



City of Florence Technical Specifications

Florence, South Carolina

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CIVIL SPECIFICATIONS:

WATER UTILITIES

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END OF SECTION



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SECTION 33 11 16 - WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings for potable water line
 - 2. Tapping sleeves and valves.
 - 3. Gate valves and boxes.
 - 4. Underground pipe markers.
 - 5. Bedding and cover materials.
 - 6. Valve Markers.

- B. Related Requirements:
 - 1. Section 31 05 16 - Aggregates for Earthwork.
 - 2. Section 31 23 17 - Trenching.
 - 3. Section 31 23 23 - Fill.
 - 4. Section 33 12 13 - Water Service Connections.
 - 5. Section 33 12 19 - Fire Hydrants.
 - 6. Section 33 13 00 - Disinfecting of Water Utility Distribution.
 - 7. Section 33 13 10 – Testing of Water Utility Distribution.

1.2 REFERENCE STANDARDS

- A. American Society of Mechanical Engineers:
 - 1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

- B. ASTM International:
 - 1. ASTM A36 - Standard Specification for Carbon Structural Steel.
 - 3. ASTM A123 - Standard Specification for Zinc-Hot-Dip Galvanized Coatings on Iron and Steel Products.
 - 5. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 6. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 7. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - 8. ASTM D2239-12a - Standard Specification for PE Pipe (SIDR-PR) Based on Controlled Inside Diameter.
 - 9. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 10. ASTM D3350 – Standard Specification for PE Pipe & Fittings Materials.

- C. American Water Works Association:
 - 1. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
 - 2. AWWA C111/A21.11-00 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.



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3. AWWA C150/A21.50-02 – American National Standard for Thickness Design of Ductile-Iron Pipe.
 4. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.
 5. AWWA C153 - Ductile-Iron Compact Fittings.
 6. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
 7. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
 8. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
 9. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
 10. AWWA C605 - Underground Installation of PVC and PVCO Pressure Pipe and Fittings.
 11. AWWA C606/A21.10 - Grooved and Shouldered Joints.
 12. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.
 13. AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, ¾ inch Through 3 inch, for Water Service.
 14. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm).
 15. AWWA C906 – Polyethylene (PE) pressure Pipe & Fittings, 4 inch through 63 inch for water.
- D. Manufacturer's Standardization Society of the Valve and Fittings Industry:
1. MSS SP-60 - Connecting Flange Joint between Tapping Sleeves and Tapping Valves.
- E. National Fire Protection Agency:
1. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.
- F. National Sanitation Foundation:
1. NSF 61 - Drinking Water System Components - Health Effects
- ### 1.3 CLOSEOUT REQUIREMENTS
- A. Project Record Documents:
1. Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- ### 1.4 QUALITY ASSURANCE
- A. Valves: Mark valve body with manufacturer's name and pressure rating.
- B. Ductile Iron Pipe: All DIP shall be domestically manufactured in the United States. Pipe shall be cast, cleaned, lined, coated, fabricated, tested and certified at a United States of America manufacturing facility. The raw material for DIP shall have an average minimum content of 90% recycled iron and steel.
- C. Perform Work according to State, county and local standards.



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- D. All materials or products which come into contact with drinking water shall be third party certified as meeting the specifications of the American National Institute/National Sanitation Foundation Standard 61 (see Section 1.3(F)). The certifying party shall be accredited by ANSI.
- E. Prepare valves and accessories for shipment according to AWWA Standards and seal valve and ends to prevent entry of foreign matter into product body.
- F. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.
- G. Store polyethylene and PVC materials out of sunlight.

PART 2 PRODUCTS

- 2.1 All material and appurtenances shall meet the following minimum standard requirements. It shall be each manufacturer's responsibility to check the proposed installation and to furnish material that will be fully capable of performing its intended function.
- 2.2 All pipes furnished for the project shall be of one type and fabricated by the same manufacturer. The age of the pipe shall not exceed 12 months when installed unless approved in writing by the owner.
- 2.3 All pipe & valve material, solder and flux shall be "lead free".
 - A. "Lead Free" refers to the Federal Reduction of Lead in Drinking Water Act, effective January 4, 2014, where,
 - 1. The wetted surface of pipe, fittings, and fixtures in potable water systems must have a weighted average lead content of less than 0.25%.
 - 2. The percent lead in solders and flux must be less than 0.20%.
 - 3. Reference the Safe Drinking Water Act (Sec. 1417) amended 01/04/2011 and other equivalent state regulations.

2.4 WATER PIPING

- A. Ductile Iron Pipe: 60-42-10 ductile cast iron, AWWA C110, AWWA C150, AWWA C151.
 - 1. To be used when cover over pipe is less than 36", or where specified on drawings.
 - 2. Pipe less than 30" shall have a pressure rating of 350 psi unless otherwise specified.
 - 3. All pipe shall have standard cement-lined interior and 2-mil thick bituminous exterior coating.
 - 4. Fittings: Ductile iron grade 70-50-05.
 - 5. Joints: Push-on or mechanical joint ends, AWWA C111, rubber gasket joint devices.
 - 6. Flanges: AWWA C606, Class 125 except where Class 250 is specifically noted. Drilling and facing shall conform to ASME/ANSI B16.1-1998 – Cast Iron Pipe Flanges and Flanged Fittings.
 - 7. All pipe shall be smooth and free of cracks or other imperfections.
 - 8. All pipe shall be manufactured in the United States and be clearly marked with the following information:
 - a. Manufacturer's name.



