

SECTION 02510
DUCTILE IRON PIPE and FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ductile iron piping, fittings and appurtenances for the use of installation of sanitary force main systems.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. *{Section XXXXX - Trenching, Backfilling and Compaction for Utilities. Define frequency and location of backfill compaction testing by an independent testing firm}.*

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
 - a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
 - b. B16.1, Cast Iron Pipe Flanges and Flanged Fittings - Classes 25, 125 and 250.
2. ASTM International (ASTM):
 - a. A48, Standard Specification for Gray Iron Castings.
 - b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - c. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
3. American Water Works Association (AWWA):
 - a. C203, Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
 - b. C213, Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
 - c. C600, Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.
4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
 - a. C104/A21.4, Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - b. C105/A21.5, Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - c. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings for Water.
 - d. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - e. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - f. C150/A21.50, Standard for Thickness Design of Ductile-Iron Pipe.
 - g. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
 - h. C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.

B. Manufacturer and Installer Qualifications:

1. Manufacturer shall have experience in manufacturing ductile iron pipe of similar size and type to that specified herein. For a manufacturer to be determined acceptable for providing ductile iron pipe, they must show evidence of manufacturing a minimum of 10,000 linear feet of ductile iron piping and ten years' experience in the design and manufacturing of ductile iron pipe of similar size, type and application (water/wastewater) as specified herein.
2. Pipe and fittings shall be by the same manufacturer and not have been used in any previous application.

1.3 SUBMITTALS

A. Shop Drawings:

1. Refer to Specification “Section 01340 – Submittals” for requirements for the mechanics and administration of the submittal process.
2. Product technical data for gaskets, pipe, fittings and appurtenances including:
 - a. Acknowledgement that products submitted meet the requirements of standards referenced.
 - 1) Acknowledgement shall be in the form of a letter or company-standard form containing all required data and signed by an officer of the manufacturing, fabricating or supplying company and at a minimum include:
 - a) Name and location of the Work.
 - b) Name and address of the Contractor.
 - c) Name of the manufacturing or fabricating company.
 - b. Certificates: Provide affidavit of compliance per AWWA C110, C153 and C151 fittings.
 - c. Test reports: Summarizing results of the final shop pressure and leakage test.
 - d. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation for each type of pipe.
3. Fabrication and/or layout drawings with information including:
 - a. Scale (minimum scale 1 IN equals 10 FT).
 - b. Dimensions of pipe lengths and fittings.
 - c. Invert or centerline elevations of pipe crossings.
 - d. Acknowledgement of bury depth requirements.
 - e. Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments and related appurtenances.
 - f. Acknowledge designated valve tag numbers, manhole numbers, instrument tag numbers, pipe and line numbers.
 - g. Line slopes and vent locations.
4. Details of temporary restraints required for testing.

B. Field quality control documents:

1. Test reports summarizing results of the final field pressure and leakage test

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect pipe, fittings, appurtenances, linings and coating during handling using methods recommended by the manufacturer and approved by the Engineer.

1. Use of bare cables, chains, hooks, metal bars or narrow skids in the contact with coated and/or lined pipe is not permitted.
2. Handle only from the outside of the pipe and fittings. Lifting by inserting forks into the pipe or fittings is not permitted.

B. Prevent damage to pipe during transit.

1. Repair abrasions, scars and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material in its entirety immediately.

C. Store pipe in a manner to keep pipe interior free from dirt and foreign matter.

1. Storing on stones or other hard material that can damage the pipe exterior is not permitted.
2. Storing pipe on top of pipe is not permitted.
3. Materials subject to corrosion shall be protected in accordance with the manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers of restrained joint systems are acceptable:

1. Restraint System for Ductile Iron Pipe and Fittings:
 - a. EBAA Iron, Inc.
 - b. Sigma Corporation.
 - c. Ford Meter Box Company.
 - d. Smith Blair Camlok
 - e. American Ductile Iron Pipe, FLEX-RING.
 - f. U.S Pipe TR-FLEX.
 - g. U.S. Pipe HDSS System.
 - h. Or approved equal
2. Mechanical Joint Adaptor:
 - a. *{Infact Corporation, Foster Mechanical Joint Adaptor. Approval by HRSD on a case by case}*
3. Lining Material:
 - a. Induron Coatings, Inc., Protecto 401.
 - b. Permox CTF
 - c. TNEMEC Series 431

B. Submit request for substitution in accordance with Specification Section *{Insert applicable section}*.

2.2 MATERIALS

A. Pipe:

1. Push-on joints:
 - a. AWWA/ANSI C151/A21.51.
 - b. Special Thickness Class 51.
 - c. Furnished where thrust restraint is not required.
 - d. Furnish for buried application.
2. Mechanical joint:
 - a. AWWA/ANSI C151/A21.51.
 - b. Special Thickness Class 51.
 - c. Furnish where thrust restraint is required and approved restraint system is not used.
 - d. Furnish at connection locations.
 - e. Furnish for buried application.
 - f. Threaded bells shall not be used.
3. Flanged joint:
 - a. AWWA/ANSI C115/A21.15.
 - b. Special Thickness Class 53.
 - c. Furnish for exposed pipe application only.
 - d. No full stick of flanged pipe shall be installed in a buried application.

