CITY OF FORT WAYNE MASTER UPDATED: 1/5/15

SECTION 33 05 33

NTS: This Section covers pressure rated ductile iron pipe for that can be used for open cut excavation for storm sewers, sanitary sewers, and large diameter water distribution applications (24” and larger). Ductile iron pipe is typically specified and ordered using AWWA standards, but is used in varying applications that may not only be pressurized flow. Review the application and jointing requirements listed in the Section based on the projects specific requirements. Ductile iron pipe for horizontal directional drill (HDD) is not specified in this specification. HDD requires flexible joints.

Coordinate this section with applicable requirements of Division 33 installation. Installation and jointing methods are included in the applicable utility piping installation section. Trenching and backfill information is in 31 00 05 Trenching and Earthwork.

Portions of this section contain detailed descriptive requirements of the product(s) of the named manufacturer(s). If the product of another manufacturer is to be included (where named) as acceptable, this section may require editing.

1. GENERAL
	1. DESCRIPTION
		1. Scope:
			1. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install ductile iron pipe and fittings as shown and specified.
			2. Extent of piping is shown on the Drawings and in the Piping Schedule.
		2. Coordination:
			1. Review installation procedures under this and other Sections and coordinate installation of items to be installed with, or before, the ductile iron utility pipe Work.
		3. Related Sections:

NTS: List below only sections covering products, construction, and equipment specifically identified in this section and specified in another section and directly referenced in this specification. Do not list administrative and procedural Division 01 sections. Insert at (--1--) the number and name of the Division 33 installation section or any other referenced sections.

* + - 1. Section 31 00 05, Trenching and Earthwork.
			2. Section (--1--).

NTS: Section “1.2” is to be included if project is bid on unit price basis. Section to be deleted or revised if project is to be bid on lump sum basis.

NTS: Section 1.2 below is used when the project requires ductile iron piping. If project only requires ductile iron fittings and not ductile iron pipe, remove requirements throughout this specification that are related to ductile iron pipe Also remove section 1.2 below and replace with the following:

1.2 MEASUREMENT AND PAYMENT

 A. Measurement and payment for ductile iron fittings and associated appurtenances, for use with

 non- ductile iron piping, shall be included in the measurement and payment of the applicable

 pipe material section.

Payment for special backfill, valves, fire hydrants, and other system components must be specified in the appropriate specification.

* 1. MEASUREMENT AND PAYMENT

NTS: Insert at (--1--), (--2--) and (--3--) below the various ductile iron pipe types and diameters to be used for project. Adjust Section “1.2” below for additional work item numbers as needed. In extreme cases consider separating the work items by diameter and depth.

* + 1. Ductile Iron Utility Piping
			1. Work Item Number and Title

**33 05 33-A (--1--) Ductile Iron Pressure Utility Piping**

**33 05 33-B (--2--) Ductile Iron Pressure Utility Piping**

**33 05 33-C (--3--) Ductile Iron Pressure Utility Piping**

NTS: Edit paragraph 2 below to suit the Project. for watermain projects consider editing the specific structures to measure from.

* + - 1. The quantity of ductile iron pipe installed shall be the number of linear feet actually installed, backfilled and tested, as measured from outside wall of structure to outside wall of structure, as measured along the centerline of the pipe. Measurements shall include length of fittings and valves.
			2. The payment of ductile iron pipe shall be based on the unit price per linear foot as listed on the submitted Bid schedule for each pipe size successfully installed. Payment for any associated restoration shall be paid for under its respective Work item.

NTS: Review paragraph 4 below and edit to suit project. For non-water projects remove work item “disinfection” if not required for project.

