

SECTION 33 11 00

WATER DISTRIBUTION
02/11

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2010; Addenda 2011) Hypochlorites
AWWA B301	(2010) Liquid Chlorine
AWWA C104/A21.4	(2008; Errata 2010) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105/A21.5	(2010) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2012) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	(2011) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151/A21.51	(2009) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C153/A21.53	(2011) Ductile-Iron Compact Fittings for Water Service
AWWA C500	(2009) Metal-Seated Gate Valves for Water Supply Service
AWWA C502	(2005) Dry-Barrel Fire Hydrants
AWWA C504	(2010) Standard for Rubber-Seated Butterfly Valves
AWWA C508	(2009; Addenda A 2011) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
AWWA C509	(2009) Resilient-Seated Gate Valves for Water Supply Service
AWWA C515	(2009) Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

AWWA C550	(2013) Protective Epoxy Interior Coatings for Valves and Hydrants
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains
AWWA C700	(2009) Standard for Cold Water Meters - Displacement Type, Bronze Main Case
AWWA C703	(2011) Cold-Water Meters - Fire Service Type
AWWA C704	(2012) Propeller-Type Meters for Waterworks Applications
AWWA C706	(2010) Direct-Reading, Remote-Registration Systems for Cold-Water Meters
AWWA C800	(2012) Underground Service Line Valves and Fittings

ASME INTERNATIONAL (ASME)

ASME B16.1	(2010) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.15	(2013) Cast Copper Alloy Threaded Fittings Classes 125 and 250
ASME B16.18	(2012) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22	(2013) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(2013) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B18.2.2	(2010) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B18.5.2.1M	(2006; R 2011) Metric Round Head Short Square Neck Bolts
ASME B18.5.2.2M	(1982; R 2010) Metric Round Head Square Neck Bolts

ASTM INTERNATIONAL (ASTM)

ASTM A307	(2012) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A47/A47M	(1999; R 2014) Standard Specification for

Ferritic Malleable Iron Castings

ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM A563	(2007a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B42	(2010) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B61	(2008; R 2013) Standard Specification for Steam or Valve Bronze Castings
ASTM B62	(2009) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube
ASTM C94/C94M	(2014) Standard Specification for Ready-Mixed Concrete

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-80	(2013) Bronze Gate, Globe, Angle and Check Valves
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	(2013) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
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UNDERWRITERS LABORATORIES (UL)

UL 246	(2011; Reprint Feb 2013) Hydrants for Fire-Protection Service
UL 262	(2004; Reprint Oct 2011) Gate Valves for Fire-Protection Service
UL 312	(2010) Check Valves for Fire-Protection Service
UL 789	(2004; Reprint Feb 2013) Standard for Indicator Posts for Fire-Protection Service

1.2 DESIGN REQUIREMENTS

1.2.1 Water Distribution Mains

Provide water distribution mains indicated as 4 through 12 inch diameter pipe sizes of ductile-iron pipe. Provide ductile iron pipe for 12 inch diameter or larger pipe sizes. Also provide water main accessories, gate

valves and check valves as specified and where indicated.

1.2.2 Water Service Lines

Provide water service lines indicated as less than 4 inch lines from water distribution main to building service at a point approximately 5 feet from building. Water service lines shall be copper tubing . Provide water service line appurtenances as specified and where indicated.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Piping Materials

Water distribution main piping, fittings, joints, valves, and coupling

Water service line piping, fittings, joints, valves, and coupling

Hydrants

Indicator posts

Corporation stops

Valve boxes

Submit manufacturer's standard drawings or catalog cuts, except submit both drawings and cuts for push-on and rubber-gasketed bell-and-spigot joints. Include information concerning gaskets with submittal for joints and couplings.

Remote Water Quality Monitoring and Distribution Flushing Equipment

SD-06 Test Reports

Bacteriological Disinfection; G.

Test results from commercial laboratory verifying disinfection

SD-07 Certificates

Water distribution main piping, fittings, joints, valves, and coupling

Water service line piping, fittings, joints, valves, and coupling

Lining

Fire hydrants

Displacement Type Meters

Compound Type Meters

Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the intervals or frequency specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

SD-08 Manufacturer's Instructions

Delivery, storage, and handling

Installation procedures for water piping

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and hydrants free of dirt and debris.

