

**SECTION 02731
FORCE MAINS**

PART 1 GENERAL

1.01 SCOPE

- A. This Section describes products to be incorporated into force mains, pressure sewers, pressure sewer services, gravity sewer services and individual pressure systems and accessories and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. General: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.

1.02 QUALIFICATIONS

If requested by the City, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

1.03 SUBMITTALS

Complete shop drawings, product data and engineering data, including shop drawings, shall be submitted to the City.

1.04 TRANSPORTATION AND HANDLING

- A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.
- B. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front loader. Do not use material damaged in handling.
- C. Lined pipe shall be handled and transported to prevent damage to linings.

1.05 STORAGE AND PROTECTION

- A. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.
- B. Stored materials shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves shall be drained and stored in a manner that will protect them from damage by freezing.
- C. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The

bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.

- D. Store joint gaskets in a cool location, out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

1.06 QUALITY ASSURANCE

- A. Product manufacturers shall provide the City with written certification that all products furnished comply with all applicable provisions of these Specifications.
- B. If ordered by the City, each pipe manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of five days during initial pipe installation.

1.07 RELATED SECTIONS

- 1. Section 02200-Basic Pipeline Construction.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE (DIP)

- A. Ductile Iron Pipe (DIP)
 - 1. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise specified or shown on the Drawings:

Pipe Sizes (inches)	Pressure Class (psi)
4 - 12	350
16 - 24	250

- B. Fittings and Accessories
 - 1. Fittings shall be ductile iron and shall conform to AWWA C110/ANSI A21.10 or AWWA C153/ANSI A21.53 with a minimum rated working pressure of 250 psi.
 - 2. Thrust Collars: Thrust collars shall be welded-on ductile iron body type capable of withstanding a thrust due to 250 psi internal pressure on a dead end from either direction on that pipe size. Weld-on collars shall be continuously welded to the pipe by the pipe manufacturer. Retainer glands may be used for thrust collars where shown on the

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Drawings and as specified in this Section.

3. Solid Sleeves: Solid sleeves shall permit the connection of plain end ductile iron pipe and plain end PVC pipe. Solid sleeves shall meet the requirements of ANSI/AWWA C110 for long pattern and have a minimum pressure rating of 250 psi. Solid sleeves shall have a mechanical or restrained joint as specified in this Section and as shown on the Drawings. Solid sleeves shall be provided with gaskets suitable for the type of pipe to be connected. Solid sleeves shall be used only in locations shown on the Drawings or at the direction of the City. Solid sleeves shall be manufactured by ACIPCO, U.S. Pipe or McWane (Clow).

C. Joints for Ductile Iron Pipe and Fittings

1. General

- a. Joints for ductile iron pipe and fittings shall be mechanical joint, flanged joint, restrained joint, push-on joint or as shown on the Drawings or specified herein.
- b. Unless otherwise shown on the Drawings, specified or directed, all ductile iron pipe laid underground shall be joined using push-on type joints. All fittings shall be mechanical joint.
- c. In all cases, gaskets shall be made of material that will not be damaged by the fluid being transported nor by the environment in which the pipe is installed.
- d. Provide the necessary bolts for connections. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A external and 2B internal fit. All bolts and nuts shall be made in the U.S.A.

2. Push-On Joints: Push-on joints and gaskets shall conform to AWWA C111/ANSI A21.11. Details of the joint design shall be in accordance with the manufacturer's standard practice such as ACIPCO "Fastite", McWane (Clow) "Bell-Tite", or U.S. Pipe "Tyton" joints.

3. Restrained Joints

- a. Restrained joints shall be ACIPCO "FLEX-RING" or "FAST-GRIP" or U.S. "TR-FLEX" or "FIELD LOK".
- b. Bolts and nuts shall be in accordance with the manufacturer's recommendations.
- c. Gaskets shall be in accordance with the manufacturer's recommendations.

D. Interior Lining: Ductile iron pipe and fittings shall be lined with polyethylene, polyurethane or epoxy, as specified below:

1. Linings shall cover all exposed surfaces of pipe and fittings subject to contact with sewer liquid or gas. The lining of the pipe barrel shall extend from spigot end through the socket to the edge of the gasket sealing area or recess for pipe using push-on gaskets, and to the edge of the gasket seat for mechanical joints. The lining shall also cover the exterior of the spigot end from the end of the pipe to beyond the gasket sealing area. The lining in fittings shall cover the interior surfaces including the socket areas as defined above. All linings shall be hermetically sealed at the ends.