B. Fittings and Flanges:

1. Fittings: AWWA/ANSI C110/A21.10 or C153/A21.53.
 - a. Reducers shall be eccentric. Match grade at top of pipe.
2. Flanges: Drilled and faced per ASME B16.1 for both 125 and 250 psi applications.

C. Saddles for Air Vents:

1. Smith Blair Service Saddle with 2-inch threaded outlet (Mueller CC threads).
2. Smith Blair Models
 - a. Style 366 for pipe 18-inche in diameter and larger
 - b. Style 313 for pipe less than 18-inch diameter
3. JCM Industries
 - a. Style 418 for pipe 24-inches and larger

b. Style 404 for pipe less than 24-inch diameter

D. Nuts and Bolts:

1. Mechanically galvanized ASTM B695, Class 40
2. Heads and dimensions per ASME B1.1.
3. Threaded per ASME B1.1.
4. Project ends 1/4 IN to 1/2 IN beyond nuts.
5. All buried nuts and bolts shall be wrapped with polyethylene encasement unless otherwise as shown on the plans or specified herein.

E. Gaskets:

1. Mechanical joint: AWWA C111.
2. Push-on joint: AWWA C111 and manufacturer's standard design dimensions and tolerances.
3. Flange: AWWA C111.
4. At no time shall gaskets be cut that will be used in the installation of pipeline

F. Linings and Coatings:

1. Provide one of the following interior linings:
 - a. Ceramic novolac epoxy lining:
 - 1) Completely cover the interior surface of pipe and fittings.
 - 2) Shop apply in accordance with the manufacturer's recommendations.
 - 3) Produce a pinhole free lining covering and properly adhered to the interior surface.
 - 4) The lining shall be 40 mils DFT nominal thickness, 35 mils DFT minimum.
 - 5) Apply within 8 hours after surface preparation.
 - 6) Apply directly to the cleaned substrate to achieve the specified dry film thickness.
 - a) Multiple pass application is permitted provided the maximum allowable recoat time is not exceeded.
 - 7) The lining shall have a 6 mils DFT nominally and 10 mils DFT maximum for the gasket area and spigot area end up to 6 IN back from the end of the spigot on the outside of the pipe.
 - a) These areas shall be coated with the approved manufacturer's joint compound applied by brush to ensure proper coverage. Care must be taken so that the joint compound is smooth without excessive build-up in the gasket seat or on the spigot ends.
 - b) Coating of the gasket seat and spigot ends shall be performed after application of the lining to all other pipe or fitting surfaces.
 - 8) The lining in all pipe barrels and fittings shall pass 2,500 volt wet sponge holiday or discontinuity detection.
 - 9) Conduct holiday detection testing over 100 percent of lined surfaces.
 - a) Testing shall be in accordance with ASTM D5162 and most recent version of NACE RP-0188.
 - b) Testing shall be conducted over 100% of all lined surfaces for ductile iron.
 - c) All holidays shall be repaired in accordance with manufacturer's instruction and retested to ensure a pinhole free lining.
 - 10) Finished lining shall be generally smooth and free of runs, sags and sharp protuberances.
 - 11) Field cutting and tapping of lined pipe and fittings is not permitted without written approval from HRSD on a case by case basis. If field cuts are allowed, contractor shall repair cut with liner repair kit in accordance with manufacturer's recommendations.
 - a) All air release valve installations shall be field tapped at the true, as-constructed high point. All taps shall be verified from the inside of the pipe and the liner shall be repaired as necessary.
 - b) Short lengths of pipe required to accommodate pipe and fitting geometry shall be furnished factory lined.
 2. Exterior coatings:

- a. Pipe, fittings, and appurtenance, include mechanical joint and retainer glands and appurtenances.
- b. Asphaltic in accordance with AWWA/ANSI C110/A21.10.
- 3. Polyethylene encasement:
 - a. All ductile iron pipe and fittings shall be wrapped *{Engineer to decide if single/double wrapping and to coordinate with HRSD Project Manager if newly introduced biowrap is acceptable or preferable}* with polyethylene encasement conforming to the requirements of ANSI/AWWA C105/A21.5 unless otherwise shown on the plans or specified herein. *{Engineer to decide if required}*
 - b. Polyethylene encasement shall have minimum thickness of 8 mil per layer.