1.4.2 Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place any other material or pipe inside a pipe or fitting after the coating has been applied. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Store rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

PART 2 PRODUCTS

2.1 WATER DISTRIBUTION MAIN MATERIALS

2.1.1 Piping Materials

2.1.1.1 Ductile-Iron Piping

- a. Pipe and Fittings: Pipe, as described in AWWA C151/A21.51, . Fittings, AWWA C110/A21.10 or AWWA C153/A21.53 with push-on joint ends conforming to the same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved, for push-on . Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the

specified joints. Pipe and fittings shall have cement-mortar lining, AWWA C104/A21.4, twice the standard thickness.

b. Joints and Jointing Material:

- (1) Joints: Joints for pipe and fittings shall be mechanical joints. Provide mechanical joints where indicated. Provide flanged joints where indicated. Provide mechanically coupled type joints using a sleeve-type mechanical coupling where indicated. Provide insulating joints where indicated. Joints made with sleeve-type mechanical coupling may be used in lieu of push-on joint, subject to the limitations specified in paragraph entitled "Sleeve-Type Mechanical Couplings."
- (2) Push-On Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly, AWWA C111/A21.11.
- (3) Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets, AWWA C111/A21.11.
- (4) Flanged Joints: Bolts, nuts, and gaskets for flanged connections as recommended in the Appendix to AWWA C115/A21.15. Flange for setscrewed flanges shall be of ductile iron, ASTM A536, Grade 65-45-12, and conform to the applicable requirements of ASME B16.1, Class 250. Setscrews for setscrewed flanges shall be 190,000 psi tensile strength, heat treated and zinc-coated steel. Gasket and lubricants for setscrewed flanges, in accordance with applicable requirements for mechanical-joint gaskets specified in AWWA C111/A21.11. Design of setscrewed gasket shall provide for confinement and compression of gasket when joint to adjoining flange is made.
- (5) Insulating Joints: Designed to effectively prevent metal-to-metal contact at the joint between adjacent sections of piping. Joint shall be of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers. Gasket shall be of the dielectric type, full face, and in other respects as recommended in the Appendix to AWWA C115/A21.15. Bolts and nuts, as recommended in the Appendix to AWWA C115/A21.15.
- (6) Sleeve-Type Mechanical Coupled Joints: As specified in paragraph entitled "Sleeve-Type Mechanical Couplings."

2.1.2 Valves, Hydrants, and Other Water Main Accessories

2.1.2.1 Gate Valves on Buried Piping

AWWA C500, AWWA C509,. Unless otherwise specified, valves conforming to:

- (1) AWWA C500 shall be nonrising stem type with double-disc gates and mechanical-joint ends or push-on joint ends as appropriate for the adjoining pipe, (2) AWWA C509 or AWWA C515 shall be nonrising stem type with mechanical-joint ends or resilient-seated gate valves 6 to 12 inches in size, and (3) UL 262 shall be inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 200 psi, and shall have mechanical-joint ends or push-on joint ends as appropriate for the pipe to which it is joined. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have O-ring stem seals, except for those

valves for which gearing is specified, in which case use conventional packing in place of O-ring seal. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. In lieu of mechanical-joint ends and push-on joint ends, valves may have special ends for connection to sleeve-type mechanical coupling. Valve ends and gaskets for connection to sleeve-type mechanical coupling shall conform to the applicable requirements specified for the joint or coupling. Where a post indicator is shown, the valve shall have an indicator post flange; indicator post flange for AWWA C500 valve shall conform to the applicable requirements of UL 262. Provide valve sizes as shown inch with gearing and indicators, AWWA C500. Valves shall be of one manufacturer.

Valves shall have a protective epoxy interior coating conforming to AWWA C550."

2.1.2.2 Gate Valves in Valve Pit(s)

AWWA C500, AWWA C509, AWWA C515, or UL 262. Unless otherwise specified, valves conforming to: (1) AWWA C500 shall be nonrising stem type with double-disc gates and flanged ends, (2) AWWA C509 or AWWA C515 shall be nonrising stem type with flanged ends, and (3) UL 262 shall be inside-screw type, shall have double-disc type gate and flanged ends, and shall be designed for a hydraulic working pressure of 150 psior 150% of normal operating pressure, whichever is greater. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Valves shall be nonrising stem type or inside-screw type. Provide valves with handwheels that open by counterclockwise rotation of the valve stem. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. In lieu of flanged ends, valves may have ends suitable for type joints, as specified in paragraph entitled "Ductile-Iron Piping." Valves shall be of one manufacturer.