2. Lining Materials

- a. Polyethylene lining material for pipe barrel shall conform to ASTM D 1248, compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during aboveground storage. The polyethylene shall be bonded to the interior of the pipe or fitting by heat. Lining material for exterior of spigot and interior of socket shall be equal to Roskote Mastic B-151 or Madewell 1104 Coal Tar Epoxy. Polyethylene lining system shall be ACIPCO Polybond or U.S. Pipe Polylined.
 - b. Polyurethane lining material shall consist of a two-part polyurethane coating system conforming to ASTM D 16, Type V, consisting of a polyisocyanate resin and a polyol resin. Polyurethane for pipe barrel and fittings shall be Corropipe II Wasteliner as manufactured by Madison Chemical Industries, Inc. Polyurethane lining material for exterior of spigot and interior of socket shall be equal to Corropipe 'S' as manufactured by Madison Chemical Industries, Inc. Polyurethane lining system shall be equal to U.S. Pipe Polythane.
 - c. Epoxy: The lining material shall be Protecto 401 Ceramic Epoxy, a two component, modified epoxy formulated for corrosion control with the following minimum requirements:
 - (1) A permeability rating of 0.0 perms when measured by ASTM E 96, Procedure A. Duration of test shall be six weeks.
 - (2) A direct impact resistance of 125 inch-pounds with no cracking when measured by ASTM D 2794.
 - (3) The ability to build at least 50 mils dry in one coat.
 - (4) The material shall be recoatable with itself for at least seven days with no additional surface preparation when exposed to direct summer sun and a temperature of 90 degrees F.
 - (5) The material shall contain at least 20 percent by volume of ceramic quartz pigment.
 - (6) A test and service history demonstrating the ability of the material to withstand the service expected.
 - (7) Possess a minimum solids volume content of 88 percent, \pm one percent.
 - (8) Possess a maximum drying time to allow recoating as follows: 50 degrees F - 72 hours; 75 degrees F - 18 hours; 90 degrees F - 8 hours. If recoating cannot be accomplished within seven days, a light brush blast shall be performed to improve intercoat adhesion.
3. All surfaces to be lined with polyethylene shall be blast cleaned equal to the requirements of SSPC-SP6. All surfaces to be lined with polyurethane shall be blast cleaned equal to the requirements of SSPC-SP10. All surfaces to be lined with epoxy shall be blasted and cleaned to remove all loose laitance, scale, or other loose material. No lining shall take place over grease, oil, etc., that would be detrimental to the adhesion of the compound to the substrate.
 4. Application
 - a. Lining of pipe barrel and fittings shall be 40 mils nominal thickness; minimum lining thickness shall be 30 mils. Lining thickness for exterior of spigot and interior of socket shall be 8 to 10 mils.

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- b. The lining shall be applied using a centrifugal lance applicator by applicators certified by the lining manufacturer. The workers shall be experienced and competent in the surface preparation, application and inspection of the lining to be applied. The compound shall not be applied when the substrate temperature is below 40 degrees F or in adverse atmospheric conditions which will cause detrimental blistering, pinholing or porosity of the film.
5. All pipe and fitting linings shall be tested for pinholes in accordance with ASTM G 62, Method B and shall be holiday free.
6. All pipe linings shall be checked for thickness using a magnetic film thickness gauge.
7. Each pipe joint and fitting shall be marked with the date of application of the lining system and with the numerical sequence of application of that date.
- E. Polyethylene Encasement: Ductile iron pipe shall be encased with polyethylene film where shown on the Drawings. Polyethylene film shall have a minimum thickness of 8 mils.

2.02 POLYVINYL CHLORIDE (PVC) PIPE

- A. 2-Inches in Diameter and Larger
 1. Pipe: PVC pipe shall conform to ASTM D 2241. The pipe shall have a Standard Dimensional Rating (SDR) of 21. PVC pipe shall be the color green. PVC pressure pipe shall be supplied in 20 foot nominal lengths.
 2. Fittings
 - a. 4-Inches in Diameter and Greater: All fittings shall be of ductile iron meeting the requirements of AWWA C110/ANSI A21.10 or AWWA C153/ANSI A21.53 with a minimum rated working pressure of 250 psi. Fittings shall be cement lined in accordance with AWWA C104/ANSI A21.4. Fittings shall be mechanical joint. Fittings shall be furnished with a bituminous outside coating. Special adapters shall be provided, as recommended by the manufacturer, to adapt the PVC pipe to mechanical jointing with cast or ductile iron pipe, fittings or valves.
 - b. Less Than 4-Inches in Diameter: Fittings shall be of the same material, strength and dimension as the pipe to which it connects.
 3. Joints: Pipe and fittings 2-inches in diameter and greater shall have integral bell and spigot type joints with elastomeric gaskets having the capability of absorbing expansion and contraction without leakage. Joints shall meet the requirements of ASTM D 3139; gaskets shall meet the requirements of ASTM F 477. Joint system shall be subject to the approval of the City.
 4. Acceptance: Acceptance will be on the basis of the City's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.
- B. Less Than 2-Inches in Diameter

1. Pipe: Schedule 40 in accordance with ASTM D 1785.
2. Fittings: Solvent weld socket type, same schedule as piping, ASTM D 2466 or D 2467.
3. Solvent Cement: ASTM D 2564.

2.03 HIGH-DENSITY POLYETHYLENE (HDPE) PIPE AND FITTING

A. Polyethylene Pipe and Fittings

1. **Qualification of Manufacturers:** The Manufacturer shall have manufacturing and quality assurance facilities capable of producing and assuring the quality of the pipe and fittings required by these Specifications. The Manufacturer's production facilities shall be open for inspection by the Owner or his Authorized Representative. The Project Engineer shall approve qualified Manufacturers.
2. **Approved Manufacturers:** Manufacturers that are qualified and approved by the Project Engineer are listed below. Products from unapproved manufacturers are prohibited.