* + - 1. This item shall include all costs to furnish all labor, materials, tools, and equipment, both permanent and temporary, to install the ductile iron pipe as shown and specified. The Work includes, but is not limited to, trench excavation, pavement removal and disposal if necessary, dewatering, furnishing and placement of bedding, pipe, placement of required backfill, disposing of excess excavated material, polyethylene encasement, installation of polyethylene encasement, testing of materials, compaction of bedding and backfill, utility verification, temporary sheeting, shoring and bracing, pressure testing, disinfection, restoration/replacement of all disturbed items not included under other Work items, protection of existing utilities and structures, and incidentals for performing all Work as specified unless otherwise provided for as a separate Work item.

NTS: Insert at (--1--), (--2--) (--3--)(--4--) and (--5--) below the various ductile iron pipe fittings types and size to be used for project. Ductile iron fittings for use with non-ductile iron piping shall be included and paid for under the project specific piping specification. Add additional work items as necessary for additional types and diameters.

The work item description below includes information specific to ductile iron fittings for watermain projects. If using this Section for other utilities edit to suit project specific requirements.

* + 1. Fittings
			1. Work Item Number and Title:

All fittings are Ductile Iron Fittings unless otherwise stated.

**33 05 33-D (--1--) 11.25, 22.5, 45 or 90 Degree Bend Ductile Iron Fittings for Ductile Iron Pipe**

**33 05 33- E (--2--) x (--3--) x (--4--) Tee Ductile Iron Fittings for Ductile Iron Pipe**

**33 05 33- F (--5--) Cross Ductile Iron Fittings for Ductile Iron Pipe**

* + - 1. The number of fittings to be measured for payment shall be the actual number installed of each size and type as shown and specified along a water main that is successfully installed, pressure tested and disinfected.
			2. The payment for these items shall be based on the contract unit price. Payment for special backfill will be under its respective bid item. Payment for excavation, placement of native backfill, disposal of excavated materials, bedding, restoration, and pressure testing and disinfection shall be included under the bid items for the water main unless otherwise broken down by the Engineer as a separate bid items.
			3. These items shall include all costs to furnish all labor, materials, tools and equipment, both permanent and temporary, to install and maintain complete the ductile iron fittings as shown and specified unless otherwise directed by the Engineer. The Work shall include, but is not limited to, any necessary joint restraining required to overcome the thrust imposed by the respective items.
	1. REFERENCES

NTS: Retain applicable standards and add/delete as required for materials.

* + 1. Standards referenced in this Section are listed below:
			1. American National Standards Institute.
				1. ANSI B18.2.1, Square and Hex Bolts and Screws Inch Series.
				2. ANSI B18.2.2, Square and Hex Nuts. (Inch Series).
			2. ASTM International.
				1. ASTM A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
				2. ASTM A194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
				3. ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
				4. ASTM A563, Specification for Carbon and Alloy Steel Nuts.
				5. ASTM A575, Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
				6. ASTM D5162, Practice for Discontinuity (Holiday) Testing of Non-Conductive Protective Coating on Metallic Substrates.
				7. ASTM G14, Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test).
			3. American Water Works Association.
				1. AWWA C104, Cement‑Mortar Lining for Ductile Iron Pipe and Fittings for Water.
				2. AWWA C105, Polyethylene Encasement for Ductile-Iron Pipe Systems.
				3. AWWA C110, Ductile Iron and Gray Iron Fittings.
				4. AWWA C111, Rubber‑Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
				5. AWWA C115, Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges.
				6. AWWA C116, Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings.
				7. AWWA C150, Standard for Thickness Design of Ductile Iron Pipe.
				8. AWWA C151, Ductile Iron Pipe, Centrifugally Cast.
				9. AWWA C153, Ductile Iron Compact Fittings for Water Service.
			4. NSF International.
				1. NSF 61, **Drinking Water System Components - Health Effects.**
			5. The Society for Protective Coatings.
				1. SSPC Painting Manual, Volume 1, Para. XIV.
				2. SSPC PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
			6. Manufacturers Standardization Society of the Valve and Fittings Industry.
				1. MSS SP-60, Connecting flange joint between tapping sleeves and tapping valves.
			7. National Association of Corrosion Engineers.
				1. NACE RP0188, Discontinuity (Holiday) Testing of Protective Coatings.
	1. QUALITY ASSURANCE

NTS: Edit or delete Paragraph “A” below, if project requirements prohibit using an experience clause. Edit experience requirements to suit the project and delete inapplicable paragraphs.

