SECTION 15056

ductile iron pipe and fittings

# GENERAL

## DESCRIPTION

### This section includes materials and installation of ductile-iron pipe and fittings for potable and recycled water systems.

## REFERENCE STANDARDS

### The publications listed below form part of this specification to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said standards unless otherwise called for.

#### ANSI B1.1 – Unified Inch Screw Threads

#### ASTM A193 – Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

#### ASTM A 307 – Standard Specification for Carbon Steel Bolts and Studs

#### ASTM C 150 – Standard Specification for Portland Cement

#### ASTM A 536 – Standard Specifications for Ductile Iron Castings

#### AWWA C104 – Cement Mortar Lining for Ductile Pipe and Fittings for Water mains

#### AWWA C105 – Polyethylene Encasement for Ductile Iron Pipe

#### AWWA C110 – Ductile Iron Fittings

#### AWWA C111 – Rubber-Gasket Joints for Ductile Iron Pipe and Fittings

#### AWWA C115 – Flanged Ductile Iron Pipe with Threaded Flanges

#### AWWA C150 – Thickness Design of Ductile Iron Pipe

#### AWWA C151 – Ductile Pipe, Centrifugally Cast

#### AWWA C153 – Ductile Iron Compact Fittings

#### AWWA C217 – Cold-Applied Petroleum Wax Tape Coatings

#### AWWA C600 – Installation of Ductile Iron Water Mains

#### AWWA C602 – Cement-Mortar Lining of Water Pipelines

#### AWWA C606 – Grooved and Shouldered Type Joints

## RELATED WORK SPECIFIED ELSEWHERE

### EVMWD Standard Drawings

### Section 01300 – Shop Drawings and Submittals

### Section 02223 – Trenching, Backfilling and Compacting

### Section 03310 – Cast-in-Place Concrete

### Section 09800 – Painting and Coating

### Section 15000 – General Piping System and Appurtenances

### Section 15044 – Hydrostatic Testing and Flushing of Pressure Pipe

### EVMWD New Water Main Chlorination and Bacteriological Testing Protocol Document

## SERVICE APPLICATION

### Ductile-iron pipe shall be used only in specific areas, locations, and uses allowed by the DISTRICT. A corrosion analysis shall be performed to determine if a cathodic protection system is required.

## SUBMITTALS

### The following items shall be submitted in accordance with SECTION 01300 and complete the DISTRICT review process prior to shipping of ductile-iron pipe and fittings:

#### An affidavit of compliance with AWWA C104, C110, C111 , C115, C150, C151, C153, and the requirements of this specification.

#### Manufacturer's information relating to dimensions, weight, thickness, lining and coating for pipe and fittings conforming to AWWA C151, C110 and C153.

#### Copy of current test reports confirming the hydrostatic design of AWWA C153 fittings and chemical analysis in accordance with Section 53-5.3 and 53-13, respectively.

#### Copy of test report on physical properties of rubber compound used in gaskets.

#### Calculations supporting selected wall thickness.

#### Calculations demonstrating that each proposed restrained joint arrangement can resist the applied forces.

#### Submit tabulated layout schedule and drawing showing location and dimensions of pipe and fittings including:

##### Pipe station and invert elevation at each change of grade and alignment.

##### Components of curves and bends, both in horizontal and vertical alignment. Including pipe lengths required (to create curvature) and

##### The limits of each segment of pipe class, (indicate pressure or thickness class), restrained joints and deflection angle between pipe lengths. For combined horizontal and vertical curves provide true angular deflection at the joint.

##### Locations and details of bulkheads for field hydrostatic testing of the pipeline.

##### Locations of closures for length adjustment and for construction convenience.

##### Locations of appurtenances and other points for draining and/or filling.

##### Locations of valves and other mechanical equipment.

#### Joint details.

#### Cathodic protection materials.

## QUALITY ASSURANCE

### The manufacturer of each shipment of pipe shall be required to supply a statement certifying that each lot or load of pipe and fittings has been subjected to and met the tests specified for ductile iron pipe and fittings per AWWA C110, C111, C115, C150, C151, and C153, as applicable.

### Ductile-iron pipe shall bear indelible identification markings as required by AWWA C151.

### All pipe shall have a home mark on the spigot end to indicate proper penetration when the joint is made.

## DELIVERY, STORAGE, AND HANDLING

### Delivery, storage, and handling of ductile-iron pipe and fittings shall follow the recommendations of AWWA C600 and as specified herein:

#### Handling of pipe shall be performed with lifts, cranes, or other suitable equipment and devices. Slings, hooks, or pipe tongs shall be padded and used in such a manner as to prevent damage to the pipe, linings, and coatings. The pipes shall not be dropped or dragged.