Performance Pipe, a division of Chevron Phillips Chemical Company, LP

3. **Materials:** Materials used for the manufacture of polyethylene pipe and fittings shall be PE 4710 high density polyethylene meeting cell classification 445574C/E for black or 445576E for stripes per ASTM D 3350; and shall be Listed in the name of the pipe and fitting Manufacturer in PPI (Plastics Pipe Institute) TR-4, "Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds", with a standard grade HDB rating of 1600 psi at 73°F. The Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.
4. **Interchangeability of Pipe and Fittings:** The same Qualified and Approved Manufacturer shall produce polyethylene pipe and fittings. Products made by subcontractors or Manufacturer's distributors are not acceptable.
5. **Polyethylene Pipe:** Polyethylene pipe shall be manufactured in accordance with AWWA C901-96 for sizes 1-1/4" thru 3" IPS diameters and to the requirements of ASTM D3035. Pipe 4" IPS and DIPS 4" and above shall be manufactured to the requirements of ASTM F714 and AWWA C906-99 (IPS). Each production lot of material or pipe shall be tested for melt index, density and % carbon. Each production lot of pipe shall be tested for dimensions and ring tensile strength.
6. **Service Identification Stripes:** Permanent identification of the piping service shall be provided by co-extruding color stripes into the pipe outside surface. The striping material shall be the same material as the pipe material except for color. Stripes printed on the pipe outside surface shall not be acceptable. IPS sized pipes shall have four equally spaced, longitudinal color stripes. DIPS sized pipes shall have three equally spaced pairs of longitudinal color stripes. The stripe color shall be green.

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7. Polyethylene Fittings & Custom Fabrications: Polyethylene fittings and custom fabrications shall be molded or fabricated by the Approved Pipe Manufacturer. All fittings and custom fabrications shall be pressure rated for the same internal pressure rating as the mating pipe. Reduced pressure-rated (de-rated) fabricated fittings are prohibited.
8. Molded Fittings: Molded fittings shall be manufactured in accordance with ASTM D 3261 and shall be so marked.
 - a) X-Ray Inspection: The Manufacturer shall submit samples from each molded fittings production lot to x-ray inspection.
9. Fabricated Fittings: Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full service pressure rating of the mating pipe.
10. Polyethylene Flange Adapters: Flange adapters shall be made with sufficient throughbore length to be clamped in a butt fusion-joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves (serrations) to promote gasketless sealing, or restrain the gasket against blowout.
11. Back-up Rings & Flange Bolts: Flange adapters shall be fitted with back-up rings pressure rated equal to or greater than the mating pipe. The back-up ring bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 2 or higher.
12. MJ Adapters: MJ Adapters 4" thru 16" may be provided with optional Stainless Steel Stiffener upon request. MJ Adapters 14" and above shall be provided with Heavy Duty Back-up Ring Kits. All MJ adapters above 16" must be provided with Stainless Steel stiffeners.
13. Compliance Tests: Manufacturer's inspection and testing of the materials. In case of conflict with Manufacturer's certifications, the Contractor, Project Engineer, or Owner may request retesting by the Manufacturer or have retests performed by an outside testing service. All retesting shall be at the requestor's expense, and shall be performed in accordance with the Specifications.

2.04 MANHOLES AND PRECAST CONCRETE PRODUCTS

- A. Provide manholes and other precast concrete products in accordance with the following:
 1. Precast Concrete Sections
 - a. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi.
 - b. The minimum wall thickness shall be one-twelfth of the inside diameter of the

base, riser or the largest cone diameter. Additionally, the wall thickness shall be sufficient for the proper installation of the rubber boots.

- c. Transition slabs which convert bases larger than four feet in diameter to four foot diameter risers shall be designed by the manhole manufacturer to carry the live and dead loads exerted on the slab.
 - d. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS202.
2. Brick and Mortar: Brick shall be whole and hardburned, conforming to ASTM C 32 Grade MS. Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150. Sand shall meet ASTM C 144.
3. Iron Castings
 - a. Cast iron manhole frames and covers shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections. No casting will be accepted which weighs less than 95 percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins.
 - b. Manhole frames and covers shall be as shown on the Standard Detail Drawings.
 - c. All frames and covers shall have machined horizontal bearing surfaces.
 - d. All manholes shall have standard frames and covers except where specifically shown otherwise on the Drawings.
 4. Rubber Boots: Provide preformed rubber boots and fasteners equal to those manufactured by Kor-N-Seal or Press Seal Gasket Corporation.
 5. Interior Lining
 - a. Precast concrete wetwells, drop manholes and air release valve manholes shall be lined (interior) with Protecto 401 Ceramic Epoxy or Corropipe II Wasteliner as manufactured by Madison Chemical Industries, Inc., or Agru Sure-Grip HDPE/PP-R concrete protective liner. Standard precast concrete manholes and valve vaults shall be lined (interior) with a coal tar epoxy equal to Carboline (Kop-Coat) Bitumastic 300M.
 - b. Surface Preparation and Application: After the manhole has cured, the equivalent of seven days at 77 degrees F, the interior of the manhole exposed to liquids and gases shall be blasted and cleaned to remove all loose laitance, form oil, or other

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loose material. After cleaning, the lining material shall be applied to yield 40 mils for the complete system using a centrifugal lance applicator. No lining shall take place over grease, oil, etc., that would be detrimental to the adhesion of the compound to the substrate. The compound shall not be applied when the substrate temperature is below 40 degrees F or in adverse atmospheric conditions which will cause detrimental blistering, pinholing or porosity of the film. In no case shall the lining be applied when the concrete surface is above 14 percent moisture content. The lining shall be applied by applicators certified by the lining manufacturer. The workers shall be experienced and competent in the surface preparation, application and inspection of the lining to be applied.

