting the requirements of ASTM F 877 tested as a system with manufacturer's PEX tubing.
 - a. PEX Press Sleeve: 304 grade or better stainless steel with three view holes and an attached sleeve to ensure proper PEX tubing insertion.
 - b. Attached sleeve fitting incorporates a tool locator ring in place while making a proper press connection.
 - c. PEX press connection made with a manufacturer supplied ratcheting PEX Press hand tool or PEX Press power tool.
8. Polymer Fittings: PEX Press Fittings manufactured from Radel®-R PPSU polymer, meeting the requirements of ASTM F 877 tested as a system with manufacturer's PEX tubing.
 - a. PEX Press Sleeve: 304 grade or better stainless steel with three view holes and an attached sleeve to ensure proper PEX tubing insertion.
 - b. Fitting includes Smart Connect feature providing quick easy identification of unpressed connections during the pressure testing process.
 - c. Unpressed connections are located by pressurizing the system to 0.5 psi to 100 psi (3.4 kPa to 689 kPa).
 - d. Attached sleeve fitting will incorporate a tool locator ring that shall be in place while making a proper press connection.
 - e. PEX Press connection made with a manufacturer supplied ratcheting PEX Press hand tool or PEX Press power tool.
9. Pressure/Temperature Rating: Manufacturer's PEX High-Density Cross-linked polyethylene tubing shall meet standard grade hydrostatic pressure ratings from Plastic Pipe Institute in accordance with TR-4/03. Three standard grade ratings are required:
 - a. 200 deg F (93 deg C) at 80 psi (551 kPa).
 - b. 180 deg F (82 deg C) at 100 psi (689 kPa).
 - c. 73.4 deg F (23 deg C) at 160 psi (1102 kPa).

2.6 PEX/AL/PE TUBE AND FITTINGS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Viega LLC; FostaPEX or comparable product by one of the following:
 1. <Insert manufacturer's name>.

- B. Tube Material: First layer of PEX, a silane cross-linked high density polyethylene plastic meeting the requirements of ASTM F876, a second layer of butt welded aluminum tube with a third layer of bonded co-extruded polyethylene meeting the requirements of ASTM F877 and CSA B137.5.
1. Meets IAPMO Standard IGC 212.
 2. Certified to NSF 14 and 61.
 3. UV Protection: 6 months.
 4. Chlorine resistance rating of 5 per ASTM F876 when tested to ASTM F2023.
 5. Certified to UL 263 ULC S101 for floor and wall assemblies (Refer to PEX manufacturer listing for installation limitations).
 6. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 and ULC S102.2 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency (Refer to PEX manufacturer listing for installation limitations).
 7. Bronze Fittings: PEX Press Fittings manufactured from UNS [C83600] [C87700] [C87710] copper alloy, meeting the requirements of ASTM F 877 tested as a system with manufacturer's PEX tubing.
 - a. PEX Press Sleeve: 304 grade or better stainless steel with three view holes and an attached sleeve to ensure proper PEX tubing insertion.
 - b. Attached sleeve fitting incorporates a tool locator ring in place while making a proper press connection.
 - c. PEX press connection made with a manufacturer supplied ratcheting PEX Press hand tool or PEX Press power tool.
 8. Polymer Fittings: PEX Press Fittings manufactured from Radel®-R PPSU polymer, meeting the requirements of ASTM F 877 tested as a system with manufacturer's PEX tubing.
 - a. PEX Press Sleeve: 304 grade or better stainless steel with three view holes and an attached sleeve to ensure proper PEX tubing insertion.
 - b. Fitting includes Smart Connect feature providing quick easy identification of unpressed connections during the pressure testing process.
 - c. Unpressed connections are located by pressurizing the system to 0.5 psi to 100 psi (3.4 kPa to 689 kPa).
 - d. Attached sleeve fitting will incorporate a tool locator ring that shall be in place while making a proper press connection.
 - e. PEX Press connection made with a manufacturer supplied ratcheting PEX Press hand tool or PEX Press power tool.
 9. Pressure/Temperature Rating: Manufacturer's PEX High-Density Cross-linked polyethylene tubing meeting standard grade hydrostatic pressure ratings from Plastic Pipe Institute in accordance with TR-4/03. Three standard grade ratings are required:
 - a. 200 deg F (93 deg C) at 80 psi (551 kPa).
 - b. 180 deg F (82 deg C) at 100 psi (689 kPa).
 - c. 73.4 deg F (23 deg C) at 160 psi (1102 kPa).

2.7 PVC PIPE AND FITTINGS

- A. PVC, Schedule 40 Pipe: ASTM D 1785.
 - 1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.
- B. PVC, Schedule 80 Pipe: ASTM D 1785.
 - 1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.
 - 2. PVC, Schedule 80 Threaded Fittings: ASTM D 2464.
- C. PVC, AWWA Pipe: AWWA C900, [**Class 150**] [**and**] [**Class 200**], with bell end with gasket, and with spigot end.
 - 1. Comply with UL 1285 for fire-service mains if indicated.
 - 2. PVC Fabricated Fittings: AWWA C900, [**Class 150**] [**and**] [**Class 200**], with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
 - 3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
 - 4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Gaskets: AWWA C111, rubber.
 - 5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.8 FIBERGLASS PIPE AND FITTINGS

- A. AWWA RTRP: AWWA C950, [**Class 150**] [**Class 200**] [**and**] [**Class 250**], Type I[**or II**], [**Grade 1, epoxy**] [**or**] [**Grade 2, polyester**], with bell-and-spigot ends [**for bonded**] [**with gasket or seal for gasketed**] joints. Liner is optional, unless otherwise indicated.[**Include FMG approval if used for fire-service mains.**]
 - 1. RTRF: AWWA C950, similar to pipe in material, pressure class, and joining method.
- B. UL RTRP: UL 1713, [**Class 150**] [**Class 200**] [**and**] [**Class 250**], with bell-and-spigot ends with gasket or seal for gasketed joints. Liner is optional, unless otherwise indicated.
 - 1. RTRF: Similar to pipe in material, pressure class, and joining method.