#### During transport, the pipe shall be supported and secured against movement using padded devices in such a manner to prevent damage.

#### Stored pipe shall be protected from damage and kept free from dirt and foreign materials by closing the ends of the pipe. Other pipeline materials shall be protected by appropriate packaging or wrapping. Gaskets shall be stored in a cool location out of direct sunlight. Bolts, nuts, and washers shall be handled and stored in a dry location in a manner that will ensure proper use with respect to types and sizes.

#### Pipe laid out for installation shall be placed on earth berms or timber cradles adjacent to the trench in the numerical order of installation.

#### Maintain plastic end caps on all pipe and fittings in good condition until the pipe is ready to be installed in the trench. Periodically open the plastic end caps and spray clean potable water inside the pipe for moisture control.

#### Under no circumstances shall ropes or other devices be attached through the fitting's interior for handling.

## POLYETHYLENE ENCASEMENT

### Polyethylene encasement shall be provided for all buried ductile iron pipe and fittings.

# MATERIALS

## DUCTILE-IRON PIPE

### Ductile iron pipe shall be manufactured in accordance with ANSI/AWWA C150/21.50 and ANSI/AWWA C151/21.51 and shall be of the sizes and thickness or pressure classes shown on the plans.

### Unless supported by calculations signed and sealed by a registered engineer or otherwise specified, ductile iron pipe having push-on mechanical or plain end connections shall be furnished within the following classes:

|  |  |  |
| --- | --- | --- |
| **Pipe Diameter** | **Minimum Pressure Class** | **Minimum Thickness Class** |
| Under 6-inch | 350 | 52 |
| 6 to 16-inch | 350 | 50 |
| 20 to 24-inch | 300 | 50 |
| 30 to 36-inch | 250 | 50 |
| 42 to 60-inch | 200 | 50 |

### Minimum thickness class for pipe having threaded flanges or threaded shoulders shall be Class 53.

### Minimum thickness class for pipe having grooved end joints shall be as shown in the following table unless otherwise noted on the Drawings:

|  |  |
| --- | --- |
| **Pipe and Fitting Size (Diameter, in.)** | **Wall Thickness per AWWA C606** |
| 16 and smaller | Class 53 |
| 18 | Class 54 |
| 20 | Class 55 |
| 24 | Class 56 |

## FITTINGS

### **General:**

#### Ductile-iron fittings shall be manufactured per AWWA C110, C111, C115, C150, C151, and C153. Gray-iron and cast-iron fittings or flanges shall not be used.

#### Ductile-iron fittings manufactured per AWWA C153 shall be installed on mains 12 inch and smaller only.

#### Joints for fittings shall be mechanical joint, flanged, or push-on in accordance with AWWA C110, C111 , and C153.

#### Except as amended herein, or otherwise shown on the Approved Plans, joints for ductile-iron fittings shall have a pressure rating equal to or greater than the adjacent piping.

#### Joints in buried piping may be of the push-on, flanged or mechanical- joint type per AWWA C111 except where particularly specified on the Approved Drawings.

#### Joints that are aboveground, within structures, or submerged shall be flanged unless otherwise shown on the Approved Plans.

### Unless otherwise specified, ductile-iron flanges shall be in accordance with AWWA C115, rated at a working pressure of 250 psi. Where required in order to connect to the flanges of 250 psi butterfly valves, or as otherwise shown on the approved plans, ductile-iron flanges shall be compatible with AWWA C207, Class "F".

### Maximum working pressure of flanges shall as specified in AWWA or ASME/ANSI. Flanges shall be solid and integrally cast per AWWA C110 or shop-threaded per AWWA C115. Hollow-back flanges, gray-iron or cast-iron flanges and threading of flanges in the field are not permitted.

### Where threaded flanges are used, the pipe or spool piece to which they are connected will be hydrostatically tested at the shop in the presence of the Engineer prior to installation. The pipe section or spool piece shall be hydrostatically tested for 15 minutes at the pressure rating of the flanges. No leaks shall be permitted.

### Plain ends shall conform to the requirement of AWWA C151 and to the dimensions included within AWWA C110 to accept a mechanical joint, push-on joint, flanged coupling adaptor, flexible coupling, or grooved coupling.

### The exterior surfaces of all pipe and fittings shall be factory coated with a minimum one (1) mil thick petroleum asphaltic material per AWWA C110 and C151.

### All pipe and fittings shall be cement-mortar lined in accordance with AWWA C104, using the double thickness requirements indicated in said standard, Type II or Type V Portland cement per ASTM C 150 shall be used.

