Section 02501

DUCTILE IRON PIPE AND FITTINGS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Ductile iron pipe and fittings for water lines, wastewater force mains, gravity sanitary sewers, and storm sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for ductile iron pipe and fittings under this Section, with the exception of extra fittings in place. Include cost in unit prices for work as specified in the following Sections, as applicable:

   a. Section 02511 - Water lines

   b. Section 02531 - Gravity Sanitary Sewers

   c. Section 02532 - Sanitary Sewage Force Mains

   d. Section 02631 - Storm Sewers

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Extra Ductile Iron Compact Fittings in Place shall be for additional fittings required to complete job. This is not to exclude extension of pipe across driveway or intersection for purpose of terminating line in more advantageous position. This determination shall be at discretion of City Engineer. This bid item includes additional fittings as may be necessary to complete job in conformance with intent of Drawings.

C. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. ANSI A 21.4 (AWWA C 104) - Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings, for Water.

B. ANSI A 21.10 (AWWA C 110) - Standard for Ductile-Iron and Gray-Iron Fittings, 3-in. through 48-in.

C. ANSI A 21.11 (AWWA C 111) - Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

D. ANSI A 21.15 (AWWA C 115) - Standard for Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges.

E. ANSI A21.16 (AWWA C 116) - Protective Fusion Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey iron Fittings for Water Supply Service.

F. ANSI A 21.50 (AWWA C 150) - Standard for Thickness Design of Ductile-Iron Pipe.

G. ANSI A 21.51 (AWWA C 151) - Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water and Other Liquids.

H. ANSI A 21.53 (AWWA C 153) - Standard for Ductile Iron Compact Fittings, 3 inches through 24 inches and 54 inches through 64 inches for Water Service.

I. ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

J. ASTM D 1248 - Standard Specification Polyethylene Plastics Molding and Extrusion Materials for Wire and Cable.

K. ASTM F 477 - Elastomeric Seals (gaskets) for Joining Plastic Pipe.

L. ASTM G 62 - Standard Test Methods for Holiday Detection in Pipeline Coatings.

M. AWWA C 102 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

N. AWWA C 300 - Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and other Liquids.

O. AWWA C 600 - Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

P. SSPC-SP 6 - Steel Structures Painting Council, Commercial Blast Cleaning.

Q. American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering.

R. American Association of State Highway Transportation Officials (AASHTO).

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. For pipes 24 inches and greater submit shop drawings signed and sealed by Professional Engineer registered in State of Texas showing the following:

1. Manufacturer’s pipe design calculations.

2. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, fitting, flange, and special details, with plan and profile view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, restrained joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to Drawings. Do not start production of pipe and fittings prior to review and approval by City Engineer. Provide final approved lay schedule on CD-ROM in Adobe portable document format (*.PDF).

3. Calculations and limits of thrust restraint.

4. Class and length of joint.

C. Submit manufacturer's certifications that ductile iron pipe and fittings meet provisions of this Section and have been hydrostatically tested at factory and meet requirements of ANSI A 21.51.

D. Submit certifications that pipe joints have been tested and meet requirements of ANSI A 21.11.

E. Submit affidavit of compliance in accordance with ANSI A21.16 for fittings with fusion bonded epoxy coatings or linings.

PART 2 P R O D U C T S

2.01 DUCTILE IRON PIPE

A. Ductile Iron Pipe Barrels: ANSI A 21.15, ANSI A 21.50 or ANSI A 21.51; bear mark of Underwriters' Laboratories approval; minimum thickness Class 51 for water lines and thickness Class 52 for sanitary sewers, or as shown on Drawings. Provide minimum thickness Class 53 for flanged pipe, and minimum thickness Class 52 for areas with pipe offset sections.

B. Provide pipe sections in standard lengths, not less than 18 feet long, except for special fittings and closure sections as indicated on shop drawings.

C. Modify pipe for cathodic protection in accordance with Section 13111 - Cathodic Protection

for Pipelines. In lieu of furnishing ductile iron pipe for water lines with cathodic protection system, furnish ductile iron pipe with polyethylene encasement, provided the following criteria is met:

1. Provide minimum thickness class of 51.

2. Provide polyethylene encasement material and installation in accordance with AWWA C105, and backfill as specified. Minimum of two complete wraps of 8-mil-thick polyethylene.

3. Use polyethylene encasement for open cut installations only. For augered sections or sections installed inside a casing, provide coating in accordance with paragraph 2.05 D.1.

4. Adhere to other requirements specified herein (e.g., insulation kits, etc.).

D. For use of pressure class pipe for water lines, design pipe and fittings to withstand most critical simultaneous application of external loads and internal pressures. Base design on minimum of AASHTO HS-20 loading, AREMA E-80 loads and depths of bury as indicated on Drawings. Design pipes with Marston's earth loads for a transition width trench for zero to 16 feet of cover. Use Marston's earth loads for a trench width of O.D. (of pipe) + 4 feet for pipe greater than 16 feet of cover. Use Marston's equations for a trench condition in both open-cut and tunnel applications. Design for most critical groundwater level condition. Pipe design conditions:

1. Working pressure = 100 psi.

2. Hydrostatic field test pressure = 150 psi.

3. Maximum pressure due to surge = 150 psi.

4. Minimum Pressure due to surge = -5 psi.

5. Design tensile stress due to surge or hydrostatic test pressure: No greater than 50% minimum yield.

6. Design bending stress due to combined earth loads and surge or hydrostatic test pressure: No greater than 48,000 psi.

7. Unit weight of fill $\underline{\$}$ 120 pcf.
8. Deflection lag factor (D_l) = 1.2.

9. Bedding constant (K) = 0.1.

10. Moment coefficient = 0.16.

11. Fully saturated soil conditions hw=h=depth of cover above top of pipe.

E. Hydrostatic Test of Pipe: AWWA C 151, Section 5.2.1, at point of manufacture. Hold test for a minimum 2 minutes for thorough inspection of pipe. Repair or reject pipe revealing leaks or cracks.

F. Pipe Manufacturer for large diameter water lines: Minimum of 5 years of successful pipe installations in continuous service. Manufacturer must maintain on site or in plant enough fittings to satisfy the following requirements:

Line Diameter	Required Bends*
20 and 24 inches	Four 45E bends per 5,000 LF of water line
> 24 inches	Four 22.5E bends per 10,000 LF of water line
*Based on total length of contract (minimum of four). Any combination of bends may be substituted at manufacturer's option (i.e. two 22.5E bends are equivalent to one 45E bend) and will be counted as one fitting.	

Manufacturer or supplier must be capable of delivering bends to job site within 12 hours of notification. Use fittings at direction of City Engineer where unforeseen obstacles are encountered during construction. These fittings are in addition to any fittings called out in construction documents and must be available at all times.

G. Provide flange adapter with insulating kit as required when connecting new piping to existing piping and piping of different materials, unless otherwise approved by City Engineer.

H. Clearly mark pipe section to show location and thickness/pressure class color coded.

2.02 JOINTS

A. Joint Types: ANSI A 21.11 push-on; ANSI A 21.11 mechanical joint; or ANSI A 21.16 flanged end. Provide push-on joints unless otherwise indicated on the Drawings or required by these specifications. For bolted joints, conform to requirements of AWWA C111; provide minimum 304 stainless steel for restraint joints.

B. Where restrained joints for buried service are required by Drawings, provide one of the following, or equal:

1. Super-Lock by Clow Corporation.

2. Flex-Ring or Lok-Ring by American Cast Iron Pipe Company.

3. TR-Flex or Field Lok by U.S. Pipe and Foundry Company.

4. One Bolt by One Bolt, Inc. (4 to 12 inches)

5. Sur-Grip by JCM Industries. (4 to 12 inches)

C. Threaded or grooved-type joints which reduce pipe wall thickness below minimum required are not acceptable.

D. Provide for restrained joints designed to meet test pressures required under Section 02515 - Hydrostatic Testing of Pipelines or Section 02532 - Sanitary Sewer Force Mains, as applicable. Provide restrained joints for test pressure or maximum surge pressure as specified, whichever is greater for water lines. Do not use passive resistance of soil in determining minimum restraint lengths.

E. Bond rubber gasketed joints to provide electrical continuity along entire pipeline, except where insulating flanges are required by Drawings.

F. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer for pipe joints or restraint joints. Submit details of other methods of providing curves and bends for consideration by City Engineer. When other methods are deemed satisfactory, install at no additional cost to City.

2.03 GASKETS:

A. Furnish, when no contaminant is identified, plain rubber (SBR) gasket material in accordance with ANSI A21.11 or ASTM F 477 (One Bolt only); for flanged joints 1/8-inch-thick gasket in accordance with ANSI A 21.15.

B. For pipes to be installed in potentially contaminated areas, see Specification Section 02105 - Sampling and Analysis in PPCA.

2.04 FITTINGS

A. Use fittings of same size as pipe. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Make reductions in piping size by reducing fittings. Line and coat fittings as specified for pipe they connect to.

B. Push-on Fittings: ANSI A 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.

C. Flanged Fittings: ANSI 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.

D. Mechanical Joint Fittings: ANSI A 21.11; pressure rated at 250 psi.

E. Ductile Iron Compact Fittings for Water lines: ANSI A 21.53; 4-inch through 12-inch diameter fusion bonded epoxy-lined or cement mortar lining.

2.05 COATINGS AND LININGS

A. Water line Interiors: ANSI A21.4, cement lined with seal coat; ANSI A 21.16 fusion bonded epoxy coating for interior.

B. Sanitary Sewer and Force Main Interiors:

1. Preparation: Commercial blast cleaning conforming to SSPC-SP6.

2. Liner thickness: Nominal 40 mils, minimum 35 mils, for pipe barrel interior; minimum 6 to 10 mils at gasket groove and outside spigot end to 6-inches back from end.

3. Testing: ASTM G 62, Method B for voids and holidays; provide written certification.

4. Acceptable Lining Materials:

a. Virgin polyethylene conforming to ASTM D 1248, with inert fillers and carbon black to resist ultraviolet degradation during storage heat bonded to interior surface of pipe and fittings; APolyline@ by American Cast Iron Pipe Company; or equal.

b. Polyurethane: Corro-pipe II by Madison Chemicals.

c. Ceramic Epoxy: Protecto-401 by Enduron Protective Coatings.

C. Sanitary Sewer Point Repair Pipe: For pipes which will be lined with high density polyethylene liner pipe or cured-in-place liner, provide cement-lined with seal coat in accordance with ANSI A 21.4. For pipes which will not be provided with named liner, provide pipe as specified in Paragraph 2.05B, Sanitary Sewer and Force Main Interiors.

D. Exterior:

1. Water Lines

a. Tunnel, Casing or Auger Holes: Conform to requirements of Section 02527 - Polyurethane Coatings on Steel or Ductile Iron Pipe.

b. Above Ground (or Exposed): Conform to requirements of Section 02502 - Steel Pipe and Fittings, Paragraph 2.03.

c. Direct Bury: Conform to requirements of Paragraph 2.05E or Section 02527 - Polyurethane Coatings on Steel or Ductile Iron Pipe as required herein.

2. Sanitary Sewers: Prime coat and outside asphaltic coating conforming to ANSI

A21.10, ANSI A21.15, or ANSI A21.51 for pipe and fittings in open cut excavation and in casings.

E. Polyethylene Wrap: For buried water lines not cathodically protected and sanitary sewers, including point repairs, provide polyethylene wrap unless otherwise specified or shown. Conform to requirements of Section 02528 - Polyethylene Wrap.

F. For flanged joints in buried service, provide petrolatum wrapping system, Denso, or equal, for the complete joint and alloy steel fasteners. Alternatively, provide bolts made of Type 304 stainless steel.

G. Pipe to be installed in potentially contaminated areas shall have coatings and linings recommended by the manufacturer for maximum resistance to the contaminants identified in the Phase II Environmental Site Assessment Report.

H. For water lines cathodically protected, supply ductile iron pipe with either tape coatings or some other bonded dielectric coating as specified in Section 02518 - Steel Pipe and Fittings for Large Diameter Water Lines.

2.06 MANUFACTURERS

A. Use pre-approved manufacturers listed in City of Tomball approved products.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Conform to installation requirements of Sections 02511 - Water Lines, 02531 - Gravity Sanitary Sewers, 02532 - Sanitary Sewer Force Mains 02561 - Storm Sewers and 02553 - Point Repairs and Obstruction Removal, except as modified in this Section.

B. Install in accordance with AWWA C 600 and manufacturer's recommendations.

C. Install all ductile iron pipe in polyethylene wrap, unless cathodic protection is provided. Do not use polyethylene wrap with a cathodic protection system.

D. Holiday Testing.

1. Polyurethane: Conform to requirements of Section 02527 - Polyurethane Coatings for Steel or Ductile Iron Pipe.

2. Fusion Bonded Epoxy: Conform to requirements for new fittings in ANSI A 21.16.

3.02 FIELD REPAIR OF COATINGS

A. Polyurethane: Conform to requirements of Section 02527 - Polyurethane Coatings for Steel or

Ductile Iron Pipe.

B. Fusion Bonded Epoxy: Conform to requirements for new fittings in ANSI A 21.16.

END OF SECTION