2.1.2.3 Check Valves

Swing-check type, AWWA C508 or UL 312. Valves conforming to: (1) AWWA C508 shall have iron or steel body and cover and flanged ends, and (2) UL 312 shall have cast iron or steel body and cover, flanged ends, and designed for a working pressure of 150 psior 150% of normal operating pressure, whichever is greater. Materials for UL 312 valves shall conform to the reference standards specified in AWWA C508. Valves shall have clear port opening. Valves shall be spring-loaded. In lieu of flanged ends, valves may have ends suitable for type joints, as specified in paragraph entitled "Ductile-Iron Piping." Valves shall be of one manufacturer.

2.1.2.4 Rubber-Seated Butterfly Valves

Rubber-seated butterfly valves shall conform to the performance requirements of AWWA C504. Wafer type valves conforming to the performance requirements of AWWA C504 in all respects, but not meeting laying length requirements will be acceptable if supplied and installed with a spacer providing the specified laying length. All tests required by AWWA C504 shall be met. Flanged-end valves shall be installed in an approved pit and provided with a union or sleeve-type coupling in the pit to permit removal. Mechanical-end valves 3 through 10 inches in diameter may be direct burial if provided with a suitable valve box, means for manual operation, and an adjacent pipe joint to facilitate valve removal. Valve operators shall restrict closing to a rate requiring approximately 60 seconds, from fully open to fully closed.

2.1.2.5 Pressure Reducing Valves

Pressure reducing valves shall maintain a constant downstream pressure regardless of fluctuations in demand. Valves shall be suitable for 150 psi operating pressure on the inlet side, with outlet pressure set for 10 psi. The valves shall be of the hydraulically-operated, pilot controlled, globe or angle type, and may be actuated either by diaphragm or piston. The pilot control shall be the diaphragm-operated, adjustable, spring-loaded type, designed to permit flow when controlling pressure exceeds the spring setting. Ends shall be threaded. Valve bodies shall be bronze, cast iron or cast steel with bronze trim. Valve stem shall be stainless steel. Valve discs and diaphragms shall be synthetic rubber. Valve seats shall be bronze. Pilot controls shall be bronze with stainless steel working parts.

2.1.2.6 Vacuum and Air Relief Valves

Vacuum and air relief valves shall be of the size shown and shall be of a type that will release air and prevent the formation of a vacuum. The valves shall automatically release air when the lines are being filled with water and shall admit air into the line when water is being withdrawn in excess of the inflow. Valves shall be iron body with bronze trim and stainless steel float.

2.1.2.7 Fire Hydrants

Dry-barrel type, except that flush-type hydrants shall be provided where indicated. Paint hydrants with at least one coat of primer and two coats of yellow enamel paint, except use red enamel paint for tops of hydrants in non-potable water systems. Stencil hydrant number and main size on the hydrant barrel using black stencil paint.

- a. Dry-Barrel Type Fire Hydrants: Dry-barrel type hydrants, AWWA C502 or UL 246, "Base Valve" design, shall have 6 inch inlet, 5 1/4 inch valve opening, one 4 1/2 inch pumper connection, and two 2 1/2 inch hose connections. Inlet shall have mechanical-joint end only, except where flanged end is indicated; end shall conform to the applicable requirements as specified for the joint. Size and shape of operating nut, cap nuts, and threads on hose and pumper connections shall be as specified in AWWA C502 or UL 246.
- b. Flush-Type Fire Hydrants: Hydrants shall conform to the applicable requirements of AWWA C502, except that they shall be of a design that will permit placement of hydrant below surface of pavement. Hydrants shall have 6 inch inlet, 4 1/4 inch minimum valve opening, one 4 1/2 inch pumper connection, and one 2 1/2 inch hose connection. Hose and pumper connections and operating nuts shall be readily accessible, and enclosed in a cast iron box with top flush with pavement and having cast-iron cover with flush lifting handle. Inlet shall have mechanical-joint or push-on joint end, except where flanged end is indicated. Size and shape of operating nut and cap nuts and threads on hose and pumper connections shall be as specified in AWWA C502.