* + 1. Manufacturer’s Qualifications:
			1. Manufacturer shall have a minimum of 5 years successful experience producing ductile iron pipe and fittings and shall be able to show evidence of at least 5 installations in satisfactory operation in the United States that are similar applications to the specified service.
			2. Lining and coating products shall be manufactured by a firm with a minimum of 5 years successful experience in protecting pipelines exposed to the specified service conditions , and shall be able to show evidence of at least 5 installations in satisfactory operation in the United States that are similar applications to the specified service.

NTS: Edit or delete Paragraph “3” below, if not required. Paragraph “3” are intended for non-standard linings and coatings (i.e., other than cement-mortar or paint). If project does require a non-standard lining/coating consider requiring a warranty from the manufacturer on the non-standard lining/coating.

* + - 1. When not applied by the manufacturer, lining and coating Subcontractor shall have a minimum of 5 years successful experience in the application of the specified linings and coatings for similar applications for the specified service, and shall be able to show evidence of at least 5 installations in satisfactory operation in the United States.
		1. Component Supply and Compatibility:
			1. Ductile iron pipe manufacturer shall review and approve or prepare all Shop Drawings and other submittals for pipe, fittings, and appurtenances furnished under this Section.
			2. Pipe, fittings, and appurtenances shall be suitable for the specified service and shall be integrated into overall piping system by ductile iron pipe manufacturer.
			3. Ductile iron pipe manufacturer shall be responsible for all products and all factory-applied linings and coatings, whether installed at pipe manufacturer’s facility or at manufacturer’s Supplier’s facility.

NTS: Edit or delete Paragraph “C.” below, if not required. Paragraph “C” is intended for potable water use.

* + 1. Regulatory Requirements:
			1. Pipe and fittings, including linings and coatings, that will convey potable water or water that will be treated to become potable, shall be certified by an accredited organization in accordance with NSF 61 as being suitable for contact with potable water, and shall comply with requirements of authorities having jurisdiction at Site.
	1. SUBMITTALS
		1. Action Submittals: Submit the following:
			1. Product Data:
				1. Submit product data for pipe, fittings, gaskets, appurtenances, linings, and coatings.

NTS: Edit or delete Paragraph “b” below, if not required. Paragraph “b” is intended for non-standard linings and coatings (i.e., other than cement-mortar or paint)

* + - * 1. Surface preparation and application reports and procedures as required for lining and coating of pipe and fittings. Ductile iron pipe and fitting manufacturer and manufacturer and applicator of lining and coating, as specified, shall mutually determine recommended surface preparation and application methods, and provide written verification of mutually selected method in the submittals.
			1. Samples:
				1. Submit Sample of pipe and fitting with each type of lining, for use at the Site to verify continuity, surface gloss, and color, as applicable, via visual inspection.
			2. Test Procedures: For linings and coatings in pipe and fittings.
		1. Informational Submittals: Submit the following:
			1. Certificates:
				1. Submit manufacturer’s certificate of compliance with standards referenced in this Section.
				2. Submit certificate signed by applicator of the linings and coatings, if other than pipe manufacturer, stating that product to be applied conforms to applicable referenced standards and that the applicator shall conform to the Contract Documents.

NTS: Delete paragraph “c.” below, if not using for potable water.