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- b. Nominal pipe size.
 - c. Pressure class.
 - d. Material designation.
 - e. National Sanitation Foundation Seal of Approval for Potable Water.
- B. PVC Pipe: Rigid polyvinyl chloride, AWWA C900 and AWWA C905, Class 235, Blue.
1. All PVC pipe must have 36" or more of cover; otherwise Ductile Iron Pipe (DIP) shall be used.
 2. Pipe 14" through 24" diameter: AWWA C-905, DR 18 (235 psi).
 3. Pipe 4" through 12" diameter: AWWA C-900, DR 18 (235 psi).
 4. Pipe less than 4" in diameter: Must be specified as ASTM D1785 or ASTM D2241, DR 21, Class 200.
 5. Fittings: 2.5" and greater, AWWA C900; AWWA C905, ductile iron with mechanical joint. Solvent weld PVC pipe and fittings shall not be used in water mains 2.5 inches and larger.
 6. Nominal laying lengths shall be a minimum of 18 feet.
 7. All pipe shall be smooth and free of cracks or other imperfections.
 8. All pipe shall be clearly marked with the following information:
 - a. Manufacturer's name.
 - b. Nominal pipe size.
 - c. DR class number.
 - d. ASTM designation.
 - e. Material designation.
 - f. National Sanitation Foundation Seal of Approval for Potable Water.
 - g. Manufactured date.
 9. Joints: ASTM D3139, integrally formed, factory fabricated bells, or twice gasketed couplings with flexible elastomeric seals. Solvent-cement couplings are not permitted.
 10. Pipe diameter specified is the inside diameter of the pipe.
 11. Store pipe out of direct sunlight.
- C. Polyethylene Pipe (HDPE): AWWA C906, ASTM D3350-12e1.
1. To be used in directional bores only.
 2. Pipe Materials: Virgin resins exhibiting a cell classification of PE 345444C as defined in ASTM D3350 with an established hydrostatic-design-basis of 1600 psi for water at 73 degrees F. The resin shall be listed by the PPI (Plastic Pipe Institute) in its pipe-grade registry Technical Report (TR) 4, "Listing of Plastic Pipe Compounds".
 3. Pipe greater than 2" diameter: DR 11, Class 200.
 4. Pipe 2" diameter or less: ASTM D2239-12a, SIDR 17, 100 psi.
 5. Fittings: AWWA C901, molded.
 6. Joints: Heat fusion, flanges, or other mechanical joint systems proven for HDPE pipes.
 7. All pipe shall be smooth and free of cracks or other imperfections.
 8. All pipe shall be clearly marked with the following information:
 - a. Manufacturer's name.
 - b. Nominal pipe size.
 - c. Pressure class.
 - d. Material designation.
 - e. National Sanitation Foundation Seal of Approval for Potable Water.



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2.5 JOINT MATERIAL

- A. Gaskets for pipe fittings, O-rings, or other products for jointing or setting meters or valves shall be of an elastomeric material which will not support microbiological growth. Gaskets shall conform to the requirements of the applicable AWWA specification for the type of pipe used.
- B. Gasket lubricant shall be soluble in cold water, non-toxic, shall not support microbiological growth and shall not impart taste or odor to the water. Use of hydrogenated vegetable oil or vegetable shortening is prohibited.

2.6 TAPPING SLEEVES AND VALVES

- A. Tapping Sleeves:
 - 1. Furnish materials according to state and local standards.
 - 2. Description: 304 Stainless Steel or Ductile iron, dual-compression type with test port.
 - 3. Outlet Flange Dimensions and Drilling: ASME B16.1, Class 125 and MSS SP-60.
 - 4. Working pressure: up to 8" diameter = 250 psi.; 10" and above = 200 psi.
 - 5. For taps into existing Asbestos-Cement (AC) pipe, use one of the following:
 - a. Romac SST stainless steel tapping sleeve.
 - b. Ford FAST stainless steel tapping sleeve.
- B. Tapping Valves:
 - 1. Furnish materials according to state and local standards.
 - 2. Description: AWWA C500, resilient wedge with non-rising stem. Inlet flanges conforming to ANSI B16.1, Class 125 and MSS SP-60. Mechanical joint outlets conforming to AWWA C111.
 - 3. Mark manufacturer's name and pressure rating on valve body.

2.7 VALVES AND FIRE HYDRANTS

- A. Resilient Wedge Gate Valves: AWWA C509; iron body, bronze or ductile iron; including the manufacturer's name, pressure rating, and year of fabrication cast into valve body.
 - 1. Resilient seats.
 - 2. Stem: Non-rising bronze stem.
 - 3. Operating Nut: Square; open counterclockwise unless otherwise indicated.
 - 4. Ends: Flanged, mechanical joint or bell end connections.
 - 5. Coating: AWWA C550; interior/exterior.
 - 6. Sizes 12 inch diameter and smaller: 200 psig.
 - 7. Sizes 16 inch diameter and larger: 150 psig.
- B. Fire Hydrants: As specified in Section 33 12 19 - Fire Hydrants.

2.8 AIR RELEASE VALVES

- A. Manufacturer List:
 - 1. Crispin Model PL10.
 - 2. Substitutions: Approved equal.



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- B. Description: Cast-iron body, stainless-steel float, housed in a cast iron meter box.

2.9 UNDERGROUND PIPE MARKERS

- A. Provide marking tape and copper tracer wire on all buried PVC, DIP or polyethylene pipe.
1. Tape and Tracer Wire to be approved for direct burial by the manufacturer.
- B. Metallic/Magnetic Marking Tape
1. Locate 18" below ground surface in pipe trench.
 2. 2" wide, 5.0 mil overall thickness with no less than a 50-gauge solid aluminum foil core.
 3. Foil is to be visible from both sides.
 4. Color to be Safety Precaution Blue.
 5. Marking:
 - a. Wording on tape to indicate "Potable Water" at no greater than 24" on center.
 - b. Use heat-set mylar inks.
 - c. No inks or printing extended to the edges of the tape.
 - d. Encase printing to avoid ink rub-off.
 6. Tensile strength = 28 lbs/inch
- C. Copper Tracer Wire
1. Locate tracer wire a minimum of 6 inches above top of water main, and in all service line trenches.
 2. Terminate tracer wire at each valve and meter and make provisions to allow for connection of testing apparatus without interfering with the proper operation of the valves and meters.
 3. Connect to the water line with duct tape at every bell connection or every 20 feet to ensure that the wire is directly over the top of the pipe.
 4. Splice at each service lateral line and tee connection with an approved copper compression lug.
 5. Test all tracer wire for conductivity in accordance with Part 3.

VALVE BOXES

2.10

- A. Valve boxes shall be of suitable size for the valve with which they are used and fully adjustable for depth of setting, extension pieces being furnished where necessary.
- B. Drop type covers shall be provided for each box with the proper word designating the valve service cast into its top surface.
- C. Basis shall be provided and shall be so designed to fully support the box without weight of the box or superimposed load being transmitted to any part of the valves or adjacent pipe on either side.
- D. 12 inch diameter Valves and Smaller: Domestic cast iron, two-piece, screw type.
- E. Valves over 12 inch diameter: Domestic cast iron, three-piece, screw type; round base.



