

# WASTEWATER FORCE MAINS

## SECTION 429

### I. GENERAL

#### I.1. SCOPE OF WORK

The Contractor shall furnish and install a sewage force main system, complete, tested and ready for operation. The work shall also include such connections, reconnections, temporary service and all other provisions in regard to the existing operation and modification as is required to perform the new work. All references to Industry Standards (ASTM, ANSI, AWWA, etc.) shall be to the latest revision unless otherwise stated. Only those materials included in the JEA Water and Wastewater Standards Manual shall be installed. All materials shall be new unless specifically called for otherwise. For the supply of domestic water during construction, the contractor shall utilize a JEA meter assembly (meter & back flow device). In most cases, domestic water will be supplied from a jumper line between the potable water main, through a JEA meter assembly and to the new wastewater force main. Un-accountable water quantities shall be minimized where possible.

For projects where pipelines are twenty four (24) inch and larger, contractor experience in the installation of large diameter (24-inches and larger) polyvinyl chloride (PVC) pipe is required. The Contractor shall thoroughly familiarize himself with all specific manufacturing and installation requirements of the PVC pipe for bid.

#### I.2. PROJECT SCHEDULE AND COOPERATION

The project schedule shall be established on the basis of working a normal work schedule including five days per week, single shift, eight hours per day or four days per week, single shift, ten hours per day. Unless approved otherwise by JEA, normal or general items of work, such as leakage and pressure testing, density testing and final inspections, shall be scheduled during the normal work schedule. Due to operational and manpower limitations on the JEA systems, JEA will require the contractor to perform work outside of the normal work schedule. These operational and manpower limitations, including but not limited to, line filling and flushing operation, tie-in work (cut-in work or other work) and other phases of the work which may impact the continued (non-interruptible) service to existing JEA customers. The contractor shall plan and anticipate the cost impact of these system limitations and provide such work or services at no additional cost to JEA.

#### I.3. SHOP DRAWING SUBMITTALS

Actual catalog data, brochures and descriptive literature will not be required for items of standard usage which meet the requirements of Chapter X and Chapter XI of the JEA Water and Wastewater Standards Manual. Any specialty item not shown in this manual will require a complete shop drawing submittal. The Engineer may at any time require the Contractor to provide a complete detailed shop drawing submittal for any material which may, in the Engineer's opinion, not be in compliance with the JEA Water and Wastewater Standards.

##### I.3.1. MATERIAL SUBMITTALS

Submit shop drawings per the specifications for the materials (restrained joints, PVC pipe and construction equipment) proposed for installation of pipelines 20 inch and larger. PVC Pipe: Industry reference standards, product description and

data sheets, gaskets, spigot insertion mark dimension, installation instructions, and other items to allow a complete review by the Engineer.

I.3.2. CONSTRUCTION EQUIPMENT

Equipment proposed for the installation of the pipeline: machinery and calibrated torque wrenches/gauges.

I.4. AS-BUILT DRAWING

As-built drawings (to be utilized in future utility locate work) are required on all water, wastewater, force main, pump station and reclaimed water projects, including projects for JEA, City of Jacksonville, JTA, DOT, private developments (utilities to be dedicated to JEA), and other City Authorities, etc. As-built drawings shall be in accordance with specification Chapter VI. - Section 501, entitled "As-built Drawings". As built drawings shall be reviewed and approved by JEA. The cost to provide as-built drawings shall be included as part of the related work requirements or general conditions for the utility work.

I.5. WARRANTY

The Contractor shall provide to JEA a two (2) year unconditional warranty after substantial project completion or acceptance or any designated portion thereof. The warranty shall include materials and installation and shall constitute complete replacement and delivery to the site of materials and installation of same to replace defective materials or defective workmanship with new materials/workmanship conforming to the specifications.

I.6. FIELD DATA SHEETS

Provide field data sheets that contain the following information for recording data during installation of the pipe (every joint), fittings, valves, specials, and restraining devices: Spigot reference mark dimension, distance between restrainer rings on each side of pipe joint, and torque values for bolts and threaded rods.