* + - * 1. Submit manufacturer’s certificate of NSF 61 compliance for all components coming into contact with potable water.
			1. Source Quality Control Submittals:
				1. When requested by Engineer submit results of specified shop tests for pipe, fittings, linings, and coatings.
				2. When requested by Engineer submit lining and coating test coupons.
	1. DELIVERY, STORAGE, AND HANDLING
		1. Ship and store in accordance with manufacture’s recommendations.
		2. Inspect all materials during unloading process.
		3. Notify Owner of any cracked, flawed or otherwise defective material.
		4. Remove all materials from the Site that are found to be unsatisfactory.
		5. Material delivery, storage and handling must conform to requirements in Contract Documents. Refer to Section 01 65 00 Product Delivery Requirements and Section 01 66 00 Product Storage and Handling Requirements.

NTS: Edit or delete Paragraphs “B and “C” below, as required.

* + 1. Handling of Pipe and Fittings Lined with Ceramic Epoxy, Fusion Bonded Epoxy, or Glass: Lifting devices shall not come into contact with lined surfaces. Use hooks, forks, chains, straps, and other lifting devices only on exterior of pipe and fittings. Pipe and fittings with damaged lining shall be replaced regardless of cause of damage.
		2. Handling of Fittings Coated with Fusion Bonded Epoxy: Hooks, forks, chains, straps, and other lifting devices shall be rubber-coated and be used only on exterior of fittings in manner to avoid damaging coating. If coating becomes damaged, notify pipe and coating manufacturer to determine if repair of damaged area or re-coating is required. Perform repairs using recommended procedures and materials provided by manufacturer, as accepted by Engineer. Pipe and fittings requiring re-coating shall be removed from Site and returned to manufacturer’s facility. Repaired or re-coated pipe and fittings shall comply with requirements of this Section.
1. PRODUCTS

NTS: For City of Fort Wayne water projects, ductile iron pipe shall only be used for a minimum pipe size of 24” and a maximum pipe size of 54”.

* 1. MATERIALS
		1. General:
			1. Piping systems shall be suitable for their intended use.

NTS: Coordinate Contract Drawings with Section 2.1.a.2 below. The location and type of joint required shall be clearly stated on the Contract Drawings.

* + - 1. Joints shall be as specified in the Contract Documents. If not specified, provide flanged joints for exposed piping and push‑on or mechanical joints for buried piping. Provide couplings on pipe with plain or grooved ends where shown or where approved by Engineer.
		1. Ductile Iron Pipe, Joints, and Fittings:

NTS: Flanged pipe is not for buried installation. Also outside coatings for above ground installations are not recommended if pipe is to be painted. Edit Section “1” and “1.a.” below to suit project.

* + - 1. Flanged Pipe: Fabricate in accordance with AWWA C115**.**

NTS: Insert the required pressure ratings in the following section(s); coordinate with installation specification to determine the required pressure rating with corresponding nominal thickness from Table 1 in ANSI/AWWA C115. AWWA C115 flanged pipe has a maximum working pressure rating of 250 psi. Higher pressure ratings (up to 350 psi or higher) are available when using special gaskets (having molded annular rings) that have been performance tested; consult with the ductile iron pipe manufacturers for additional information and edit gasket specifications below. The thicknesses listed in the table correspond to special thickness Class (STCL) 53 for pipe diameter three-inch through 54-inch diameter. For 60- and 64-inch diameter, the thicknesses correspond to Pressure Class 350. Because flanged joints are not normally used for buried piping, edit/remove this paragraph if appropriate.

* + - * 1. Pressure Rating: As specified in on Contract Drawings. If not otherwise specified, 3 inch to 12 inch diameter pipe shall be a minimum Pressure Class 350 in accordance with AWWA C150. Water main pipe with a diameter larger than 12 inch shall be a minimum Pressure Class 250 in accordance with AWWA C150.
			1. Non-Flanged Pipe: Conform to AWWA C151 for material, pressure, dimensions, tolerances, tests, markings, and other requirements.
				1. Pressure Class:

3 inch diameter through 12 inch diameter shall be a minimum Pressure Class 350 in accordance with AWWA C150.