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2.11 MATERIALS

- A. Bedding: Fine aggregate per Section 31 05 16 – Aggregates for Earthwork.
- B. Cover/Backfill: per Section 31 23 23 - Fill.

2.12 FINISHES

- A. Steel: Galvanizing, ASTM A123; hot-dip galvanize after fabrication.

2.13 VALVE MARKERS

- A. Valve markers shall be as shown on the Drawings.
 - 1. Material: Reinforced concrete.
 - 2. Markings: Recessed letters "MV" (Main Valve), "AV" (Air Valve) or "BO" (Blowoff).

2.14 ACCESSORIES

- A. Joint Restraint:
 - 1. MegaLug joint restraint
 - 2. Threaded Steel Rods, Bolt, Lugs, and Brackets: ASTM A36 or ASTM A307, Grade A carbon steel.
- B. Protective Coating: Bituminous coating.

2.15 THRUST BLOCKS

- A. General:
 - 1. Provide thrust blocks, or metal tie rods and clamps or lugs, on plugs, caps, tees, hydrants, and bends deflecting 11-1/4 degrees or more either vertically or horizontally, and on all except restrained joint water lines. Thrust blocking is not required where restrained joints are indicated.
 - 2. Provide concrete thrust blocking with a compressive strength of 3000 psi in 28 days.
 - 3. Size of the blocking will be determined by the Engineer, based on soil bearing capacity.
 - 4. Provide 8 mil polyethylene film between the thrust block and fittings.
- B. Installation:
 - 1. Locate thrust blocking between solid ground and the fitting to be anchored.
 - 2. Unless otherwise shown or directed by the Engineer, place the base and thrust bearing sides of thrust blocking directly against undisturbed earth.
 - 3. Sides of thrust blocking not subject to thrust may be placed against forms.
 - 4. Place thrust blocking so the fitting joints will be accessible for repair.
 - 5. Protect steel rods and clamps by hot dipped galvanizing.



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PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that existing utility water main size, location, and invert are as indicated on Drawings.
- C. Determine exact location and size of valves from Drawings; obtain clarification and directions from Engineer prior to execution of work.

3.2 PREPARATION

- A. Identify required lines, levels, contours and datum locations.
- B. Locate, identify, and protect utilities to remain from damage.
- C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
- D. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws is not permitted. Grind edges smooth with beveled end for push-on connections.
- E. Remove scale and dirt on inside and outside before assembly.
- F. Prepare pipe connections to equipment with flanges or unions.

3.3 BEDDING

- A. Excavate pipe trench as specified in Section 31 23 17 - Trenching for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.
- B. A continuous and uniform bedding shall be provided in the trench for all buried pipe. Backfill material shall be tamped in layers around the pipe and to a sufficient height to adequately support and protect the pipe. Stones, other than crushed bedding, shall not come into contact with, or be located within six (6) inches of the pipe.
- C. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
- D. Provide sheeting and shoring as specified in Section 31 23 17 - Trenching.
- E. Place bedding material per the Drawings and Section 31 23 17 - Trenching.



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3.4 SPECIAL CONDITIONS

- A. Potable Water Supply Interconnections. There shall be no physical connections between the public or private potable water supply system and a sewer, or appurtenance thereto, which may permit the passage of any sewage or polluted water into the potable supply. No potable water pipe shall pass through or come into contact with any Part of a sewer manhole.
- B. Horizontal and Vertical Separation from Potable Water Mains. Potable water lines shall be laid at least ten (10) feet horizontally from any existing or proposed sewer mains. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, the Department may allow deviation on a case by case basis, if supported by data from the design engineer.

Such deviation may allow installation of the water line closer to a sewer main, provided that the potable water main is in a separate trench or on in undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the potable water main is at least 18 inches above the top of the sewer.

- C. Crossings. Potable water lines crossing sewer mains shall be laid to provide a minimum vertical separation of 18 inches between the outside of the potable water main and the outside of the sewer. This shall be the case where the possible water main is either above or below the sewer. Whenever possible, the potable water main shall be located above the sewer main.

Where a new sewer line crosses a new potable water main, a full-length of pipe shall be used for both the sewer line and potable water main and the crossing shall be arranged so that the joints of each line shall be as far as possible from the point of crossing and each other. Where a possible water main crosses under a sewer, adequate structural support shall be provided for the sewer line to prevent damage to the potable water main while maintaining line and grade.

Potable lines shall not be laid less than 25 feet horizontally from any portion of a waste-water tile-field or spray-field, or shall be otherwise protected by an acceptable method approved by SC DHEC.

- D. HOT TAPS: If installation requires tapping a live water main, the tap must be air pressure tested and the test witnessed by the Engineer or a representative of the Water Utility. Notify the Witness at least 24 hours in advance of the tap.

3.5 INSTALLATION

- A. Pipe:
1. Install pipe according to AWWA C600 and AWWA C605.
 2. Handle and assemble pipe according to manufacturer's instructions and as indicated on Drawings.
 3. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.
 4. Install ductile-iron piping and fittings according to AWWA C600, or grooved and shouldered pipe joints according to AWWA C606, as appropriate.



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5. Route pipe in straight line. Relay pipe that is out of alignment or grade.
 6. Install pipe with no high points. If unforeseen field conditions arise that necessitate high points, install air release valves as directed by Engineer.
 7. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.
 8. Prevent foreign material from entering pipe during placement.
 9. Install pipe to allow for expansion and contraction without stressing pipe or joints.
 10. Close pipe openings with watertight plugs during Work stoppages.
 11. Install access fittings to permit disinfection of water system performed under Section 33 13 00 - Disinfecting of Water Utility Distribution.
 12. Establish elevations of buried piping with not less than three feet of cover. Measure depth of cover from final surface grade to top of pipe barrel.
 13. Install plastic ribbon tape continuous over top of pipe, above pipe line; as specified below.
- B. Marking Tape & Tracer Wire:
1. Install magnetic ribbon tape continuous over top of pipe, buried 18 inches below finish grade, above pipe center line; coordinate with Section 31 23 23 Fill.
 2. Install trace wire continuous over top of pipe, located 6 inches above pipe center line; coordinate with Section 31 23 23 Fill.
 3. Tracer Wire Testing:
 - a. General:
 - 1) Utilize an approved magnetic locating device, M Scope or Equal.
 - 2) Connect a cable conductively from the transmitter to a metal ground rod and the tracer wire.
 - 3) Locate the line following the instructions of the magnetic locating device.
 - 4) If interference is encountered from adjacent utilities or if the depth of bury or line length interferes with the signal, install a dummy valve box with access to the tracer wire at no additional cost to the Owner.
 - 5) Where there is a break in the tracer wire, repair with 3M DBY or ILSCO#IK-8 repair kit, or Engineer-approved equal, and wrap with poly wrap for cathodic protection.
 - b. Creek Crossing and Wetland Areas:
 - 1) Send a prescribed frequency with a shore line base signal ejector between 25 and 1024 HZ down a metal medium and read by a receiver.
 - 2) Select a frequency based on the depth and length of the line.
 - 3) If the tracer wire has a break, reinstall the cable and repeat the conductivity test at no additional cost to the Owner.
 - c. Conduct all testing in the presence of the Engineer. Please give a 48-hour advance notice to allow for scheduling.
- C. Valves and Hydrants:
1. Install valves in conjunction with pipe laying; set valves plumb.
 2. Provide buried valves with valve boxes installed flush with finished grade.
 3. Install hydrants as specified in Section 33 12 19 - Fire Hydrants.
- D. Tapping Sleeves and Valves:



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1. Install tapping sleeves and valves as indicated on Drawings and according to manufacturer's instructions.

3.6 THRUST RESTRAINTS

- A. Install tie rods, clamps, setscrew retainer glands, or restrained joints. Protect metal-restrained joint components against corrosion by applying a bituminous coating or by concrete mortar encasement of metal area. Do not encase pipe and fitting joints to flanges.
- B. Install thrust blocks, tie rods, and joint restraint at dead ends of water main.

3.7 SERVICE CONNECTIONS

- A. Install service connections as specified in Section 33 12 13 - Water Service Connections.

3.8 BACKFILLING

- A. Backfill around sides and to top of pipe as specified in Section 31 23 17 - Trenching.
- B. Maintain optimum moisture content of bedding material to attain required compaction density.
- C. All water mains shall be provided with a minimum thirty six (36) inches of cover. Where this is not possible, pipe shall be steel, concrete, ductile iron, or any other approved material and method approved by the Department.
- D. In instances where a pipe is buried with less than thirty (30) inches of cover, it may be necessary to insulate the pipe to prevent freezing. Refer to the Construction Drawings for details.

3.9 DISINFECTION OF POTABLE WATER PIPING SYSTEM

- A. Flush and disinfect system as specified in Section 33 13 00 - Disinfecting of Water Utility Distribution.

3.10 FIELD QUALITY CONTROL

- A. Perform pressure test on domestic Site water distribution system according to Section 33 13 10 – Testing of Water Utility Distribution.
- B. Compaction Testing for Bedding: According Section 31 23 17 - Trenching.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION



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SECTION 33 12 13 - WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for domestic water service connections to buildings.
2. Tapping saddles.
3. Corporation stop assembly.
4. Curb stop assembly.
5. Meter setting equipment.
6. Water meters.
7. Precast Meter boxes.
8. Backflow preventers.
9. Underground pipe markers.
10. Bedding and cover materials.

B. Related Requirements:

1. Section 31 05 16 - Aggregates for Earthwork.
2. Section 31 23 16 - Excavation.
3. Section 31 23 17 - Trenching.
4. Section 31 23 23 - Fill.
5. Section 33 11 16 – Water Utility Distribution Piping.
6. Section 33 13 00 - Disinfecting of Water Utility Distribution
7. Section 33 13 10 – Testing of Water Utility Distribution.

1.2 REFERENCE STANDARDS

A. American Society of Sanitary Engineering:

1. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.

B. American Society of Mechanical Engineers:

1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

C. ASTM International:

1. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
3. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
6. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
4. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
5. ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
6. ASTM F877 – Standard Specification for Crosslinked Polyethylene (REX) Plastic Hot- and Cold-Water Distribution Systems.



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7. ASTM F2023 – Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Pipe, Tubing and Systems to Hot Chlorinated Water

D. American Water Works Association:

1. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
2. AWWA C111/A21.11-00 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C150/A21.50-02 – American National Standard for Thickness Design of Ductile-Iron Pipe.
4. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.
5. AWWA C606/A21.10 - Grooved and Shouldered Joints
6. AWWA C800 - Underground Service Line Valves and Fittings.
7. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
8. AWWA C904 – Crosslinked Polyethylene (PEX) Pressure Tubing, 1/2 in. through 3 in, For Water Service

E. Other:

1. CSA B137.5 – Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.

1.3 CLOSEOUT REQUIREMENTS

A. Project Record Documents:

1. Record actual locations of meter boxes, water main connections and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

QUALITY ASSURANCE

- 1.4 A. Perform Work in accordance with State and local standards.

PART 2 PRODUCTS

- 2.1 All pipe & valve material, solder and flux shall be “lead free”.

A. “Lead Free” refers to the Federal Reduction of Lead in Drinking Water Act, effective January 4, 2014, where,

1. The wetted surface of pipe, fittings, and fixtures in potable water systems must have a weighted average lead content of less than 0.25%.
2. The percent lead in solders and flux must be less than 0.20%.
3. Reference the Safe Drinking Water Act (Sec. 1417) amended 01/04/2011 and other equivalent state regulations.

2.2 WATER PIPING AND FITTINGS

- A. Ductile Iron Pipe: 60-42-10 ductile cast iron, AWWA C150, AWWA C151.



