

## SECTION 15105

### DUCTILE IRON PIPE AND FITTINGS

#### PART 1 GENERAL

##### 1.1 SUMMARY

This section includes furnishing and installing ductile iron pipe and fittings as shown on the Drawings and Standard Details. The OWNER reserves the right to provide ductile iron pipe. A list of additional materials to be provided by the OWNER, if applicable, is shown in Specification Section 01000.

##### 1.2 RELATED WORK

- A. Specification Section 01000 – Summary of Work
- B. Specification Section 15000 – Piping – General Provisions
- C. Specification Section 02210 – Trenching, Backfilling, and Compacting
- D. Specification Section 15130 – Piping Specialties

##### 1.3 REFERENCES

Refer to current Standards:

- A. AWWA C104 – American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
- B. AWWA C105 – American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
- C. AWWA C110 – American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids
- D. AWWA C111 – American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- E. AWWA C115 – American National Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
- F. 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
- G. AWWA C150 – American National Standard for the Thickness Design of Ductile-Iron Pipe

- H. AWWA C151 – American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water
- I. AWWA C153 – American National Standard for Ductile-Iron Compact Fittings, 3-inch through 24-inch and 54-inch through 64-inch, for Water Service
- J. AWWA C600 -- AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances
- K. ISO 8179-1 – Ductile Iron Pipes-External Zinc-based coating-Part1: Metallic Zinc with Finishing Layer

#### 1.4 SUBMITTALS

- A. Submit shop drawings and manufacturer's literature for all CONTRACTOR supplied materials.
- B. Submit in accordance with Section 01300.

### **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 OWNER immediately. Stop installing piping in the area of suspected contamination until direction is provided by the OWNER.

#### 2.1 PIPE MATERIALS

##### 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 exterior of ductile iron pipe shall be coated with a layer of arcsprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m<sup>2</sup> of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The coating system shall conform in every respect to ISO 8179-1 "Ductile iron pipes - External zinc-based coating - Part 1: Metallic zinc with finishing layer. Second edition 2004- 06-01."

The pipe or fitting exterior shall be topcoated with a bituminous coating in accordance with AWWA Standard C151. The pipe or fitting interior shall be cement mortar lined and seal coated in compliance with the latest revision of AWWA Standard C104.

B. Quality

Pipe and fittings shall meet the 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

Ductile iron water pipe and fittings will be accepted on the basis of the Manufacturer's certification that the material conforms to this specification. The certification for 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 pressure and thickness class of pipe to be furnished shall be in accordance with **Table 1** and the notes listed below.

**Table 1**

**MINIMUM** Rated Working Pressure

For Ductile Iron Pipe Manufactured In Accordance With AWWA Standard C151

Pipe Size (Inch)	Thickness Class
6	52
8	52
12	54
16	54
20	54
24	54

NOTES:

1. Larger pipe sizes up to 54-inch can be installed as pressure Class 200 with cover up to nine (9) feet and an operating pressure of 200 psi, where approved by the ENGINEER. When trench depths exceed fifteen (15) feet for pipe sizes of 16-inch or larger, the ENGINEER shall direct the CONTRACTOR on the proper class pipe to use.
2. The noted pressure 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.
3. There are special conditions where a larger wall thickness is required. The ENGINEER shall direct the CONTRACTOR on the proper pressure 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. Mechanical and Push-On joints including accessories shall conform to AWWA Standard C111.
2. 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.

Furnish all flanged joints with 1/8-inch thick, red rubber or styrene butadiene rubber gaskets. 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 aggressive soils shall feature a baked-on, ceramic filled fluorocarbon resin such as Xylan or FluoroKote #1. Preferred Manufacturer for bolts is Cor-Blue, or equal.

3. Restrained Joint for pipes shall be of the boltless push-on type which provides joint restraint independent of the joint seal. Restrained push-on joints allowed for pipe only shall have accessories conforming to AWWA Standard C111. Restrained system shall be suitable for the following minimum working pressures:

Pipe Size (Inch)	Pressure (psi)
Less than 20	350
20	300
24	250
30 - 64	200

- F. Acceptable Suppliers are listed in the most current version of the Supplemental Technical Specifications.