- c. Inspection
 - (1) All manholes shall be checked for thickness using a magnetic film thickness gauge on metal coupons attached to five percent of the manhole coated.
 - (2) All manholes shall be pinhole detected with a non-destructive 2,500 volt test.
 - (3) Each manhole section shall be marked with the date of application of the lining system and with its numerical sequence of application of that date.
 - d. Handling: Equipment used to handle and transport the lined manholes shall be suitably designed and operated not to damage the lining. Any damage which occurs shall be repaired prior to the installation of the manholes in accordance with the manufacturer's recommendations, so the repaired area is equal to the undamaged lining and coating in all respects.
 - e. Joints: All surfaces in the joint areas that are concrete and that are in contact with the sewer liquids and gases shall be prepared for coating and coated as specified for the manhole. Any area in the joint area that is not smooth shall be made so using a quick setting epoxy grout. Care shall be exercised so that all areas exposed to the sewer liquids and gases are coated.
 - f. Lining shall be applied at the point of manufacture of the manhole and precast concrete product.
6. Exterior Coating
- a. The exterior of manholes, wetwells and valve vaults shall be coated with a product as specified in Paragraph 5. above or with Farbertite, as manufactured by Briggs Bituminous Composition Company of Philadelphia, PA.
 - b. Surface preparation, application, inspection, handling and joints shall be as specified in Paragraph 5. above.
 - c. Coating shall be applied at the point of manufacture of the manhole and precast concrete product.

2.05 MISCELLANEOUS ACCESSORIES

- A. Detection Tape and Tracer Wire: Detection tape shall be composed of a solid aluminum foil

encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Sanitary Sewerage Systems, Safety Green, "Caution: Sewer Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape. In addition, prior to backfill of trench the Contractor shall furnish and install 12 gauge, stranded, green coated copper wire. The wire shall be installed along the pipe during the backfill operation. Wire shall be brought up at each manhole. Wire shall be spliced together using DRYCONN waterproof connectors.

B. Retainer Glands

1. Retainer glands for ductile iron pipe shall be Megalug, Series 1100, as manufactured by EBBA Iron Sales, Inc.
2. Retainer glands for polyvinyl chloride pipe shall be Megalug Series 2000 PV, as manufactured by EBAA Iron Sales, Inc.

C. Anchor Couplings: Lengths and sizes shall be as shown on the Drawings. Anchor couplings shall be equal to Tyler Pipe 5-198.

D. Flange Adapter: The flange adapter shall permit the connection of unthreaded, ungrooved, open-ended ductile iron pipe to ANSI/ASME B16.1, Class 125 flanges. The flange adapter shall meet the test requirements of ANSI/ASME B16.1 for Class 125 flanges. The adapter shall be a ductile iron casting incorporating a flange with extended throat, set screws and gasket. The gasket shall provide a compression seal between the adapter, the pipe and the adjacent flange. Flange adapters shall be used only in locations specifically shown on the Drawings or at the direction of the City, and in accordance with the manufacturer's recommendations. The flange adapter shall be manufactured by McWane or EBAA Iron. Additionally, flange adapters shall be provided with 304 stainless steel harness rods of the diameter and quantity shown on the Drawings or directed by the City.

E. Pipe Supports: Pipe supported from underneath and not subject to expansion shall have adjustable pipe saddle supports on properly sized pipe stanchions and ample, properly grouted floor flanges. Saddle supports shall be equal to Grinnell, Figure 264 or Fee and Mason, Figure 291.

F. Pressure Gauges with Diaphragm Seal: Pressure gauges and diaphragm shall be installed as shown on the drawings. Pressure gauges shall be equal to DASCO 987 Series process gauge, Type 4501S, ½" connection, glycerine filled or approved equal. Diaphragm seal shall be equal to an Ashcroft Type 500 or approved equal.

2.06 CONCRETE

Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the City. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

2.07 PLUG VALVES (PV)

- A. Valves shall be 90 degree turn, non-lubricated, eccentric type with resilient faced plugs. Design of the valve shall provide that contact between the seat and the plug shall only occur in the final degrees of plug movement. Valves shall be suitable for throttling service and service where valve operation is infrequent.
- B. Valves shall provide drip-tight shut-off up to the full pressure rating with pressure in either direction. Pressure ratings shall be established by hydrostatic tests conducted in accordance with ANSI B16.1. Valves shall be rated at a minimum of 150 psi.
- C. Valves shall have a port area equal to at least 80 percent of the full pipe area.
- D. Bodies shall be cast-iron, conforming to ASTM A 126, Class B (carbon steel for 2-inch valves).
- E. Valve ends shall be a mechanical joint type, except where flanged or restrained joint ends are shown on the Drawings. Mechanical joint valves shall have bell ends conforming to applicable requirements of AWWA C111/ANSI A21.11. Flanged joints shall meet the requirements of ANSI B16.1, Class 125. Flanged valves with flange-to-MJ adapters shall not be acceptable in lieu of MJ valves.
- F. Valve seats shall be a raised, welded-in overlay of not less than 90 percent pure nickel, machined to mate with the resilient faced plug. Overlay shall be minimum of 1/8-inch thick.
- G. The plug shall be of semi-steel, conforming to ASTM A 126, Class B. The plug facing shall be a synthetic rubber compound of approximately 70 durometer hardness bonded to the plug. Facing material shall be abrasion resistant and suitable for service in sewage and sludge applications.
- H. Valves shall be furnished with replaceable, sleeve-type bearings in the upper and lower journals. Bearings shall comply with applicable requirements of AWWA C507. Bearing materials shall have a proven record of service of not less than five years.
- I. The valve body shall be fitted with a bolted bonnet incorporating a stuffing box and pull-down packing gland. Packing shall be the split chevron type. Design of exposed valves shall allow visible inspection of the shaft seal, adjustment of the packing, and replacement of the packing, all without disturbing the bonnet or valve operator. The shaft seal shall comply with the requirements of AWWA C504.
- J. Actuators
 - 1. Valves for exposed service, 3 through 8-inches in diameter, shall be lever operated. Hand levers shall be steel with a non-metallic grip.
 - 2. Actuators for buried service and valves 10-inches and larger, shall be equipped with manual operated geared actuators. Geared actuators shall be totally enclosed, oil lubricated, worm and gear type. Shaft seals shall be provided to prevent entry of dirt and water into the actuator. All shaft bearings shall be permanently lubricated bronze