I.7. LOCATE WIRE REPORT

Contractor shall submit for approval a final Locate Wire Report as described in Paragraph III.10.2. of this section prior to substantial completion. The JEA representative shall scan the Locate Wire Report and ensure the documents are filed in the electronic file folder for the project.

## II. MATERIALS

All material shall be free from defects impairing strength and durability, shall be of the best commercial quality for the purpose specified, and shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

II.1. PIPE

Pipe for force main lines in sizes up to and including 48 inches shall be polyvinyl chloride (PVC), fiberglass or high density polyethylene (HDPE), as shown on the drawings and as herein specified. Pipe for force main lines larger than 48 inches shall be fiberglass as shown on the drawings and herein specified. Pipe to be used as a casing in sizes 4 inches and larger shall be welded steel pipe as shown on the drawings and as herein specified. Pipe to be installed underground shall be push-on joint, fused or mechanical joint type. Pipe installed on bridges, piles or other above ground installations shall be Stainless Steel. PVC pipe shall not be used in

above ground applications unless incased. Underground pipe shall be furnished in nominal 18 or 20 foot laying lengths unless indicated otherwise on the drawings. Pipe shall be cut to length as required to fit installation conditions. PVC or HDPE piping shall not be utilized on bridges or other above ground applications unless incased. Pipe sizes and applications shall conform to the following chart.

PIPE	PIPE SIZE	JOINT TYPE	APPLICATION
PVC DR18	4 inches and larger*	Push-on joint	below ground
PVC DR18	4 to 12 inches	Fusible PVC	below ground
PVC DR 25	16 inches and larger*	Push-on joint	below ground
PVC (Sch. 40)	3 inches and smaller	Solvent Weld	below ground
PVC (Sch. 80)	3 inches and smaller	Solvent Weld	below ground
Polyethylene (HDPE)	4 inches and larger	Fused	directional drill, pipe bursting or approved JEA (below ground)
Fiberglass Reinforced Polymer Mortar Pipe	24 inches and larger	Bell-spigot joint	above or below ground
Stainless Steel	4 inches and larger	Welded, flanged	above or below ground
Steel	4 inches and larger	Welded	casing only

\*Pipe sizes 14" and 18" shall not be utilized unless specifically approved by JEA excluding HDEP.

II.1.1. POLYVINYL CHLORIDE PRESSURE PIPE

Pipe shall be virgin polyvinyl chloride (PVC) pipe for force main and shall have a bell type coupling with a thickened wall section integral with the pipe barrel in accordance with ASTM D3139. Elastomeric seals shall meet ASTM F477 and shall be attached to the bell utilizing glue (AWWA and manufacturer's approved type) or rieber ring. The pipe material shall be clean, virgin, National Sanitation Foundation No. 14 approved, Class 12454-A or 12454-B PVC compound conforming to ASTM resin specification D1784. Each length shall be clearly marked with the name of the manufacturer, location of the plant, pressure rating, nominal pipe diameter and length. Storage and handling of PVC pipe shall be in accordance with chapter 6 of AWWA Manual M23. All PVC DR 18 and DR 25 pipe shall be green.

II.1.1.1. PVC 1120, CLASS 100, DR 25 PIPE

Pipe shall conform to AWWA Standard C905 for 14 inch through 36 inch pipe. Pipe is to be manufactured to ductile iron pipe equivalent outside diameters.

II.1.1.2. PVC 1120, CLASS 150, DR 18 PIPE

Pipe shall conform to AWWA Standard C900 for 4 inch through 12 inch pipe, and AWWA Standard C905 for 14 inch through 36 inch pipe. Pipe is to be manufactured to ductile iron pipe equivalent outside diameters.