Larger than 12 inch diameter shall be a minimum Pressure Class 250 in accordance with AWWA C150.

* + - * 1. Special Thickness Class: As specified in piping schedules.
			1. Pipe Joints:

NTS: Specified flanges are flat (plain faced) and rated for 250 psi working pressure. However, 24-inch diameter and smaller flanged joints with ductile-iron flanges may be rated for a maximum working pressure of 350 psi with the use of special gaskets whose rating is supported by performance testing as described in Section 4.5 of ANSI/AWWA C111/A21.11. Consult with the manufacturers. They will match with ANSI B16.1, Class 125 but will not match with ANSI B16.1, Class 250. They will match with ASME/ANSI B16.5 Class 150 only, ASME/ANSI B16.42 Class 150 only (flat and 0.06-inch raised-face flanges, and AWWA C207 Class B, Class D, and Class E only. Coordinate with equipment and valves to which pipe will connect. Refer to ANSI/AWWA C115 and ANSI/AWWA C110, Appendix A, and ANSI/AWWA C111, Appendix C, for bolting and gasket requirements. Use high strength bolts (ASTM A307, Grade A) only as indicated. High strength bolts and higher-torque values should not be used with a gray-iron flange.

* + - * 1. Flanged Joints: Conform to AWWA C110 and AWWA C111 capable of meeting the pressure rating or special thickness class, and test pressure specified in piping schedule or on Contract Drawings.

NTS: Coordinate gaskets with desired pressure rating. Gaskets specified below are for a pressure rating of 250 psi. For higher pressure ratings, specify special gaskets described in the NTS above. Information on gasket suitability is online at: [http://www.dipra.org/pdf/gasketsfordip.pdf](http://www.dipra.org/pdf/gasketsForDIP.pdf).

Gaskets: Unless otherwise specified, gaskets shall be at least 1/8 inch thick, ring or full-face as required for the pipe, of synthetic rubber compound containing not less than 50 percent by volume nitrile or neoprene, and shall be free from factice, reclaimed rubber, and other deleterious substances. Gaskets shall be suitable for the service conditions specified, specifically designed for use with ductile iron pipe and fittings.

NTS: Bolts and nuts specified below have been coordinated for compatibility. Edits made below will require proper coordination for compatibility. Paragraph “2” below is referenced later in this section. Coordinate changes with all references.

Bolts: Comply with ANSI B18.2.1.

Exposed: ASTM A307, Grade B.

Buried or Submerged: ASTM A193, Grade B8M, Class 2, Heavy hex, Type 316 stainless steel.

Nuts: Comply with ANSI B18.2.2.

Exposed: ASTM A563, Grade A, Heavy hex.

Buried or Submerged: ASTM A194, Grade B8M, Heavy hex, Type 316 stainless steel.

* + - * 1. Mechanical Joints: Comply with AWWA C111 and AWWA C151, capable of meeting pressure rating or special thickness class, and test pressure specified.

Glands: Ductile iron.

Gaskets: Plain tip.

Bolts and Nuts: Cor Blue, Ble Fluoro, or approved equal.

NTS: Grooved end joints (couplings) are available in four-inch through 24-inch diameter. When used, pipe thickness shall be STCL 53 for four-inch through 16-inch diameter, STCL 54 for 18-inch, STCL 55 for 20-inch, and STCL 56 for 24-inch diameter in accordance with ANSI/AWWA C151. Coordinate required thicknesses with the piping schedules.

* + - * 1. Push‑On Joints: Comply with AWWA C111 and AWWA C151, capable of meeting pressure class or special thickness class, and test pressure specified.

Gaskets: Vulcanized SBR, unless otherwise specified.

Stripes: Each plain end shall be painted with a circular stripe to provide a guide for visual check that joint is properly assembled.

