

## **SECTION 15106**

### **DUCTILE IRON PIPE AND FITTINGS** **(Contractor Furnished)**

#### **PART 1: GENERAL**

##### **1.01 COORDINATION OF WORK**

Connection to existing pipelines may require shutdown of Owner facilities. Closely coordinate construction work and connections with the Owner through the Engineer. The Engineer, in consultation with the Owner, may select the time for connection to existing pipelines, including Saturdays, Sundays, or holidays, which, in the opinion of the Engineer, will cause the least inconvenience to the Owner and/or its customers. Make such connections at such times as may be directed by the Owner, at the Contract prices, with no claim for premium time or additional costs.

##### **1.02 RELATED WORK**

Piping - General Provisions - Specification Section 15000

##### **1.03 SUBMITTALS**

Submit manufacturer's product data, installation instructions and certification for all materials to be furnished in accordance with Specification Section 1300. Submit classification and gradation test results for embedment and pipe backfill material.

##### **1.04 REFERENCES**

Refer to current AWWA Standards:

AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems

AWWA C110 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids

AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C115 - American National Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

AWWA C116 - American National Standard for Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service

AWWA C150 - American National Standard for the Thickness Design of Ductile-Iron Pipe

AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water

AWWA C153 - American National Standard for Ductile-Iron Compact Fittings, 3-inch through 24-inch and 54-inch through 64-inch, for Water Service

AWWA C600 -- AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances

ISO 8179-1 Ductile Iron Pipes-External Zinc-Based Coating

## **PART 2: PRODUCTS**

Research has documented that certain elastomers (such as those used in gasket material) may be subject to permeation by lower-molecular weight organic solvents or petroleum products. Products supplied under this Specification Section assume that petroleum products or organic solvents will not be encountered. If during the course of pipeline installation the Contractor identifies, or suspects the presence of petroleum products or any unknown chemical substance, notify the Engineer immediately. Stop installing piping in the area of suspected contamination until direction is provided by the Engineer.

### **2.01 PIPE MATERIAL**

#### **A. General**

Ductile iron pipe shall conform to the latest specifications as adopted by the American National Standards Institute, Inc., (ANSI) and the American Water Works Association (AWWA). Specifically, ductile iron pipe shall conform to AWWA Standard C151.

The pipe exterior shall be coated with a bituminous coating in accordance with AWWA Standard C151 or arc-sprayed zinc applied mass of 200 g/m<sup>2</sup> in accordance with ISO 8179 as directed by the Engineer. The pipe interior shall be cement mortar lined and seal coated in compliance with the latest revision of AWWA Standard C104. The pipe interior may be non-seal coated at the direction of the Engineer.

#### **B. Quality**

Pipe and fittings shall meet the following minimum quality requirements by conforming to the following:

1. AWWA C105 / ANSI A21.5 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water Polyethylene Encasement for Ductile-Iron Pipe Systems
2. AWWA C110 / ANSI A21.10 Ductile Iron and Gray Iron Fittings, 3 NPS through 48 NPS for Water AWWA C111 / ANSI A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
3. AWWA C115 / ANSI A21.15 Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

4. AWWA C116 / ANSI A21.16 Protective Fusion-Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service
5. AWWA C150 / ANSI A21.50 Thickness Design of Ductile-Iron Pipe
6. AWWA C151 / ANSI A21.51 Ductile-Iron Pipe, Centrifugally Cast, for Water
7. AWWA C153 / ANSI A21.53 Ductile-Iron Compact Fittings, 3 NPS through 24 NPS and 54 NPS through 64 NPS, for Water Service

Standard ductile iron water pipe and fittings will be accepted on the basis of the Manufacturer's certification that the material conforms to Section 15106. Specialty ductile iron fittings listed in Piping Specialties Section 15131 shall meet the requirements of Section 15131. The certification for standard ductile iron fittings shall list a fitting description, quantity, bare fitting weight and source, (AWWA Standard C110, C153 or Manufacturer, if fitting is not listed in either standard). The certification shall accompany the material delivered to the project site. The Owner reserves the right to sample and test this material subsequent to delivery at the project site. If foreign manufactured fittings are provided, then the Contractor is obligated to notify the Engineer with a submittal and provide the necessary documentation to satisfy the Engineer and the Owner that the materials provided meet the specified AWWA standards and, among other documentation that may be required, provide certificates of compliance on the component supplied.

