

Specifications for Ductile Iron Pipe & Fittings

1 - OVERVIEW

A. General: The CONTRACTOR shall furnish and install ductile iron pipe, fittings and all appurtenances, complete in place, all in accordance with the requirements of the Contract Documents. Where standards, specifications, or methods are cited without dates, the reference shall be construed to apply to the latest revision in effect at the time of contract.

B. Manufacturer: The term "MANUFACTURER" shall mean the party that manufactures, fabricates, or produces materials or products.

C. Applicable Standards:

ANSI/AWWA C104/A21.4 Cement-mortar Lining for Ductile Iron Pipe and Fittings for Water

ANSI/AWWA C105/A21.5 Polyethylene Encasement for Ductile Iron Pipe Systems

ANSI/AWWA C110/A21.10 Ductile Iron and Gray Iron Fittings, 3-in. through 48-in. for Water and Other Liquids

ANSI/AWWA C111/A21.11 Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings

ANSI/AWWA C115/A21.15 Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges

ANSI/AWWA C150/A21.50 Thickness Design of Ductile Iron Pipe

ANSI/AWWA C151/A21.51 Ductile Iron Pipe, Centrifugally Cast for Water

ANSI/AWWA C153/A21.53 Ductile Iron Compact Fittings, 3"-24" and 54"-64" for Water Service

ANSI/AWWA C600 Installation of Ductile Iron Water Mains and their Appurtenances

ANSI/AWWA C606 Grooved and Shouldered Joints

ANSI/AWS D11.2 Guide for Welding Iron Castings

D. Shop Drawings/Lay Schedules: The CONTRACTOR upon request shall submit catalog cuts of pipe and fittings in accordance with the requirements of this Section.

1. Certified dimensional drawings of all pipes, fittings, and appurtenances.
2. Certified dimensional drawings of joints, showing the manufacturer's allowable deflections.
3. Copies of the manufacturer's approved installation instructions for the types of joints being used.

E. Certifications: Upon request the CONTRACTOR shall furnish a certified affidavit of compliance for all pipe and other products or materials furnished under this Section, as specified in the referenced standards and as specified in *Section 2 - Quality Assurance*.

F. Sample Costs: All expenses incurred in making samples for certification of specified tests shall be borne by the MANUFACTURER.

2 - QUALITY ASSURANCE

A. ISO/Third Party Inspection:

The pipe and fitting MANUFACTURER shall be ISO 9001:2000 registered or provide the services of an Independent Inspection Agency. ISO 9001:2000 registration shall have been certified by a qualified ISO registrar.

B. Factory Hydrostatic Test: All pipe shall be subject to a factory hydrostatic test of at least 500 psi for a period of not less than 10 seconds. All C153 fittings shall be subject to a factory hydrostatic test of at least 350psi. All C110 fittings shall be subject to a factory hydrostatic test of at least 250psi.

C. Inspection: All pipes and fittings shall be subject to inspection at the place of manufacture, in accordance with the provisions of the referenced standards.

D. Tests: All materials used in the manufacture of the pipes, fittings and specials shall be tested in accordance with requirements as applicable.

E. Test Costs: The MANUFACTURER shall perform said material tests at no additional cost to the OWNER. The ENGINEER shall have the right to witness all testing conducted by the MANUFACTURER, provided that the MANUFACTURER's and CONTRACTOR's schedule is not delayed for the convenience of the ENGINEER.

F. Plant Access: During the manufacture of the pipe and fittings, the ENGINEER shall be given access to all areas where manufacturing and testing is in process and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

G. Affidavits: Upon request the CONTRACTOR shall submit affidavits of compliance from the MANUFACTURER for the following:

1. Ductile iron pipe in accordance with the requirements of AWWA C151 and these specifications.
2. Cement-mortar lining of ductile iron pipe, specials, and fittings in accordance with the requirements of AWWA C104 and these specifications.
3. Polyethylene encasement for ductile iron piping in accordance with AWWA C105 (if specified).
4. Rubber gasket joints for ductile iron pressure pipe and fittings in accordance with the requirements of AWWA C111 and these specifications.
5. Charpy impact testing of ductile iron used in the manufacture of pipe shall be performed in accordance with AWWA C151.
6. Low-temperature impact tests shall be made from at least 10% of the test pipe to assure compliance.

