SECTION 402040 DUCTILE-IRON PIPE

PART 1 - GENERAL

A. Description

This section describes materials, testing, and installation of ductile-iron pipe and fittings for potable water transmission.

B. Related Work Specified Elsewhere

1. Cold-Applied Wax Tape Coating: 099752.

2. Polyethylene Sheet Encasement: 099754.

3. Fusion-Bonded Epoxy Linings and Coatings: 099761.

4. Trenching, Backfilling, and Compacting: 312316.

5. General Pressurized Piping Requirements: 400500.

6. Pressure Testing of Piping: 400515.

7. Flexible Couplings: 400722.

C. Submittals

1. Submit shop drawings in accordance with the General Conditions and Section 013300.

2. Provide an affidavit of compliance with standards referenced in this specification, e.g., AWWA C151. Submit copy of report of pressure tests for qualifying the designs of all sizes and types of AWWA C153 fittings that are being used in the project. The pressure test shall demonstrate that the minimum safety factor described in AWWA C153, Section 5.5 is met.

3. Provide the following information:

   a. Mortar lining thickness.

   b. Wall thickness.

   c. Material test data for this project.

   d. Show deflections at push-on and mechanical joints.

   e. Submit joint and fitting details and manufacturer's data sheets.

4. Submit calculations and test data proving that the proposed restrained joint arrangement can transmit the required forces with a minimum safety factor of 1.5.

5. Submit certificate that cement for mortar lining complies with ASTM C 150, designating type.

6. Submit test report on physical properties of rubber compound used in the gaskets.

7. Submit copies of delivery slips for all materials specified in this section.

## PART 2 - MATERIALS

### A. Pipe

Pipe shall be cast ductile (nodular) iron, conforming to AWWA C151. Provide pipe in nominal 18- or 20-foot laying lengths.

### B. Wall Thickness/Pressure Class

1. Minimum wall thickness for pipe having push-on joints, mechanical joints, restrained joints, or plain ends shall be Pressure Class 250.

2. Push-on, mechanical joint, restrained joint, and flanged fittings 24 inches and smaller shall conform to AWWA C110 with a minimum pressure rating of 250 psi.

3. Minimum pipe wall thickness required for tapped outlets shall be in accordance with Table A.1 of AWWA C151 for four full threads. Reducing tee fittings are required for outlets larger than 2 inches nominal.

### C. Pipe Marking

Plainly mark each length of straight pipe and each fitting at the bell end to identify the design pressure class, the ductile-iron wall thickness, and the date of manufacture. Mark the spigot end of restrained joint pipe to show clearly the required depth of insertion into the bell.

### D. Design Criteria

1. Obtain the following information from the drawings:

   a. Elevation of the pipe centerline and of the completed ground.

   b. Alignment of the pipeline.

   c. Nominal pipe size.

d. Design internal pressure class.

e. Joint types(s).

E. Fittings

1. Push-on, mechanical joint, restrained joint, and flanged fittings 24 inches and smaller shall conform to AWWA C110 with a minimum pressure rating of 250 psi. Material shall be ductile iron.

F. Flanges

1. Flanges shall be solid back, Class 125 per AWWA C115 with a pressure rating of 250 psi. Material shall be ductile iron.

2. Flanges shall be flat faced.

G. Pipe Lining--Cement Mortar

1. Line pipe interior and fittings with cement-mortar per AWWA C104. Lining thickness shall be the double thickness listed in AWWA C104, Section 4.7. Cement for lining material shall conform to ASTM C 150, Type II, for water service.

2. Maintain a moist environment inside the lined pipe and fittings by sealing the ends with polyethylene sheet.

3. Loose areas of cement-mortar lining are not acceptable. Remove and reconstruct lining in areas where quality is defective, such as sand pockets, voids over sanded areas, blisters, drummy areas, cracked areas, and thin spots. Longitudinal cracks in excess of 1/32 inch in width or where crack extends to metal shall be repaired with epoxy. Repair all cracks larger than 1/16 inch with epoxy.

H. Gaskets for Mechanical, Push-On, and Restrained Joints

Synthetic or natural rubber in accordance with AWWA C111.

I. Gaskets for Flanges

See Section 400500.

J. Joints

1. Joints in aboveground or submerged piping or piping located in vaults and structures shall be flanged.

2. Joints in buried piping shall be of the push-on or mechanical-joint type per AWWA C111 except where flanged joints are required to connect to valves

or other equipment. Provide restrained joints to the limits shown in the drawings. Provide unrestrained buried joints except where restrained joints are specifically shown in the drawings.