2.1.2.8 Indicator Posts

UL 789. Provide for gate valves where indicated.

2.1.2.9 Valve Boxes

Provide a valve box for each gate valve on buried piping. Valve boxes

shall be of cast iron of a size suitable for the valve on which it is to be used and shall be adjustable. Cast-iron boxes shall have a minimum cover and wall thickness of 3/16 inch. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. . Cast-iron box shall have a heavy coat of bituminous paint.

2.1.2.10 Valve Pits

Valve pits shall be constructed at locations indicated or as required above and in accordance with the details shown.

2.1.2.11 Propeller Type Meters

Propeller type meters shall conform to AWWA C704. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons . Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register designed in accordance with AWWA C706 . Meters shall comply with the accuracy and capacity requirements of AWWA C703.

2.1.2.12 Meter Vaults

Large meters shall be installed in reinforced concrete vaults manufactured in accordance with Section 03 40 00.00 10 PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION. Large meters shall be installed in reinforced concrete vaults in accordance with the details shown on the drawings.

2.1.2.13 Sleeve-Type Mechanical Couplings

Couplings shall be designed to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling shall consist of one middle ring flared or beveled at each end to provide a gasket seat; two follower rings; two resilient tapered rubber gaskets; and bolts and nuts to draw the follower rings toward each other to compress the gaskets. The middle ring and the follower rings shall be true circular sections free from irregularities, flat spots, and surface defects; the design shall provide for confinement and compression of the gaskets. For ductile iron and PVC plastic pipe, the middle ring shall be of cast-iron or steel; and the follower rings shall be of malleable or ductile iron. Malleable and ductile iron shall, conform to ASTM A47/A47M and ASTM A536, respectively. Gaskets shall be designed for resistance to set after installation and shall meet the applicable requirements specified for gaskets for mechanical joint in AWWA C111/A21.11. Bolts shall be track-head type, ASTM A307, Grade A, with nuts, ASTM A563, Grade A; or round-head square-neck type bolts, ASME B18.5.2.1M and ASME B18.5.2.2M with hex nuts, ASME B18.2.2. Bolts shall be 5/8 inch in diameter; minimum number of bolts for each coupling shall be per manufacturer's recommendation. Bolt holes in follower rings shall be of a shape to hold fast the necks of the bolts used. Mechanically coupled joints using a sleeve-type mechanical coupling shall not be used as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint. Mechanical couplings shall provide a tight flexible joint under all reasonable conditions, such as pipe movements caused by expansion, contraction, slight setting or shifting in the ground, minor variations in trench gradients, and traffic vibrations. Couplings shall be of strength not less than the adjoining pipeline.

2.1.2.14 Bonded Joints

For all ferrous pipe, a metallic bond shall be provided at each joint, including joints made with flexible couplings, caulking, or rubber gaskets, of ferrous metallic piping to effect continuous conductivity. The bond wire shall be Size 1/0 copper conductor suitable for direct burial shaped to stand clear of the joint. The bond shall be of the thermal weld type.

2.1.2.15 Tracer Wire for Nonmetallic Piping

Provide bare copper or aluminum wire not less than 0.10 inch in diameter in sufficient length to be continuous over each separate run of nonmetallic pipe.

2.1.2.16 Remote Water Quality Monitoring and Distribution Flushing Equipment

Provide an automatic water distribution flushing equipment designed to be utilized in a permanent or semi-permanent manner for monitoring of water quality conditions, recording water quality results, and automatically flushing of potable water distribution lines when select water quality conditions fail to meet Federal, State and Local water quality standards.

The primary purpose for this equipment shall be to automatically flush the desired amounts of water from the water distribution system for the purpose of improving and maintaining water quality.

In addition, this equipment must be engineered in a way to allow water quality and utility managers to receive and send critical field data from the remote monitoring and flushing station for the periodical verification of current water quality conditions and establish a cost effective and system efficient flushing response program.

This equipment shall be connected as a self-contained unit to a water distribution line, and must be designed for automatic flushing through the opening of a control valve that is integral part of the unit. The equipment shall be capable of being programmed to activate when chlorine or chloramine residual levels fall outside acceptable limits per applicable standards as determined by the facility at MCB Quantico.

