

SECTION 33 11 00  
WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Pipe and fittings for potable water line and fire water line.
  2. Valves and Valve Boxes
  3. Fire Hydrants.
  4. Tapping Sleeves and Valves.
  5. Air Release valves.
  6. Underground pipe markers.
  7. Thrust Blocking.
  8. Pressure Testing
  9. Polyethylene encasement.
- B. Related Sections:
1. Section 31 23 17 - Trenching: Excavation and backfill requirements.
  2. Section 33 05 14 - Utility Manholes and Structures: Valve vaults.
  3. Section 33 05 19 - Pressure Piping Tied Joint Restraint Systems.
  4. Section 33 05 23 - Trenchless Utility Installation: Waterline installation under roadways and other obstructions.
  5. Section 33 12 13 - Water Service Connections: Tapping and Backflow prevention at water main.
  6. Section 33 13 00 - Disinfecting of Water Utility Distribution: Disinfection of water piping.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
- B. American Water Works Association:
1. AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
  2. AWWA C105 - Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
  3. AWWA C110 - Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm), for Water.
  4. AWWA C111 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  5. AWWA C115 - Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
  6. AWWA C151 - Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
  7. AWWA C153 - Standard for Ductile-Iron Compact Fittings for Water Service.
  8. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
  9. AWWA C300 - Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
  10. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
  11. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
  12. AWWA C502 - Dry-Barrel Fire Hydrants.
  13. AWWA C504 - Rubber-Sealed Butterfly Valves.
  14. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
  15. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.

16. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
17. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings.
18. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution.
19. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in. for Water Service.
20. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 36 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution.

C. ASTM International:

1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
3. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
4. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
5. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
6. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
7. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

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 Sanitation Foundation:

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

F. National Fire Protection Association:

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

G. SCDOT Standard Specifications:

1. Standard Specifications for Highway Construction, 2007, published by the South Carolina Department of Transportation.

### 1.3 DEFINITIONS

- A. Utility Company: City of Lancaster

### 1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate piping layout, including piping specialties.
- C. Product Data: Submit data on pipe materials, pipe fittings, valves, hydrants, and accessories.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

- E. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
- F. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

#### 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with SCDOT Standard Specifications except as modified herein.
- B. Perform work in accordance with utility company standards.
- C. Maintain one copy of each document on site.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver and store valves in shipping containers with manufacturer's name and pressure rating labeling in place.
- C. Block individual and stockpiled pipe lengths to prevent moving.
- D. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
- E. Store polyethylene materials out of sunlight.

### PART 2 PRODUCTS

#### 2.1 WATER PIPING

- A. Ductile Iron Pipe (DIP): AWWA C151. Bituminous outside coating: AWWA C151. Cement Mortar Lining: AWWA C104.
  - 1. Pipe Thickness Class: 50.
  - 2. Pressure Rating: 350 psi. for 3" through 12".
  - 3. Fittings: Ductile iron, AWWA C110. Compact fittings, Ductile Iron, AWWA C153.
    - a. Pressure Rating: 200 psi minimum.
    - b. Coating: Bituminous Coating, AWWA C110.
    - c. Lining: Cement Mortar Lining, AWWA C104
  - 4. Joints:
    - a. Mechanical Joints: AWWA C111.
    - b. Push-On Joints: AWWA C111.
    - c. Flanged Joints: AWWA C115.
    - d. Boltless Restrained Joints: Boltless, push-on type, joint restraint independent of joint seal. Conform to pipe manufacturers specifications.
    - e. Tied Restrained Joints: Per Section 33 05 19.
- B. Polyvinyl Chloride (PVC): AWWA C900 and AWWA C905, marked with NSF 61 designation for potable water use.
  - 1. Pipe Class: DR 18, 150 psi. and DR 14, 200 psi.
  - 2. Fittings:

- a. PVC, AWWA C900 and AWWA C905.
  - b. Ductile Iron, Mechanical Joint, AWWA C110.
3. Joints:
- a. PVC, ASTM D3139 with ASTM F477 flexible elastomeric seals.
  - b. Ductile Iron, Mechanical Joint, AWWA C111.
  - c. Boltless Restrained Joints: Boltless, push-on type, joint restraint independent of joint seal. Conform to pipe manufacturers specifications.

## 2.2 TAPPING SLEEVES AND VALVES

- A. Manufacturers:
1. American Flow Control.
  2. Clow Valve Company.
  3. Mueller Company.
  4. Substitutions: Equal per Section 01 60 00 - Product Requirements.
- B. Tapping Sleeves:
1. Ductile iron or cast-iron dual compression type.
  2. Outlet Flange Dimensions and Drilling: MSS SP-60.
- C. Tapping Valves:
1. AWWA C500, double disc with non-rising stem. Inlet flanges shall conform to ANSI B16.1, Class 125 and MSS SP-60. Mechanical joint outlets shall conform to AWWA C111.