2.9 SPECIAL PIPE FITTINGS

- A. Ductile-Iron Rigid Expansion Joints:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. EBAA Iron, Inc.
 - b. U.S. Pipe and Foundry Company.
 - c. Zurn Industries, LLC.
 - d. **<Insert manufacturer's name>**.
2. Description: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 - a. Pressure Rating: **250 psig (1725 kPa)** minimum.
 - b. Expansion Required: **<Insert inches (mm)>**.
- B. Ductile-Iron Flexible Expansion Joints:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. EBAA Iron, Inc.
 - b. Hays Fluid Controls.
 - 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.
 - a. Pressure Rating: **250 psig (1725 kPa)** minimum.
 - b. Offset: **<Insert inches (mm)>**.
 - c. Expansion Required: **<Insert inches (mm)>**.
- C. Ductile-Iron Deflection Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. EBAA Iron, Inc.
 - b. **<Insert manufacturer's name>**.
 2. Description: Compound, ductile-iron coupling fitting with sleeve and 1 or 2 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.
 - a. Pressure Rating: **250 psig (1725 kPa)** minimum.

2.10 JOINING MATERIALS

- A. Refer to Section 330500 "Common Work Results for Utilities" for commonly used joining materials.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series.
- C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.
- D. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.11 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. Hays Fluid Controls.
 - e. JCM Industries, Inc.
 - f. Smith-Blair, 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.
 - a. Standard: AWWA C219.
 - b. Center-Sleeve Material: **[Manufacturer's standard] [Carbon steel] [Stainless steel] [Ductile iron] [Malleable iron]**.
 - c. Gasket Material: Natural or synthetic rubber.
 - d. Pressure Rating: **[150 psig (1035 kPa)] [200 psig (1380 kPa)] <Insert pressure> minimum.**
 - e. Metal Component Finish: Corrosion-resistant coating or material.
- C. Split-Sleeve Pipe Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Victaulic Company.
 - b. **<Insert manufacturer's name>**.

2. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
 - a. Standard: AWWA C219.
 - b. Sleeve Material: [**Manufacturer's standard**] [**Carbon steel**] [**Stainless steel**].
 - c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
 - d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
 - e. Pressure Rating: [**150 psig (1035 kPa)**] [**200 psig (1380 kPa)**] <Insert pressure> minimum.
 - f. Metal Component Finish: Corrosion-resistant coating or material.

D. Flexible Connectors:

1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

E. Dielectric Fittings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Viega LLC; ProPress Zero Lead Dielectric Unions or comparable product by one of the following:
 - a. <Insert manufacturer's name>.
2. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
3. Dielectric Unions:
 - a. Description:
 - 1) Standard: ASSE 1079.
 - 2) Pressure Rating: [**125 psig (860 kPa) minimum at 180 deg F (82 deg C)**] [**150 psig (1035 kPa)**] [**250 psig (1725 kPa)**].
 - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
4. Dielectric Flanges:
 - a. Description:
 - 1) Standard: ASSE 1079.
 - 2) Factory-fabricated, bolted, companion-flange assembly.
 - 3) Pressure Rating: [**125 psig (860 kPa) minimum at 180 deg F (82 deg C)**] [**150 psig (1035 kPa)**] [**175 psig (1200 kPa)**] [**300 psig (2070 kPa)**].
 - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
5. Dielectric-Flange Insulating Kits:

- a. Description: ASME B16.24, Class 150, two-piece adapter flange; powder coated.
 - 1) Nonconducting materials for field assembly of companion flanges.
 - 2) Pressure Rating: [150 psig (1035 kPa)] <Insert pressure>.
 - 3) Gasket: Neoprene or phenolic.
 - 4) Bolt Sleeves: Phenolic or polyethylene.
 - 5) Washers: Phenolic with steel backing washers.

6. Dielectric Nipples:

- a. Description:
 - 1) Standard: IAPMO PS 66
 - 2) Electroplated steel nipple complying with ASTM F 1545.
 - 3) Pressure Rating: [300 psig (2070 kPa) at 225 deg F (107 deg C)] <Insert pressure and temperature>.
 - 4) End Connections: Male threaded or grooved.
 - 5) Lining: Inert and noncorrosive, propylene.

2.12 CORROSION-PROTECTION PIPING ENCASUREMENT

A. Encasement for Underground Metal Piping:

- 1. Standards: ASTM A 674 or AWWA C105.
- 2. Form: [Sheet] [Sheet or tube] [Tube].
- 3. Material: LLDPE film of 0.008-inch (0.20-mm) minimum thickness.
- 4. Material: LLDPE film of 0.008-inch (0.20-mm) minimum thickness, or high-density, crosslaminated PE film of 0.004-inch (0.10-mm) minimum thickness.
- 5. Material: High-density, crosslaminated PE film of 0.004-inch (0.10-mm) minimum thickness.
- 6. Color: [Black] [Natural] <Insert color>.

2.13 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American AVK Co.
 - b. American Cast Iron Pipe Company.
 - c. Clow Valve Company; a subsidiary of McWane, Inc.
 - d. Crane; Crane Energy Flow Solutions.
 - e. EJ.
 - f. Flomatic Corporation.
 - g. Kennedy Valve Company; a division of McWane, Inc.
 - h. M & H Valve Company; a division of McWane, Inc.
 - i. McWane, Inc.
 - j. Mueller Co.

- k. NIBCO INC.
 - l. Tyler Pipe; a subsidiary of McWane Inc.
 - m. U.S. Pipe and Foundry Company.
 - n. Zurn Industries, LLC.
 - o. <Insert manufacturer's name>.
2. Nonrising-Stem, Metal-Seated Gate Valves:
 - a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
 - 1) Standard: AWWA C500.
 - 2) Minimum Pressure Rating: 200 psig (1380 kPa).
 - 3) End Connections: Mechanical joint.
 - 4) Interior Coating: Complying with AWWA C550.
 3. Nonrising-Stem, Resilient-Seated Gate Valves:
 - a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 200 psig (1380 kPa).
 - 3) End Connections: Mechanical joint.
 - 4) Interior Coating: Complying with AWWA C550.
 4. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:
 - a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.
 - 1) Standard: AWWA C509.
 - 2) Minimum Pressure Rating: 250 psig (1725 kPa).
 - 3) End Connections: Push on or mechanical joint.
 - 4) Interior Coating: Complying with AWWA C550.
 5. OS&Y, Rising-Stem, Metal-Seated Gate Valves:
 - a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.
 - 1) Standard: AWWA C500.
 - 2) Minimum Pressure Rating: 200 psig (1380 kPa).
 - 3) End Connections: Flanged.
 6. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:
 - a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.
 - 1) Standard: AWWA C509.