H. Warranty: The MANUFACTURER shall provide the OWNER a 5 year warranty against manufacturing defects.

3 - DUCTILE IRON PIPE

A. Standards: Ductile iron pipe shall conform to AWWA C151, subject to the following supplemental requirements. The pipe shall be of the diameter and class shown, shall be furnished complete with rubber gaskets as indicated in the Contract Documents. Ductile iron pipe shall be manufactured or supplied by Electrosteel USA, or equal.

B. Markings: Upon request the CONTRACTOR shall require the MANUFACTURER to legibly mark specials in accordance with the laying schedule and marking diagram.

C. Laying Lengths: Pipe-laying lengths shall be provided in 18-foot and 20-foot nominal lengths with allowable trim-pipe lengths in accordance with AWWA C151 and special shorter lengths provided as required by the Drawings.

D. Design Parameters: All ductile iron pipes shall be designed and manufactured in accordance with AWWA C150 and AWWA C151, respectively, for the following minimum operating conditions:

1. The minimum internal design pressure shall be 150 psi with a 100-psi surge allowance, with a safety factor of 2, for a total internal design pressure of 500 psi. No reduction of safety factor for transient pressures shall be allowed.
2. The external loads design criteria shall be a minimum of 4 feet depth of cover at 120 lbs. per cubic feet soil weight, and live load based on one AASHTO H-20 truck load. The thickness design of ductile iron pipe shall be in accordance with AWWA C150.
3. The horizontal deflection of cement-mortar-lined ductile iron pipe resulting from external load conditions shall not exceed three percent of the pipe diameter.
4. The pipe trench for design purposes shall be no less than Laying condition Type 2 as described in AWWA C150.

5. For purposes of restrained joint calculations per the Ductile Iron Pipe Research Association (DIPRA) method, the soil classification¹ for both the native trench soil and also the backfill soil to surround the pipe shall be defined with one or more of the following options:

- | | | |
|-----------|----------------------|--------------|
| 1. Clay 1 | 4. Silt 2 | 7. Good Sand |
| 2. Silt 1 | 5. Cohesive-Granular | |
| 3. Clay 2 | 6. Sand Silt | |

1. As described in DIPRA's "Thrust Restraint Design for Ductile Iron Pipe," latest edition.

E. Minimum Pipe Class: Ductile iron pipe shall conform to AWWA C151. All pipes shall have a minimum pressure rating as follows:

Pipe Size (in)	Class
4"-12"	350
14"-20"	250
24"	200

4 - FITTINGS

A. General: Fittings shall be ductile iron in accordance with AWWA C110, AWWA C153, or AWWA C606, latest revisions.

B. Buried Service Fittings: Fittings, sizes 4" — 24", with push-on, restrained push-on, or mechanical joints shall be rated for 350 psi working pressure. Fittings, sizes 30" — 64", with push-on, restrained push-on, or mechanical joints shall be rated for 250 psi working pressure.

C. Aboveground Service Fittings: Fittings, sizes 4" — 64", with flanged joints shall be rated for 250 psi working pressure.

5 - JOINT DESIGN - DUCTILE IRON PIPE, FITTINGS AND SPECIALS

A. General: Ductile Iron pipe and fittings shall be furnished with push-on joints, push-on restrained joints, mechanical joints, flanged joints, and grooved joints as required.

B. Push-on Joints: Push-on joints shall conform to AWWA C111. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR.) Push-on joints shall be Pushtite, as manufactured by Electrosteel USA or equal. The pressure rating for push-on joints shall be a minimum of 350 psi or the specified pressure rating of the pipe, whichever is less. Standard allowable joint deflection for 4" — 24" Pushtite pipe shall be five degrees.