## 2.3 DOUBLE-DISC GATE VALVES

- A. Manufacturers:
1. Mueller Company.
  2. Substitutions: Equal per Section 01 60 00 - Product Requirements.
- B. Furnish materials in accordance with utility company or governing agency requirements.
- C. Double-Disc Gate Valves: AWWA C500, NSF 61; iron body, bronze trim.
1. Gate: Double disc parallel seat gate.
  2. Stem: Non-rising stem.
  3. Seals: O-ring stem seals.
  4. Operating Nut: 2" square; open counterclockwise unless otherwise indicated.
  5. Ends: Flanged, mechanical joint or bell end connections.
  6. Coating: AWWA C550; interior and exterior.
  7. Provide valves 16 inch diameter and larger with bypass valves and gear operators.
  8. Sizes 4-Inch Diameter and Larger: 175 psig working, 300 psig test.
  9. Valves 16-Inch Diameter and larger shall be installed with a bypass valve unless otherwise indicated. The bypass valve shall conform to the most recent AWWA C-500.
  10. Sizes 3-Inch Diameter and Smaller: AWWA approved, bronze and non-rising stem, square operating nut, O-ring seals, test pressure not less than 250 psig, Wolverine #467, Jenkins 4370 or approved equal.

## 2.4 RESILIENT WEDGE GATE VALVES

- A. Manufacturers:
1. Mueller Company.
  2. American Flow Control.
  3. Clow Valve Company.

- 4. Substitutions: Equal per Section 01 60 00 - Product Requirements.
- B. Furnish materials in accordance with utility company or governing agency requirements.
- C. Resilient Wedge Gate Valves: AWWA C509; iron body, bronze or ductile iron.
  - 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.

## 2.5 BUTTERFLY VALVES

- A. Manufacturers:
  - 1. Mueller Company.
  - 2. American Flow Control.
  - 3. Clow Valve Company.
  - 4. Substitutions: Equal per Section 01 60 00 - Product Requirements.
- B. Size 12 Inch to 24 Inch: AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, ten infinite position lever handle.
- C. Furnish materials in accordance with utility company or governing agency requirements.

## 2.6 VALVE BOXES

- A. Vales 12-Inch Diameter and Smaller: Cast iron, two-piece, Mueller #H-10364 or approved equal.
- B. Valves Larger Than 12-Inch Diameter: Cast iron, three-piece, screw type; round base.
- C. Cast iron lid marked "WATER".

## 2.7 FIRE HYDRANTS

- A. Manufacturers:
  - 1. Mueller.
  - 2. Waterous.
  - 3. Trend.
  - 4. Pacer.
  - 5. Substitutions: Equal per Section 01 60 00 - Product Requirements.
- B. Furnish materials in accordance with utility company or governing agency requirements.
- C. 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 inch diameter.
  - 4. Ends: Mechanical Joint or Bell End.
  - 5. Bolts and Nuts: Corrosion resistant.
  - 6. Coating: AWWA C550; interior.
  - 7. Direction of Opening: Counterclockwise unless otherwise indicated.
- D. One pumper, two hose nozzles.

1. Obtain thread type and size from local fire department.
  2. Attach nozzle caps by separate chains.
- E. Finish: Primer and two coats of enamel, color in accordance with utility company, fire department, or NFPA 281 requirements.

## 2.8 AIR RELEASE VALVES

- A. Manufacturers:
1. Apco Valve and Primer Co.
  2. Crispin Valve Co.
  3. Valmatic Valve and Manufacturing Corp.
  4. Substitutions: Equal per Section 01 60 00 - Product Requirements.
- B. Furnish materials in accordance with utility company or governing agency requirements.

## 2.9 UNDERGROUND PIPE MARKERS

- A. Plastic Ribbon and Trace Wire Tape: Brightly colored blue continuously printed with "WATER SERVICE" in large letters, minimum 6 inch wide by 4 mils thick, with magnetic detectable conductor manufactured for direct burial service.

## 2.10 PRECAST CONCRETE VALVE VAULTS AND METER BOXES

- A. Conform to Section 33 05 14 – Utility Manholes and Structures.
- B. Provide size and type as indicated on Drawings.

## 2.11 CONCRETE FOR THRUST RESTRAINT, ENCASEMENT AND CRADLES

- A. Concrete: Class A Concrete conforming to Division 500 of the SCDOT Standard Specifications.
1. Compressive strength of 3,000 psi at 28 days.
  2. Air entrained.
  3. Water cement ratio of 0.488 with rounded aggregate and 0.532 with angular aggregate.
  4. Maximum slump of 3.5 inch for vibrated concrete and 4 inch for non-vibrated concrete.
  5. Minimum cement content of 564 pounds per cubic yard for vibrated concrete and 602 pounds per cubic yard for non-vibrated concrete.

## 2.12 BEDDING AND COVER MATERIALS

- A. Bedding for Rigid Pipe (DIP, PVC C900, PVC C905, and PCCP): Clean sand, slightly silty sand, or slightly clayey sand having a Unified Soil Classification of SP, SP-SM or SP-SC.
- B. Backfill Around Pipe and Above Pipe: As specified in Section 31 23 17 -Trenching.