- 2) Minimum Pressure Rating: 200 psig (1380 kPa).
- 3) End Connections: Flanged.

B. UL/FMG, Cast-Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Cast Iron Pipe Company.
 - b. Clow Valve Company; a subsidiary of McWane, Inc.
 - c. Crane; Crane Energy Flow Solutions.
 - d. Kennedy Valve Company; a division of McWane, Inc.
 - e. M & H Valve Company; a division of McWane, Inc.
 - f. McWane, Inc.
 - g. Mueller Co.
 - h. NIBCO INC.
 - i. Stockham; Crane Energy Flow Solutions.
 - j. U.S. Pipe and Foundry Company.
 - k. Zurn Industries, LLC.
 - l. <Insert manufacturer's name>.
2. UL/FMG, Nonrising-Stem Gate Valves:
 - a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
 - 1) Standards: UL 262 and FMG approved.
 - 2) Minimum Pressure Rating: 175 psig (1207 kPa).
 - 3) End Connections: Flanged.
3. OS&Y, Rising-Stem Gate Valves:
 - a. Description: Iron body and bonnet and bronze seating material.
 - 1) Standards: UL 262 and FMG approved.
 - 2) Minimum Pressure Rating: 175 psig (1207 kPa).
 - 3) End Connections: Flanged.

C. Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Hammond Valve.
 - c. Jenkins Valves; Crane Energy Flow Solutions.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Red-White Valve Corporation.
 - g. Stockham; Crane Energy Flow Solutions.
 - h. Zurn Industries, LLC.

- i. <Insert manufacturer's name>.
2. OS&Y, Rising-Stem Gate Valves:
 - a. Description: Bronze body and bonnet and bronze stem.
 - 1) Standards: UL 262 and FMG approved.
 - 2) Minimum Pressure Rating: 175 psig (1207 kPa).
 - 3) End Connections: Threaded.
3. Nonrising-Stem Gate Valves:
 - a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
 - 1) Standard: MSS SP-80.

2.14 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Cast Iron Pipe Company.
 - b. Clow Valve Company; a subsidiary of McWane, Inc.
 - c. EJ.
 - d. Flowserve Corporation.
 - e. Kennedy Valve Company; a division of McWane, Inc.
 - f. M & H Valve Company; a division of McWane, Inc.
 - g. McWane, Inc.
 - h. Mueller Co.
 - i. U.S. Pipe and Foundry Company.
 - j. <Insert manufacturer's name>.
2. Description: Sleeve and valve compatible with drilling machine.
 - a. Standard: MSS SP-60.
 - b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
 - c. Valve: AWWA, cast-iron, nonrising-stem, [metal] [resilient]-seated gate valve with one raised face flange mating tapping-sleeve flange.

- ### B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.15 CHECK VALVES

A. AWWA Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American AVK Co.
 - b. American Cast Iron Pipe Company.
 - c. APCO Willamette Valve and Primer Corporation.
 - d. Clow Valve Company; a subsidiary of McWane, Inc.
 - e. Crane; Crane Energy Flow Solutions.
 - f. Flomatic Corporation.
 - g. Kennedy Valve Company; a division of McWane, Inc.
 - h. M & H Valve Company; a division of McWane, Inc.
 - i. McWane, Inc.
 - j. Mueller Co.
 - k. NIBCO INC.
 - l. Stockham; Crane Energy Flow Solutions.
 - m. Watts; a Watts Water Technologies company.
 - n. **<Insert manufacturer's name>**.
2. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
 - a. Standard: AWWA C508.
 - b. Pressure Rating: **175 psig (1207 kPa)**.

B. UL/FMG, Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Cast Iron Pipe Company.
 - b. Clow Valve Company; a subsidiary of McWane, Inc.
 - c. Crane; Crane Energy Flow Solutions.
 - d. Globe Fire Sprinkler Corporation.
 - e. Kennedy Valve Company; a division of McWane, Inc.
 - f. Kidde Fire Fighting; A UTC Business Unit.
 - g. Matco-Norca.
 - h. McWane, Inc.
 - i. Mueller Co.
 - j. NIBCO INC.
 - k. Reliable Automatic Sprinkler Co., Inc. (The).

- l. Stockham; Crane Energy Flow Solutions.
 - m. Tyco Fire & Building Products LP.
 - n. United Brass Works, Inc.
 - o. Victaulic Company.
 - p. Viking Corporation.
 - q. Watts; a Watts Water Technologies company.
 - r. **<Insert manufacturer's name>**.
2. Description: Swing-check type with pressure rating; rubber-face checks, unless otherwise indicated; and ends matching piping.
 - a. Standards: UL 312 and FMG approved.
 - b. Pressure Rating: [**175 psig (1207 kPa)**] [**250 psig (1725 kPa)**].

2.16 DETECTOR CHECK VALVES

A. Detector Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Fire & Waterworks.
 - b. Badger Meter, Inc.
 - c. FEBCO.
 - d. Globe Fire Sprinkler Corporation.
 - e. Kennedy Valve Company; a division of McWane, Inc.
 - f. McWane, Inc.
 - g. Mueller Co.
 - h. Victaulic Company.
 - i. Viking Corporation.
 - j. Watts; a Watts Water Technologies company.
 - k. Zurn Industries, LLC.
 - l. **<Insert manufacturer's name>**.
2. 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.
 - a. Standards: UL 312 and FMG approved.
 - b. Pressure Rating: **175 psig (1207 kPa)**.
 - c. 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.
3. Description: Iron body, corrosion-resistant clapper ring and seat ring material, flanged ends, with connections for bypass and installation of water meter.
 - a. Standards: UL 312 and FMG approved.

- b. Pressure Rating: 175 psig (1207 kPa).

2.17 BUTTERFLY VALVES

A. AWWA Butterfly Valves: Class 150, EPDM.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DeZURIK/Copes-Vulcan.
 - b. Flomatic Corporation.
 - c. Milliken Valve Company.
 - d. Milwaukee Valve Company.
 - e. Mosser Valve.
 - f. Mueller Co.
 - g. Pratt, Henry Company.
 - h. Val-Matic Valve & Manufacturing Corp.
 - i. <Insert manufacturer's name>.
2. Description: Rubber seated.
 - a. Standard: AWWA C504.
 - b. Body: Cast or ductile iron.
 - c. Body Type: [Wafer] [Wafer or flanged] [Flanged].
 - d. Pressure Rating: 150 psig (1035 kPa).