#### C. Pipe Class

The thickness class of pipe to be furnished shall be in accordance with Table 1 and the notes listed below or as otherwise shown on the drawings or specified by the Engineer.

**TABLE 1**  
**MINIMUM RATED WORKING THICKNESS CLASS**  
**FOR DUCTILE IRON PIPE MANUFACTURED IN ACCORDANCE**  
**WITH AWWA Standard C151**

| Pipe Size (Inch) | <u>Class</u> |
|------------------|--------------|
| 4                | 52           |
| 6                | 52           |
| 8                | 52           |
| 12               | 52           |
| 16               | 54           |
| 20               | 54           |
| 24               | 54           |

#### NOTES:

1. The noted thickness class is adequate to support 3/4 and 1-inch corporation stops. Use a full saddle for larger taps (e.g., air relief valves or larger corporations) due to limited wall thickness.

2. There are special conditions where a larger wall thickness is required. The Engineer shall direct the Contractor on the proper thickness class pipe to use in specific instances; e.g. at treatment plant or booster station sites where frequent excavation can be anticipated in the vicinity of pipe, where the pipeline is laid on a river channel bottom to prevent external damage to the pipe and minimize the potential for costly pipe replacement, etc.

#### D. Testing

Perform a hydrostatic test of all pipe and appurtenances as required by AWWA Standard C151 and Specification Section 15030.

#### E. Joints

##### 1. Push-On and Mechanical

Push-On joint is preferred but Mechanical joint may be substituted if approved by the Engineer. Push-On and Mechanical joints including accessories shall conform to AWWA Standard C111.

##### 2. Flanged

Flanged joints shall conform to AWWA Standard C110 or ANSI B16.1 for fittings and AWWA Standard C115 for pipe. Do not use flanged joints in underground installations except within structures.

Gaskets for Ductile Iron flanged joints shall be full face type SBR (styrene butadiene rubber) elastomer or suitable material for application as directed by the Engineer per ANSI/AWWA C111/A21.11 and shall be 1/8" thickness. Flanged gaskets shall be the high performance type satisfying the special requirements of ANSI/AWWA C111/A21.11 Appendix C, Sec. C.2 and have at least (2-3) bulb type rings molded into both faces of the gasket. Flat EPDM (Ethylene Propylene Diene Monomer) gaskets may be used at the direction of the Engineer. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in American Standard for Wrench Head Bolts and Nuts and Wrench Openings (ANSI B18.2). For bolts of 1-3/4-inches in diameter and larger, bolt studs with a nut on each end are recommended. The high-strength, low-alloy steel for bolts and nuts shall have the characteristics listed in Table 6 of AWWA Standard C111. Exposed bolts and nuts in soils shall be Xylan or FluoroKote #1.

##### 3. Restrained Joint Pipe

Restrained pipe joints shall be of the boltless push-on type which provides joint restraint independent of the joint seal. Joint restrained gasket are allowed on pipe to pipe applications only on main installations 4"-12" at the direction of the Engineer. Restrained push-on joints allowed

for pipe only shall have accessories conforming to AWWA Standard C111. Restrained system shall be the thickness class as described in 2.01 C above and suitable for the following minimum working pressures:

| <u>Size (inch)</u> | <u>Pressure (psi)</u> |
|--------------------|-----------------------|
| Less than 20"      | 350                   |
| 20"                | 300                   |
| 24"                | 250                   |
| 30" - 64"          | 250                   |