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1. To be used when cover over pipe is less than 36", or where specified on drawings.
 2. Pipe shall have a pressure rating of 350 psi unless otherwise specified.
 3. All pipe shall have standard cement-lined interior and 2-mil thick bituminous exterior coating.
 4. Fittings: Ductile iron grade 70-50-05.
 5. Joints: Push-on or mechanical joint ends, AWWA C111, rubber gasket joint devices.
 6. Flanges: AWWA C606, Class 125 except where Class 250 is specifically noted. Drilling and facing shall conform to ASME/ANSI B16.1-1998 – Cast Iron Pipe Flanges and Flanged Fittings.
 7. All pipe shall be smooth and free of cracks or other imperfections.
 8. All pipe shall be manufactured in the United States and be clearly marked with the following information:
 - a. Manufacturer's name.
 - b. Nominal pipe size.
 - c. Pressure class.
 - d. Material designation.
 - e. National Sanitation Foundation Seal of Approval for Potable Water.
- B. PVC Pipe: Rigid polyvinyl chloride, ASTM D1785 or ASTM D2241, DR 21, Class 200.
1. Nominal laying lengths shall be a minimum of 18 feet.
 2. For 2" sizes and above.
 3. All pipe shall be smooth and free of cracks or other imperfections.
 4. All pipe shall be clearly marked with the following information:
 - a. Manufacturer's name.
 - b. Nominal pipe size.
 - c. DR class number.
 - d. ASTM designation.
 - e. Material designation.
 - f. National Sanitation Foundation Seal of Approval for Potable Water.
 - g. Manufactured date.
 5. Joints: ASTM D3139, integrally formed, factory fabricated bells, or twice gasketed couplings with flexible elastomeric seals. Solvent-cement couplings are not permitted.
- C. Crosslinked Polyethylene (PEX) Pipe: AWWA C904, ASTM F876
1. Pipe Materials: Muncipex high-pressure peroxide extrusion method cross-linked polyethylene (PEXa) with co-extruded blue PE shield for protection against ultraviolet light (sunlight).
 2. IPS tube sizes.
 3. Fittings: AWWA C901, molded.
 4. All pipe shall be smooth and free of cracks or other imperfections.
 5. All pipe shall be clearly marked with the following information:
 - a. Manufacturer's name.
 - b. Nominal pipe size.
 - c. Pressure class.
 - d. Material designation.
 - e. National Sanitation Foundation Seal of Approval for Potable Water.



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2.3 TAPPING SADDLES

- A. Provide tapping saddles or couplings for all water mains tapped for the purpose of installing a service connection.
- B. Minimum main size: $\frac{3}{4}$ inch.
- C. Tapping Saddle:
 - 1. Material: ductile iron body (fusion plastic coated), Lead Free
 - 2. Flattened double strap or wide strap non-slip design, combined strap width of 3-1/4" minimum, shaped to accurately fit the main pipe O.D.
 - 3. Fitted with a rubber gasket cemented in a retaining groove for pressure-tight seal on the main.
 - 4. Straps, bolts nuts and washers are to be 18-8 stainless steel.
 - 5. Saddle shall be recommended for water main pipe material and corporation shop furnished.
 - 6. For taps into PVC C900 or equivalent pipe, use JCM 406 Coated service saddle with double stainless steel straps.
 - 7. For taps into existing Asbestos-Cement (AC) pipe, use one of the following:
 - a. Romac SST stainless steel tapping sleeve.
 - b. Ford FAST stainless steel tapping sleeve.
- D. Tapped Couplings:
 - 1. Acceptable for connections to existing AC pipe material.
 - 2. Pressure rating: 150 psig working pressure.

2.4 CORPORATION STOP ASSEMBLY

- A. Corporation Stops:
 - 1. Cast bronze body conforming to ASTM B62, Lead Free.
 - 2. Ground key type suitable for 150 psig working pressure.
 - 3. Inlet end threaded for tapping according to AWWA C800.
 - 4. Outlet end suitable for service pipe specified.
 - 5. Mueller or approved equal.

2.5 CURB STOP ASSEMBLY

- A. Curb Stops:
 - 1. Brass or red brass alloy body conforming to ASTM B62, Lead Free.
 - 2. Ground key, round way inverted key type.
 - 3. Arrow shall be cast into body of the curb stop indicating direction of flow.
 - 4. Provide lock cap or locking stop suitable for padlocking stop in shutoff flow position.
 - 5. Positive pressure sealing.
 - 6. Outlet end suitable for service pipe specified.
- B. Curb Boxes and Covers:
 - 1. Cast iron body, Ford Type.
 - 2. Lid with inscription WATER, with Pentagon Plug.



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2.6 METER SETTING EQUIPMENT

- A. Furnish materials in accordance with State and local standards.

Outside Meter Setting:

1. Meter Yokes: Copper or iron, riser type assembly with bronze inlet inverted key angle valve expansion type outlet connection and Ell fitting; flared copper tubing connections both ends.
2. Meter Yokes: Copper or iron, inlet and outlet horizontal or vertical setting with matching couplings, fittings and stops.

2.7 WATER METERS

- A. Water Meter: Make and model to be specified by the local authority. See Drawings.

1. $\frac{3}{4}$ " service: Sensus iPERL Smart Water Meter
2. 1" service and above: Sensus Omni C²
3. Manufacturer Specifications are included at the end of this section for calculating head losses.

2.8 BACKFLOW PREVENTERS

- A. Furnish materials in accordance with State and local standards.

- B. Approved backflow preventers are listed in the SC DHEC document *Notice of Approved Backflow Prevention Assemblies for South Carolina, dated December 3, 2022*.

- C. Backflow preventers are required on all commercial sites, regardless of size, and on all water services of 1-1/2" or greater.

- D. Backflow Preventers are to be privately installed, maintained, and tested annually. Initial testing after installation must be witnessed by a representative of the City of Florence.

- E. Double Check Valve Assemblies: Comply with ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

- F. Reduced Pressure Backflow Preventers:

1. Comply with ASSE 1013.
2. Bronze body, with bronze internal parts and stainless steel springs, Lead Free.
3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.9 UNDERGROUND PIPE MARKERS

- A. Provide copper tracer wire on all buried PVC, DIP or polyethylene pipe.

1. Tracer Wire to be approved for direct burial by the manufacturer.

- B. Copper Tracer Wire



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1. Locate tracer wire a minimum of 6 inches above top of water main, and in all service line trenches.
2. Terminate tracer wire at each valve and meter and make provisions to allow for connection of testing apparatus without interfering with the proper operation of the valves and meters.
3. Connect to the water line with duct tape at every bell connection or every 20 feet to ensure that the wire is directly over the top of the pipe.
4. Splice at each service lateral line and tee connection with an approved copper compression lug.
5. Test all tracer wire for conductivity in accordance with Part 3.

2.10 PRECAST METER BOXES

- A. Meter and backflow preventer box type shall be specified by the local authority. See Drawings.