bushings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. Construction of actuator housing shall be semi-steel. Gear actuators shall comply with requirements of AWWA C504.

3. Gear actuators for buried valves 10-inches and larger in diameter shall be mounted above ground on an extended bonnet.
4. Motorized actuators shall be provided where shown on the Drawings and as specified in this Section.
5. Valves and operators for submerged or buried service shall have seals on all shafts and gaskets on valve operator covers to prevent the entry of water. Operator mounting brackets for submerged service shall be totally enclosed and shall have gasket seals.

K. Operators

1. Valves for non-buried service, six feet or more above the operating floor shall be furnished with a chainwheel operator and chain for operation from floor level. All other valves shall be equipped with a handwheel operator.
2. Valves, 3 through 8-inches, for buried service shall have a nut type operator and shall be equipped with a valve box and stem extension required to bring the operation nut within 6-inches of finished grade. Valve boxes and extension stems shall be as specified in this Section.

L. All exposed bolts, nuts, and washers for buried or submerged valves shall be stainless steel. All exposed nuts, bolts, springs, washers, and miscellaneous hardware shall be zinc coated in accordance with ASTM A 153 unless specified otherwise.

M. The exterior of all buried valves shall have a factory applied, two coat coal tar epoxy coating system. The coal tar epoxy shall be Tnemec Tneme-Tar 46-413, Indurall Ruffstuff 2100 Coal Tar Epoxy or Kop-Coat Bitumastic No. 300-M. Each coating shall have a minimum dry film thickness of 8-10 mils.

N. All ferrous metal interior surfaces of plug valves shall be provided with a factory applied epoxy interior coating conforming to the requirements of AWWA C550. The coating shall be either TNEMEC Series 20 Pota Pox, Valspar Series 78 or Kopcoat Hi Gard Epoxy. Each coating shall have a minimum dry film thickness of 4 to 6 mils.

O. Acceptable Manufacturers: All plug valves shall be products of a single manufacturer who must submit evidence of five years satisfactory service in sewage applications of the same design and of the sizes required. Valves shall be manufactured by DeZurik or Keystone.

2.08 CHECK VALVES

A. Check valves shall be hinged disc type with cast iron body and bronze or bronze-fitted disc. Valves shall be designed for 200 psi and shall not slam shut on pump shutdown. Valves shall be equipped with a ½ inch stop cock at the high point of the valve for bleeding air from the line.

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- B. Valves shall be outside spring and lever type.
- C. Valves shall be of the globe design with ANSI 125 pound flanges.
- D. Valves shall be G.A. Industries APCO, M&H C508 or AVK.

2.09 AIR VALVES FOR SEWERAGE SERVICE

- A. General: Unless specifically approved by the City, combination air valves shall be installed in accordance with these Specifications.
- B. Air Release Valves: Valves shall be automatic air release valves designed to allow escape of air under pressure and close water-tight when liquid enters the valve. Valve shall have a 1-inch NPT inlet and a maximum orifice diameter of 3/32-inch. The valve body shall be cast iron, designed to facilitate disassembly for cleaning and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion-resistant materials. Valves shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without dismantling the valve.
- C. Air/Vacuum Valves: Valves shall be automatic air and vacuum valves designed to allow escape of air, close water-tight when liquid enters the valve, and allow air to enter in the event of a vacuum. The valve body shall be cast iron, designed to facilitate disassembly for cleaning and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion-resistant materials. Valves shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without dismantling the valve. The valves shall have an orifice diameter of 2-inches and NPT inlet and outlet diameters of 2 x 2-inches.
- D. Combination air valve shall consist of an air release valve tapped into the body of an air and vacuum valve.
- E. Single Body Valve: In lieu of D. above, a single body, double orifice, sewage combination valve may be used. Materials of construction, orifice size, venting capacity and accessories shall meet the requirements of B. and C. above.
- F. Valves shall be recommended by the manufacturer for wastewater service with normal operating pressures to approximately 60 psig, and frequent surge pressures of approximately 175 psig and shall be equal to APCO Valve Corporation or Val-Matic.