## GASKETS

### Gaskets shall be furnished in accordance with SECTION 15000.

## BOLTS AND NUTS FOR FLANGES

### Bolts and nuts shall be furnished in accordance with SECTION 15000.

## COUPLINGS

### Couplings shall be furnished in accordance with SECTION 15000.

## pAINTING AND COATING

### Buried ductile-iron pipe shall receive an asphaltic coating in accordance with AWWA C151.

### Materials for coating of pipe and fittings located above ground and in structures shall be in accordance with SECTION 09800 of these specifications.

### Materials for coating buried mechanical joint and hardware shall be in accordance with SECTION 09800 of these specifications.

## IMPORTED GRANULAR MATERIAL FOR PIPE AND TRENCH ZONES

### Imported granular material for use in pipe and trench zones shall be in accordance with SECTION 02223.

## CONCRETE

### Concrete for thrust and anchor blocks shall be in accordance with SECTION 03300.

## POLYETHYLENE ENCASEMENT

### Polyethylene encasement shall be furnished in accordance with SECTION 15000.

## TRACER WIRE

### Tracer wire shall be furnished in accordance with SECTION 15000.

## WARNING/IDENTIFICATION TAPE

### Warning/Identification tape shall be furnished in accordance with SECTION 15000.

# EXECUTION

## GENERAL

### At all times when the work of installing pipe is not in progress, including worker break times, ends of the pipe shall be closed with a vermin-proof and child-proof cap or plug. Do not permit trench water to enter the pipe. Do not place tools, clothing, or other materials in the pipe. The Contractor shall maintain the interior of the pipe in a sanitary condition free from foreign materials.

## TRENCHING, BACKFILLING AND COMPACTING

### Trenching, backfilling and compacting shall be performed in accordance with SECTION 02223.

## DEWATERING

### The Contractor shall provide and maintain at all times during construction ample means and devices to promptly remove and dispose of all water from any source entering trench excavations or other parts of the work in accordance with SECTION 02223. Any damage caused by flooding of the trench shall be the Contractors responsibility.

### Dewatering shall be performed by methods that will maintain a dry excavation, preservation of the final lines and grades and protection of all utilities. If flooding of the trench does occur, the Contractor shall immediately dewater and restore the trench. Damaged or altered pipeline appurtenances or trench materials shall be repaired or replaced as directed by the Engineer.

## PIPE INSTALLATION

### The Contractor shall furnish and install all pipe, specials, fittings, closure pieces, valves, supports, bolts, nuts, gaskets, jointing materials, and all other appurtenances as shown on the Approved Plans and as required to provide a complete and workable installation. Install pipe in the trench as follows:

#### Inspect each pipe and fitting before lowering the pipe or fitting into the trench. Inspect the interior and exterior protective coatings. Patch damaged areas in the field with material recommended by the protective coating manufacturer. Thoroughly clean the ends of the pipe. Remove foreign matter and dirt from inside of the pipe and keep pipe clean during and after installation.

#### Install pipe according to the manufacturer's approved order of installation. Install pipes uphill if the grade exceeds 10%. Lower the pipe onto the bedding at the proper lines and grades.

#### The manufacturer's printed installation guide outlining the radius of curvature that can be negotiated with pipe sections of various lengths shall be followed, except they shall not exceed the deflections allowed in AWWA C600 according to joint type. Combined deflections at rubber gasket or flexible coupling joints shall not exceed that recommended by the manufacturer.

#### The pipe shall have firm bearing along its full length, and bell holes shall be provided at each joint to permit visual inspection of the joint and prevent the pipe from being supported by the bell end or coupling.

### **Pipe Assembly:**

#### **Push-On Type:** Assemble the pipe joint using a lubricant selected from the Approved Materials List. Insert the spigot end into the bell or coupling to the proper insertion mark. Check that the elastomeric ring has not left the groove during assembly by passing a feeler gauge around the completed joint. Drive spigot ends of the pipe into bell ends in accordance with the manufacturer's recommendations. Stabbing shall not be permitted.

#### **Mechanical Joint Type:** Assembly of mechanical joint fittings shall be in accordance with the manufacturer's recommendations regarding installation.

### At all times when pipe laying is not in progress, the open end of the pipe shall be closed with a tight-fitting cap or plug to prevent the entrance of foreign matter into the pipe. These provisions shall apply during the break periods as well as overnight. In no event shall the pipeline be used as a drain for removing water which has infiltrated into the trench.

