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## **WATER DISTRIBUTION SYSTEMS (OAKDALE 2611)**

### **PART 1 GENERAL**

#### **1.01 SUMMARY**

- A. Section Includes:
  - 1. Water Main Pipe and Fittings
  - 2. Valves and Boxes
  - 3. Hydrants
  - 4. Services
  - 5. Insulation
- B. Related Sections;
  - 1. Section 2451 – Trench Excavation and Backfill
- C. Method of Measurement:
  - 1. Valves and Boxes: Measure valve and box of each size and type as a unit.
  - 2. Corporation Stops: Measure corporation stops of each size and type as a unit.
  - 3. Curb Stops and Boxes: Measure curb stops of each size and type as a unit.
  - 4. Water Main Pipe:
    - a. Measure by distance in linear feet.
    - b. Measure each size separately.
  - 5. Service Pipe:
    - a. Measure by distance in linear feet.
    - b. Measure each size separately.
    - c. Measure from center of water main to center of curb stop plus 1-foot for slack.
  - 6. Insulation: Measure by area in square yards.
  - 7. Connect to Existing Water Main and Services:
    - a. Measure as a unit.
    - b. Includes all labor, equipment and materials. Valves will be measured and pair for separately.
  - 8. Repair Gate Valve Box:
    - a. Measure by length in feet of valve box acceptably repaired.
    - b. Includes all labor, equipment and materials to repair or replace existing damaged valve boxes.
  - 9. Repair or Adjust Curb Stop Box:
    - a. Measure actual laborer and backhoe time in hours.
    - b. Measurement will only be for 1 laborer and 1 3 CY backhoe regardless of actual number of laborers or size of backhoe.
  - 10. Adjust Gate Valve Box:
    - a. Measure by the unit for existing valve boxes adjusted to new grade.
    - b. Do not measure new boxes as an adjustment.
  - 11. Cut In or Salvage and Replace Gate Valve and Box:

- a. Measure as a unit.
- b. Includes isolating and cutting existing water main, salvaging valve and box, furnishing and installing new gate valve, box and fittings, connecting to existing main, and delivering existing valve and box to Oakdale Public Works.

12. Remove and Replace Hydrant and Gate Valve Assembly:

- a. Measure as a unit.
- b. Includes isolating existing water main, salvaged existing hydrant and valve assembly to tee, furnishing and installing new hydrant and valve assembly and delivering existing hydrant and valve assembly to Oakdale Public Works.

13. Salvage Hydrant, Furnish and Install Hydrant, Gate Valve and Box:

- a. Measure by the unit for each location.
- b. Includes salvaging existing hydrant, furnishing and installing new hydrant, gate valve, box and hydrant lead and sheeting or trench box, and all labor, equipment and materials.

14. Replace Gate Valve Bolts:

- a. Measure as a unit for replacing all existing bolts and nuts with stainless steel, on a gate valve. Measurement is per valve not per bolt.

15. Remove and Replace PRV Manhole, Pipe and Valve Assembly:

- a. Measure as a lump sum for entire removal and replacement.
- b. Includes removing existing pressure reducing valve, manhole and gate valve, furnishing and installing new manhole, water main, sleeves, gate valves and boxes, and installing new City furnished PRV.

16. Exploratory Excavation:

- a. Measure by the unit.
- b. Includes exposing existing and examining water main, obtaining soil samples, and backfilling disturbed area.
- c. Measurement will be made only when no other work is being performed on the water main.

17. Drinking Fountain:

- a. Measure by the unit.
- b. Includes furnishing and installing unit with specified accessories, connecting to new water service, and all other labor, equipment and materials.

D. Basis of Payment:

1. Payment for acceptable quantities of water main and appurtenances shall be at the Contract Unit Price as listed on the Bid Form. All associated Work items shall be considered incidental.

## 1.02 REFERENCES

- A. ANSI/AWWA C150/A21.50: American National Standard for the Thickness Design of Ductile Iron Pipe and for Polyethylene Encasement.
- B. ANSI/AWWA C151/A21.51: American National Standard for Ductile – Iron Pipe, Centrifugally Cast for Water and other Liquids.
- C. ANSI/AWWA C153/A21.53: American National Standard for Ductile – Iron Compact Fittings, 3-inch through 64-inch, for Water Service.
- D. ANSI/AWWA C502: AWWA Standard for Dry-Barrel Fire Hydrants

- E. ANSI/AWWA C509: AWWA Standard for Resilient – Seated Gate Valves, for Water and Sewerage Systems.
- F. ANSI/AWWA C600: AWWA Standard for Installation of Ductile Iron Water Mains and their Appurtenances.