II.1.1.3. PVC 1120, SCHEDULE 40 AND SCHEDULE 80 PIPE  
Pipe shall conform to ASTM D1784 and D1785. Green color pipe. Pipe is to be manufactured to I.P.S. (Steel) Standard Pipe equivalent outside diameters. Pipe shall be marked NSF-PW approved. To insure a water-tight connection, the contractor shall utilize "purple primer" and "rain or shine glue" or JEA approved equal.

II.1.2. FIBERGLASS REINFORCED POLYMER MORTAR PIPE

II.1.2.1. PRODUCTS

II.1.2.1.1. MATERIALS

II.1.2.1.1.1. RESIN SYSTEMS

The manufacturer shall use only polyester resin systems with a proven history of performance in this particular application. The historical data shall have been acquired from a composite material of similar construction and composition as the proposed product.

II.1.2.1.1.2. GLASS REINFORCEMENTS

The reinforcing glass fibers used to manufacture the components shall be of highest quality commercial grade E-glass filaments with binder and sizing compatible with impregnating resins.

II.1.2.1.1.3. SILICA SAND

Sand shall be minimum 98% silica with a maximum moisture content of 0.2%.

II.1.2.1.1.4. ADDITIVES

Resin additives, such a curing agents, pigments, dyes, fillers, thixotropic agents, etc., when used shall not detrimentally affect the performance of the product.

II.1.2.1.1.5. ELASTOMERIC GASKETS

Gaskets shall be supplied by qualified gasket manufacturers and be suitable for the service intended.

II.1.2.1.2. MANUFACTURE AND CONSTRUCTION

II.1.2.1.2.1. PIPES

Manufacture (CCFRPM) pipe by the centrifugal casting process to result in a dense nonporous, corrosion-resistant, consistent composite structure. The pipe nominal pressure class (PN) shall be equal to or greater than the maximum sustained operating pressure of the line (PN 150 minimum). The maximum transient (operating plus surge) pressure of the line shall not exceed the pipe nominal pressure class by more than 40%. No exterior pipe color required.

**II.1.2.1.2.2. JOINTS**

Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings that utilize elastomeric sealing gaskets made of EPDM rubber compound as the sole means to maintain joint watertightness. The joints must meet the performance requirements of ASTM D4161. Tie-ins, when needed, may utilize gasket-sealed mechanical couplings. Restrained joints may be provided by reinforced fiberglass materials as per the pipe manufacturer's recommendation and as approved by JEA. Other restraint devices must be approved by JEA (follow the D.I.P. Restraint Joint Schedule, at a minimum).

**II.1.2.1.2.3. FITTINGS**

Flanges, elbows, reducers, tee, wyes, laterals and other fittings shall be capable of withstanding all operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays. If approved by JEA, properly protected standard ductile iron fittings may also be used. Unbalanced thrust forces shall be restrained with thrust blocks, axial restraint systems or other suitable methods as approved by JEA. Fiberglass tees, wyes, laterals, or other similar fittings shall be fully encased in reinforced concrete designed to withstand the pressure forces. The pipe manufacturer shall be consulted during the design of the restraint system.

**II.1.2.1.2.4. ACCEPTABLE MANUFACTURER**

HOBAS Pipe USA, Inc., or JEA approved equal.

**II.1.2.1.3. DIMENSIONS****II.1.2.1.3.1. DIAMETERS**

The actual outside diameter (18" to 48") of the pipes shall be in accordance with AWWA C950. For other diameters, OD's shall be per manufacturer's literature.

**II.1.2.1.3.2. LENGTHS**

Pipe shall be supplied in nominal lengths of 20 feet. Actual laying length shall be nominal +1, -4 inches. At least 90% of the total footage of each size and class of pipe, excluding special order lengths, shall be furnished in nominal length sections.

**II.1.2.1.3.3. WALL THICKNESS**

The minimum wall thickness shall be the stated design thickness. For pipe sizes 27 inch thru 36 inch utilize PN 150 minimum. For pipe sizes larger than 36 inch utilize PN 100 minimum.