B. UL Butterfly Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Viega LLC ProPress or comparable product by one of the following:
 - a. Kennedy Valve Company; a division of McWane, Inc.
 - b. McWane, Inc.
 - c. Milwaukee Valve Company.
 - d. Mueller Co.
 - e. NIBCO INC.
 - f. Pratt, Henry Company.
 - g. <Insert manufacturer's name>.
2. Description: Metal on resilient material seating.
 - a. Standards: UL 1091 and FMG approved.
 - b. Body: Cast or ductile iron.
 - c. Body Type: [Wafer] [Wafer or flanged] [Flanged].
 - d. Pressure Rating: 175 psig (1207 kPa).

2.18 PLUG VALVES

A. Plug Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DeZURIK/Copes-Vulcan.
 - b. Homestead Valve.
 - c. M & H Valve Company; a division of McWane, Inc.
 - d. McWane, Inc.
 - e. Milliken Valve Company.
 - f. Pratt, Henry Company.
 - g. Val-Matic Valve & Manufacturing Corp.
 - h. <Insert manufacturer's name>.

2. Description: Resilient-seated eccentric.
 - a. Standard: MSS SP-108.
 - b. Body: Cast iron.
 - c. Pressure Rating: 175-psig (1207-kPa) minimum CWP.
 - d. Seat Material: Suitable for potable-water service.

2.19 [CORPORATION VALVES] [AND] [CURB VALVES]

A. Manufacturers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. Y. McDonald Mfg. Co.
 - b. Amcast Industrial Corporation.
 - c. Ford Meter Box Company, Inc. (The).
 - d. Jones, James Company.
 - e. Master Meter, Inc.
 - f. Mueller Co.
 - g. Red Hed Manufacturing Company; a division of Everett J. Prescott, Inc.
 - h. <Insert manufacturer's name>.

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

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. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

- D. 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, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.20 WATER METERS

- A. Water meters will be furnished by utility company.
- B. Manufacturers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. AMCO Water Metering Systems.
 - b. Badger Meter, Inc.
 - c. Carlon Meter.
 - d. Hays Fluid Controls.
 - e. McCrometer, Inc.
 - f. Mueller Co.
 - g. Neptune Technology Group Inc.
 - h. Sensus Metering Systems.
 - i. <Insert manufacturer's name>.
- C. Displacement-Type Water Meters:
1. Description: With bronze main case.
- a. Standard: AWWA C700.
 - b. Registration: Flow in [gallons (liters)] [cubic feet (cubic meters)].
- D. Turbine-Type Water Meters:
1. Description:
- a. Standard: AWWA C701.
 - b. Registration: Flow in [gallons (liters)] [cubic feet (cubic meters)].
- E. Compound-Type Water Meters:
1. Description:
- a. Standard: AWWA C702.
 - b. Registration: Flow in [gallons (liters)] [cubic feet (cubic meters)].
- F. Remote Registration System:

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

G. Remote Registration System:

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

2.21 DETECTOR-TYPE WATER METERS

A. Detector-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Badger Meter, Inc.
 - b. Mueller Co.
 - c. Neptune Technology Group Inc.
 - d. Sensus Metering Systems.
 - e. <Insert manufacturer's name>.

B. Description: Main line, proportional meter with second meter on bypass. Register flow in [gallons (liters)] [cubic feet (cubic meters)].

1. Standards: AWWA C703, UL listed, and FMG approved.
2. Pressure Rating: 150 psig (1035 kPa).
3. Bypass Meter: [AWWA C701, turbine] [AWWA C702, compound]-type, bronze case.
 - a. Size: At least one-half nominal size of main-line meter.

C. Description: Main-line turbine meter with strainer and second meter on bypass. Register flow in [gallons (liters)] [cubic feet (cubic meters)].

1. Standards: AWWA C703, UL listed, and FMG approved.
2. Pressure Rating: 175 psig (1207 kPa).
3. Bypass Meter: AWWA C701, turbine-type, bronze case.
 - a. Size: At least NPS 2 (DN 50).

D. Remote Registration System:

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

E. Remote Registration System:

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

2.22 PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Water Controls.
 - d. Watts; a Watts Water Technologies company.
 - e. Wilkins.
 - f. Zurn Industries, LLC.
 - g. <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: 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. Valves for Booster Heater Water Supply: Include integral bypass.
10. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CLA-VAL Automatic Control Valves.
 - b. Flowmatic Corporation.
 - c. OCV Control Valves.
 - d. Watts; a Watts Water Technologies company.
 - e. Wilkins.
 - f. Zurn Industries, LLC.
 - g. **<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.
 - a. Pressure Rating: Initial pressure of **150 psig (1035 kPa)** minimum.
 - b. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
 - 1) Size: **<Insert NPS (DN)>**.
 - 2) Pattern: **[Angle] [Globe]**-valve design.
 - 3) Trim: Stainless steel.
 - c. Design Flow Rate: **<Insert gpm (L/s)>**.
 - d. Design Inlet Pressure: **<Insert psig (kPa)>**.
 - e. Design Outlet Pressure Setting: **<Insert psig (kPa)>**.
 - f. End Connections: Threaded for **NPS 2 (DN 50)** and smaller; **[flanged]** **<Insert type>** for **NPS 2-1/2 (DN 65)** and larger.

2.23 RELIEF VALVES

A. Air-Release Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crispin-Multiplex Manufacturing Co.
 - b. GA Industries, Inc.
 - c. Val-Matic Valve & Manufacturing Corp.
 - d. **<Insert manufacturer's name>**.

2. Description: Hydromechanical device to automatically release accumulated air.
 - a. Standard: AWWA C512.
 - b. Pressure Rating: **[300 psig (2070 kPa)] <Insert pressure>**.
 - c. Body Material: **[Cast iron] <Insert material>**.
 - d. Trim Material: Stainless steel[, **brass, or bronze**].
 - e. Water Inlet Size: **<Insert NPS (DN)>**.
 - f. Air Outlet Size: **<Insert NPS (DN)>**.
 - g. Orifice Size: **<Insert inch (mm)>**.

- h. Design Air-Release Capacity: <Insert **cfm (L/s)**> at <Insert **psig (kPa)**> pipeline pressure.