2.10 VALVE BOXES (VB) AND EXTENSION STEMS

- A. Valve Boxes
 - 1. Unless shown otherwise on the Drawings, all valves shall be equipped with valve boxes. The valve boxes shall be cast iron two-piece screw type with drop covers. Valve boxes shall have a 5.25-inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6-inches up or down from the nominal required cover over the pipe. Valve boxes shall be of sufficient length that bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Covers shall have "SEWER" cast

into them. Valve boxes shall be manufactured in the United States.

2. Valve boxes shall be manufactured by Tyler or Opelika.

B. Extension Stems: Extension stems shall be provided if depth of bury places the operating nut in excess of 60-inches beneath finished grade, so as to set the top of the operating nut 30-inches below finished grade. Connection to the valve shall be with a wrench nut coupling and a set screw to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller 26441 or M & H Valve, Style 3801.

2.11 CORPORATION COCKS AND CURB STOPS

Corporation cocks and curb stops shall be ground key type, shall be made of bronze conforming to ASTM B 61 or B 62, and shall be suitable for the working pressure of the system. Ends shall be suitable for grip type joint. Threaded ends for inlet and outlet of corporation cocks shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ANSI B16.26. Corporation cocks and curb stops shall be manufactured by Mueller or Ford.

PART 3 EXECUTION

3.01 LAYING AND JOINTING PIPE AND ACCESSORIES

A. Lay all pipe and fittings to accurately conform to the lines and grades established by the construction drawings.

B. Pipe Installation (DI & PVC)

1. Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe, fittings and valves shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to sewer materials and protective coatings and linings. Under no circumstances shall sewer materials be dropped or dumped into the trench.

2. All pipe, fittings, valves and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the City, who may prescribe corrective repairs or reject the materials.

3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe which contains dirt shall be laid.

4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.

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5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
6. It is common practice to lay pipe with the bells facing the direction in which work is progressing, however, it is not mandatory.
7. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted.
8. Provide tracer wire and detection tape for all non-metallic pressure pipe. The tracer wire shall be wrapped around the pipe and shall be looped up to the surface at all valve and/or manhole locations. Detection tape shall be installed on top of all pipe.
9. Polyethylene Encasement: Installation shall be in accordance with AWWA C105 and the manufacturer's instructions. All ends shall be securely closed with tape and all damaged areas shall be completely repaired to the satisfaction of the City.

C. Pipe Installation (HDPE)

1. General: When delivered, a receiving inspection shall be performed and any shipping damage shall be reported to the Manufacturer within 7 days. Installation shall be in accordance with ASTM D 2774, Manufacturer's recommendations and this specification. All necessary precautions shall be taken to ensure a safe working environment in accordance with all applicable safety codes and standards.
2. Excavation: Trench excavations shall conform to the plans and drawings, as authorized in writing by the Project Engineer or his Approved Representative, and in accordance with all applicable codes. The Contractor shall remove excess groundwater. Where necessary, trench walls shall be shored or reinforced, and all necessary precautions shall be taken to ensure a safe working environment.
3. Large Diameter Fabricated Fittings: One plain-end connection of 16" IPS and larger fabricated directional fittings (elbows, tees, etc.) shall be butt fused to the end of a pipe length. The remaining fitting connections shall be made in the trench using butt fusion, flange or other connection means in accordance with G.2 listed below. Flange and other mechanical connections shall be assembled, and tightened in accordance with the connection manufacturer's instructions and C.4 listed below. Handling, lifting, moving or lowering a 16" IPS or larger fabricated fitting that is connected to more than one pipe length is prohibited. The installing contractor at his expense shall correct fitting damage caused by such improper handling.
4. Mechanical Joint & Flange Installation: Mechanical joint and flange connections shall be installed in accordance with the Manufacturer's recommended procedure. MJ Adapters and flanges shall be centered and aligned to the mating component before assembling and tightening bolts. In no case shall MJ gland or flange bolts be used to draw the connection into alignment. Bolt threads shall be lubricated, and flat washers should be used under the nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of

the Manufacturer. At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be as recommended by the Manufacturer.

5. Foundation & Bedding: Pipe shall be laid on grade and on a stable foundation. Unstable trench bottom soils shall be removed, and a 6" foundation or bedding of compacted granular material shall be installed to pipe bottom grade. Excess groundwater shall be removed from the trench before laying the foundation or bedding for the pipe. A trench cut in rock or stony soil shall be excavated to 6" below pipe bottom grade, and brought back to grade with compacted granular bedding. All ledge rock, boulders and large stones shall be removed.
6. Pipe Handling: When lifting with slings, only wide fabric choker slings capable of safely carrying the load shall be used to lift, move, or lower pipe and fittings. Wire rope and chain are prohibited. Slings shall be of sufficient capacity for the load, and shall be inspected before use. Worn or damaged equipment shall not be used.
7. Backfilling: Embedment material soil type and particle size shall be in accordance with ASTM D 2774. Embedment shall be placed and compacted to at least 90% Standard Proctor Density in 6" lifts to at least 6" above the pipe crown. During embedment placement and compaction, care shall be taken to ensure that the haunch areas below the pipe springline are completely filled and free of voids.
8. Protection against shear and bending loads: In accordance with ASTM D 2774, connections shall be protected where an underground polyethylene branch or service pipe is joined to a branch fitting such as a service saddle, branch saddle or tapping tee on a main pipe, and where pipes enter or exit casings or walls. The area surrounding the connection shall be embedded in properly placed, compacted backfill, preferably in combination with a protective sleeve or other mechanical structural support to protect the polyethylene pipe against shear and bending loads.
9. Final Backfilling: Final backfill shall be placed and compacted to finished grade. Native soils may be used provided the soil is free of debris, stones, boulders, clumps, frozen clods or the like larger than 8" in their largest dimension.

