

SECTION 15105

DUCTILE IRON PIPE AND FITTINGS

PART 1: GENERAL

1.01 SCOPE OF WORK

The work under this section consists of providing all labor, materials, tools, equipment, and services required to install and test all ductile iron (DI) pipe and fittings (4 inch through 48 inch nominal diameter) for water distribution and transmission as indicated on the Drawings and as specified within this section and related sections of the Specification. Contractor shall furnish and install all required pipe restraint components and other related components that are not furnished by the Owner. Refer to Sections 01000, 01011, and 01075 for materials to be furnished by the Owner.

1.02 SUBMITTALS

- A. Contractor shall submit Shop Drawings, manufacturer's literature and product data, installation instructions, and certifications for all products furnished under this section in accordance with Section 01300.
- B. Required certifications include those specified under Quality Assurance below.

1.03 QUALITY ASSURANCE

- A. Ductile iron pipe and fittings shall meet the minimum quality requirements by conforming to the below-referenced AWWA/ANSI standards as modified herein. Ductile iron pipe and fittings will be accepted on the basis of the Manufacturer's certification that the materials conform to this section.
- B. The certification for ductile iron fittings shall list a fitting description, quantity, bare fitting weight, source, and applicable AWWA standard (C110 or C153). The certification shall accompany each delivery of the material to the project site.
- C. Owner reserves the right to sample and test these materials subsequent to delivery at the project site.
- D. Bolt manufacturer's certification of compliance must accompany each shipment.
- E. If foreign-manufactured fittings are furnished, Contractor shall notify the Engineer in the Shop Drawing submittal and provide the necessary documentation to satisfy the Engineer and the Owner that the materials furnished meet the specified AWWA standards and, among other documentation that may be required, provide certificates of compliance on the components supplied.

1.04 RELATED WORK

- A. Section 01000 Summary of Work
- B. Section 01011 Special Provisions
- C. Section 01075 Basis of Payment
- D. Section 01300 Submittals
- E. Section 01600 Products
- F. Section 02210 Trenching, Backfilling and Compacting
- G. Section 02558 Identification/Location Guide
- H. Section 15000 Piping - General Provisions
- I. Section 15020 Disinfecting Pipelines
- J. Section 15025 Flushing and Cleaning Pipelines
- K. Section 15030 Pressure and Leakage Tests
- L. Section 15130 Piping Specialties
- M. Section 15150 Gate Valves
- N. Section 15155 Butterfly Valves
- O. Section 15170 Tapping Sleeves, Saddles, and Valves
- P. Section 15180 Fire Hydrants
- Q. Section 15185 Abandonment of Mains and Hydrants
- R. Section 15190 Air Valves, Blow-off Assemblies and Sampling Taps
- S. Section 15200 Service Lines

1.05 REFERENCE

Unless otherwise indicated, all references herein to other standards (e.g. AWWA, ASTM, ASME, ANSI etc.) shall mean the most current available revision. The following referenced documents are a part of this section. Comply with all applicable provisions and recommendations of the following documents, except as otherwise specified herein. Where a referenced document contains references to other standards, those other standards are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this section shall prevail.

- A. ASME / ANSI B1.1 - Unified Inch Screw Threads

- B. ASME / ANSI B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300
- C. ASME / ANSI B18.2 - Square and Hex Bolts and Screws (Inch Series)
- D. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength
- E. ASTM A536 – Standard Specification for Ductile Iron Castings
- F. AWWA C104 / ANSI A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
- G. AWWA C105 / ANSI A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems
- H. AWWA C110 / ANSI A21.10 - Ductile-Iron and Gray-Iron Fittings
- I. AWWA C111 / ANSI A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- J. AWWA C115 / ANSI A21.15 - Flanged Ductile-Iron Pipe with Threaded Flanges
- K. AWWA C116 / ANSI A21.16 - Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service
- L. AWWA C150 / ANSI A21.50 - Thickness Design of Ductile-Iron Pipe
- M. AWWA C151 / ANSI A21.51 - Ductile-Iron Pipe, Centrifugally Cast
- N. AWWA C153 / ANSI A21.53 - Ductile-Iron Compact Fittings
- O. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances
- P. NSF/ANSI 61 Drinking Water System Components – Health Effects

PART 2: PRODUCTS

2.01 GENERAL

- A. No foreign-manufactured pipe or appurtenances, except for ductile iron fittings, shall be allowed. All pipe and restraints shall be produced solely in the United States.
- B. All materials that come in contact with potable water, including lubricants, shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard 61.