Products and Manufacturers: Provide one of the following:

Tyton or Fastite Joint by Clow Water Systems, Atlantic States Cast Iron Pipe Company, Canada Pipe Company, Ltd., McWane Cast Iron Pipe Company, Pacific States Cast Iron Pipe Company, and Griffin Pipe Products Company.

Fastite Joint by American Cast Iron Pipe Company.

Tyton Joint by U.S. Pipe and Foundry Company.

Or equal.

* + - * 1. Restrained Joints: Restrained joints shall comply with AWWA C110 or AWWA C153. Restrained push-on joints shall be capable of being deflected after full assembly. Field cuts of restrained pipe are not allowed without approval of Engineer.

NTS: When waterline is 16 inches or larger delete parts b. thru e. below.

Products and Manufacturers: Provide restrained joints by one of the following:

Megalug, Series 1100, by EBBA Iron Sales, Inc.

Romac, by RomaGrip

Sigma, by One-Lok

Star Grip 3000 Series, by Star Pipe

Or equal.

NTS: When space available for installation prevents using fittings with normal laying lengths (ANSI/AWWA C110), consider using ductile iron compact fittings (ANSI/AWWA C153), standard for which currently covers up to 64-inch diameter. Note, compact fittings are available with MJ ends in three-inch through 48-inch diameter, and flanged or push-on joint ends in 54-inch through 64-inch diameter, however, the pressure rating of 54-inch through 64-inch is 150 psi. Compact fittings are normally used for pressurized water supply piping, and can be used for wastewater piping.

* + - 1. Flanged and Push-On Joint Fittings: Comply with AWWA C110 and AWWA C111.
				1. Material: Ductile iron.
				2. Pressure rating, gaskets, bolts, and nuts shall be as specified for flanged joints. Pressure rating of fittings shall meet, but not exceed, specified pressure rating or special thickness class of the connected pipe.
			2. Mechanical Joint Fittings: Comply with AWWA C110 and AWWA C111.
				1. Material: Ductile iron.
				2. Glands: Ductile iron.
				3. Pressure rating, gaskets, bolts, and nuts shall be as specified for mechanical joints. Pressure rating of fittings shall meet, but not exceed, specified pressure rating or special thickness class of connected pipe.

NTS: ANSI/AWWA C110 does not standardize orientation of bolt holes in flanges of mechanical joint fittings. If required for harnessing or other purposes use Paragraph “d” below. Insert at (--1--) the fittings or locations or both where required. Coordinate with valves or hydrants where same orientation may be required.

* + - * 1. Mechanical Joint Bolt Holes: Orient bolt holes to straddle vertical centerline of the following fittings:

(‑‑1‑‑).

NTS: Edit or delete Paragraphs “C” or “D” below as required.

NTS: Unless otherwise specified, cement-mortar lining will be provided by manufacturer with a bituminous seal-coat as standard. Seal coat is generally intended for soft water applications that may react with the cement mortar lining to degrade drinking water quality. Services for which cement-mortar lining are commonly used are listed online at: [http://www.dipra.org/pdf/liningsfordip.pdf](http://www.dipra.org/pdf/liningsForDIP.pdf). Consider alternate lining for services involving abrasives, fluid temperatures above 150 degrees F (212 degrees F without seal coat), pH levels below 4 and above 12 (6 and 12 without seal coat), acids, industrial recycle wastes, chemicals, and scum and grease lines.

* + 1. Cement-mortar Lining:
			1. Where specified in piping schedules included in Contract Drawings, pipe and fittings shall be lined with bituminous seal coated cement‑mortar lining in accordance with AWWA C104.
		2. Specials:

NTS: Connections to old pit cast-iron pipe may require special castings not readily available from all ductile iron pipe manufacturers. Before using Paragraph “b” below, consider the possibility of Owner obtaining required data and pre-purchasing transition piece to assure timely completion of the project.

* + - 1. Transition Pieces:
				1. Provide suitable transition pieces (adapters) for connecting to existing piping.
				2. Unless otherwise shown or indicated, expose existing piping to determine material, dimensions, and other data required for transition pieces.

