Section 6

Wastewater Force Mains
Ductile Iron Pipe (DIP) and Fittings

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6.01 General

A. DIP shall be allowed for use as wastewater force main pipe where compatible with the specific conditions of the project. The use of material other than ductile iron may be required by IRCDUS during construction permit review or by IRCDUS field personnel during construction, if it is determined that DIP is unsuitable for the particular application.

B. All DIP shall be manufactured in accordance with AWWA Standard Specifications C151/A21.51 and C151/A51, or latest revisions, and shall be pressure Class 300 or 350 minimum as depicted on Table 6.1 on page 6-2. All DIP crossings under roadways and other traffic areas shall be pressure Class 350 minimum.

C. Unless specifically indicated otherwise, restrained push-on underground piping shall be manufactured bell and spigot and above ground piping shall be flanged.

D. Cutting of DIP shall be by sawing.

E. All exposed DIP shall be painted “green” per Approved Manufacturers’ Products List.

6.02 Pipe

A. DIP shall be bell and spigot cast in accordance with AWWA Standard Specifications C150/A21.50and C151/A51, latest revisions. Cast DIP shall have a minimum tensile strength of 60,000 psi with a minimum yield strength of 42,000 psi. Pipe wall thicknesses shall be computed in accordance with AWWA Standard Specification C150/A21.50, latest revision, using the physical characteristics cited above with a minimum working pressure of 300 psi and a Laying Condition “Type 2.” Unless otherwise indicated or specified herein, the pipe shall have the minimum wall thickness according to class designation for diameters shown. All pipe shall be given a minimum factory hydrostatic test of 500 pounds per square inch.

TABLE 6.1
Pressure Class 300 and 350

Nominal Size Diameter (Inches)	Actual Outside Diameter (Inches)	300 PSI Wall Thickness (Inches)	350 PSI Wall Thickness (Inches)
3	3.96	---	0.25
4	4.80	---	0.25
6	6.90	---	0.25
8	9.05	---	0.25
10	11.10	---	0.26
12	13.20	---	0.28
14	15.30	0.30	0.31
16	17.40	0.32	0.34
18	19.50	0.34	0.36
20	21.60	0.36	0.38
24	25.80	0.40	0.43
30	32.00	0.45	0.49
36	38.30	0.51	0.56
42	44.50	0.52	0.63
48	50.80	0.64	0.70
54	57.56	0.72	0.79
60	61.61	0.76	0.83
64	65.67	0.80	0.87

6.03 Fittings

A. All underground fittings shall be either push-on, restrained, or mechanical joint. Mechanical joints shall conform to AWWA Standard Specification C110/A21.10) or C153/A21.53), or latest revisions. All aboveground fittings shall be flanged joint.

B. The pressure rating shall be 350 psi (Class 350 Pipe).

C. All fittings shall be lined with the same material as specified for the pipe, as per paragraph 6.04.

D. Joint restraints, when required, shall be in accordance with IRCDUS Approved Manufacturers' Products List or approved equal.

6.04 Lining and Coating

A. Unless otherwise indicated, all DIP shall be factory lined and coated.

B. For 4 inches and larger, the interior protective coating shall be an amine cured novalac epoxy (Protecto 401 or similar). The epoxy material shall be applied in 1 coat with a minimum dry film

thickness of 40.0 mils, in accordance with IRCDUS Approved Manufacturers' Products List

C. Unless otherwise specified, the exterior of the pipe shall have a bituminous coating to a minimum dry film thickness of 1.0 mil. See Approved Manufacturers' Products list for coating material.

D. Lining Inspection:

1. All DIP and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined SSPC-PA-2 film thickness rating.

2. The interior lining of all pipe and fittings shall be tested for pinholes with a nondestructive 2,500-volt test.

3. Each pipe joint and fitting shall be marked with the date of application of the lining system and with its numerical sequence of application on that date.

E. The pipe or fitting manufacturer must supply a certificate attesting to the fact that the applicator met the requirements of this specification, and that the material used was as specified, and that the material was applied as required by the specification.

F. Anywhere that the coating is removed purposely or accidentally, the area shall be cleaned of any rust, grease, and dirt and re-coated to a minimum dry film as specified for the individual piece.