#### F. Suppliers

Suppliers acceptable to American Water are

1. United States Pipe & Foundry Co.  
1101 East Pearl Street  
Burlington, NJ 08016 (Griffin Pipe  
Purchased by US Pipe in 2014)
2. McWane Cast Iron Pipe Co.  
2900 Highway 280, Ste 300  
Birmingham, AL 35223
3. American Cast Iron Pipe Company  
2916 16h Street North  
Birmingham, AL 35207

## 2.02 **FITTINGS**

#### A. Ductile Iron Fittings

Standard fittings shall be ductile iron conforming to AWWA Standard C110. Compact ductile iron fittings shall meet the requirements of AWWA Standard C153. Ductile iron specialty fittings listed in Piping Specialties Section 15131 shall meet the requirements listed in Section 15131.

#### 1. Working Pressures.

Fittings shall be suitable for the following working pressures unless otherwise noted in AWWA Standard C110 or C153:

| <u>Pressure (psi)</u> | <u>Compact Fittings</u> | <u>Standard Fittings</u>                                 |
|-----------------------|-------------------------|----------------------------------------------------------|
| <u>Size</u>           | <u>Ductile Iron</u>     | <u>Ductile Iron</u>                                      |
| 3" - 24"              | 350                     | 250, 350 (with special gaskets-<br>Flanged Applications) |
| 30" - 48"             | 250                     | 250                                                      |
| 54" - 64"             | 250                     | N/A                                                      |

The use of standard ductile iron fittings having a 250 psi pressure rating with ductile iron pipe (having a rating of 350 psi) is not permitted except by the expressed written approval by the Engineer.

## 2. Coating and Lining

The fittings shall be coated on the outside with a petroleum asphaltic coating in accordance with AWWA Standard C110 or fusion coated epoxy in accordance with AWWA Standard C116 and lined inside with cement-mortar and seal coated in accordance with AWWA Standard C104 or fusion coated epoxy in accordance with AWWA Standard C116.

## B. Joints

### 1. Mechanical and Push-On

Mechanical and push-on joints including accessories shall conform to AWWA Standard C111. Anti-Rotation I T-Bolts shall be used on mechanical joints shall be of domestic origin, high strength, low alloy steel bolts only, meeting the current provisions of American National Standard ANSI/AWWA C111/A21.1-90 for rubber gasket joints for cast iron or ductile iron pipe and fittings. The manufacturer's certification of compliance must accompany each shipment. All T-bolts shall be Xylan or FluoroKote #1., (corrosion resistant) to handle corrosive conditions on any buried bolts.

### 2. Flanged

Flanged joints shall meet the requirements of AWWA Standard C115 or ANSI B16.1. Do not use flanged joints in underground installations except within structures. Gaskets for Ductile Iron flanged joints shall be full face type SBR (styrene butadiene rubber) elastomer or suitable material for application as directed by the Engineer per ANSI/AWWA C111/A21.11 and shall be 1/8" thickness. Flanged gaskets shall be the high performance type satisfying the special requirements of ANSI/AWWA C111/A21.11 Appendix C, Sec. C.2 and have at least (2-3) bulb type rings molded into both faces of the gasket. Flat EPDM (Ethylene Propylene Diene Monomer) gaskets maybe used at the direction of the Engineer. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in ANSI B18.2. Xylan or FluoroKote #1 Hex Bolts, (corrosion resistant) to handle corrosive conditions shall be used on any buried flanged bolts.

Bolts and nuts hall be threaded in accordance with ASME/ANSI B1.1, Unified Inch Screw Threads (UN and UNR Thread Form) class 2A external and class 2B internal. For bolts of 1-3/4-inches in diameter and larger, bolt studs with a nut on each end are recommended. Material for bolts and nuts shall conform to ASTM A307, 60,000 PSI Tensile Strength, Grade B, unless otherwise specified. Bolt manufacturer's certification of compliance must accompany each shipment.