### **1.03 SUBMITTALS**

- A. Submit Certificate of Compliance for products listed under Article 1.04.
- B. Submit proposed method of joint conductivity.

### **1.04 QUALITY ASSURANCE**

- A. Provide Certificates of Compliance from the manufacturer certifying that the following products meet the respective requirements listed in Article 1.02:
  1. Pipe
  2. Hydrants
  3. Valves

### **1.05 DELIVERY, STORAGE & HANDLING**

- A. Inspection:
  1. Inspect all pipe and products during the unloading process.
  2. Notify Engineer of any cracked, flawed or otherwise defective products.
  3. Remove all products found to be defective by the Engineer from the Site.
- B. Handling and Storage:
  1. Handling and storage of products shall be in accordance with Section 2.2 of ANSI/AWWA C600.

## **PART 2 PRODUCTS**

### **2.01 WATER MAIN PIPE**

- A. Ductile Iron: ANSI/AWWA C151/A21.51.
- B. Cement-Mortar Lining: ANSI/AWWA C104/A21.4.
- C. Thickness Class: 52.
- D. Joints: Push-On.
- E. Joint Conductivity:
  1. Conductive gaskets as manufactured by American Ductile Iron Pipe Co.
  2. Field Application Methods:
    - a. Burndy – Thermoweld by Burndy Corp., Norwalk, Connecticut.
    - b. Cadweld by Erico Products Co., Cleveland, Ohio.
  3. Copper Jumpers:
    - a. Minimum 1/16-inch by 1/2-inch wide flat copper strip.
    - b. Annealed round copper wire conforming to ASTM B152, Type DHP.

4. Nuts and Bolts: Silicon Bronze.

## 2.02 FITTINGS

- A. Ductile Iron (3-inch through 16-inch): ANSI/AWWA C153/A21.53.
- B. Ductile Iron (18-inch through 48-inch): ANSI/AWWA C110/A21.10.
- C. Cement-Mortar Lining: ANSI/AWWA C104/A21.4.
- D. Joints: Mechanical. Stainless steel bolts.

## 2.03 VALVES AND BOXES

- A. Gate Valves (6"-12")
  - 1. Resilient Seated: AWWA C509.
  - 2. Working Pressure: 200 psi.
  - 3. Ends: Mechanical Joint with stainless steel bolts.
  - 4. Operating Stem: Non-Rising with O-ring Seals.
  - 5. Operating Nut: 2-inch Square, Open Left.
  - 6. Markings to be cast on the bonnet or body:
    - a. Open indicating arrow.
    - b. Manufacturer's name.
    - c. Pressure rating.
    - d. Year manufactured.
    - e. Size.
  - 7. Stainless steel bolts.
- B. Butterfly Valves (>12"):
  - 1. Rubber Seated: ANSI/AWWA C504.
  - 2. Class: 150B.
  - 3. Body Type: Mechanical – Joint-End with stainless steel bolts.
  - 4. Disc:
    - a. 316 stainless steel edge
    - b. 3-inch thru 24-inch: ASTM A126 Class B Cast Iron
    - c. 30-inch and larger: ASTM A536 Ductile Iron
  - 5. Seat:
    - a. 3-inch through 20-inch: Bond to body per ASTM D429, Method B.
    - b. 24-inch and larger: Retain in body without use of metal retainers.
  - 6. Operator:
    - a. Traveling nut actuator.
    - b. Open left.
  - 7. Markings to be cast on the body:
    - a. Open indicating arrow.
    - b. Manufacturer's name.
    - c. Class.
    - d. Year of manufacture.
    - e. Size.
  - 8. Stainless steel bolts.
- C. Boxes:
  - 1. Cast Iron, 5-1/4-inch shaft.

2. Vertical, 3 piece, Buffalo type.
3. Box length to provide for 7.5 feet of pipe cover.
4. Adjustable to 6 inches up or down from standard box length.
5. Furnish and install Gate Valve Adapter or Butterfly Valve Adapter as manufactured by Adapter, Inc. (414.764.6733).