D. Alignment and Gradient

1. Lay pipe straight in alignment and gradient or follow true curves, where shown on the Drawings, as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.
2. Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.
3. Do not install force main such as to generate a high point except where shown on the

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Drawings. Prior to backfilling trench, the Contractor shall survey elevation of force main top of pipe barrel at minimum 100-foot intervals, at all bends, at all air valves, and where elevations are shown on the Drawings. The location description and elevation of each benchmark used for this survey shall be recorded. Vertical deflections required to avoid existing underground obstructions shall not result in a high point in the force main unless approved by the City.

4. Any section of force main which is determined to have been installed such that a high point is generated at a location other than that shown on the Drawings shall be removed and reinstalled to the correct elevation, unless the variation in elevation was approved in writing by the City.
- E. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the City.
- F. Joint Assembly (DI & PVC)
1. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.
 2. Each restrained joint shall be inspected by the Contractor to ensure that it has been "homed" 100 percent.
- G. Joining (HDPE)
1. Heat Fusion Joining: Joints between plain end pipes and fittings shall be made by butt fusion. Joints between the main and saddle branch fittings shall be made using saddle fusion. The butt fusion and saddle fusion procedures used shall be procedures that are recommended by the pipe and fitting Manufacturer. The Contractor shall ensure that persons making heat fusion joints have received training in the Manufacturer's recommended procedure. The Contractor shall maintain records of trained personnel, and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall not be removed.
 - a) Butt Fusion of Unlike Wall Thickness: Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR, for example, SDR 13.5 to SDR 17, or SDR 11 to SDR 13.5. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means or electrofusion. SDR's for polyethylene pipe are 7.3, 9, 11, 13.5, 17, 21, 26, 32.5 and 41.
 - b) Heat Fusion Training Assistance: Upon request and at the requestor's

expense, training personnel from the Manufacturer or his Representative shall be made available.

2. Joining by Other Means: Polyethylene pipe and fittings may be joined together or to other materials by means of (a) flanged connections (flange adapters and back-up rings), (b) mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, (c) MJ Adapters or (d) electrofusion. When joining by other means, the installation instructions of the joining device manufacturer shall be observed.
 - a) ID Stiffener and Restraint. A stiffener shall be installed in the bore of the polyethylene pipe when an OD compression mechanical coupling is used and when connecting plain end PE pipe to a mechanical joint pipe, fitting or appurtenance. External clamp and tie rod restraint shall be installed where PE pipe is connected to the socket of a mechanical joint pipe, fitting or appurtenance except where an MJ Adapter is used.
3. Branch Connections. Branch connections to the main shall be made with saddle fittings or tees. Polyethylene saddle fittings shall be saddle fused to the main pipe per G.1 listed below.

H. Cutting Pipe

1. Cut ductile iron pipe using an abrasive wheel saw.
2. Cut PVC pipe using a suitable saw.
3. Remove all burrs and smooth the end before jointing.
4. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.

I. Valve, Fitting and Pressure Gauge Installation

1. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves shall be corrected or held for inspection by the City. Valves shall be closed before being installed.
2. Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified in this Section for cleaning, laying and joining pipe, except that 12-inch and larger valves shall be provided with special support, such as treated timbers, crushed stone, concrete pads or a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve.
3. A valve box shall be provided on each underground valve. They shall be carefully set, centered exactly over the operating nut and truly plumbed. The valve box shall not transmit shock or stress to the valve. The bottom flange of the lower belled portion of

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the box shall be placed below the valve operating nut. This flange shall be set on brick, so arranged that the weight of the valve box and superimposed loads will bear on the base and not on the valve or pipe. Extension stems shall be installed where depth of bury places the operating nut in excess of 30-inches beneath finished grade so as to set the top of the operating nut 30-inches below finished grade. The valve box cover shall be flush with the surface of the finished area or such other level as directed by the City.

4. Three pressure gauges shall be installed within valve vault. Pressure gauges shall have bronze or stainless bourbon tube elements. Lens shall be heavy glass, with an oil-resistant gasket seal. The dial shall be a minimum of 4.5-inches in diameter with white coated metal lithographed with black metal graduations and numerals; graduations shall be in feet; mount as required. Connection shall be ½-inch NPT with square wrench surface. Provide cartridge snubber, diaphragm seal unit and polished brass gauge cock. Range shall be 0 to 150 feet. Accuracy shall be +/- 0.5 percent.
5. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.

J. Air Valve Manholes

1. Construct the vault or manhole as detailed on the Drawings.
2. The frame and cover shall be cast into the top slab or cone.
3. Where vent pipe are shown on the Drawings, vents shall be of one-piece, welded steel construction. Vent pipes shall equal air valve size, but no less than 4-inches. The vent pipe shall be grouted into a precast hole in the vault. The discharge of the vent pipe shall be provided with a 3/16-inch PVC coated mesh screen.