G. Utility Marking Tape:

- 1. Subsurface utility marking tape shall be of a durable, metalized, plastic film, bright green in color, imprinted with the legend “CAUTION: SEWER BELOW”.
 - a. The utility marking tape shall be manufactured by Griffolyn Company or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Items of material furnished under this Section shall be subject to inspection by the Owner’s representation prior to installation.
- 1. Items found not to be in compliance with this Section shall be removed from the project site and replaced with items that have been approved for installation.
 - 2. Inspections and approvals do not relieve the Contractor from complying with the Contract Documents.

3.2 PIPE INSTALLATION

- A. Trenching:
- 1. Excavate trenches by open cut method to depth and width necessary to accommodate Work.
 - 2. Support existing utility lines traversing trench and stabilize excavation to prevent undermining of existing utility lines.
 - 3. Open only length of trench required to complete each day’s piping installation.
- B. Dewatering:
- 1. Install a dewatering system as required to prevent softening and disturbance of subgrade during construction. All dewatering system design is the Contractor’s responsibility.
 - 2. Groundwater shall be maintained at least 2 FT below the bottom of any excavation.
 - 3. Keep dewatering system in operation until backfill to cover pipe is in place.
 - 4. Dispose of uncontaminated groundwater to an area which will not impair construction operations or damage existing construction.
 - 5. Refer to the requirements of “Section 02710 - Contaminated Groundwater Management” if suspected or confirmed presence of hydrocarbon and other defined contaminants in the removed groundwater. *{Engineer to determine applicability of this section}*
 - 6. Contractor shall adhere to locality noise ordinance for operation of dewatering pumps and generators.
- C. Preparation of Foundation for Pipe Laying:
- 1. Subgrade Stabilization:
 - a. If subgrade of pipe trenches is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as authorized by Engineer in writing.
 - b. Loose, wet, or soft materials, when approved by Engineer in writing, may be stabilized by a compacted working mat of well graded crushed stone.

- 1) Over-excavate up to a depth of 2 FT below the design final subgrade elevation to remove the unsuitable material.
 - c. Compact stone bedding material thoroughly into subgrade to avoid future migration of fines into the stone voids.
 - d. Unstable trench bottoms caused by the Contractor's failure to dewater or Contractor operations shall be replaced at no additional compensation.
- D. Laying Pipe in Trench:
1. Clean each pipe length thoroughly and inspect for compliance to Specifications.
 2. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom.
 3. Install gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.
 4. Lay pipe in only suitable weather with good trench conditions.
 - a. Never lay pipe in water except where approved by Engineer.
 5. Seal open end of line with watertight plug if pipe laying stopped.
 6. Remove water in trench before removal of plug.
- E. Joining Method - Push-On Joints:
1. Install in accordance with AWWA C600.
 2. Assemble push-on joints in accordance with manufacturer's directions.
 3. Lubricate spigot end of pipe to facilitate assembly without damage to gasket.
 - a. Use lubricant that has no deteriorating effects on the gasket material
 4. Assure the gasket groove is thoroughly clean.
 5. For cold weather installation, warm gasket prior to placement in bell.
 6. Taper of bevel shall be approximately 30 degrees with centerline of pipe and approximately 1/4 IN back.
 7. Lining Up Push-On Joint Piping:
 - a. Pipe deflections shall not exceed 50% of the maximum deflection values stated in manufacturer's written literature.
 - b. Install shorter lengths of pipe in such length and number that angular deflection of any joint does not exceed 50% of the maximum deflection values stated in manufacturer's written literature.
- F. Joining Method - Push-On Mechanical Joints (Restrained):
1. Install in accordance with AWWA C600.
 2. Assemble mechanical joints in accordance with manufacturer's directions.
 3. Bevel and lubricate spigot end of pipe to facilitate assembly without damage to gasket.
 - a. Use lubricant that has no deteriorating effects on the gasket material
 4. Assure the gasket groove is thoroughly clean.
 5. For cold weather installation, warm gasket prior to placement in bell.
 6. Taper of bevel shall be approximately 30 degrees with centerline of pipe and approximately 1/4 IN back.
 7. Do not overstress bolts. The use of a torque wrench is required.
 8. Install restraint system in accordance with manufacturer's directions and as required in the plans.
- G. Installation of Saddles for Air Vents *{Engineer to review this requirement against HRSD Standard Detail}*
1. Approved stainless steel saddle shall be used to install air vent assembly at each high point along pipeline.
 2. Field taps shall be made at each location for air vent assembly.
- H. Polyethylene Encasement:
1. *{Double/Single Engineer to decide which is appropriate for type of wrap specified}* Wrap all ductile iron pipe, fittings, and nuts and bolts in polyethylene encasement in full compliance to ANSI/AWWA C105/A21.5 unless otherwise shown on the plans or specified herein.
 - a. Encase underground appurtenances required as part of installation.