## 2.04 HYDRANTS

- A. Dry Barrel: ANSI/AWWA C502.
- B. Waterous Pacer WB67-250 with high pressure conversion, epoxy coated, valve washers, bronze cross arm, and Cor-Blue steel bolts, or equal.
- C. Hose Connections: 2 each at 2-1/2-inch diameter.
- D. Steamer Connection: 1 each at 4-inch diameter.
- E. Pumper Nozzle:
  1. The hydrant pumper nozzle shall be of 1-piece design, compatible with 4-inch Storz hose coupling. The nozzle shall be an integral part of the fire hydrant and must be furnished by the manufacturer or authorized distributor designated by the manufacturer. Storz adapters will not be accepted.
- F. Threads: National Standard.
- G. Operating Stem: Open Left with O-ring Seals.
- H. Traffic flange.
- I. Hub; 6-inch Mechanical Joint.
- J. Main Valve Opening: 5-inch diameter.
- K. Barrel Diameter: 5-inch.
- L. Drain to operate only when hydrant is closed.
- M. Bury Depth: 8 feet (ground to bottom of hub).
- N. Minimum Nozzle Height (from top nut to flange): 28 inches.
- O. Cap Nuts: Pentagon.
- P. Color: Red.
- Q. Provide permanent markings which indicate:
  1. Manufacturer's name.
  2. Year of manufacture.
  3. Bury depth.
- R. Accessories:
  1. Nut caps with cadmium plated steel chain.

2. Two 3-inch red flex-stakes per hydrant.

S. Stainless steel bolts.

## **2.05 SERVICE PIPE**

A. Copper: ASTM B88.

B. Type: K, Soft.

## **2.06 CORPORATION STOPS**

A. Type: Mueller H-25000, Ford FB600, or McDonald 4701B.

B. Inlet: AWWA CC Thread.

C. Outlet: Copper Service Thread.

## **2.07 CURB STOPS AND BOXES**

A. Valve:

1. Type: Mueller B-25-154, Ford B-22-444M or McDonald 6104.

2. Inlet: Copper Service Thread.

3. Outlet: Copper Service Thread.

B. Box:

1. Type: Mueller H10300, Ford EM2-75-56 or McDonald 5614.

2. Length: 7.5 feet.

3. Adjustable to 6 inches up or down from specified length.

4. Cap Type: Mueller 89375, Ford PL or McDonald 5614-L with 1-1/4 inch diameter brass concentric plug.

5. 1-1/4 inch diameter upper section.

6. 1-1/2 inch diameter tapped base.

7. Adjustable to 6 inches up or down from specified length.

## **2.08 INSULATION**

A. Rigid, extruded polystyrene board insulation.

B. Thermal Resistance (R): 5.0.

C. Thickness: 2-inch.

D. Board Size: 48-inch by 96-inch.

E. Compressive Strength: Minimum 25 psi.

F. Water Absorption in accordance with ANSI/ASTM D2842: 0.1 percent by volume, maximum.

G. Edges: Square.

## 2.09 ENCASEMENT

- A. Polyethylene Sheet
  - 1. Three layers co-extruded linear low density polyethylene (LLDPE)
  - 2. Infused with a blend of anti-microbial biocide and volatile corrosion inhibitor.
- B. Thickness: 8 mil minimum.

## 2.10 MAGNESIUM ANODE

- A. Magnesium Anodes: Shall be furnished by Coropro Companies, Inc. 1055 West Smith Rd., Medina, OH 44256 tel: 330-723-5082 fax: 330-722-7606 or approved equal.
- B. High Potential Magnesium: Chemical Composition as follows:

Aluminum	0.01% maximum
Manganese	0.5 – 1.3%
Zinc	0.00%
Silicon	0.00%
Copper	0.02% maximum
Nickel	0.001% maximum
Iron	0.03% maximum
Magnesium	Remainder

- C. Lead Wires: Type TW insulated copper conductors, No. 12 solid AWG.
- D. Lead Wire Connection: Cast electrodes with a galvanized steel core rod. Recess one end of the anode to provide access to the rod for connection of the lead wire. Silver braze the lead wire to the rod, make the connection mechanically secure before brazing. Insulate the connection to a 600 volt rating by filling the recess with epoxy. Extend the insulating material over the lead wire insulation by not less than one-half inch. Repair all damaged lead wire insulation.
- E. Anode Backfill: Chemical Composition as follows:

Hydrated gypsum – 75%  
Bentonite clay – 20%  
Sodium sulfate – 5%

- 1. Backfill shall be granular with 100 percent passing through a 100 mesh screen. Pack electrode and backfill in a cloth bag. Center the electrode in the bag and firmly pack the backfill around the electrode by use of mechanical vibration. The total package weight of a 48 pound electrode shall be 96 pounds nominal weight. All electrodes shall be tested and for electrode oxidation potential and ampere hours for quality assurance per ASTM G97-89.