## 2.13 ACCESSORIES

- A. Polyethylene Jackets: AWWA C105 polyethylene jacket. Single layer, lapped over pipe joint, and secured with 10 mil polyethylene tape.
- B. Steel rods, bolt, lugs and brackets: ASTM A36 or ASTM A307 carbon steel.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify existing utility water main size, location, and inverts are as indicated on Drawings.

### 3.2 EXCAVATION

- A. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.
- B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
- C. Provide sheeting and shoring as required.
- D. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches in compacted depth; compact to 95 percent.

### 3.3 INSTALLATION – PIPE

- A. Install ductile iron pipe and fittings in accordance with AWWA C600 and manufactures' instructions.
- B. Install PVC pipe in accordance with AWWA C605 and manufactures' instructions.
- C. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated on Drawings.
- D. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.
- E. Maintain minimum 10-foot horizontal separation and 18-inch vertical separation of water main from sewer piping or as required by local code.
- F. Install pipe to indicated elevation to within tolerance of 1/2 inch.
- G. 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 will not be permitted. Grind edges smooth with beveled end for push-on connections.
- H. Remove scale and dirt on inside and outside before assembly.
- I. Flanged Joints: Not to be used in underground installations except within structures.
- J. Route pipe in straight line. Relay pipe that is out of alignment or grade.
- K. Install pipe with no high points. If unforeseen field conditions arise which necessitate high points, install air release valves as directed by Architect/Engineer.
- L. 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.

- M. Prevent foreign material from entering pipe during placement.
- N. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- O. Close pipe openings with watertight plugs during work stoppages.
- P. Install access fittings to permit disinfection of water system performed under Section 33 13 00.
- Q. Install underground marking tape continuously 12 inches above pipe line.
- R. Establish elevations of buried piping with not less than 3 feet of cover. Measure depth of cover from final surface grade to top of pipe barrel.

### 3.4 INSTALLATION – FIRE HYDRANTS

- A. Install fire hydrants; provide support blocking and drainage gravel; do not block drain hole.
- B. Set hydrants plumb with pumper nozzle facing roadway; set hydrants with centerline of pumper nozzle 18 inches above finished grade and safety flange not more than 6 inches or less than 2 inches above grade.
- C. Paint hydrants in accordance with local color scheme.
- D. After hydrostatic testing, flush hydrants and check for proper drainage.

### 3.5 INSTALLATION - VALVES

- A. Install valves in conjunction with pipe installation; set valves plumb.
- B. Provide buried valves with valve boxes installed flush with finished grade.

### 3.6 INSTALLATION - TAPPING SLEEVES AND VALVES

- A. Install tapping sleeves and valves in accordance with utility company requirements, as indicated on Drawings, and in accordance with manufacturer's instructions.
- B. Have Engineer witness tap.

### 3.7 POLYETHYLENE ENCASEMENT

- A. Encase Ductile Iron piping in polyethylene where indicated on Drawings to prevent contact with surrounding backfill material.
- B. Install in accordance with AWWA C105.
- C. Terminate encasement 3 to 6 inches above ground where pipe is exposed.

### 3.8 CONCRETE THRUST RESTRAINT

- A. Provide valves, tees, bends, caps, plugs, and dead ends with concrete thrust blocks as indicated on Drawings.



- B. Pour concrete thrust blocks against undisturbed earth. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and so pipe and fitting joints will be accessible for repair.
- C. Do not encase fitting joints and flanges.

3.9 TIED JOINT RESTRAINT

- A. Install tied joint restraint systems in accordance with Section 33 05 19.

3.10 SERVICE CONNECTIONS

- A. Install service connections in accordance with Section 33 12 13.

3.11 BACKFILLING

- A. Backfill and compact around sides and to top of pipe in accordance with Section 31 23 17.
- B. Maintain optimum moisture content of material to attain required compaction density.

3.12 DISINFECTION OF POTABLE WATER PIPING SYSTEM

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

3.13 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Compaction Testing: Perform soil compaction tests in accordance with Section 31 23 17.
- C. Pressure Tests: Perform pressure test on potable water distribution system in accordance with AWWA C600.
- D. Notification: Notify Engineer and Owner 72 hours in advance of test and have witness test.
- E. Test Pressure: Not less than 200 psi or 50 psi in excess of maximum static pressure, whichever is greater.
- F. Pressure Test Procedure:
  - 1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct concurrent pressure and leakage tests.
  - 2. Provide equipment required to perform leakage and pressure tests.
  - 3. Conduct tests for at least two-hour duration.
  - 4. No pipeline installation will be approved when pressure varies by more than 5 psi at completion of hydrostatic pressure test.
  - 5. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, close corporation cocks and apply test pressure. At conclusion of tests, remove corporation cocks removed and plug resulting piping openings.
  - 6. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.

7. Examine exposed piping, fittings, valves, hydrants, and joints carefully during pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.
8. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

$L = (SD\sqrt{P})/133,200$
L = allowable, in gallons per hour
S = length of pipe tested, in inches
D = nominal diameter of pipe, in inches
P = average test pressure during leakage test, in pounds per square inch (gauge)

9. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.

END OF SECTION