**II.1.2.1.4. TESTING****II.1.2.1.4.1. PIPES**

Pipes shall be manufactured in accordance with the applicable standard.

**II.1.2.1.4.2. JOINTS**

Coupling joints shall meet the requirements of ASTM D4161.

**II.1.2.1.4.3. STIFFNESS**

Minimum pipe stiffness when tested in accordance with ASTM D2412 shall normally be 36 psi.

**II.1.2.1.4.4. TENSILE STRENGTH**

Pipe hoop tensile strength for pressure pipe shall be verified as specified in applicable standard (ASTM D3754 or AWWA C950) or by random burst testing at the same sampling frequency. All pipes shall be capable of withstanding a test pressure of two (2) times the maximum sustained operating pressure of the line without leaking or cracking. This performance shall be verified as agreed between the buyer and seller.

**II.1.3. STEEL CASING PIPE**

Pipe to be used as a casing shall conform to either ASTM Standard A139 for "Electric Fusion (arc) Welded Steel Pipe" with minimum yield strength of 35,000 psi or "API Specification API-5LX, Grade X-42 Welded Steel Pipe". Wall thickness shall meet the requirements of the latest Revision of the American Railway Engineering Association Manual of Recommended Practice or the Florida Department of Transportation Standard Specification for Road and Bridge Construction, as applicable. For street uses which are not DOT or railroad, use DOT casing thickness unless otherwise indicated by Engineer. All pipe furnished by the manufacturer shall be cast and machined at one foundry location to assure quality control and provide satisfactory test data. Full pipe length shall be provided. No short pipe lengths less than 8-feet long will be allowed unless approved by JEA. The pipe ends shall be tapered where welding is required.

**II.1.4. HIGH DENSITY POLYETHYLENE (HDPE) PIPE**

It should be noted that the use of this product (especially for DR-11 pipe) may require up-sizing the main so that the inside diameter is approximately the same as PVC size where applicable. See Horizontal Directional Drilling (Chapter VI. 2. - Section 750 and 755) for technical specifications for this product and associated construction standards.

**II.1.5. STAINLESS STEEL PIPE AND FITTING SYSTEM**

Pipe shall be manufactured from ASTM-A240 annealed and pickled sheets and plates in accordance with ASTM A778 in grade 316L stainless steel. Pipe shall be manufactured to nominal pipe sizes as listed in ANSI B36.19, Table 2. The pipe wall thickness shall be schedule 40 for all pipe sizes. Piping system shall be capable of withstanding

satisfactorily all resultant forces exerted by normal pressure conditions, thermal expansion & contraction, and any surge pressures which may arrive from flow reversals during start up or shut down of the system. Fittings may be 316 stainless steel flanged type manufactured in accordance with ASTM-A774, AWWA C110 of the same raw material and in the same thicknesses as the pipe. Fittings may also be flanged ductile iron with specialty inside coating. The fittings utilized at wastewater pump station sites shall only be flanged stainless steel (no butt weld fittings) or flanged ductile iron with specialty inside coating. The finish on the raw material, manufactured to ASTM A-240 will be No. 1, HRAP (hot rolled annealed and pickled) or better. The finish on the completed pipe and fittings shall be as specified in ASTM A778 and A774, respectively. Transition from PVC to stainless steel flange to mechanical joint.

II.1.6. FUSIBLE PVC PIPE (4"-12" SIZE)

May be used on potable water or reclaimed water systems. Fusible PVC may be utilized for directional drilling and direct bury applications. Pipe shall meet C-900 pressure class, DR-18 wall thickness and color coded. The pipe shall be marked with the name and location of the manufacturer, pressure rating and size. Unless approved otherwise by JEA, the bending radius shall not exceed 50% of the manufacturer's recommendation and the pulling force shall not exceed 80% of the manufacturer's recommendation.