2.11 BEDDING AND COVER MATERIALS

- A. Bedding: Fine aggregate per Section 31 05 16.
- B. Cover/Backfill: per Section 31 23 23 - Fill.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION - CORPORATION STOP ASSEMBLY

- A. Make connection for each different kind of water main using suitable materials, equipment and methods approved by the Engineer.
- B. Provide service clamps for mains other than of cast iron or ductile iron mains.
- C. Screw corporation stops directly into tapped and threaded iron main at 10 and 2 o'clock position on main's circumference; locate corporation stops at least 12 inches apart longitudinally and staggered.
- D. For plastic pipe water mains, provide full support for service clamp for full circumference of pipe, with minimum 2 inches width of bearing area; exercise care against crushing or causing



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other damage to water mains at time of tapping or installing service clamp or corporation stop.

- E. Use proper seals or other devices so no leaks are left in water mains at points of tapping; do not backfill and cover service connection until approved by the Engineer.
- F. HOT TAPS: If installation of the service requires tapping a live water main, the tap must be air pressure tested and the test witnessed by the Engineer or a representative of the Water Utility. Notify the Witness at least 24 hours in advance of the tap.

3.4 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section.
- B. Backfill around sides and to top of pipe as specified in Section 31 23 17 - Trenching.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.5 SPECIAL CONDITIONS

- A. Potable Water Supply Interconnections. There shall be no physical connections between the public or private potable water supply system and a sewer, or appurtenance thereto, which may permit the passage of any sewage or polluted water into the potable supply. No potable water pipe shall pass through or come into contact with any Part of a sewer manhole.
- B. Horizontal and Vertical Separation from Potable Water Mains. Potable water lines shall be laid at least ten (10) feet horizontally from any existing or proposed sewer mains. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, the Department may allow deviation on a case by case basis, if supported by data from the design engineer.

Such deviation may allow installation of the water line closer to a sewer main, provided that the potable water main is in a separate trench or on in undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the potable water main is at least 18 inches above the top of the sewer.

- C. Crossings. Potable water lines crossing sewer mains shall be laid to provide a minimum vertical separation of 18 inches between the outside of the potable water main and the outside of the sewer. This shall be the case where the possible water main is either above or below the sewer. Whenever possible, the potable water main shall be located above the sewer main.

Where a new sewer line crosses a new potable water main, a full-length of pipe shall be used for both the sewer line and potable water main and the crossing shall be arranged so that the joints of each line shall be as far as possible from the point of crossing and each other. Where a possible water main crosses under a sewer, adequate structural support shall be provided for the sewer line to prevent damage to the potable water main while maintaining line and grade.



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3.6 INSTALLATION

A. Pipe:

1. Handle and assemble pipe according to manufacturer's instructions and as indicated on Drawings.
2. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.
3. Install ductile-iron piping and fittings according to AWWA C600, or grooved and shouldered pipe joints according to AWWA C606, as appropriate.
4. Route pipe in straight line. Relay pipe that is out of alignment or grade.
5. Install pipe with no high points. If unforeseen field conditions arise that necessitate high points, install air release valves as directed by Engineer.
6. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.
7. Prevent foreign material from entering pipe during placement.
8. Install pipe to allow for expansion and contraction without stressing pipe or joints.
9. Close pipe openings with watertight plugs during Work stoppages.
10. Install access fittings to permit disinfection of water system performed under Section 33 13 00 - Disinfecting of Water Utility Distribution.
11. Establish elevations of buried piping with not less than three feet of cover. Measure depth of cover from final surface grade to top of pipe barrel.
12. Install plastic ribbon tape continuous over top of pipe, above pipe line; as specified below.

B. Tracer Wire:

1. Install trace wire continuous over top of pipe, located 6 inches above pipe center line; coordinate with Section 31 23 23 Fill.
2. Tracer Wire Testing:
 - a. General:
 - 1) Utilize an approved magnetic locating device, M Scope or Equal.
 - 2) Connect a cable conductively from the transmitter to a metal ground rod and the tracer wire.
 - 3) Locate the line following the instructions of the magnetic locating device.
 - 4) If interference is encountered from adjacent utilities or if the depth of bury or line length interferes with the signal, install a dummy valve box with access to the tracer wire at no additional cost to the Owner.
 - 5) Where there is a break in the tracer wire, repair with 3M DBY or ILSCO#IK-8 repair kit, or Engineer-approved equal, and wrap with poly wrap for cathodic protection.
 - b. Creek Crossing and Wetland Areas:
 - 1) Send a prescribed frequency with a shore line base signal ejector between 25 and 1024 HZ down a metal medium and read by a receiver.
 - 2) Select a frequency based on the depth and length of the line.
 - 3) If the tracer wire has a break, reinstall the cable and repeat the conductivity test at no additional cost to the Owner.
 - c. Conduct all testing in the presence of the Engineer. Please give a 48-hour advance notice to allow for scheduling.



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3.7 INSTALLATION - CURB STOP ASSEMBLY

- A. Set curb stops on compacted soil.
- B. Center and plumb curb box over curb stops. Set box cover flush with finished grade.

3.8 INSTALLATION - WATER METERS

- A. The City will supply and install the water meters after the tap fees have been paid.

3.9 INSTALLATION - BACKFLOW PREVENTERS

- A. Install backflow preventer where indicated on the Contract Drawings and in accordance with manufacturer's instructions.
- B. Comply with local water company requirements and plumbing codes in regards to testing and installation requirements.

3.10 INSTALLATION - SERVICE CONNECTIONS

- A. Install in accordance with State and local standards.

3.11 DISINFECTION OF POTABLE WATER PIPING SYSTEM

- A. Flush and disinfect system per State and Local standards.

3.12 FIELD QUALITY CONTROL

- A. Perform pressure test on domestic Site water distribution system according to Section 33 13 10 – Testing of Water Utility Distribution.
- B. Compaction Testing for Bedding: According Section 31 23 17 - Trenching.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION



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SECTION 33 12 19 - FIRE HYDRANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire hydrants.
2. Post fire hydrants.

B. Related Sections:

1. Section 31 05 16 - Aggregates for Earthwork.
2. Section 31 23 17 - Trenching.
3. Section 33 11 16 - Site Water Utility Distribution Piping.
4. **Section 33 12 13 - Water Service Connections.**
5. **Section 33 12 16 - Water Utility Distribution Valves.**
6. Section 33 13 00 - Disinfecting of Water Utility Distribution.
7. Section 33 13 10 - Testing of Water Utility Distribution.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Fire Hydrants:

1. Basis of Measurement: Each.
2. Basis of Payment: Includes excavation, fire hydrant, tap, valve, accessories, test and backfill.