NTS: Drawings should show location, size and threading specification for pipe and fitting taps. Refer to additional notes to specifier at the end of this section. Coordinate threading specification with item to be attached. (e.g. corporation stop, pipe nipple, etc.).

* + - 1. Taps:
				1. Provide taps where shown or required for small-diameter piping or instrumentation connections.
				2. Provide corporation stops where shown or required.

NTS: Insert at (--1--) the number of threads. Specifier should consult with manufacturer and edit Paragraph “c” below, if bosses are required on fittings.

* + - * 1. Where pipe wall thickness or tap diameter will not allow engagement of (--1--) full threads, provide tapping saddle with outlet joints conforming to requirements of flanged joints of this Section for 4 inch through 12 inch diameter pipe, and Paragraph mechanical for 14 inch through 54 inch diameter pipe.
				2. For flanged connections on tapping saddle outlet branch, counterbore flange in accordance with MSS SP-60 dimensions. Inside diameter of outlet shall be 1/4 inch greater than nominal diameter.
			1. Tangential Outlets:
				1. Provide tangential outlet fittings where shown or indicated.
				2. Flanged and grooved end joints are not allowed.
	1. MARKING FOR IDENTIFICATION
		1. Stamp, mark, and identify push-on joint and mechanical joint pipe with:
			1. Name or trademark of manufacturer.
			2. Weight, class or nominal thickness, and casting period.
			3. Country where cast.
			4. Year the pipe was produced.
			5. Letters “DI” or “Ductile” shall be cast or metal stamped
			6. Pipe Size
		2. In addition to identification markings specified, also stamp, mark, and identify flanged pipe with:
			1. Flange manufacturer’s mark, size, and letters “DI” cast or stamped on the flanges.
			2. Fabricator’s mark if other than flange manufacturer.
			3. Length and weight.
			4. Pipe Size
		3. In addition to identification markings specified, also stamp, mark, and identify fittings with:
			1. Manufacturer’s identification.
			2. Pressure rating.
			3. Nominal diameters of openings.
			4. Country where cast.
			5. Number of degrees or fraction of the circle on bends.
			6. Letters “DI” or “Ductile” cast on them.
	2. EXTERIOR SURFACE PREPARATION AND COATINGS
		1. Buried Pipe and Fittings:
			1. Asphaltic Coating: Coat pipe and fittings with an asphaltic coating approximately 1 mil thick, in accordance with AWWA C151, AWWA C115, AWWA C110, and AWWA C153, as applicable.

NTS: Edit or delete Paragraph “2” below as required. Fusion bonded epoxy coating is typically used in above ground applications or corrosive soil or sewage applications and where cathodic disbondment protection is required. Consider after performing soils investigation.

* + - 1. Fusion Bonded Epoxy Coating for Fittings:
				1. When specified, fittings shall be factory coated with 100 percent solids, thermosetting, dry powder epoxy, in conformance with AWWA C116.
				2. Apply coating utilizing a method, recommended by manufacturer that meets requirements of this Section, with finished dry film thickness of at least 6 mils, with exception of joint areas, which shall receive at least a 4 mil dry film thickness coating. Heat and cure fittings in accordance with coating manufacturer’s recommendations.
				3. Source Quality Control: Cut a test coupon from coated fitting no less than 6 inches in diameter, and approximately four inches long, and split coupon lengthwise into 2 equal sections. Surface preparation, application procedure, thickness, and curing parameters shall be the same for test coupon as for Project fittings. Perform the following tests on test coupon:

Scribe coating material through to bare surface of fitting with an “X” across full length of test coupon. Immerse coupon for 500 hours in 150 degree F bath of distilled water. Coating shall show no signs of disbondment or blistering.

Test coupon shall be impact tested using ASTM G14 test method with 20 inch pound impact applied near center of convex section of test coupon. Coating shall show no signs of cracking or disbondment without magnification.