The system shall consist of the following components:

1. Integral System Management Control Hardware and Software
2. Integral Piping and Control Valve
3. Self-contained unit
4. Sampling System
5. Electrical or Electronic System
6. Dechlorination, depending on the local ordinance.

2.2 WATER SERVICE LINE MATERIALS

2.2.1 Piping Materials

2.2.1.1 Copper Pipe and Associated Fittings

Pipe, ASTM B42, regular, threaded ends. Fittings shall be brass or bronze, ASME B16.15, 125 pound.

2.2.1.2 Copper Tubing and Associated Fittings

Tubing, [ASTM B88](#), Type K. Fittings for solder-type joint, [ASME B16.18](#) or [ASME B16.22](#); fittings for compression-type joint, [ASME B16.26](#), flared tube type.

2.2.1.3 Ductile-Iron Piping

Comply with "Ductile-Iron Piping" subparagraph under paragraph "Water Distribution Main Materials."

2.2.1.4 Insulating Joints

Joints between pipe of dissimilar metals shall have a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.2.2 Water Service Line Appurtenances

2.2.2.1 Corporation Stops

Ground key type; bronze, [ASTM B61](#) or [ASTM B62](#); and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops, [AWWA C800](#); coupling nut for connection to flared copper tubing, [ASME B16.26](#).

2.2.2.2 Curb or Service Stops

Ground key, round way, inverted key type; made of bronze, [ASTM B61](#) or [ASTM B62](#); and suitable for the working pressure of the system. Ends shall be as appropriate for connection to the service piping. Arrow shall be cast into body of the curb or service stop indicating direction of flow.

2.2.2.3 Service Clamps

Service clamps used for repairing damaged cast-iron, steel, PVC or asbestos-cement pipe shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

2.2.2.4 Goosenecks

Type K copper tubing. Joint ends for goosenecks shall be appropriate for connecting to corporation stop and service line. Length of goosenecks shall be in accordance with standard practice.

2.2.2.5 Dielectric Fittings

Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

2.2.2.6 Check Valves

Check valves shall be designed for a minimum working pressure of 150 psi or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve. Valves 2 inches and larger shall be outside lever and spring type.

Valves 2 inches and smaller shall be all bronze designed for screwed fittings, and shall conform to MSS SP-80, Class 150, Types 3 and 4 as suitable for the application.

2.2.2.7 Gate Valves 3 Inch Size and Larger on Buried Piping

Gate valves 3 inch size and larger on buried piping AWWA C500 or UL 262 and of one manufacturer. Valves, AWWA C500, nonrising stem type with double-disc gates. Valves, UL 262, inside-screw type with operating nut, split wedge or double disc type gate, and designed for a hydraulic working pressure of 175 psi. Materials for UL 262 valves conforming to the reference standards specified in AWWA C500. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have O-ring stem seals and shall be bolted and constructed so as to permit easy removal of parts for repair. Valves shall have threaded ends.

2.2.2.8 Gate Valves Smaller than 3 Inch in Size on Buried Piping

Gate valves smaller than 3 inch size on Buried Piping MSS SP-80, Class 150, solid wedge, nonrising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve. Provide handwheel operators.

2.2.2.9 Gate Valves Smaller Than 3 Inch Size in Valve Pits

MSS SP-80, Class 150, solid wedge, inside screw, rising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve and a handwheel operator.

2.2.2.10 Curb Boxes

Provide a curb box for each curb or service stop. Curb boxes shall be of cast iron of a size suitable for the stop on which it is to be used. Provide a round head. Cast the word "WATER" on the lid. Each box shall have a heavy coat of bituminous paint.

2.2.2.11 Valve Boxes

Provide a valve box for each gate valve on buried piping. Valve boxes shall be of cast iron of a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Cast-iron box shall have a heavy coat of bituminous paint.

2.2.2.12 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable iron, split-sleeve type with

flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 150 psi or 150% of normal operating pressure, whichever is greater. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 50 foot-pound.

2.2.2.13 Displacement Type Meters

Displacement type meters shall conform to AWWA C700. Registers shall be straight-reading and shall read in cubic meters U.S. gallon. Meters in sizes 13 through 1/2 through 1 shall be frost-protection design. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706. Meters shall comply with the accuracy and capacity requirements of AWWA C700.