3.02 MANHOLE AND PRECAST CONCRETE PRODUCT CONSTRUCTION

- A. Construct manholes as shown on the Drawings.
- B. Precast Concrete: Handle sections carefully to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent uneven loading. Install gaskets and joint sealants in accordance with manufacturer's recommendations to produce a watertight structure.
- C. Brick: Bed the bottom and sides of every brick in mortar. Apply a smooth coat of mortar, 3/4-inch thick, on the inside and outside.
- D. Top Elevations: Build manholes outside of paved areas to 18-inches above finished grade unless otherwise shown on the Drawings or directed by the City. Build manholes in paved areas to existing grades.
- E. Frames and Covers: Unless frame and cover is at grade, the frame shall be cast into the cone section.
- F. Manholes shall be constructed such that their walls are plumb.

3.03 THRUST RESTRAINT

- A. Provide restraint at all points where hydraulic thrust may develop.
- B. Retainer Glands: Provide retainer glands where shown on the Drawings and all associated fittings, valves and related piping. Retainer glands shall be installed in accordance with the manufacturer's recommendations, particularly, the required torque of the set screws. The Contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.
- C. Harnessing: Provide harness rods only where specifically shown on the Drawings or directed by the City. Harness rods shall be manufactured in accordance with ASTM A 36 and shall have an allowable tensile stress of no less than 22,000 psi. Harness rods shall be hot dip galvanized or field coated with bitumastic before backfilling. Where possible, harness rods shall be installed through the mechanical joint bolt holes. Where it is not possible, provide 90 degree bend eye bolts. Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe size. The eye shall be welded closed. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod. Eye bolts shall be of the same material and coating as the harness rods.
- D. Concrete Blocking
 - 1. Provide concrete blocking for all other bends, tees, valves, and other points where thrust may develop, except where other means of thrust restraint are specifically shown on the Drawings.
 - 2. Form and pour concrete blocking at fittings as shown on the Drawings and as directed by the City. Pour blocking against undisturbed earth. Increase dimensions when required by over excavation.
- E. Thrust Collars: Collars shall be constructed as shown on the Drawings. Concrete and reinforcing steel shall meet the requirements specified in Article 2.03 of this Section. The welded-on collar shall be attached to the pipe by the pipe manufacturer.

3.04 CONCRETE COLLARS

Construct collars as shown on the Drawings.

3.05 INSPECTION AND TESTING (DI & PVC)

- A. Pressure and Leakage Test
 - 1. All sections of pipeline subject to internal pressure shall be pressure tested in accordance with AWWA C600. A section of line will be considered ready for testing after completion of all thrust restraint and backfilling. Each segment of pipeline between line valves shall be tested individually.
 - 2. Test Preparation
 - a. Flush pipeline section thoroughly at flow velocities adequate to remove debris from pipe and valve seats. Partially operate valves and hydrants to clean out

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- seats. Provide correctly sized temporary outlets in number adequate to achieve flushing velocities.
- b. Provide temporary blocking, bulkheads, flanges and plugs as necessary, to assure all new pipe, valves and appurtenances will be pressure tested.
 - c. Before applying test pressure, air shall be completely expelled from the pipeline and all appurtenances. Unless permanent air vents are in place, insert temporary corporation stops at highpoints to expel air as line is filled with water.
 - d. Fill pipeline slowly with water. Provide a suitable pump with an accurate water meter to pump the line to the specified pressure. Differential pressure at valves and hydrants shall equal the maximum possible, but shall not exceed manufacturer's pressure rating.
3. **Test Pressure:** Test the pipeline such that no point has a pressure less than 100 psi for at least two hours. The test pressure shall not vary by more than 5 psi for the test duration. Should the pressure drop more than 5 psi at any time during the test period, the pressure shall be restored to the specified test pressure. Provide an accurate pressure gage with graduation not less than 5 psi.
 4. **Leakage:** Leakage shall be defined as the quantity of water that must be pumped into the test section equal to the sum of the water, to maintain pressure within 5 psi of the specified test pressure for the test duration. Leakage shall be the total cumulative amount measured on a water meter. The City assumes no responsibility for leakage occurring through existing valves.
 5. **Test Results:** No test section shall be accepted if the leakage exceeds the limits determined under Section 4 of AWWA C600. The leakage test shall be repeated until the test section is accepted. All visible leaks shall be repaired regardless of leakage test results.
 6. **Completion:** After a pipeline section has been accepted, relieve test pressure. Record type, size and location of all outlets on record drawings.
- B. **Re-Testing:** Any alterations made to pipeline or manholes performed after initial testing shall be re-tested and pass again, regardless of initial test results.
 - C. **Notification:** The City of Thomasville shall be notified 24-hours in advance prior to Contractor performing any testing.

3.06 TESTING (HDPE)

- A. **Fusion Quality:** The Contractor shall ensure the field set-up and operation of the fusion equipment, and the fusion procedure use by the Contractor's fusion operator while on site. Upon request by the Owner, the Contractor shall verify field fusion quality by making and testing a trial fusion. The trial fusion shall be allowed to cool completely; then test straps

shall be cut out and bent strap tested in accordance with ASTM D 2657. If the bent strap test of the trial fusion fails at the joint, the field fusions represented by the trial fusion shall be rejected. The Contractor at his expense shall make all necessary corrections to equipment, set-up, operation and fusion procedure, and shall re-make the rejected fusions.

- B. Leak Testing: Hydrostatic leak testing shall be conducted in accordance with Performance Pipe Technical Note 802 "Leak Testing". Pneumatic pressure testing is prohibited.

END OF SECTION