### 3. Restrained

Restrained joints for push-on fittings shall be of the boltless push-on type which provides joint restraint independent of the joint seal. Joint restrained gaskets are NOT permitted on valves or fittings. Restrained push-on joints and restrained mechanical joints allowed for fittings only shall have accessories conforming to AWWA Standard C111. Restrained mechanical joint accessories shall also conform to Section 15131.2.04. Restrained system shall be suitable for the following minimum working pressures:

| <u>Size</u>   | <u>Pressure (psi)</u> |
|---------------|-----------------------|
| Less than 20" | 350                   |
| 20"           | 350                   |
| 24"           | 250                   |
| 30" - 64"     | 250                   |

#### C. Suppliers acceptable to American Water:

1. Star Pipe Products  
4018 Westhollow Pkwy  
Houston, Texas 77082
2. American Cast Iron Pipe Company (Metalfit, Star and Sigma through)  
American Cast Iron Pipe Company  
2916 16h Street North  
Birmingham, AL 35207
3. (Metalfit, Star and Sigma through) United States Pipe & Foundry Co.  
1101 East Pearl Street  
Burlington, NJ 08016

## **PART 3: EXECUTION**

### **3.01 INSTALLATION**

Follow the provisions of Specification Section 15000 and 02210 in addition to the following requirements:

#### A. Push-On Joints

Clean the surfaces that the gasket will contact thoroughly, just prior to assembly using a bacteria free solution (bleach, potable water or NSF approved material). Insert the gasket into the groove in the bell. Apply a liberal coating of special lubricant in accordance with Section 15000.3.02.E to the gasket and the spigot end of the pipe before assembling the joint. Center the spigot end in the bell and push home the spigot end.

#### B. Mechanical Joints

Clean the surfaces that the gasket will contact thoroughly, just prior to assembly using a bacteria free solution (bleach, potable water or NSF approved material). Apply a liberal coating of special lubricant in accordance with Section 15000.3.02.E to all the surfaces that the gasket will contact. Slip the follower gland and gasket over the pipe plain end making sure that the small side of the gasket and lip of the gland face the bell socket. Insert the plain end into socket. Push gasket into position with fingers. Seat gasket evenly. Slide gland into position, insert bolts, and tighten nuts by hand. Tighten bolts alternately (across from one another) to the recommended manufacturing rating or if not provided, to the following normal torques:

| <u>Bolt Size</u> | <u>Range of Torque<br/>In Foot-Pounds</u> |
|------------------|-------------------------------------------|
| 5/8"             | 40 - 60                                   |
| 3/4"             | 60 - 90                                   |
| 1"               | 70 - 100                                  |
| 1-1/4"           | 90 - 120                                  |

After field installation, all bolts shall receive petrolatum tape or petroleum wax protection or other approved coating material. If pipe is to be polywrapped, coating protection for the bolts shall be applied before applying polyethylene encasement per specification 15131.

#### C. Restrained Joints

##### 1. Ball and Socket

Assemble and install the ball and socket joint according to the manufacturer's recommendations. Thoroughly clean and lubricate the joint in accordance with Section 15106.3.01.A. Check the retainer ring fastener.

##### 2. Push-On

Assemble and install the push-on joint according to the manufacturer's recommendations. Thoroughly clean and lubricate the joint. Check the retainer ring fastener.

Protect pipe from damage from the jacking device (backhoe bucket, pipe jack, etc.) when "pushing home" any pipe by using wood or other suitable (non metallic) material.

- D. Pipe Protection Protect pipe from damage from the jacking device (backhoe bucket, pipe jack, etc.) when "pushing home" any pipe. Wood or other suitable material (non metallic) shall be used to push home the pipe.



- E. Gaskets Gaskets shall be as provided or recommended by the manufacturer and satisfy AWWA standard C111 in all respects. As noted in the products section of this specification, some gasket materials are prone to permeation of certain hydrocarbons which may exist in the soil (see part 2). Under these conditions and at the Engineer's discretion require contractor to provide FKM (Viton, Flourel) gasket material in areas of concern.

**END OF SECTION**