1.3 REFERENCES

A. American Water Works Association:

1. AWWA C502 - Dry-Barrel Fire Hydrants.
2. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
3. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

B. National Sanitation Foundation:

1. NSF 61 - Drinking Water System Components - Health Effects

C. National Fire Protection Association:

1. NFPA 281 - Recommended Practice for Fire Flow Testing and Marking of Hydrants

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Design Data: Submit manufacturer's latest published literature. Include illustrations, installation instructions, maintenance instructions and parts lists.



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1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of fire hydrants.
- B. Verify that hose connections are a minimum of 18" above the adjacent ground level.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with City of Florence standards.

1.7 QUALIFICATIONS

- A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years' experience.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing and protecting products.
- B. Prepare hydrants and accessories for shipment according to AWWA Standards and seal hydrant and ends to prevent entry of foreign matter into product body.
- C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.10 COORDINATION

- A. Coordinate work with local authorities, and utilities within construction area.

PART 2 PRODUCTS

2.1 FIRE HYDRANTS

A. Manufacturers:

- 1. Mueller A-423 Centurion
- 2. Substitutions: substitution of equivalent product is allowed.

B. Dry-barrel Break-away Type: AWWA C502; cast-iron body, compression type valve.

- 1. Bury Depth: As indicated on the Drawings.
- 2. Inlet Connection: 6 inches.
- 3. Valve Opening: 5-1/4 inches diameter.



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4. One integral 5-1/4 inch STORZ pumper nozzle connection.
5. Two 2-1/2 inch hose nozzles with standard threads.
6. Ends: Mechanical Joint or Bell End.
7. Bolts and Nuts: Galvanized steel.
8. Coating: AWWA C550; interior.
9. Direction of Opening: Counterclockwise unless otherwise indicated.
10. Maximum working pressure: 200 psig

C. One pumper, two hose nozzles.

1. Obtain thread type and size from local fire department.
2. Attach nozzle caps by separate chains.

D. Finish: Primer and two coats of enamel color, yellow barrel with orange bonnet.

2.2 POST-TYPE FIRE HYDRANTS

A. Manufacturers:

1. **Mueller 2-1/8" Post Type Fire Hydrant**
2. **Substitutions: substitution of equivalent product is allowed.**

B. Dry-barrel Break-away Type: AWWA C502; cast-iron body, compression type valve.

1. **Bury Depth: As indicated on the Drawings.**
2. **Inlet Connection: 4 inches.**
3. **Ends: Mechanical Joint or Bell End.**
4. **Bolts and Nuts: Galvanized steel.**
5. **Coating: AWWA C550; interior.**
6. **Direction of Opening: Counterclockwise unless otherwise indicated.**
7. **Maximum working pressure: 150 psig**

C. One 2-1/8" hose nozzle.

1. **Obtain thread type and size from local fire department.**
2. **Attach nozzle cap with chain.**

D. Finish: Primer and two coats of enamel color in accordance with local fire department requirements.

2.3 Ductile Iron Pipe: per Section 33 11 16 – Water Utility Distribution Piping

2.4 PVC Pipe: per Section 33 11 16 – Water Utility Distribution Piping

2.5 ACCESSORIES

A. Aggregate for hydrant drainage: Type B or C as specified in Section 31 05 16 – Aggregates for Earthwork.

B. Tapping Sleeves (if necessary – see Drawings):

1. Furnish materials according to state and local standards.
2. Description: Ductile iron or cast iron, dual-compression type.
3. Outlet Flange Dimensions and Drilling: ASME B16.1, Class 125 and MSS SP-60.
4. For taps into existing Asbestos-Cement (AC) pipe, use one of the following:



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- a. Romac SST stainless steel tapping sleeve.
- b. Ford FAST stainless steel tapping sleeve.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Determine exact location and size of hydrants from Drawings; obtain clarification and directions from Engineer prior to execution of work.
- C. Verify invert elevations prior to excavation and installation of fire hydrants. This includes verification of the final grade of the ground surrounding the hydrant.

3.2 PREPARATION

- A. Identify required lines, levels, contours and datum locations.
- B. Locate, identify, and protect utilities to remain from damage.
- C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
- D. Perform trench excavation, backfilling and compaction in accordance with Section 31 23 17.

3.3 INSTALLATION

- A. Install Work in accordance with State and local standards.
- B. HOT TAPS: If installation requires tapping a live water main, the tap must be air pressure tested and the test witnessed by the Engineer or a representative of the Water Utility. Notify the Witness at least 24 hours in advance of the tap.

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 33 13 00.

3.5 FIELD QUALITY CONTROL

- A. Verify that the center of the lowest hydrant connection is at least 18" above the final grade.
- B. Perform pressure test on site water distribution system per Section 33 13 10 – Testing of Water Utility Distribution.

END OF SECTION



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SECTION 33 13 00 - DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes disinfection of potable water distribution system; testing the system and reporting results.

B. Related Sections:

1. Section 33 11 16 - Water Utility Distribution Piping.
2. Section 33 12 13 – Water Service Connections.
3. Section 33 12 19 – Fire Hydrants.
4. Section 33 13 10 – Testing of Water Distribution Piping.

1.2 REFERENCES

A. American Water Works Association:

1. AWWA C651 - Disinfecting Water Mains.

B. State of South Carolina Department of Health and Environmental Control (SC DHEC).

1. R.61-58.7E(15) – State Primary Drinking Water Regulation

1.3 CLOSEOUT REQUIREMENTS

A. Test Reports: Indicate results of bacteriological and residual chlorine laboratory test reports.

B. Bacteriological Report will contain:

1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.
5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certify water conforms, or fails to conform, to bacterial standards of SC DHEC.
8. Bacteriologist's signature and authority associated with testing.

C. Testing Firm: Company specializing in testing potable water systems, certified by the State of South Carolina.



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PART 2 PRODUCTS

2.1 CONTRACTOR RESPONSIBILITY

- A. The contractor shall furnish all necessary testing equipment including hose, temporary piping, force pump, pressure gauges, approved pipe plugs, tank trucks and flow measurement facilities.

2.2 DISINFECTION CHEMICALS

- A. Chemicals: Chlorine Forms in accordance with AWWA C651.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify piping system has been cleaned, inspected, and pressure tested.
- C. Coordinate scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 PREPARATION

- A. Provide and attach required equipment to perform the Work of this section. The contractor shall be responsible for furnishing all required equipment and chemicals.
- B. Protect aquatic life and vegetation from damage from disinfectant solution purged from tank.