B. Air/Vacuum Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crispin-Multiplex Manufacturing Co.
 - b. GA Industries, Inc.
 - c. Val-Matic Valve & Manufacturing Corp.
 - d. <Insert **manufacturer's name**>.
2. Description: Direct-acting, float-operated, hydromechanical device with large orifice to automatically release accumulated air or to admit air during filling of piping.
 - a. Standard: AWWA C512.
 - b. Pressure Rating: [**300 psig (2070 kPa)**] <Insert **pressure**>.
 - c. Body Material: [**Cast iron**] <Insert **material**>.
 - d. Trim Material: Stainless steel[, **brass, or bronze**].
 - e. Inlet and Outlet Size: <Insert **NPS (DN)**>.
 - f. Orifice Size: <Insert **inch (mm)**>.
 - g. Design Air Capacity: <Insert **cfm (L/s)**> at <Insert **psig (kPa)**> differential pressure.

C. Combination Air Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crispin-Multiplex Manufacturing Co.
 - b. GA Industries, Inc.
 - c. Val-Matic Valve & Manufacturing Corp.
 - d. <Insert **manufacturer's name**>.
2. Description: Float-operated, hydromechanical device to automatically release accumulated air or to admit air.
 - a. Standard: AWWA C512.
 - b. Pressure Rating: [**300 psig (2070 kPa)**] <Insert **pressure**>.
 - c. Body Material: [**Cast iron**] <Insert **material**>.
 - d. Trim Material: Stainless steel[, **brass, or bronze**].
 - e. Inlet and Outlet Size: <Insert **NPS (DN)**>.
 - f. Orifice Size: <Insert **inch (mm)**>.
 - g. Design Air Capacity: <Insert **cfm (L/s)**> at <Insert **psig (kPa)**> differential pressure.

2.24 VACUUM BREAKERS

A. Pressure Vacuum Breaker Assembly:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Fire & Waterworks.
 - b. Conbraco Industries, Inc.
 - c. FEBCO.
 - d. Flowmatic Corporation.
 - e. Toro Company (The).
 - f. Watts; a Watts Water Technologies company.
 - g. Wilkins.
 - h. Zurn Industries, LLC.
 - i. **<Insert manufacturer's name>**.
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: [**5 psig (35 kPa)**] **<Insert pressure>** maximum, through middle 1/3 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. Accessories: Ball valves on inlet and outlet.

2.25 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Fire & Waterworks.
 - b. Conbraco Industries, Inc.
 - c. FEBCO.
 - d. Flowmatic Corporation.
 - e. Watts; a Watts Water Technologies company.
 - f. Wilkins.
 - g. Zurn Industries, LLC.
 - h. **<Insert manufacturer's name>**.
2. Standard: [**ASSE 1013**] [or] [**AWWA C511**].
3. Operation: Continuous-pressure applications.
4. Pressure Loss: [**12 psig (83 kPa)**] **<Insert pressure>** maximum, through middle 1/3 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: 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Fire & Waterworks.
 - b. Conbraco Industries, Inc.
 - c. FEBCO.
 - d. Flowmatic Corporation.
 - e. Watts; a Watts Water Technologies company.
 - f. Wilkins.
 - g. Zurn Industries, LLC.
2. Standard: [**ASSE 1015**] [or] [**AWWA C510**].
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: [**5 psig (35 kPa)**] <Insert pressure> maximum, through middle 1/3 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: 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Ames Fire & Waterworks.
 - b. Conbraco Industries, Inc.
 - c. FEBCO.
 - d. Watts; a Watts Water Technologies company.
 - e. Wilkins.
 - f. Zurn Industries, LLC.
 - g. **<Insert manufacturer's name>**.
2. Standards: ASSE 1047 and UL listed or FMG approved.
 3. Operation: Continuous-pressure applications.
 4. Pressure Loss: [**12 psig (83 kPa)**] **<Insert pressure>** maximum, through middle 1/3 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: [**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, FMG-approved, 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Fire & Waterworks.
 - b. Conbraco Industries, Inc.
 - c. FEBCO.
 - d. Watts; a Watts Water Technologies company.
 - e. Wilkins.
 - f. Zurn Industries, LLC.
 - g. **<Insert manufacturer's name>**.
2. Standards: ASSE 1048 and UL listed or FMG approved.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: [**5 psig (35 kPa)**] **<Insert pressure>** maximum, through middle 1/3 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: [**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, FMG-approved, 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. FEBCO.
 - c. Flowmatic Corporation.
 - d. Watts; a Watts Water Technologies company.
 - e. Wilkins.
 - f. Zurn Industries, LLC.
 - g. <Insert manufacturer's name>.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.26 WATER METER BOXES

- A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" in 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" in 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" in 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** (6800 kg minimum over 254 by 254 mm) square.

2.27 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.
1. Ladder: ASTM A 36/A 36M, steel or polyethylene-encased steel steps.
 2. Manhole: ASTM A 48/A 48M Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.
 - a. Dimension: **24-inch (610-mm)** minimum diameter, unless otherwise indicated.
 3. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron traffic frame and cover.
 - a. Dimension: **24-inch- (610-mm-)** minimum diameter, unless otherwise indicated.
 4. 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.

2.28 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aqua Shield.
 - 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. Watts; a Watts Water Technologies company.
 - i. **<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)**.
 - a. Standard: ASSE 1060.
 - b. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
 - c. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
 - 1) Housing: Reinforced**[-aluminum] [or] [-fiberglass] <Insert housing>** construction.

- a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
 - b) Drain opening for units with drain connection.
 - c) Access doors with locking devices.
 - d) Insulation inside housing.
 - e) Anchoring devices for attaching housing to concrete base.
- 2) 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. Aqua Shield.
 - 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. Watts; a Watts Water Technologies company.
 - i. **<Insert manufacturer's name>**.
 2. Description: Uninsulated enclosure designed to protect aboveground water piping, equipment, or specialties from weather and damage.
 - a. Standard: ASSE 1060.
 - b. Class III: For equipment or devices other than pressure or atmospheric vacuum breakers.
 - c. Class III-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
 - 1) Housing: Reinforced[**-aluminum**] [**or**] [**-fiberglass**] **<Insert housing>** construction.
 - a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
 - b) Drain opening for units with drain connection.
 - c) Access doors with locking devices.
 - d) 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. Le Meur Welding & Manufacturing Co.