- b. Where tapping polyethylene encased pipe, first wrap location of tap with three (3) layers of polyethylene adhesive tape and make tap through tape.
 - c. Make sections of tubing 2 FT longer than pipe section to be covered.
 - d. Slip tube over pipe while pipe is suspended immediately before placing in trench.
 - e. After installing in trench, pull tube ends over joint and overlap.
 - f. Fasten securely in-place on each side of each joint with joint tape or strapping.
 - g. Pull loose tube along pipe barrel up snugly around pipe and fasten in-place with joint tape at 3 FT intervals.
 - h. Completely cover fittings and connections with film held snugly in-place with joint tape or strapping.
2. Mid span restraints used for the construction of the thrust collars shall be wrapped in polyethylene encasement.
- I. Backfilling Methods:
- 1. Comply with the following:
 - a. Observe specific pipe manufacturer's recommendations regarding backfilling and compaction.
 - b. Over excavation shall be filled with #57 stone at the contractor's expense.
 - c. Place backfill in lifts not exceeding 8 IN (loose thickness).
 - d. Hand place, shovel slice, and pneumatically tamp all backfill to a depth of 6-IN above top of pipe.
 - e. Compact each lift to specified requirements
 - f. Compaction testing as defined in the Bid Documents for locations and frequency will be performed by an independent testing firm
 - g. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.
 - 2. Water flushing for consolidation is not permitted.
- J. Utility Marking Tape:
- 1. Install utility marking tape in accordance with the following:
 - a. Tape shall be placed no less than 6 IN and no greater than 12 IN below the proposed finished grade.

3.3 CONNECTIONS WITH EXISTING PIPING

- A. Scheduling: Refer to "Section 01520 – Maintenance of Pipe and Pumping Operations" for notification requirements.
- B. Prior to the beginning of pipe laying, verify the location, configuration, type, and dimensions of the existing joint and pipe where the connections to the existing system are to be installed. This information shall be furnished to the Engineer for review.
- C. Provide suitable equipment to dewater, drain, and dispose of liquid removed from existing pipe during connection.

3.4 FIELD QUALITY CONTROL

- A. Backfill Compaction Testing
 - 1. Compaction testing as required and defined in the Bid Documents for locations and frequency to be tested by an independent firm.
- B. Testing of Pipe:
 - 1. General Procedures for Hydrostatic Pressure Testing:
 - a. Testing shall be in accordance with AWWA C600.
 - b. Provide temporary restraints for exposed joints during test.
 - c. All piping and appurtenances (including air vents) shall be fully installed to the extent possible prior to performing testing.
 - d. Test buried piping after backfilling.

- e. Ports for testing shall be at 2-IN taps for proposed air vents or in plugs installed for testing. Under no circumstances shall the contractor tap the proposed force main for testing purposes.
- f. Test requirements:
 - 1) Test medium: Potable water only.
 - 2) Pressure: 100 psi.
 - 3) Duration: 2 hrs.
- g. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates. *{Note to Engineer: coordinate with HRSD Project Manager as to a preference for Owner provided calibrated gauge verses Contractor provided calibrated gauge for specific hydrostatic test}*
 - 1) Contractor shall furnish and use a gauge that has been calibrated within 12 months of the planned use. Contractor shall provide to Engineer verification certification of stated calibration of the pressure test gauge.
 - 2) Select each gauge so that the specified test pressure falls within the upper half of the gauge's range.
 - 3) Notify the Owner's Representative a minimum of 2 business days prior to each test.
 - 4) Owner's Representative shall be present during the test.
- h. Completely assemble and test new piping systems prior to connection to existing pipe systems.
- i. The hydrostatic pressure test shall not be done against any valve.
- j. The test allowance shall be calculated in accordance with AWWA C600. The testing allowance is defined as the quantity of water that must be supplied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure. No installation will be accepted if the quantity of makeup water is greater than that determined by the formula:

$$Q = \frac{LD\sqrt{P}}{148,000}$$

Where:

Q = quantity of makeup water (gph)

L = length of pipe section being tested (FT)

D = nominal diameter of the pipe (IN)

P = average test pressure during the hydrostatic test (psig)

- k. The Contractor shall bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.
- l. Prepare hydrostatic test report and submit to Engineer in accordance with "Section 01340 – Submittals".

END OF SECTION