### F. PIPELINE CABLE CONNECTION:

- 1. Exothermic weld type suitable for attaching copper wire to pipe.
  - a. EXOTHERMIC WELD COATING:
    - 1) Non-metallic, elastomer filled shield

**G. Drinking Fountain:**

1. Pedestal surface mounted fountain, model 440 SM with stainless steel surface carrier, internal surface mount, top bowl, ADA arm bowl, pet fountain and jug filler attachments as manufactured by Most Dependable Fountains (MDF), Inc.

## **PART 3 EXECUTION**

### **3.01 CONSTRUCTION REQUIREMENTS**

**A. Connect to Existing Water Main:**

1. Notify all affected customers prior to water main service disruption.
2. Isolate existing water main section.
3. Connect to existing water main with approved adapters.
4. Restrain all joints with megalugs or approved equal.
5. Pressure Tap:
  - a. Install tap in location shown on the Drawings.
  - b. Use approved tapping machine designed specifically for tapping under pressure.
  - c. Install tapping sleeve and gate valve as part of assembly.
  - d. Install blocking as required.
6. Cut-In Connection:
  - a. Isolate segment of pipe to be cut and drain water from the line.
  - b. Connect tee and sleeve assembly to pipe ends.
  - c. Install blocking as required.
7. Connect to Inplace Fitting:
  - a. Isolate segment of inplace pipe and remove blocking as required.
  - b. Remove plug and drain water from the line.
  - c. Install blocking as required.

**B. Pipe Installation:**

1. Install pipe at the alignment and grade shown on the Drawings.
2. Provide a minimum of 7.5 feet of cover over the pipe.
3. Install appurtenances in the locations shown on the Drawings.
4. Remove all dirt and foreign material from the pipe interior prior to installation.
5. See Section 2451 for pipe foundation and backfill procedures.
6. See Section 2451 in case of conflicts with existing pipes.
7. Cut and cap existing water main as directed by the Engineer.

**C. Valve and Box Installation:**

1. Verify that subgrade material is adequate to support valve assembly.
2. Install valves with stems vertical and plumb.
3. Install boxes plumb and centered over the valve nut.
4. Verify that box remains plumb and centered during backfill.
5. Adjust box cover to required grade.

**D. Hydrant Installation:**

1. Verify that subgrade material is adequate to support hydrant.
2. Place thrust block, crushed rock and tar paper in accordance with Drawing Details.
3. Install and maintain hydrant in a plumb position.
4. Where groundwater is present, plug drain hole and affix "Pump After Use" tag to the hydrant.

**E. Joint Conductivity:**

1. Provide electrical bond across all joints between pipes and appurtenances.
2. Install copper jumpers by either shop or field applications.
3. Fasten multiple jumper strips with silicon bronze bolts and nuts.
4. Welding:
  - a. Grind surfaces to be welded to remove coating and oxide and to provide clean metal surface.
  - b. Use metallic-arc process for stop applications.
  - c. Use exothermic process for field applications.
  - d. Refinish welded area with protective coating after connection is made.

**F. Thrust Restraint:**

1. Install thrust restraints at all bends, tees and plugs.
2. Concrete Blocking:
  - a. Place between the fitting and undisturbed trench wall.
  - b. Minimum thickness: 12 inches.
  - c. Minimum area in square feet shall be in accordance with the following:

PIPE	TEE OR PLUG	1/4 BEND	1/32 & 1/8 BEND	1/16 BEND
6-inch	2.9	3.1	1.6	0.8
8-inch	3.7	5.3	2.9	1.4
10-inch	5.7	8.1	4.4	2.2
12-inch	8.1	13.4	6.6	3.2

- d. Size blocking based on the larger main.
- e. Verify that bolts are accessible after concrete is poured.
3. Timber Blocking:
  - a. Use for temporary blocking only for maximum 8-inch mains.
  - b. Minimum timber size: 4-inch by 4-inch.
4. Restrained Joints:
  - a. Submit method and type to Engineer for approval.
  - b. Install in accordance with "Thrust Restraint Design for Ductile Iron Pipe".

**G. Service Installation:**

1. Corporation Stops:
  - a. Provide watertight connection with approved taping machine.
  - b. Install under main pressure.
  - c. Place a double wrap of Teflon tape around the threads prior to installation.
2. Copper Service Pipe:
  - a. Install pipe between corporation stop and curb stop with not joints or unions.
  - b. Bury Depth: 7.5 feet.
  - c. Provide minimum 1-foot of slack in the pipe to allow for settlement and movement.
3. Curb Stop and Box:
  - a. Install at the locations shown on the Drawings.
  - b. Verify that subgrade material is adequate to support the curb box assembly.
  - c. Install boxes plumb and centered over the tee head.
  - d. Verify that box remains plumb and properly aligned during backfill.
  - e. Adjust box cover to required grade.
  - f. Key all curb stops after backfill to ensure proper operation.