## 2.2 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.

1. Working Pressures - Fittings shall be suitable for the following working pressures unless otherwise noted in AWWA Standard C110 or C153:

Size (inch)	Compact Fittings Working Pressure (psi)	Standard Fitting Working Pressure (psi)
3 - 24	350	250 (350 with special gaskets)
30 - 48	250	250
54 - 64	150	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 exterior of ductile iron pipe fittings shall be coated with a layer of arcsprayed zinc per ISO 8179 or coated with a zinc rich paint per ISO 8179-2. The mass of the zinc applied shall be 200 g/m<sup>2</sup> of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The coating system shall conform in every respect to ISO 8179-1 “Ductile iron pipes - External zinc-based coating - Part 1: Metallic zinc with finishing layer. Second edition 2004-06-01” Or ISO 8179-2 “Ductile iron pipes, fittings, accessories and their joints – External zinc-based coating – Part 2: Zinc-rich paint.” The fittings shall be topcoated 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.
  3. For sanitary sewer applications, the interior of the pipe shall be coated with a ceramic modified amine-cured novolac epoxy coating. The coating shall be applied in two separate 20-mil coatings for a total nominal thickness of 40 MILS Dry Film Thickness (DFT).
- B. Acceptable Suppliers are listed in the most current version of the Supplemental Technical Specifications.
- C. Joints
1. Mechanical and Push – On joints including accessories shall conform to AWWA Standard C111. Anti-Rotational T-Bolts shall be used on mechanical joints and shall be of domestic origin, high strength, low alloy steel, meeting the current provisions of ANSI/AWWA C111/A21.1-90 for rubber gasket joints for cast iron or ductile iron pipe and fittings. Bolt manufacturer’s certification of compliance must accompany each shipment. T-bolts shall feature a baked-on, ceramic-filled fluorocarbon resin such as Xylan or FluoroKote #1, (corrosion resistant) to handle corrosive conditions on any buried bolts. Standard T-Bolts may be allowed by the OWNER but must adhere to the above characteristics.
  2. 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. Furnish all flanged joints with a minimum 1/8-inch thick red rubber or styrene butadiene rubber gasket. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in ANSI B18.2. Xylan or FluoroKote #1 Coated Hex Bolts (corrosion resistant) to handle corrosive conditions shall be used on any buried flanged bolts. Flange gaskets shall be rubber in composition; paper gaskets are not permitted.
- Bolts and nuts shall 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 joints for valves and fittings shall be of the boltless push-on type which provides joint restraint independent of the joint seal. Field Lok gaskets are not permitted on valves or fittings. Restrained push-on joints allowed for pipe only shall have accessories conforming to AWWA Standard C111. Restrained system shall be suitable for the following minimum working pressures:

Pipe Size (Inch)	Pressure (psi)
Less than 20	350
20	300
24	250
30 - 64	200

Where adjacent fittings are to be placed (as in a mechanical joint hydrant tee and a mechanical joint hydrant valve), the use of a suitably sized Foster adaptor is permitted to facilitate restraint between the fittings.

### **PART 3 EXECUTION**

#### **3.1 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 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 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 the 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:

Bolt Size (inch)	Range of Torque (foot-pounds)
5/8	40 - 60
3/4	60 - 90
1	70 - 100
1-1/4	90 - 120

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. 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.

3. Mechanical Joint. Assemble and install the mechanical joint according to the manufacturer's recommendations. Thoroughly clean and lubricate the joint. Use approved restrained joint device on fittings and valves where required and approved for use by OWNER.

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 OWNER's discretion provide FKM (Viton, Flourel) gasket material in areas of concern.

3.2 BASIS OF PAYMENT

The installation of water main, or restrained joint water main, will be paid at the Contract Unit Price per linear foot measured without deducting for length of fittings and valves for various sizes of water or sewer main installation. The installation of fittings will be paid at the Contract Unit Price for each type and size of fitting installed. The unit price includes furnishing labor, material (except when provided by OWNER), and equipment to install water main. Items specified in other Specification Sections that are considered incidental to water main installation shall be included in this Contract Unit Price including, but not limited to, excavation, backfill, shoring, polywrap, tracer wire, location tape, testing, disinfection, thrust restraint, air relief valves, and temporary blow-off outlets.

Note: Fire hydrant piping is not included in this item.

**–END OF SECTION 15105–**