3. Joints for piping shall be rated at 350 psi working pressure.

4. Restrained joints for piping shall be American Cast Iron Pipe "Lok-Ring" or "Flex-Ring," U.S. Pipe "TR-Flex," or equal. All weldments for restrained joints shall be tested by the liquid penetrant method per ASTM E 165. Restrained joints for field closures shall be “mega-lug” by EBAA Iron (See Paragraph K below)

5. Where thrust restraint is called for in the drawings, provide pipe with restrained joints capable of transmitting 1.5 times the thrust, as calculated by the following equation:

$$T = 1.5 * (0.785 * P * D^2)$$

where:

P = Pressure class of pipe in psi.
D = Outside diameter of pipe in inches.
T = Thrust in pounds.

K. Mechanical Joint Restraint System Using Follower Ring and Wedges

The restraining mechanism shall consist of a follower gland having a seal gasket and individually actuated wedges that increase their resistance to pullout as pressure or external forces increase. The system manufacturer shall provide all the components (follower ring, wedges, and gaskets) for the restraining device. The device shall be capable of full mechanical joint deflection during assembly, and the flexibility of the joint shall be maintained after burial. The joint restraint ring and its wedging components shall be constructed of ductile iron conforming to ASTM A 536, Grade 60-42-10. The wedges shall be ductile iron, heat-treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with mechanical joint bells conforming to AWWA C111 and AWWA C153. The design shall use torque limiting twist-off nuts to provide actuation of the restraining wedges. Minimum rated pressure shall be 250 psi. Products: Megalug Series 1100 as manufactured by EBAA Iron, Inc., or equal.

L. Ductile-Iron Pipe Weldments

1. All welding to ductile-iron pipe, such as for bosses, joint restraint, and joint bond cables, shall be done at the place of manufacture of the pipe. Perform welding by skilled welders experienced in the method and materials to be used. Welders shall be qualified under the standard qualification procedures of the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications.

2. Welds shall be of uniform composition, neat, smooth, full strength, and ductile. Completely grind out porosity and cracks, trapped welding flux, and other defects in the welds in such a manner that will permit proper and complete repair by welding.

3. Completed welds shall be inspected at the place of manufacture by the liquid penetrant method. Conform to the requirements specified in ASTM E 165, Method A, Type I or Type II. The materials used shall be water washable and nonflammable.

## PART 3 - EXECUTION

### A. Delivery, Unloading, and Temporary Storage of Pipe at Site

1. Limit onsite pipe storage to a maximum of one week.

2. Use unloading and installation procedures that avoid cracking of the lining. If necessary, use plastic sheet bulkheads to close pipe ends and keep cement-mortar lining moist.

3. Deliver the pipe alongside the pipelaying access road over which the pipe trailer-tractors can travel under their own power. Place the pipe in the order in which it is to be installed and secure it from rolling.

4. Do not move pipe by inserting any devices or pieces of equipment into the pipe barrel. Field repair linings damaged by unloading or installation procedures.

### B. Sanitation of Pipe Interior

1. During laying operations, do not place tools, clothing, or other materials in the pipe.

2. When pipelaying is not in progress, close the ends of the installed pipe by a child- and vermin-proof plug.

### C. Installing Flanged Fittings

1. Install in accordance with Section 400500. Cut the bore of the gaskets such that the gaskets do not protrude into the pipe when the flange bolts are tightened.

### D. Installing Buried Piping

1. Install in accordance with AWWA C600, Section 312316 and as follows.

2. When installing piping in trenches, maintain line and grade per Section 312316.3.I.

3. Assemble restrained joints per manufacturer's instructions.

E. Joint Deflections for Buried Pipe

1. For restrained joints, do not exceed 80% of the manufacturer's recommended maximum deflections.

2. Small angular changes (less than 5 degrees) in vertical alignment may be accomplished by the use of pulled joints. For larger vertical deflections, place an elbow at the station and elevation of the vertical PI shown in the drawings. Provide thrust restraint as required in the drawings.

3. Assemble joints in accordance with AWWA C600 and the manufacturer's recommendations.

F. Coating and Polyethylene Encasement of Buried Pipe and Fittings

1. Provide asphaltic coating on buried pipe and fittings per AWWA C151.

2. Coat buried mechanical and restrained joint glands, bolts, nuts, and connecting hardware with wax tape per Section 099752.

3. Wrap buried pipe, fittings, valves, and joints with polyethylene sheet per Section 099754.

G. Buried Warning Tape

Install buried warning tape per Specification Section 312316.

H. Hydrostatic Pressure Testing

Test pressures are shown in Section 400515. Test in accordance with Section 400515.

END OF SECTION