C. Restrained Joints: Restrained joints shall be "PushtiteRJ" as manufactured by Electrosteel USA or equal.

D. Flanged Joints — Pipe: Candidate pipe for 4"– 54" flanged pipe thread-fabrication shall be Special Thickness Class 53 and for 60" — 64" flanged thread-fabrication shall be Pressure Class 350 ductile iron pipes, all in accordance with AWWA C115. Threaded companion flanges for ductile iron pipe shall be ductile iron in accordance with AWWA C115. Bolt circle and bolt holes shall match those of ANSI B16.1 class 125 and ANSE B16.5 class 150 flanges. The flanges shall be rated for at least 250 psi working pressure. The threaded flanges shall be individually fitted and machine tightened on the pipe ends. Bolts, gaskets, and installation shall be in accordance with AWWA C115, Appendix A requirements. Flanged gaskets shall have a raised bulb in the seating area to assure proper sealing. Flange facing shall be smooth or with shallow serrations per AWWA C115.

E. Flanged Joints — Fittings: Flange fittings shall be ductile iron in accordance with AWWA C110 or AWWA C153. The flanges shall be rated for at least 250 psi working pressure. Bolts, gaskets, and installation shall be in accordance with AWWA C110 or AWWA C115, Appendix A requirements. Flange

gaskets shall have a raised bulb in the sealing area. Flange facing shall be smooth or with shallow serrations per AWWA C110 or AWWA C153.

F. Welded-on Thrust Collars: Welded-on thrust collars, for wall pipe and pipe thrust restraint, shall be welded steel collars designed for the thrust generated by 250 psi working pressure with a safety factor of at least two (2.0) against failure. Welded-on thrust collars shall be as manufactured by Electrosteel USA or equal. The manufacturer shall qualify all welding procedures and welders per the requirements of a documented quality assurance system based on ANSI/AWS D11.2.

G. Mechanical Joints: Mechanical joints shall conform to AWWA C111. Bolts shall be high-strength, low-alloy steel per AWWA C111. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR) per this standard.

6 - CEMENT-MORTAR LINING

A. Cement-mortar Lining for Shop Application: Except otherwise provided herein, interior surfaces of all ductile iron pipe, fittings, and specials shall be cleaned and lined in the shop with a standard thickness cement-mortar lining applied in conformity with AWWA C104, Portland cement mortar. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty at delivery site, the damaged or unsatisfactory portions shall be repaired or replaced with lining conforming to these Specifications.

B. Lining Thickness: The minimum lining thickness shall be per AWWA C104, latest addition.

C. Seal Coat or Non-seal Coat Cement-mortar Lining:

At the MANUFACTURER'S option and in accordance with AWWA 104, ductile iron pipe, specials, and fittings may be supplied with or without a 1-mil asphaltic seal coating.

7 - EXTERIOR COATING

A. Buried Ductile Iron Pipe and Fittings (non-corrosive soils): The exterior of ductile iron pipe, specials, and fittings shall be coated with a 1-mil asphaltic coating in accordance with AWWA C151.

B. Buried Ductile Iron Pipe (corrosive soils): Corrosion control of ductile iron pipe can be addressed by either of the following methods:

- When specified, loose polyethylene encasement shall be supplied and installed in accordance with AWWA C105 and M41.
- Ductile iron pipe shall have 1 mil of zinc welded to its exterior in accordance with EN 545/ISO 2531. Zinc shall be applied to achieve a mean mass of 130g/m² minimum (with local minimum of 110g/m²). A 3 mil epoxy coating shall be applied over the zinc surface to provide mechanical protection of the zinc. This epoxy shall be provided in a color suitable for identifying the pipe for its intended application (i.e. blue = potable water).

C. Aboveground Ductile Iron Pipe and Fittings: The exterior of ductile iron pipe, specials, and fittings shall be coated with one of the following coatings or primers:

- **Above Ground — Exterior (Mild Exposure)**
Standard 1-mil Asphaltic Coating per AWWA C151
- **Above Ground — Interior/Exterior Immersion/Non-immersion (Mild to Aggressive Exposure)**
Universal Moisture-cured Urethane or MC-Ferro Clad Primer. Can be top coated with NSF-61 certified coatings where NSF-61 compliance is required. Shop coat thickness: 3.0-5.0 mils dry film thickness.