3.3 DISINFECTING

- A. Disinfect pipeline installation in accordance with AWWA C651. Use of liquid chlorine is not permitted.
- B. Inject treatment disinfectant into the piping system. The sterilizing solution shall be introduced at one end of the main as water is being withdrawn from the other end, in such proportion as to give 50 ppm of free chlorine throughout the main.
- C. Maintain disinfectant in the system for 24 hours, at which time it shall have a residual chlorine concentration of at least 25 ppm, throughout the main, or the process shall be repeated.
- D. Flush, circulate, and clean with the municipal domestic water until the chlorine residual is equal to that of the existing water mains.
- E. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.



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- F. Replace permanent system devices removed for disinfection.

3.4 TESTING

- A. After final flushing and before pipeline is connected to existing system, or placed in service, a minimum of two (2) samples from each site shall be taken at least 24 hours apart and the chlorine residual recorded when the samples are taken. These samples shall be delivered to a state certified independent laboratory and tested for total coliform. Both samples shall show a negative bacteriological results with the process shall be repeated.
- B. If the membrane filter method of analysis is used for the coliform analysis, non-coliform growth must be reported. If the non-coliform growth is greater than eighty (80) colonies per one hundred (100) millimeters, the sample result is invalid and must be repeated.
- C. Furnish written reports of test results to engineer with both chlorine residual and bacteriological results.
- D. The number of sampling sites depends on the amount of new construction but must include all dead and lines and be representative of the water in the newly constructed mains. The engineer will determine number of sampling sites. Samples shall be taken at a minimum of every 1,200 linear feet of water main. All samples shall be analyzed by a state approved laboratory. The results will be submitted with the registered professional engineer's letter of certification.
- E. Water for testing and sterilizing will be furnished by the Owner at no cost to the contractor. The contractor shall furnish all necessary pipe or hose extensions or transportation to the point of use and shall exercise care in the use of water. The contractor shall bear all costs of bacteriological testing.

3.5 FIELD QUALITY CONTROL

- A. When water samples fail to meet State Health Standards for potable water perform the following corrective measures until water quality conforms to State Health Standards:
 - 1. Eliminate source of contamination, repeat disinfection, and retest water quality.

3.6 CLEANUP

- A. Final cleanup will meet the approval of the Engineer, the Owner, and the property owner where applicable, with all defects in ditch settlement, pavement patches or other deficiencies being promptly corrected.

END OF SECTION



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SECTION 33 13 10 – TESTING OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pressure Testing of Piping.
- B. Related Sections:
 - 1. Section 33 11 16 – Water Utility Distribution Piping.
 - 2. Section 33 12 13 – Water Service Connections.
 - 3. Section 33 12 19 – Fire Hydrants.
 - 4. Section 33 13 00 – Disinfecting of Water Utility Distribution.

1.2 REFERENCES

- A. American Water Works Association:
 - 1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
- B. National Sanitation Foundation:
 - 1. NSF 61 - Drinking Water System Components - Health Effects

1.3 CLOSEOUT REQUIREMENTS

- A. Test Reports: Furnish written reports of test results to Engineer.

PART 2 PRODUCTS

- 2.1 The contractor is responsible for furnishing all necessary testing equipment including hose, temporary piping, force pump, pressure gauges, approved pipe plugs, mandrels, lamps, tank trucks and flow measurement facilities.
 - A. Pressure gauge requirements: Provide a gauge calibrated to 0.1 psi with increments no greater than 0.5 psi.
 - B. Flow meter requirements: Provide a flow meter calibrated to 0.1 gpm with increments no greater than 0.5 gpm.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify all piping is ready for testing. Verify trenches are backfilled.



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3.2 PIPING PREPARATION

- A. The contractor shall furnish all necessary testing equipment and have it on site prior to the arrival of the witnesses to the test (Engineer and/or City representative).
- B. Notify the City 48 hours in advance of the testing to allow sufficient time for the Engineer to arrange to witness the tests.
- C. Flushing Lines:
 1. On completion of the pipe installation, the contractor shall flush all lines and remove any sediment. On large lines if flushing does not remove foreign material, the contractor shall use a vacuum truck or other acceptable means to clean the line to the satisfaction of the Owner and Engineer.
- D. Plug outlets, close valves to isolate system; brace plugs to resist test pressures.

3.3 TESTING

- A. The pressure lines shall be tested for their full length. The contractor will have the option of testing the full-length at one time or testing in separate length increments.
- B. Pressure Test:
 1. Pressure test system in accordance with AWWA C600 and the following:
 2. Test Pressure: 150 psig or one hundred fifty percent (150%) of the pipe's expected working pressure, whichever is greater.
 3. Test Duration: Two hours *after* the water pressure has been stable (ie, no pressure change) for a minimum of 30 minutes.
- C. Passing / Failing the Pressure Test:
 1. The test is considered FAILED if any of these apply:
 - a. The pressure *does not stabilize* after adding makeup water and allowing adequate time for air pockets and thermal adjustments, or
 - b. If the pressure *drops 2 psi or more* over the two-hour testing period, or
 - c. If makeup water is needed to return the pressure to 150 psig and it *exceeds the allowable make-up water (L)* from the AWWA formula (see below), or
 - d. If there are *visible leaks* observed in the system.
- D. Methodology:
 1. Slowly fill section to be tested with water, expelling air from piping via temporary corporation cocks at high points if necessary. Close air vents and corporation cocks after air is expelled. Raise pressure to specified test pressure.
 2. Hold pressure until the system has stabilized. Add make-up water as needed to keep the system at 150 psig.
 - a. "Stabilized" in this context means no discernable pressure change in the pipe over the course of 30 minutes.
 - b. During this interval, observe joints, fittings and valves for signs of leakage.
 3. When the system has stabilized, hold the pressure for two hours without adding make-up water.



City of Florence Technical Specifications

Florence, South Carolina

- a. At the end of the two hours, if make-up water as needed to bring the pressure back to 150 psig, it must be less than the following formula:

$L = (2 \text{ hours})(SD\sqrt{P})/C$
L = allowable make-up water, in gallons
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during hydrostatic test, in psig
C = 148,000
When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

4. Correct visible deficiencies. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage.
5. Correct visible leaks regardless of quantity of leakage.
6. Retest as necessary.

END OF SECTION