- e. <Insert manufacturer's name>.
2. Description: Enclosure designed to protect aboveground water piping, equipment, or specialties from damage.
- a. Material: ASTM F 1267, expanded metal side and top panels, of weight and with reinforcement of same metal at edges as required for rigidity.
 - b. Type: Type[**I, expanded**] [**II, expanded and flattened**].
 - c. Class: Class[**1, uncoated carbon steel**] [**2, hot-dip, zinc-coated carbon steel**] [**3, corrosion-resisting steel**].
 - d. Finish: Manufacturer's enamel paint.
 - e. Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
 - f. Locking device.
 - g. Lugs or devices for securing enclosure to base.

D. Enclosure Bases:

1. Description: [**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.

2.29 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American AVK Co.
 - b. American Cast Iron Pipe Company.
 - c. American Foundry Group, Inc.
 - d. Clow Valve Company; a subsidiary of McWane, Inc.
 - e. EJ.
 - f. Kennedy Valve Company; a division of McWane, Inc.
 - g. M & H Valve Company; a division of McWane, Inc.
 - h. McWane, Inc.
 - i. Mueller Co.
 - j. Troy Valve.
 - k. U.S. Pipe and Foundry Company.
 - l. <Insert manufacturer's name>.
2. Description: Freestanding, with one **NPS 4-1/2 (DN 115)** and two **NPS 2-1/2 (DN 65)** outlets, **5-1/4-inch (133-mm)** main valve, drain valve, and **NPS 6 (DN 150)** mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
 - a. Standard: AWWA C502.
 - b. Pressure Rating: [**150 psig (1035 kPa) minimum**] [**250 psig (1725 kPa)**].

3. Description: Freestanding, with one **NPS 4-1/2 (DN 115)** and two **NPS 2-1/2 (DN 65)** outlets, **5-1/4-inch (133-mm)** main valve, drain valve, and **NPS 6 (DN 150)** mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
 - a. Standards: UL 246, FMG approved.
 - b. Pressure Rating: [**150 psig (1035 kPa) minimum**] [**250 psig (1725 kPa)**].
 - c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
 - d. Operating and Cap Nuts: Pentagon, **1-1/2 inches (38 mm)** point to flat.
 - e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
 - f. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

B. Wet-Barrel Fire Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American AVK Co.
 - b. Clow Valve Company; a subsidiary of McWane, Inc.
 - c. Jones, James Company.
 - d. McWane, Inc.
 - e. Mueller Co.
 - f. **<Insert manufacturer's name>**.
2. Description: Freestanding, with one **NPS 4-1/2 (DN 115)** and two **NPS 2-1/2 (DN 65)** outlets, **NPS 6 (DN 150)** threaded or flanged inlet, and base section with **NPS 6 (DN 150)** mechanical-joint inlet. Include interior coating according to AWWA C550.
 - a. Standard: AWWA C503.
 - b. Pressure Rating: **150 psig (1035 kPa) minimum**.
3. Description: Freestanding, with one **NPS 4-1/2 (DN 115)** and two **NPS 2-1/2 (DN 65)** outlets, **NPS 6 (DN 150)** threaded or flanged inlet, and base section with **NPS 6 (DN 150)** mechanical-joint inlet.
 - a. Standards: UL 246 and FMG approved.
 - b. Pressure Rating: **150 psig (1035 kPa) minimum**.
 - c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
 - d. Operating and Cap Nuts: Pentagon, **1-1/2 inches (38 mm)** point to flat.
 - e. Direction of Opening: Open hydrant valves by turning operating nut to left or counterclockwise.
 - f. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.30 FLUSHING HYDRANTS

A. Post-Type Flushing Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GIL Industries, Inc.
 - b. Kupferle Foundry Co. (The).
 - c. Mueller Co.
2. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.
 - a. Pressure Rating: 150 psig (1035 kPa) minimum.
 - b. Outlet: One, with horizontal discharge.
 - c. Hose Thread: NPS 2-1/2 (DN 65), with NFPA 1963 external hose thread for use by local fire department, and with cast-iron cap with brass chain.
 - d. Barrel: Cast-iron or steel pipe with breakaway feature.
 - e. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.
 - f. Security: Locking device for padlock.
 - g. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.
 - h. Inlet: NPS 2 (DN 50) minimum.
 - i. Operating Wrench: One for each unit.

B. Ground-Type Flushing Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kupferle Foundry Co. (The).
 - b. Mueller Co.
 - c. <Insert manufacturer's name>.
2. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.
 - a. Pressure Rating: 150 psig (1035 kPa) minimum.
 - b. Outlet: One, with [vertical] [angle] discharge.
 - c. Hose Thread: NPS 2-1/2 (DN 65), with NFPA 1963 external hose thread for use by local fire department, and with cast-iron cap with brass chain.
 - d. Barrel: Cast-iron or steel pipe.
 - e. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.
 - f. Inlet: NPS 2 (DN 50) minimum.
 - g. Hydrant Box: Cast iron with cover, for ground mounting.
 - h. Operating Wrench: One for each unit.

C. Post-Type Sampling Station:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GIL Industries, Inc.
 - b. Kupferle Foundry Co. (The).
 - c. <Insert manufacturer's name>.

2. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.
 - a. Pressure Rating: **100 psig (690 kPa)** minimum.
 - b. Sampling Outlet: One unthreaded nozzle with handle.
 - c. Valve: Bronze body with bronze-ball or plunger closure. Include operating handle.
 - d. Drain: Tubing with separate manual vacuum pump.
 - e. Inlet: **NPS 3/4 (DN 20)** minimum.
 - f. Housing: Weatherproof material with locking device. Include anchor device.
 - g. Operating Wrench: One for each unit.

2.31 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkhart Brass Mfg. Co., Inc.
 - b. Fire End & Croker Corporation.
 - c. Guardian Fire Equipment, Inc.
 - d. Kidde Fire Fighting; A UTC Business Unit.
 - e. Potter Roemer LLC.
 - f. Reliable Automatic Sprinkler Co., Inc. (The).
 - g. **<Insert manufacturer's name>**.
2. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; **18-inch- (460-mm-)** high brass sleeve; and round escutcheon plate.
 - a. Standard: UL 405.
 - b. Connections: Two **NPS 2-1/2 (DN 65)** inlets and one [**NPS 4 (DN 100)**] [**NPS 6 (DN 150)**] outlet.
 - c. Connections: [**Three**] [**Four**] **NPS 2-1/2 (DN 65)** inlets and one **NPS 6 (DN 150)** outlet.
 - d. Connections: Six **NPS 2-1/2 (DN 65)** inlets and one [**NPS 6 (DN 150)**] [**NPS 8 (DN 200)**] outlet.
 - e. Inlet Alignment: [**Inline, horizontal**] [**Square**].
 - f. Finish Including Sleeve: [**Polished chrome-plated**] [**Rough chrome-plated**] [**Polished bronze**].
 - g. Escutcheon Plate Marking: "[**AUTO SPKR**] [**&**] [**STANDPIPE**]."