**H. Repair Valve Box:**

1. Remove and replace existing damaged valve box sections as directed by Engineer.

- I. Connect to Existing Services:
  - 1. Locate and connect all existing services to new curb stops with a flared copper connection.
  - 2. If adapters or fittings are necessary, they must be pre-approved by Engineer.
- J. Polyethylene Encasement:
  - 1. Install on new water main in accordance with manufacturers recommendations.
- K. Anode:
  - 1. Install in areas as directed by the Engineer and in conformance with manufacturer's recommendations.

## 3.02 FIELD QUALITY CONTROL

- A. Perform the following tests upon completion of the system and prior to being placed into service:
  - 1. Pressure and Leakage Test:
    - a. Perform pressure and leakage test in accordance with ANSI/AWWA C600.
    - b. Test Pressure: 150 psi.
    - c. Test Duration: 2 hours.
    - d. Do not allow pressure to vary more than 5 psi during the test.
    - e. Do not allow pressure to vary more than 2 psi during the last hour of the test.
    - f. Allowable Leakage: One-half of the volume allowed by ANSI/AWWA C600 in accordance with the following:  

$$L = \frac{SD\sqrt{P}}{266,400}$$
  - L = Allowable Leakage in Gallons per Hour  
 S = Length of Pipe Tested in Feet  
 D = Nominal Diameter of Pipe in Inches  
 P = Average Test Pressure during Test in Pounds/ Square Inch (Gage)
- 2. Testing Services:
  - a. Perform separate pressure and leakage test on the services with the corporation stops open.
  - b. Test Pressure: 100 psi.
  - c. Allowable Leakage: None.
  - d. At Contractor's option, service testing may be done concurrent with main testing.
- 3. Electrical Conductivity Test:
  - a. Perform electrical conductivity test to verify that electrical thawing of the system may be accomplished by Owner.
  - b. Test Parameters:
    - 1) Perform test within 1 week after pressure testing.
    - 2) Perform test after back-filling is completed and while line is at normal operating pressure.
    - 3) Test Current: 350 amperes DC plus or minus 10 percent.
    - 4) Test Duration: 5 minutes.
    - 5) Test between hydrants in segments of convenient length.
  - c. Procedures:
    - 1) Furnish DC current source, cable and all required equipment of adequate capacity to accomplish the test.
    - 2) Clamp cables to hydrant flange bolts.
    - 3) Conduct test with hydrant in the open position and caps on.

- 4) Measure current continuously throughout the test with a DC ammeter hooked on a cable lead.
- 5) Start test at minimum current level and increase to test level.
- 6) Drain hydrant and tighten caps after test.

d. Failure and Correction:

- 1) Failure of a segment shall be determined by current measurements that are insufficient, intermittent or unsteady.
- 2) Isolate and correct defective contact points as indicated by failed tests.
- 3) Retest failed segments after correction.

### **3.03 DISINFECTION**

- A. Disinfect all newly installed water mains, appurtenances and services in accordance with ANSI/AWWA C651.
- B. Flush system within 24 hours after disinfection is completed.
- C. Sampling and Testing:
  1. After final flushing, obtain 2 sets of samples taken a minimum of 24 hours apart.
  2. Each sample set shall include:
    - a. One sample for every 1,200 feet of main.
    - b. One sample at each dead end.
    - c. Ensure that 1 sample is obtained from each branch of main.
    - d. Minimum sample required: 2
  3. Perform coliform tests on each sample.
  4. Rechlorinate if any sample tests positive for coliform.

### **3.04 MAGNESIUM ANODE**

- A. Set the anode a minimum of 3 feet offset from the pipe at pipe depth or below at the locations designated by the engineer.
- B. Do not lift or support anode by the lead wire. Exercise care to preclude damaging the anode and the lead wire insulation.
- C. Backfill the anode with stone-free native soil.
- D. Make the test lead wire attachment to the pipe using an exothermic weld connection.
- E. Connect the anode wires to the test station terminals leaving a minimum of 18-inches of slack coiled in the test station shaft so the terminal board can be lifted out of the test station.

### **3.05 DRINKING FOUNTAIN**

- A. Connect fountain to new water service provided installed with this contract.
- B. Surface mount on concrete pad installed with this contract.
- C. Provide an approximate 3 cubic yard gravel sump wrapped in geotextile fabric around subsurface drainpipe.
- D. Install according to manufacturer's recommendations.

**END OF SECTION**