G. If and when directed by IRCDUS's Engineer, a polyethylene encasement shall be provided around pipe, fittings, and valves. The material, installation, and workmanship shall conform to applicable sections of AWWA Standard Specifications C105/A21.5-99, or latest revision. Installation methods A or B shall be employed using flat tube polyethylene. The Contractor shall make provisions to keep the polyethylene from direct exposure to sunlight prior to installation. Backfilling following installation shall be completed without delay to avoid exposure to sunlight.

6.05 Bell and Spigot Connections

A. Joints in bell and spigot pipe shall be push-on, mechanical, or restrained joints in accordance with AWWA Standard Specifications C111/A21.11-00, or latest revision. Pipe restraints shall also be in accordance with IRCDUS Standards or as directed by IRCDUS's Engineer.

6.06 Flanged Connections

A. All flanged pipe barrels shall comply with the physical and chemical requirements as set forth in the Handbook of Ductile Iron Pipe Research Association. Flanges shall be in accordance with ANSI Specification B16.1 for Class 125 flanges. Bolts shall be 316 stainless steel and comply with ANSI Specification B18.2.

B. Flanged pipes shall be faced and drilled to the American Standard Drilling, unless special drilling is called for or required. Where tap or stud bolts are required, flanges shall be tapped. Flanges shall be accurately faced and drilled smooth and true, at right angles to the pipe axis, and shall be covered with zinc dust and tallow or a rust preventive compound immediately after facing and drilling.

C. Flanged pipe with screwed-on flanges shall be furnished with long hubs, and the flanges shall be screwed on the threaded end of the pipe in the shop and the face of the flange and end of pipe refaced together. There shall be no leakage through the pipe threads and the flanges shall be designed to prevent corrosion of the threads from outside.

D. Flanged joints shall be made with bolts or stud bolts and nuts. Bolts, stud bolts, and nuts shall conform to American Standard heavy dimensions, semi-finished with square or hexagonal heads and cold punched hexagonal nuts, 316SS. Bolt sizes shall be American Standard for the flanges specified, and bolts and nuts shall have good, true threads.

E. Gaskets shall be in accordance with AWWA Standard Specifications C115/A21.15 latest revision.

6.07 Submittals

A. Before starting fabrication of the DIP and fittings, the Contractor shall submit one set of complete working drawings (shop drawings) to the Engineer of Record and IRCDUS for approval. Such drawings shall show the pipe, fittings, valves, expansion joints, hangers, supports, and other appurtenances to be installed. Where special fittings are required, they shall be shown in large detail with all the necessary dimensions. The Engineer of Record shall review the drawings and notify IRCDUS of the drawings approved and not approved. IRCDUS shall also review the drawings and coordinate approvals and disapprovals with the Engineer of Record and Contractor. The drawings submitted shall show flanged jointed sections placed so as to be removable without disturbance to the main pipe sections.

6.08 Marking

A. Number 10 stranded conductor copper trace wire shall be spiral wrapped or affixed to the top of the pipe. See Trace Wire Details Drawing M-14 for specifications regarding installation.

B. Trace Wire is required over or around all pipes.

C. Location tape is required over all pipes. Tape is to be installed 12" below proposed finished grade and additional tape shall be adhered directly on top of the pipe if required by IRCDUS engineering.

6.09 Installation

A. Handling and Protection of Pipe: Unless otherwise noted on the drawings or in other sections of this specification, the pipe shall be handled and installed in strict accordance with the manufacturers' instructions. The Contractor shall use every precaution during construction to protect the pipe against the entry of non-potable water, dirt, wood, small animals, and any other foreign material that would hinder the operation of the pipeline. Where the groundwater elevation is above the bottom of the trench, the Contractor shall provide suitable dewatering equipment at no additional cost to the IRCDUS. All piping shall be placed in a dry trench, unless IRCDUS approves wet trench installation.

B. Depth of Cover and Pipe Elevation: Unless otherwise shown on the drawings, or otherwise authorized by the Engineer, all pipe shall have a minimum cover of 36 inches. Contractor shall determine top of pipe elevation and top of ground elevation for every two joints of pipe installed using a level. Pipe must have the minimum cover described above and must be within +/- 0.2 feet of the top of pipe elevation indicated on the drawings. Installed pipe, which does not meet these requirements, shall be reinstalled until it does meet these requirements. Contractor shall record top of pipe and top of ground elevations and the locations of where these elevations were determined and submit this information to IRCDUS. IRCDUS reserves the right to have Contractor excavate and check top of pipe and top of ground elevations to see if they conform to the aforementioned requirements, at no cost to the IRCDUS.

END OF SECTION