2.02 DUCTILE IRON PIPE

- A. 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 C151 in standard supplied sizes, except as modified herein. Pipe shall be supplied in 18 or 20 foot nominal lengths or as required to meet the requirements of the Drawings.
- B. The pipe exterior shall be coated with an asphaltic coating in accordance with AWWA C151. The pipe interior shall be cement mortar lined and asphaltic seal coated in compliance with the latest revision of AWWA C104.
- C. Pipe Class: Pipe wall thickness shall be the required ~~pressure-or~~ thickness class based on the design conditions in accordance with AWWA C150. The ~~pressure-or~~ thickness class of pipe to be furnished shall be as required on the Drawings and/or as specified in Section 01011 but shall not be less than recommended by the pipe manufacturer or less than the minimum requirements indicated in Table 1.

Table 1

**MINIMUM RATED WORKING PRESSURE FOR DUCTILE IRON PIPE
MANUFACTURED IN ACCORDANCE WITH AWWA STANDARD C151**

<u>Pipe Nominal Size (Inches)</u>	<u>Pressure-Thickness Class</u>
12 and smaller	52 350
16 – 20	54 300
24 and larger	54 250

Note:

- 1. The noted ~~pressure-thickness~~ class is adequate to support 3/4 and 1-inch corporation stops by direct tapping. Provide a full tapping sleeve or saddle in accordance with Section 15170 and/or 15200 (as appropriate) for taps larger than 1-inch due to limited wall thickness.
- D. Plain ends shall be suitably beveled to permit easy entry into the bell and shall have home marks to indicate when the spigot is fully seated in the bell.
 - E. All non-restrained joints for pipe to pipe connections shall be standard push-on joints recommended by the pipe manufacturer and conforming to AWWA C151 and C111. Mechanical joints are not allowed for pipe to pipe connections. Push-on joints shall be of a type which employs a single elongated groove gasket to effect the joint seal.
 - F. Restrained Joint Pipe (12-inch and smaller): Unless otherwise indicated on the Drawings or in Section 01011 or furnished by the Owner, restrained joints for pipe to pipe connections 12-inch nominal size and smaller shall use push-on restraining gaskets with integral stainless steel locking segments recommended by the pipe manufacturer and conforming to AWWA C111. Restraint system shall be UL-listed and rated for a working pressure of 350 psi. Restraining gaskets shall not be used

on connections to valves or fittings or for connections to pipe materials other than ductile iron (e.g. gray cast iron). If required by the Drawings or Section 01011 and/or if furnished by the Owner, restrained-joint pipe such as specified below for 16-inch and larger pipe shall be used for 12-inch and smaller piping.

- G. Restrained Joint Pipe (16-inch and larger): Restrained joints for pipe to pipe connections (16-inch and larger) shall consist of factory-welded retainer bead or ring on the pipe spigot, and either factory manufactured bolted retainer rings, ductile iron locking segments held in place by rubber retainers, or ductile iron retaining rings that lock over the bell of the joint and are secured to prevent rotation. All components of the bolted or snap rings assemblies shall be constructed of corrosion-resistant, high-strength, low-alloy steel and shall conform to AWWA C111 as applicable. Restrained joint pipe shall be U.S. Pipe TR Flex, Bolt-Lok, or HP LOK; Clow TR Flex or Super Lock; American Flex-Ring or Lok-Ring. Restrained system shall be suitable for the following minimum working pressures:

<u>Size (Inch)</u>	<u>Pressure (psi)</u>
Less than 20	350
20	300 350
24	250 350
30 - 48	200 350

Gaskets utilizing integral locking segments such as Field Lok gaskets are not permitted for restraint of pipe 16-inch or larger. Restrained joint pipe per this article shall not be acceptable where ball and socket pipe is required by the Drawings, Section 01000, and/or Section 01011. Restrained joint ductile iron pipe installed by horizontal directional drill method shall also comply with Section 02458.

- H. Ball and Socket Pipe:

Ball and socket pipe shall comply with AWWA C150 and C151 and shall be U.S. Pipe USIFLEX Boltless Flexible Joint Pipe, American Flex-Lok Ball Joint Pipe, McWane Ball and Socket Joint Pipe.

- I. Flanged piping shall be Thickness Class 53 ductile iron unless otherwise required by the Drawings or Section 01011.
- J. Acceptable ductile iron pipe manufacturers are:
1. United States Pipe & Foundry Co. (including Griffin Pipe)
 2. McWane Family of Companies (Clow, Atlantic States, etc.)
 3. American Cast Iron Pipe Company.