2.2.2.14 Meter Boxes

Meter boxes shall be of cast iron, concrete, or plastic. Concrete meter boxes shall be manufactured in accordance with Section 03 40 00.00 10 PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION. The boxes shall be of sufficient size to completely enclose the meter and shutoff valve or service stop. Meter boxes set in paved areas subject to vehicular traffic shall be cast iron, or concrete with cast iron lid and cast iron meter reader lid. Boxes set in sidewalks, not subject to vehicular traffic, shall be concrete with cast iron lid and cast iron meter reader lid. Plastic boxes and lids shall be used in unpaved areas or grass areas not subject to vehicular traffic. Box height shall extend from invert of the meter to final grade at the meter location. The lid shall have the word "WATER" cast in it.

2.2.2.15 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to all pipeline installation except where specific exception is made in the "Special Requirements..." paragraphs.

3.1.1.1 Location of Water Lines

Where water piping is required to be installed within 3 feet of existing

structures, the water pipe shall be sleeved. Provide ductile-iron or Schedule 40 steel sleeves. Annular space between pipe and sleeves shall be filled with mastic. The Contractor shall install the water pipe and sleeve ensuring that there will be no damage to the structures and no settlement or movement of foundations or footings.

Terminate the work covered by this section at a point approximately 5 feet from the building, unless otherwise indicated. Do not lay water lines in the same trench with gas lines, fuel lines, or electric wiring.

a. Water Piping Installation Parallel With Sewer Piping

Normal Conditions: Lay water piping at least 10 feet horizontally from a sewer or sewer manhole whenever possible. Measure the distance edge-to-edge.

- (1) The bottom (invert) of the water piping shall be at least 18 inches above the top (crown) of the sewer piping.
- (2) Where this vertical separation cannot be obtained, the sewer piping shall be constructed of AWWA-approved water pipe and pressure tested in place without leakage prior to backfilling. Approved waste water disposal method shall be utilized.
- (3) The sewer manhole shall be of watertight construction and tested in place.

b. Installation of Water Piping Crossing Sewer Piping

- (1) Normal Conditions: Water piping crossing above sewer piping shall be laid to provide a separation of at least 18 inches between the bottom of the water piping and the top of the sewer piping.
- (2) Unusual Conditions: When local conditions prevent a vertical separation described above, use the following construction:
 - (a) Sewer piping passing over or under water piping shall be constructed of AWWA-approved ductile iron water piping, pressure tested in place without leakage prior to backfilling.
 - (b) Water piping passing under sewer piping shall, in addition, be protected by providing a vertical separation of at least 18 inches between the bottom of the sewer piping and the top of the water piping; adequate structural support for the sewer piping to prevent excessive deflection of the joints and the settling on and breaking of the water piping; and that the length, minimum 20 feet, of the water piping be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer piping.

c. Sewer Piping or Sewer Manholes: No water piping shall pass through or come in contact with any part of a sewer manhole.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

3.1.1.3 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or any other water line material into trenches. Cut pipe in a neat workmanlike manner accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at proper elevation and grade. Secure firm, uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Depth of cover over top of pipe shall not be less than 3 1/2 feet.

3.1.1.4 Installation of Tracer Wire

Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.1.1.5 Connections to Existing Water Lines

Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped .

3.1.1.6 Penetrations

Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

3.1.1.7 Flanged Pipe

Flanged pipe shall only be installed above ground or with the flanges in valve pits.

3.1.2 Special Requirements for Installation of Water Mains

3.1.2.1 Installation of Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the requirements of [AWWA C600](#) for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

- a. Jointing: Make push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of [AWWA C600](#) for joint assembly. Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of [AWWA C600](#) for joint assembly and the recommendations of Appendix A to [AWWA C111/A21.11](#). Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer. Make insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves shall be full size for the bolt holes. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.
- b. Allowable Deflection: The maximum allowable deflection shall be as given in [AWWA C600](#). If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.
- c. Pipe Anchorage: Provide concrete thrust blocks (reaction backing) or metal harness for pipe anchorage, except where metal harness is indicated. Thrust blocks shall be in accordance with the requirements of [AWWA C600](#) for thrust restraint, except that size and positioning of thrust blocks shall be as indicated. Use concrete, [ASTM C94/C94M](#), having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength. Metal harness shall be in accordance with the requirements of [AWWA C600](#) for thrust restraint, using tie rods and clamps as shown in [NFPA 24](#), except as otherwise indicated.
- d. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet, using Method A polyethylene film encasement, in accordance with [AWWA C105/A21.5](#).