* + - * 1. Manufacturer’s Inspection and Certification:

All coated fittings shall be visually inspected by manufacturer and show no sign of blisters, cracks, or lack of coverage.

Check all coated fittings for coating thickness using magnetic film thickness gage utilizing method outlined in SSPC PA 2 Film Thickness Rating.

Holiday-test all coated fittings in accordance with ASTM D5162, NACE RP0188, and SSPC Painting Manual Volume 1, Paragraph XIV, with low-voltage, wet sponge holiday detector. Repair methods and materials for holidays shall be as recommended by coating manufacturer and made prior to shipment to the Site.

* + - * 1. Products and Manufacturers: Provide one of the following:

PipeClad 1500, by Valspar Corporation.

Or equal.

NTS: If project does not require the use of polyethylene encasement then delete Article “2.4” below. If removed coordinate with the requirements listed in Article “3.3” below.

* 1. POLYETHYLENE ENCASEMENT
		+ 1. Supply polyethylene in tubes or sheets.
			2. Provide polyethylene encasement for ductile iron piping to prevent contact between pipe and surrounding bedding material and backfill.
			3. Polyethylene encasement materials shall be in accordance with AWWA C105.
	2. SOURCE QUALITY CONTROL
		1. Shop Tests:
			1. Pipe manufacturer shall maintain continuous quality control program.
			2. Where applicable and when requested by Engineer, submit results of source quality control tests specified in reference standards.
1. EXECUTION
	1. INSPECTION
		1. Inspect pipe materials for defects in material and workmanship. Verify compatibility of pipe and fittings.
	2. INSTALLATION
		1. Buried Piping Installation
			1. Refer to the applicable Division 33 piping installation section.
		2. Bedding and Backfill
			1. Refer to Section 31 00 05 Trenching and Earthwork.

NTS: Specifier to consider known construction sequencing and procedures when determining pipe design. Heavy construction loading should be avoided for installed pipes with shallow cover.

* + 1. Contractor shall be responsible for verification of pipe loading during construction. Pipe design is based on final installation depth and required cover.

NTS: If using this specification section for fittings only, delete section “3.3” below. If laying pipe, keep section “3.3”. Coordinate with article “2.4” above.

* 1. POLYETHYLENE ENCASEMENT
		1. Provide polyethylene encasement for ductile iron piping to prevent contact between pipe and surrounding bedding material and backfill.
		2. Polyethylene encasement installation shall be in accordance with AWWA C105.
		3. Lumps of clay, mud, cinders etc. on the pipe surface shall be removed prior to installation of the polyethylene encasement.
		4. Polyethylene film shall be fitted to the contour of the pipe creating a snug, but not tight, encasement with the minimum space between the polyethylene and the pipe. Sufficient slack shall be provided in contouring to prevent stretching the polyethylene where it bridges irregular surfaces, such as, bell-spigot interfaces, bolted joints or fittings and to prevent damage to the polyethylene caused by backfilling operations.
		5. Overlaps and ends shall be secured with adhesive tape of plastic tie straps.
		6. Installations below the water table tube-form polyethylene should be used with both ends thoroughly sealed with adhesive tape or plastic tie straps at the joint overlaps.
		7. Circumferential wraps of tape shall be placed at 2 foot internals along the barrel of the pipe.

NTS: Coordinate article “3.4” below with project specific testing requirements listed within Section 33 11 00, Water Piping Installation. Edit the installation specification reference if a different installation (sanitary, storm) section is used. Ensure that the installation section has the applicable requirements.

* 1. FIELD QUALITY CONTROL
		1. Leakage Testing
			1. Complete pipe leakage testing; refer to Section 33 11 00, Water Piping Installation.
		2. Disinfection
			1. Complete pipe disinfection; refer to Section 33 11 00, Water Piping Installation.

+ + END OF SECTION + +