2.03 FITTINGS

- A. Ductile Iron Fittings: Standard fittings shall be ductile iron conforming to AWWA C110. Compact ductile iron fittings shall meet the requirements of AWWA C153.

Fittings shall be suitable for the following working pressures unless otherwise noted in AWWA C110 or C153. **No gray cast iron fittings are permitted.**

Working Pressure Rating (psi)

<u>Size (inch)</u>	<u>MJ Fittings</u>	<u>Flanged Fittings</u>
3 – 24	350	250
30 – 48	250	250

- B. Coating and Lining: The fittings shall be coated on the outside with either asphaltic coating in accordance with AWWA C110 or fusion-bonded epoxy in accordance with AWWA C116, and the fittings shall be lined inside with either cement-mortar and asphaltic seal coating in accordance with AWWA C104 or fusion-bonded epoxy in accordance with AWWA C116.
- C. All fittings shall have mechanical joint bell ends conforming to AWWA C111 unless otherwise shown on the Drawings. However, for pipe 16-inch and larger, fittings with restrained bell joints compatible with the restrained joint pipe used will be permitted when authorized by the Engineer or Owner.
- D. Restrained MJ Joints (all sizes): Restrained joints shall be used for all connections to valves and fittings, and all such connections shall be restrained mechanical joint type using retainer glands as specified in Section 15130. However, when restrained joint pipe (with factory-welded retainer bead or ring on the pipe spigot) is used, fittings manufactured with restrained joints compatible with the restrained joint pipe may be used in lieu of fittings with restrained mechanical joints. Restraining gaskets with integral stainless steel locking segments (including MJ Field-Lok gaskets) are not permitted on valves or fittings.
- E. Non-restrained mechanical and push-on joints are not allowed for connections to valves, hydrants, or fittings.
- F. Acceptable ductile iron fittings manufacturers are:
 - 1. Sigma through United States Pipe & Foundry Co. (domestic or foreign)
 - 2. McWane Cast Iron Pipe Co. (Tyler Union domestic only)
 - 3. Star Pipe Products (domestic or foreign)

2.04 JOINTS – ADDITIONAL REQUIREMENTS

- A. All gaskets for buried pipe and fittings shall be of styrene butadiene rubber (SBR), unless otherwise required by the Drawings, Section 01011, or as directed by the Engineer.
- B. Anti-rotation T-bolts shall be used on mechanical joints, except where special bolts are supplied with the approved restraint device, and shall be of domestic origin meeting the current provisions of AWWA C111. T-bolts and nuts shall be high-strength, corrosion-resistant low-alloy steel with the characteristics listed in Table 6 of AWWA C111. T-bolts shall be Xylan or FluoroKote #1 (corrosion resistant).

- C. Retainer glands of any style are not acceptable for pipe to pipe joints.
- D. Anchor Couplings: Anchor couplings for anchoring the hydrant valve to pipeline tee's branch and for anchoring the hydrant to the valve shall consist of a plain end mechanical joint pipe with a rotating follower gland, retained by a welded ring, on one or both ends. Anchor couplings shall be installed for each hydrant branch and other locations where shown on the Drawings. Anchor couplings shall be manufactured from Thickness Class 53 ductile iron and shall meet the applicable requirements for both ductile iron pipe and fittings as specified in this section. Standard MJ gaskets as specified herein shall be used with anchor couplings.
- E. Flanged: Flanged joints shall conform to AWWA C110 (for fittings) or AWWA C115 (for pipe) and also to ANSI B16.42 Class 150. Unless otherwise noted on the Drawings (including bridge crossings), all exposed ductile iron pipe and fittings shall have flanged joints. Flanged joints are not permitted in underground installations except where exposed within structures or if allowed for tapping sleeves, saddles, and valves as specified in Sections 15150 and/or 15170.
1. Gaskets for all flanged joints shall be 1/8-inch thick, styrene butadiene rubber (SBR) or EPDM gaskets. Paper flange gaskets are not permitted.
 2. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in ANSI B18.2. 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. Material for bolts and nuts shall conform to ASTM A307, 60,000 psi tensile strength, Grade B, unless otherwise specified in Section 01011. Xylan or FluoroKote #1 hex bolts (corrosion resistant) shall be used on any buried flange bolts used with ductile or gray cast iron flanges.
 3. Each flange shall be fully compatible with its mating flange.
- F. Connections to existing piping shall comply with Section 15000. When connecting to existing ductile iron pipe, connection shall be made either as described in this section or using couplings in accordance with Section 15130. A restrained mechanical joint solid sleeve as specified above for ductile iron fittings may be used to connect an existing plain spigot end to a new pipe plain spigot end. When connection is to be made to an existing pipe with a joint type not allowed within this section, the existing pipe shall be cut to a plain spigot end unless otherwise approved by the Engineer.