3.1.2.2 Installation of Valves and Hydrants

- a. Installation of Valves: Install gate valves, [AWWA C500](#) and [UL 262](#), in accordance with the requirements of [AWWA C600](#) for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to [AWWA C500](#). Install gate valves, [AWWA C509](#) or [AWWA C515](#), in accordance with the requirements of [AWWA C600](#) for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to [AWWA C509](#) or [AWWA C515](#). Install check valves in accordance with the applicable requirements of [AWWA C600](#) for valve-and-fitting installation. Make and assemble joints to gate valves and check valves as specified for making and assembling the same type joints between pipe and fittings.
- b. Installation of Hydrants: Install hydrants in accordance with [AWWA C600](#) for hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Provide metal harness as specified under pipe anchorage requirements for the respective pipeline material to which hydrant is attached. Install hydrants with the 4 1/2 inch connections facing the adjacent paved surface. If there are two paved

adjacent surfaces, contact the Contracting Officer for further instructions.

3.1.3 Installation of Water Service Piping

3.1.3.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line at the points indicated; such water service lines shall be closed with plugs or caps.

3.1.3.2 Service Line Connections to Water Mains

Connect service lines 1 1/2 inch size to the main by a corporation stop and gooseneck and install a service stop below the frostline as indicated. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps.

3.1.4 Special Requirements for Installation of Water Service Piping

3.1.4.1 Installation of Metallic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the applicable requirements of AWWA C600 for pipe installation, unless otherwise specified.

a. Jointing:

- (1) Screwed Joints: Make screwed joints up tight with a stiff mixture of graphite and oil, inert filler and oil, or graphite compound; apply to male threads only. Threads shall be full cut; do not leave more than three threads on the pipe exposed after assembling the joint.
- (2) Joints for Copper Tubing: Cut copper tubing with square ends; remove fins and burrs. Handle tubing carefully; replace dented, gouged, or otherwise damaged tubing with undamaged tubing. Make solder joints using ASTM B32, 95-5 tin-antimony or Grade Sn96 solder. Solder and flux shall contain not more than 0.2 percent lead. Before making joint, clean ends of tubing and inside of fitting or coupling with wire brush or abrasive. Apply a rosin flux to the tubing end and on recess inside of fitting or coupling. Insert tubing end into fitting or coupling for the full depth of the recess and solder. For compression joints on flared tubing, insert tubing through the coupling nut and flare tubing.
- (3) Flanged Joints: Make flanged joints up tight, taking care to avoid undue strain on flanges, valves, fittings, and accessories.

3.1.5 Disinfection

Prior to disinfection, obtain Contracting Officer approval of the proposed method for disposal of waste water from disinfection procedures. Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the

systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying nonpotable water is not required.

3.1.6 Remote Water Quality Monitoring and Distribution Flushing Equipment Location

Prior to installation of the flushing equipment, the drainage patterns for the intended location must be reviewed by the Contractor as to ensure that any discharge water will not create hazardous conditions for vehicular or pedestrian traffic. The selected location's drainage pattern must permit discharged water to flow away from the automatic flushing valve or be absorbed by the surrounding soil to prevent pooling. The area 36" around the automatic flushing valve shall be prepared in order to prevent erosion. The automatic flushing valve shall be disinfected in accordance with ADH and AWWA standards.

3.2 FIELD QUALITY CONTROL

3.2.1 Field Tests and Inspections

Prior to hydrostatic testing, obtain Contracting Officer approval of the proposed method for disposal of waste water from hydrostatic testing. The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.

3.2.2 Testing Procedure

Test water mains and water service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test ductile-iron water mains and water service lines in accordance with the requirements of AWWA C600 for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical-joints shall not exceed the amounts given in AWWA C600; no leakage will be allowed at joints made by any other method. Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at copper pipe joints, copper tubing joints (soldered, compression type, brazed), flanged joints, and screwed joints.

3.2.3 Special Testing Requirements

For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 200 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at

the same time and at the same test pressure as the pressure test.

3.3 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --