Section 02620 - DUCTILE IRON PIPE

1. SCOPE. This section covers ductile iron pipe. Ductile iron pipe shall be furnished complete with all fittings, jointing materials, blocking, encasement, and other necessary appurtenances.

Piping furnished hereunder shall be complete with all joint gaskets, bolts, and nuts required for installation of valves and equipment furnished by others for installation under this contract.

Pipe shall be tested in accordance with the pipeline pressure and leakage testing section.

Pipe trenching, bedding, and backfill are covered in the earthwork section.

2. MATERIALS.

Pipe	Ductile iron, ANSI/AWWA C151/A21.51; thickness class as listed in the table at the end of this section.
Fittings	
Material, Dimensions, and Manufacture	Ductile iron, ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53.
Push-on and Mechanical Joint	
24 Inch and Smaller	350 psi pressure rating.
30 Inch and Larger	250 psi pressure rating.
Flanged	250 psi pressure rating.
Push-on Joints	ANSI/AWWA C111/A21.11, except gaskets shall be neoprene or other synthetic rubber. Natural rubber will not be acceptable.
Restrained Push-on Joints (4-inch through 12-inch)	American “Fast-Grip” or U.S. Pipe “Field Lok Gasket”.

Restrained Push-on Joints (4-inch through 20-inch)	EBAA Iron “Megalug” Series 1700, or U.S. Pipe “Field Lok Gasket” without exception.
Restrained Push-on Joints (4-inch through 64 inch)	American "Flex-Ring", "Lok-Fast", or "Lok-Ring"; Clow "Super-Lock"; U.S. Pipe "TR Flex"; or Griffin "Snap-Lok". Use of setscrews bearing on the pipe wall will not be acceptable.
Flanged Joints	ANSI/AWWA C115/A21.15.
Flanges	Ductile iron, ANSI/AWWA C115/A21.15, flat faced with shallow serrations.
Bolts	ASTM A307, chamfered or rounded ends projecting 1/4 to 1/2 inch beyond outer face of nut.
Nuts	ASTM A307, hexagonal, ANSI/ASME B18.2.2, heavy semi-finished pattern.
Gaskets	ASTM D1330, Grade I rubber, full face type, 1/8-inch thick.
Mechanical Joints	ANSI/AWWA C111/A21.11, except gaskets shall be neoprene or other synthetic rubber. Natural rubber will not be acceptable. See Push-on Joints for restraining.
Mechanical Joints with Tie Rods	See details at the end of this section.
Tie Rods	ASTM A307.
Steel Pipe	ASTM A53, standard weight.
Washers	ANSI B18.22.1, plain steel.
Grooved Couplings	AWWA C606.

Pipe Ends	Grooved, with dimensions conforming to AWWA C606, Table 5, for rigid joints.
Couplings, through 24-inch psi pressure	Victaulic "Style 31".
Threaded Connections	ANSI/ASME B1.20.1, NPT; provide boss or tapping saddle wherever wall thickness minus the foundry tolerance at the tapped connection is less than that required for 4-thread engagement as set forth in Table A.1, Appendix A, of ANSI/AWWA C151/A21.51.
Mechanical Couplings	
Couplings	Dresser "Style 53".
Gaskets	Oil-resistant synthetic rubber.
Shop Coating and Lining	
Cement Mortar Lining	ANSI/AWWA C104/A21.4, and Fed Spec WW-P421-C.
Asphaltic Coating	Manufacturer’s standard.
Coal Tar Coating	Thixotropic coal tar, MIL-C-18480; Kop-Coat "Bitumastic No. 50" or Tnemec "46-450 Heavy Tnemecol".
Conductive Tracer	#12 plastic coated solid copper wire connected to the pipe at valves. See standard drawings for installation at valve boxes.
Location Tape	Non-Metallic location tape shall be placed 1 foot above mains.

Polyethylene Tube	Seamless, ANSI/AWWA C105/A21.5, installation method A if required in Special Conditions.

3. SHOP COATING AND LINING. The interior of all pipe and fittings for water service shall be cement mortar lined. The interior of all sewer pipe and fittings shall have 1 mil of asphaltic lining.

Exterior surfaces of all pipe and fittings shall be asphaltic coated.

4. HANDLING. Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in sound, undamaged condition. Equipment, tools, and methods used in handling and installing pipe and fittings shall not damage the pipe and fittings. Hooks inserted in ends of pipe shall have broad, well-padded contact surfaces.

Pipe and fittings in which the lining has been damaged shall be replaced. With the concurrence of the Engineer, small and readily accessible damaged areas may be repaired.

All pipe coating which has been damaged shall be repaired by the Contractor before the pipe is installed.

5. CUTTING PIPE. Cutting shall be done in a neat manner, without damage to the pipe or the lining. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed with a file or power grinder to remove all roughness and sharp edges. The cut ends of push-on joint pipe shall be suitably beveled.

Ends of ductile iron pipe shall be cut with a portable guillotine saw, abrasive wheel, saw, milling cutter, or oxyacetylene torch. The use of hydraulic squeeze type cutters will not be permitted. Field-cut holes for saddles shall be cut with mechanical cutters; oxyacetylene cutting will not be permitted.

6. CLEANING. The interior of all pipe and fittings shall be thoroughly cleaned of all foreign matter prior to installation and shall be kept clean until the work has been accepted. Before jointing, all joint contact surfaces shall be wire brushed if necessary, wiped clean, and kept clean until jointing is completed.

Precautions shall be taken to prevent foreign material from entering the pipe during installation. Debris, tools, clothing, or other materials shall not be placed in or allowed to enter the pipe.

Whenever pipe laying is stopped, the open end of the pipe shall be sealed with a watertight plug which will prevent trench water from entering the pipe.

7. INSPECTION. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation; spigot ends shall be examined with particular care. All defective pipe and fittings shall be removed from the site of the work.

8. ALIGNMENT. Piping shall be laid to the lines and grades indicated on the Drawings. Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the values stipulated in Table 4 or Table 5 of AWWA C600, unless specially designed bells and spigots are provided.

Either shorter pipe sections or fittings shall be installed where required to conform to the alignment or grade indicated on the Drawings.

If laser beam equipment is used, periodic elevation measurements shall be made with surveying instruments to verify accuracy of grades. If such measurements indicate thermal deflection of the laser beam due to differences between ground temperature and the air temperature within the pipe, precautions shall be taken to prevent or minimize further thermal deflections.

9. LAYING PIPE. Pipe shall be protected from lateral displacement by placing the specified pipe embedment material. Under no circumstances shall pipe be laid in water, and no pipe shall be laid under unsuitable weather or trench conditions.

Pipe shall be laid with the bell ends facing the direction of laying, except when reverse laying is specifically authorized by the Engineer.

Prior to final acceptance by the Owner, Contractor shall perform continuity tests on the conductive tracer to ensure proper installation. All defective areas shall be repaired and the conductive tracer retested.

10. FIELD JOINTS. Joints in buried locations shall be mechanical joint or push-on type unless otherwise indicated on the Drawings. Bells on wall castings and wall sleeves shall be mechanical joint type with tapped holes for tie rods or stud bolts. All other joints shall be flanged unless otherwise indicated on the Drawings.

All push-on and mechanical joint valves, tees, Y-branches, bends, and plugs installed in buried locations shall be restrained r by restrained push-on or mechanical joints.

Where permitted by the Engineer, grooved couplings may be used in lieu of flanges, provided rigid grooving is used to preclude longitudinal pipe movement and angular deflection at joints. Fittings, valves, and other items of equipment installed using grooved couplings shall be adequately supported and blocked or restrained as required to prevent rotation.

11. MECHANICAL JOINTS. Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Bolts shall be uniformly tightened to the torque values listed in Appendix A of ANSI/AWWA C111/A21.11. Overtightening of bolts to compensate for poor installation practice will not be permitted.

The holes in mechanical joints with tie rods shall be carefully aligned to permit installation of the tie rods. In flange and mechanical joint pieces, holes in the mechanical joint bells and the flanges shall straddle the top (or side for vertical piping) center line. The top (or side) center line shall be marked on each flange and mechanical joint piece at the foundry.

12. PUSH-ON JOINTS. The pipe manufacturer's instructions and recommendations for proper jointing operations shall be followed. All joint surfaces shall be lubricated with heavy vegetable soap solution immediately before the joint is completed. Lubricant shall be suitable for use in potable water, shall be stored in closed containers, and shall be kept clean. Each spigot end shall be suitably beveled to facilitate assembly.

Pipe ends for restrained joint pipe shall be prepared in accordance with the pipe manufacturer's recommendations.

13. FLANGED JOINTS. Pipe shall extend completely through screwed-on flanges. The pipe end and flange face shall be finish machined in a single operation. Flange faces shall be flat and perpendicular to the pipe center line.

When bolting flanged joints, care shall be taken to avoid restraint on the opposite end of the pipe or fitting, which would prevent uniform gasket compression or which would cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually and at a uniform rate, to ensure uniform compression of the gasket.

Special care shall be taken when connecting to pumping equipment to ensure that pipe stresses are not transmitted to the pump flanges. All such piping shall be permanently supported so that accurate matching of bolt holes and uniform contact over the entire surface of abutting pump and piping flanges are obtained before installation of any bolts in those flanges. In addition, pump connection piping shall be free to move parallel to its longitudinal center line while the flange bolts are being tightened.

Each pump shall be leveled, aligned, and wedged into position to fit the connecting piping, but shall not be grouted until the initial fitting and alignment of the pipe so that the pump may be shifted on its foundation as necessary. Each pump shall be grouted before final bolting of the connecting piping.

14. MECHANICAL COUPLINGS. Mechanical couplings shall be carefully installed in accordance with the manufacturer's recommendations. A space of at least 1/4 inch and not more than 1 inch shall be left between the pipe ends. Pipe and coupling surfaces which contact gaskets shall be clean and free from dirt and other foreign matter during assembly. All assembly bolts shall be uniformly tightened so that the coupling is free from leaks and all parts of the coupling are square and symmetrical with the pipe. Following installation of the coupling, damaged areas of shop coatings on the pipe and coupling shall be repaired to the satisfaction of the Engineer.

The interior surfaces of the middle rings shall be prepared for painting in accordance with instructions of the paint manufacturer and shall then be coated with liquid epoxy in accordance with ANSI/AWWA C210. The remaining components shall be cleaned and shop primed with the manufacturer's standard rust-inhibitive primer.

15. GROOVED END JOINTS. Grooved couplings shall be installed in accordance with the coupling manufacturer's recommendations. Completed joints shall be rigid and shall not allow angular deflection or longitudinal movement. Except for closure pieces, field grooving of pipe will not be permitted.

Special care shall be taken when connecting to pumping equipment to avoid transmitting pipe stresses to the pump flanges. Piping shall be permanently supported so that accurate matching of piping and abutting pump flanges is obtained before any bolts are installed in the flanges.

16. REDUCERS. Where indicated on the Drawings, reducers shall be eccentric pattern, installed with the straight side on top so that air traps are not formed. All other reducers shall be concentric pattern.

17. OUTLETS. Where a 12 inch or smaller branch outlet is indicated and the diameter of the line pipe is at least twice the diameter of the branch, either a tee, factory welded-on boss, or a tapping saddle will be acceptable.

Connection of gauges to 6 inch and smaller cast iron pipe shall be made using a tapping saddle, or a tee complete with blind flange drilled and tapped to accept the gauge piping specified. Connection of gauges to 8 inch and larger piping shall be made by means of a factory welded-on boss or a tapping saddle. Drilling and tapping of the pipe wall will also be acceptable provided the wall thickness, minus the foundry tolerance, at the point of connection equals or exceeds the wall thickness required for 4-thread engagement in accordance with Table A.1, Appendix A, of ANSI/AWWA C151/A21.51.

18. CONNECTIONS WITH EXISTING PIPING. Connections between new work and existing piping shall be made using fittings suitable for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by the Owner. Facilities shall

be provided for proper dewatering and for disposal of all water removed from the dewatered lines and excavations without damage to adjacent property.

Special care shall be taken to prevent contamination when dewatering, cutting into, and making connections with existing potable water piping. Trench water, mud, or other contaminating substances shall not be permitted to enter the lines. The interior of all pipe, fittings, and valves installed in potable water connections shall be thoroughly cleaned and then swabbed with, or dipped in, chlorine solution having a chlorine content of 200 milligrams per liter.

19. CONCRETE ENCASEMENT. Concrete encasement shall be installed as indicated on the details and Drawings. Concrete and reinforcing steel shall be as specified in the cast-in-place concrete section. All pipe to be encased shall be suitably supported and blocked in proper position, and shall be anchored to prevent flotation.

20. REACTION ANCHORAGE AND BLOCKING. All exposed piping with mechanical couplings, push-on or mechanical joints, or similar joints subject to internal pressure shall be blocked, anchored, or harnessed to preclude separation of joints. All push-on and mechanical joint tees, Y-branches, bends deflecting 22-1/2 degrees or more, and plugs which are installed in buried piping (subjected to internal hydrostatic heads in excess of 30 feet) shall be provided with suitable reaction blocking, anchors, joint harness, or other acceptable means for preventing movement of the pipe caused by internal pressure. Regardless of the restraining system provided, all valves, tees, Y-branches, bends, and plugs shall be restrained with tie rods or by restrained push-on joints.

Concrete blocking shall extend from the fitting to solid undisturbed earth and shall be installed so that all joints are accessible for repair. The dimensions of concrete reaction blocking shall be as indicated on the Drawings or as directed by the Engineer. If adequate support against undisturbed ground cannot be obtained, metal harness anchorages shall be installed to provide the necessary support. Metal harness anchorages shall consist of steel rods extending across the joint and securely anchored to pipe and fitting, or other adequate anchorage facilities shall be installed to provide the necessary support. If the lack of suitable solid vertical excavation face is due to improper trench excavation, metal harness anchorages shall be furnished and installed by and at the expense of the Contractor.

Reaction blocking, anchorages, or other supports for fittings installed in fills or other unstable ground, installed above grade, or exposed within structures shall be provided as required by the Drawings or as directed by the Engineer.

All ferrous metal clamps, rods, bolts, and other components of tapping saddles, reaction anchorages, or joint harness, subject to submergence or contact with earth or other fill material and not encased in concrete, shall be protected from corrosion by two coats of thixotropic coal tar applied in the field to clean, dry metal surfaces. The first coat shall

be dry and hard before the second coat is applied. Metal surfaces exposed above grade or within structures shall be painted with one prime coat and two finish coats of a paint acceptable to the Engineer.

21. DIMENSIONS. The thickness class for ductile iron pipe shall be as indicated in the following table:

Location	Nominal Size inches	ANSI/AWWA Pressure Class	Minimum Thickness Class
Water	3 to 12	350	N/A
Water	16 and larger	250 or as otherwise required	N/A
Wastewater	All sizes	N/A	50

Note

The specified pressure class includes corrosion allowance and foundry tolerance.

Pipe wall thickness for threaded pipe shall be increased if necessary to comply with the following minimum thicknesses:

Pipe Size	Minimum Thickness Class Threaded Ends (1)	Minimum Thickness Class Grooved Ends (2)
4-16 inch	53	53
18 inch	53	54
20 inch	53	55
24 inch and larger	53	56

(1) Complies with ANSI/AWWA C115/A21.15 for minimum pipe wall thickness for threaded flanges.

(2) Grooved couplings are cataloged through 24 inch; larger sizes require cast-on or threaded-on shoulders.

22. DRAWINGS AND DATA. Complete layout drawings, details, and specifications covering all ductile iron piping and accessories shall be submitted in accordance with the submittals section.

Submittal data shall clearly indicate the country of origin of pipe, fittings, restraining devices, and accessories. When requested by the Engineer, certified copies of physical and chemical test results shall be submitted for the materials to be provided.

End of Section