PART 3: EXECUTION

3.01 INSTALLATION

Installation of ductile iron pipe and appurtenances shall be in full accordance with AWWA C600 except as modified herein. Contractor shall follow the provisions of Sections 02210 and 15000, other sections as applicable (including related sections listed in Part 1 above), and all manufacturers' recommendations, in addition to the following requirements:

A. All Joint Types:

Immediately prior to assembly, thoroughly clean the surfaces that the gasket will contact using a bacteria-free solution (bleach, potable water or NSF-61 compliant material).

B. Non-restrained Push-On Joints:

Insert the gasket into the groove in the bell. Apply a sufficient coating of manufacturer approved NSF-61 certified lubricant to the gasket and the spigot end of the pipe before assembling the joint in accordance with the manufacturer's requirements, AWWA C600, and other requirements of this section. The use of improper lubricants can damage gaskets, so ensure that only lubricants approved by the gasket manufacturer are used. Center the spigot end in the bell, and push home the spigot end. The maximum allowable deflection at the joints for push-on joint pipe shall be the lesser of manufacturer's recommendations or as described in the DIPRA Guideline, Installation Guide for Ductile Iron Pipe, as follows:

<u>Size of Pipe</u>	<u>Deflection Angle</u>	<u>Maximum Deflection</u>	
		<u>(18-ft Length)</u>	<u>(20-ft Length)</u>
4" - 12"	5 degrees	19"	21"
14" - 42"	3 degrees	11"	12"
48" - 64"	3 degrees	N/A	12"

C. Restrained Push-On:

Assemble and install the restrained push-on joint with the pipes aligned in the same axis according to the manufacturer's recommendations. Use feeler gauge to check all joints installed with push-on restraining gaskets with integral stainless steel locking segments. Contractor shall not reuse restraining gaskets once a joint is disassembled. Check the retainer ring fastener where present. Unless otherwise directed by the manufacturer, joints shall not be deflected until the joint has been fully assembled and checked for proper assembly; deflection shall not exceed manufacturer's recommended allowances.

D. Restrained Mechanical Joints:

1. Use approved restrained joint device according to Section 15130. 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 the bell socket. Push the gasket into position with fingers only, and seat gasket evenly. Slide gland into position, insert bolts, and tighten nuts by hand. Tighten MJ flange bolts alternately per manufacturer's recommendations to the manufacturer's recommended torque rating or, if not provided, to the following normal torques as specified in AWWA C111 Table A.1:

<u>Bolt Size (inch)</u>	<u>Pipe Nominal Size (inches)</u>	<u>Range of Torque in Foot-Pounds</u>
5/8	3	45 -60
3/4	4 – 24	75 – 90
1	30 – 36	100 – 120
1-1/4	42 – 48	120 - 150

2. Secure restrained joint device to pipe barrel in accordance with Section 15130 and the restraint device manufacturer's recommendations.

E. Ball and Socket Joints:

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.

F. Pipe Protection

1. Comply with requirements of Section 15000. Lift pipe in accordance with AWWA Standards C600 and manufacturer's recommendations, subject to the restrictions herein and in Section 15000.
2. Protect cement-mortar lining from damage during transportation (off- and on-site), preparation and installation. Transporting or lifting pipe by inserting lifting forks, chains, hooks, or any other device inside the pipe shall not be permitted. No exception shall be made during application of polyethylene encasement or any other time.
3. Protect asphaltic coating from damage during off- and on-site transportation, preparation and installation. Contractor shall not utilize metal chains, steel cable, etc. to lift or transport pipe. Transporting or lifting pipe using forks on construction equipment shall not be permitted unless the pipe is supported on pallets or lumber and lifted indirectly with the forks.
4. Protect pipe from damage from the jacking device (backhoe bucket, pipe jack, etc.) when assembling each pipe joint (i.e. "pushing home" every pipe). Wood or other suitable (non-metallic) material consistent with the pipe manufacturer's recommendations shall be used to push home the pipe.

END OF SECTION