2.32 ALARM DEVICES

- A. Alarm Devices, General: UL 753 and FMG approved, 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 2 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. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping [**NPS 3/4 to NPS 3 (DN 20 to DN 80)**] <Insert pipe size range> shall be[**any of**] the following:
 - 1. 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, press-connect fittings; and press-connect**] joints.
 - 2. PE, ASTM pipe; [**insert fittings for PE pipe; and clamped**] [**molded PE fittings; and heat-fusion**] joints.
 - 3. PVC, Schedule [**40 pipe; PVC, Schedule 40**] [**80 pipe; PVC, Schedule 80**] socket fittings; and solvent-cemented joints.
 - 4. **NPS 1 to NPS 3 (DN 25 to DN 80)** fiberglass, AWWA RTRP, Class [**150**] [**200**] [**250**]; RTRF; and bonded joints.
 - 5. Fiberglass, AWWA RTRP, Class [**150**] [**200**] [**250**]; RTRF; and bonded joints.
- F. Underground water-service piping [**NPS 4 to NPS 8 (DN 100 to DN 200)**] <Insert pipe size range> shall be[**any of**] the following:

1. 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 joints.
 2. Ductile-iron, [push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed] [mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical] [grooved-end pipe; ductile-iron-pipe appurtenances; and grooved] joints.
 3. PE, AWWA pipe; PE, AWWA fittings; and heat-fusion joints.
 4. PVC, Schedule [40 pipe; PVC, Schedule 40] [80 pipe; PVC, Schedule 80] socket fittings; and solvent-cemented joints.
 5. NPS 4 and NPS 6 (DN 100 and DN 150): NPS 6 (DN 150) PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 [fabricated] [or] [molded] fittings; and gasketed joints.
 6. NPS 8 (DN 200): PVC, AWWA Class 200 pipe; [PVC, AWWA Class 200 fabricated] [push-on-joint, ductile-iron] [mechanical-joint, ductile-iron] fittings; and gasketed joints.
 7. Fiberglass, AWWA RTRP, Class [150] [200] [250]; RTRF; and bonded joints.
- G. Water Meter Box Water-Service Piping [NPS 3/4 to NPS 2 (DN 20 to DN 50)] <Insert pipe size range> shall be same as underground water-service piping.
- H. Aboveground[and Vault] Water-Service Piping [NPS 3/4 to NPS 3 (DN 20 to DN 80)] <Insert pipe size range> shall be[any 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, press-connect fittings; and press-connect] joints.
 2. PVC, Schedule 80 pipe; PVC, Schedule 80 [socket fittings; and solvent-cemented] [threaded fittings; and threaded] joints.
 3. NPS 1 to NPS 2 (DN 25 to DN 50) fiberglass, AWWA RTRP, Class [150] [200] [250]; RTRF; and bonded joints.
- I. Aboveground [and vault] water-service piping [NPS 4 to NPS 8 (DN 100 to DN 200)] <Insert pipe size range> shall be[any 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 joints.
 2. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.
 3. PVC, Schedule 80 pipe; PVC, Schedule 80 [socket fittings; and solvent-cemented] [threaded fittings; and threaded] joints.
 4. Fiberglass, AWWA RTRP, Class [150] [200] [250]; RTRF; and bonded joints.
- J. Underground Fire-Service-Main Piping [NPS 4 to NPS 12 (DN 100 to DN 300)] <Insert pipe size range> shall be[any of] the following:
1. Ductile-iron, [push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed] [mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical] [grooved-end pipe; ductile-iron-pipe appurtenances; and grooved] joints.
 2. PE, Class [150] [200], fire-service pipe; molded PE fittings; and heat-fusion joints.
 3. PVC, AWWA Class 150 pipe listed for fire-protection service; PVC Class 150 fabricated or molded fittings; and gasketed joints.

4. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC Class 200 fabricated fittings; and gasketed joints.
 5. Fiberglass, AWWA, FMG-approved RTRP, Class [150] [200]; RTRF; and gasketed joints.
 6. Fiberglass, UL RTRP, Class [150] [200] [250]; RTRF; and gasketed joints.
- K. Aboveground[**and Vault**] Fire-Service-Main Piping [**NPS 4 to NPS 12 (DN 100 to DN 300)**] <Insert pipe size range> shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.
- L. Underground Combined Water-Service and Fire-Service-Main Piping [**NPS 6 to NPS 12 (DN 150 to DN 300)**] <Insert pipe size range> shall be[**any of**] the following:
1. Ductile-iron, [**push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed**] [**mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical**] [**grooved-end pipe; ductile-iron-pipe appurtenances; and grooved**] joints.
 2. PVC, AWWA Class [150] [200] pipe listed for fire-protection service; PVC fabricated or molded fittings of same class as pipe; and gasketed joints.
 3. Fiberglass, AWWA, FMG-approved RTRP, Class [150] [200]; RTRF; and gasketed joints.
- M. Aboveground[**and Vault**] Combined Water Service and Fire-Service-Main Piping [**NPS 6 to NPS 12 (DN 150 to DN 300)**] <Insert pipe size range> shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

3.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for **NPS 3 (DN 80)** and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for **NPS 2 (DN 50)** and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Underground Valves, **NPS 3 (DN 80)** and Larger: AWWA, cast-iron, nonrising-stem, [**metal**] [**resilient**] [**high-pressure, resilient**]-seated gate valves with valve box.
 2. Underground Valves, **NPS 4 (DN 100)** and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
 3. Use the following for valves in vaults and aboveground:
 - a. Gate Valves, **NPS 2 (DN 50)** and Smaller: Bronze, [**nonrising**] [**rising**] stem.
 - b. Gate Valves, **NPS 3 (DN 80)** and Larger: [**AWWA, cast iron, OS&Y rising stem, metal seated**] [**AWWA, cast iron, OS&Y rising stem, resilient seated**] [**UL/FMG, cast iron, OS&Y rising stem**].
 - c. Check Valves: [**AWWA C508**] [**UL/FMG**], swing type.
 4. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.