### The Contractor shall maintain the inside of the pipe free from foreign materials and in a clean and sanitary condition until its acceptance by the Owner. When the work requires and the size of the pipe allows entry of personnel into the pipe, the Contractor shall comply with all Federal and State regulations for confined space entry. Work inside pipelines shall not be undertaken until all the tests and safety provisions of the Code of Federal Regulations 1910.146, and the General Industry Safety Orders of the California Code of Regulations, Title 8, Section 5159 for confined space entry have been performed and the area is verified as safe to enter.

## INSTALLING BURIED FITTINGS

### The DISTRICT's Representative will inspect all fittings prior to installation for damage to the interior protective coatings. Patch damaged areas in the field with material similar to the original.

### For mechanical joint fittings, clean the bell socket and the plain end of the pipe of all foreign material and dirt. Place the gland on the pipe spigot with the lip extension toward the plain end. Lubricate the pipe spigot and gasket. Use the same lubricant as supplied by the pipe manufacturer. Install the gasket on the pipe spigot with the narrow edge of the gasket toward the plain end. Insert the pipe into the bell socket and press the gasket firmly into the gasket recess. Keep the joint straight during assembly. Push the gland towards the socket and center it around the pipe with the gland lip against the gasket. Insert bolts and hand tighten nuts. Make joint deflection after assembly but before tightening bolts. Uniformly tighten bolts and nuts in a progressive diametrically opposite sequence, and torque nuts to 75 to 90 foot pounds with a calibrated torque wrench.

### For push on joint fittings, clean the bell ends of the fitting of all foreign material and dirt. Insert the gasket in the groove of the bell and make sure the gasket faces the correct direction. Feel that the gasket is completely and evenly seated in the groove. When pipe is cut in the field, bevel the plain end prior to installation. Lubricate the exposed gasket surface and the beveled pipe spigot with the same lubricant supplied by the pipe manufacturer. Insert the spigot into the bell and force it slowly into position, keeping the joint straight while pushing. Make joint deflection after the joint is assembled.

### When necessary to deflect pipe with push-on joints from a straight line in either the horizontal or vertical plane, do not exceed the following joint deflection angles for buried fittings. The angles shown are for each joint of a ductile iron fitting and are maximum deflections.

| **Nominal Pipe Size (inches)** | **Joint Deflection (degrees)** |
| --- | --- |
| 12 and smaller | 4 |
| 14 to 20 | 3 |
| 24 | 2.5 |

### Deflections of pipe with restrained joints shall not exceed a maximum of 80-percent of the manufacturer’s recommended maximum deflection.

## FLANGED PIPE AND FITTINGS

### Flanged connections shall be installed where indicated on the Approved Drawings.

#### Bolt holes shall straddle the horizontal and vertical centerlines.

#### The bolts, nuts and flange faces shall be thoroughly cleaned by wire brush prior to assembly.

#### All bolts, nuts and washers shall be lubricated with a DISTRICT-approved anti-seize compound.

#### Assemble all bolts, nuts and washers in the flange.

#### All nuts shall be tightened in an alternating "star" pattern to the manufacturer's recommended torque with a calibrated torque wrench.

#### If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight. Replace galled, cracked, or distorted bolts and nuts.

#### Coat all exposed portions of bolts, nuts and washers in polyethylene wrap in accordance with SECTION 15000.

#### Coat the exterior of exposed flanges, bolts and nuts located aboveground or within vaults in accordance with SECTION 09800.

## POLYETHYLENE ENCASEMENT

### Polyethylene encasement shall be installed in accordance with SECTION 15000.

## MECHANICAL JOINT CONNECTIONS

### Mechanical joint connections shall be installed in accordance with SECTION 15000.

## COUPLINGS FOR DUCTILE-IRON PIPE

### Mechanical type flexible couplings shall be installed where shown on the Plans and in accordance with SECTION 15000.

## CONCRETE

### Concrete thrust and anchor blocks shall be installed in accordance with SECTION 03300 and the Standards Drawings. Prior to filling the pipeline with water, refer to SECTION 03300 for the minimum concrete curing time required.

## TRACER WIRE

### Tracer wire shall be installed in accordance with DISTRICT Standard Drawing W-35.

## WARNING/IDENTIFICATION TAPE

### Warning/Identification tape shall be installed in accordance with SECTION 15000.

## DISINFECTION AND BACTERIOLOGICAL TESTING

### Disinfection, bacteriological testing, and flushing shall be performed in accordance with SECTION 15044 and EVMWD’s New Water Main Chlorination and Bacteriological Testing Protocol.

## HYDROSTATIC TESTING

### Field hydrostatic testing shall be performed in accordance with SECTION 15044.

**END OF SECTION**