5. Relief Valves: Use for water-service piping in vaults and aboveground.
 - a. Air-Release Valves: To release accumulated air.
 - b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
 - c. Combination Air Valves: To release or admit air.
6. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. See Section 330500 "Common Work Results for Utilities" for piping-system common requirements.

3.5 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with 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 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.
 1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
 2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
 - G. Install PE pipe according to ASTM D 2774 and ASTM F 645.
 - H. Install PEX tubing in accordance with AWWA C904.
 - 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> cover over top.
 2. Under Railroad Tracks: With at least [**48 inches (1220 mm)**] <Insert dimension> cover over top.
 3. In Loose Gravelly Soil and Rock: With at least [**12 inches (300 mm)**] <Insert dimension> additional cover.
 - L. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
 - M. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
 - N. Sleeves are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
 - O. Mechanical sleeve seals are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
 - P. 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.
 - Q. See Section 211200 "Fire-Suppression Standpipes," Section 211313 "Wet-Pipe Sprinkler Systems," and Section 211316 "Dry-Pipe Sprinkler Systems" for fire-suppression-water piping inside the building.
 - R. See Section 221116 "Domestic Water Piping" for potable-water piping inside the building.
- 3.6 JOINT CONSTRUCTION
- A. See Section 330500 "Common Work Results for Utilities" for basic piping joint construction.
 - B. Make pipe joints according to the following:

1. Copper-Tubing, Press-connect Joints: Use proprietary electro-hydraulic press tool and procedure recommended by copper, Press-connect fitting manufacturer.
2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
4. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
5. Steel-Piping, Press-connect Joints: Join schedule 5 to schedule 40 black steel pipe and carbon steel Press-connect fittings.
 - a. Ream and remove burrs from pipe ends.
 - b. Prepare pipe surface per manufacturer's installation instructions.
 - c. Mark proper insertion depth prior to making press connection.
 - d. Use tool and jaw/rings recommended by fitting manufacturer.
6. Stainless Steel-Piping, Press Connect Joints: Join Pipe Standard: Stainless steel pipe shall conform to the material requirements of ASTM A 312 or ASTM A 554 and be provided by the fitting manufacturer.
 - a. Ream and remove burrs from pipe ends.
 - b. Mark proper insertion depth prior to making press connection.
 - c. Use tool and jaw/rings recommended by fitting manufacturer.
7. Copper-Tubing, Press-Connect Joints: Join copper tube and copper press-connect fittings.
 - a. Ream and remove burrs from pipe ends.
 - b. Mark proper insertion depth prior to making press connection.
 - c. Use tool and jaw/rings recommended by fitting manufacturer.
8. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
9. 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 and pipe manufacturer's written instructions.
10. Fiberglass Piping Bonded Joints: Use adhesive and procedure recommended by piping manufacturer.
11. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - a. Dielectric Fittings for [NPS 2 (DN 50)] <Insert pipe size> and Smaller: Use dielectric [nipples] [unions].
 - b. Dielectric Fittings for [NPS 2-1/2 to NPS 4 (DN 65 to DN 100)] <Insert pipe size range>: Use dielectric [flanges] [flange kits] [nipples].
 - c. Dielectric Fittings for [NPS 5 (DN 125)] <Insert pipe size> and Larger: Use dielectric flange kits.

3.7 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. Include anchorages for the following piping systems:
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.
 4. Fire-Service-Main Piping: According to NFPA 24.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 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/FMG, 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/FMG, 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. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.9 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, meters, shutoff valves, and piping on brick or concrete piers.

3.10 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 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 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 full-size valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.11 ROUGHING-IN FOR WATER METERS

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

3.12 VACUUM BREAKER ASSEMBLY INSTALLATION

- A. Install pressure vacuum breaker assemblies 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 pressure vacuum breaker assemblies in vault or other space subject to flooding.

3.13 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, valves, and piping near floor and on brick or concrete piers.

3.14 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.

3.15 CONCRETE VAULT INSTALLATION

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

3.16 PROTECTIVE ENCLOSURE INSTALLATION

- A. Install concrete base level and with top approximately [**2 inches (50 mm)**] <Insert **measurement**> above grade.
- B. Install protective enclosure over valves and equipment.
- C. Anchor protective enclosure to concrete base.

3.17 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.
- C. AWWA Fire Hydrants: Comply with AWWA M17.
- D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.18 FLUSHING HYDRANT INSTALLATION

- A. Install post-type flushing hydrants with valve below frost line and provide for drainage. Support in upright position. Include separate gate valve or curb valve and restrained joints in supply piping.
- B. Install ground-type flushing hydrants with valve below frost line and provide for drainage. Install hydrant box flush with grade. Include separate gate valve or curb valve and restrained joints in supply piping.
- C. Install sampling stations with valve below frost line and provide for drainage. Attach weather-resistant housing and support in upright position. Include separate curb valve in supply piping.

3.19 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**] <Describe arrangement> each fire department connection. Pipe bollards are specified in Section 055000 "Metal Fabrications."

3.20 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 fire alarm system. Wiring and fire-alarm devices are specified in Section 283111 "Digital, Addressable Fire-Alarm System" and Section 283112 "Zoned (DC Loop) Fire-Alarm System."

3.21 CONNECTIONS

- A. See Section 330500 "Common Work Results for Utilities" for piping connections to valves and equipment.
- B. Connect water-distribution piping to [**utility water main**] [**existing water main**] <Insert piping system>. Use [**tapping sleeve and tapping valve**] [**service clamp and corporation valve**] <Insert method>.
- C. Connect water-distribution piping to interior [**domestic water**] [**and**] [**fire-suppression**] piping.
- D. Connect waste piping from concrete vault drains to [**sanitary sewerage system. See Section 221313 "Facility Sanitary Sewers" for connection to sanitary-sewer**] [**storm-drainage system. See Section 334100 "Storm Utility Drainage Piping" for connection to storm-sewer**] piping.
- E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.22 FIELD QUALITY CONTROL

- A. 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.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times 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 1 hour; decrease to **0 psig (0 kPa)**. Slowly increase again to test pressure and hold for 1 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.
- C. Prepare reports of testing activities.

3.23 IDENTIFICATION

- A. Install continuous underground[**detectable**] warning tape during backfilling of trench for underground water-distribution 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 water-service piping, on main electrical meter panel. See Section 330500 "Common Work Results for Utilities" for identifying devices.

3.24 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution 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 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 to stand for 3 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.

END OF SECTION 221113