II.2. FITTINGS

Pipe furnished except as follows or as otherwise specified. PVC fittings 3 inch and smaller shall be solvent weld. Fittings 4 inches and larger on push-on joint pipe installed underground shall be PVC with restrained push-on bell type joint pressure rating to match the pipe, at a minimum. Fittings 4 inches and larger installed above ground shall be ductile iron with flanged ends or restrained joints unless shown otherwise on the drawings. Large tee fittings (16 inches and larger) shall be ductile iron only.

II.2.1. DUCTILE IRON FITTINGS

Ductile iron fittings shall have a minimum working pressure of 250 psi. Fittings shall conform to ANSI Specification A21.10 (AWWA C110), A21.11 (AWWA C111), A21.15 (AWWA C115) and/or A21.53 (AWWA C153). Fittings shall also be certified by ISO 9000 by an accredited registrar. Compact fittings shall normally be installed. Long body fittings shall be used where the drawings specifically call for long body fittings, where compact fittings are not available, or at the option of the Contractor when the laying length is not controlled by compact fitting patterns. All fittings shall be UL/FM approved and shall conform to NSF Standard 61 as applicable. All fittings furnished by the approved manufacturer shall be cast and machined at one foundry location to assure quality control and provide satisfactory test data. Fittings shall have cast on them the pressure rating, nominal diameter of openings, manufacturer's name, foundry location, plant code and degrees or fraction of the circle. Cast letters and figures shall be on the outside body of the fitting. The JEA may require random ductile testing of manufacturer's fittings. All ductile iron fittings shall be externally coated and internally lined as specified in this section. Ductile iron welded-on outlets are not acceptable. In lieu of ductile tee/fittings, a tapping sleeve may be utilized on 24 inch and larger (D.I.P or PVC) pipe for outlets 12 inches and smaller.

## II.2.2. POLYVINYL CHLORIDE FITTINGS

Fittings that are 3-inch and smaller may be PVC with push-on bell type joint or PVC with solvent weld joints as outlined above. Fittings that are 4 inches and larger shall be restrained push on bell joint. Restraints shall be in accordance with this specification regarding installation and material. The fittings shall conform to the appropriate sections of these specifications for PVC pipe and PVC pipe joints.

### II.2.2.1. PVC 1120, CLASS 150, DR 18 FITTINGS

PVC fittings 4-inch through 12-inch may be used with PVC C900 pipe. Fittings shall be PVC injection molded, made from materials meeting or exceeding the requirements of cell class 12454-B material as defined in ASTM D1784. All PVC fittings must comply with, or exceed, AWWA C907. All fittings must be designed to the pressure class of DR18, with a pressure rating of 150 psi and a 2.5 to 1 factor of safety. Virgin materials only shall be used in the manufacture of PVC pressure fittings. These fittings must have UL-FM approval and shall comply with or exceed all ASTM Standards for PVC fittings. All fittings must have NSF-61 approval. The elastomeric gasket shall comply with the requirements specified in ASTM F477 and shall be attached to the bell utilizing glue (AWWA and manufacturer's approved type) or rieber ring.

### II.2.2.2. PVC FABRICATED FITTINGS (14" And Larger)

Fittings (except TEE fittings) shall be fabricated from PVC pipe meeting the requirements of AWWA C-905. The component pipe segments and bonds between fittings shall be free from voids, cracks, inclusions and other defects. The joining surfaces of the spigots and bells shall be free from imperfections that could cause leaks. When component segments are joined using solvent cement, the procedure shall conform with the standard practice for making pressure joints outlined in ASTM D2855. Reinforcement may be applied and permanently bonded to the outside surfaces of the fitting. Reinforcement overwrap shall be in compliance with the appropriate sections of AWWA C-905. Tee fittings must be ductile iron. The elastomeric gasket shall comply with the requirements as specified in ASTM-F472 and shall be attached to the bell utilizing glue (AWWA and manufacturer's approved type) or rieber ring. Fittings shall be tested in accordance with the appropriate sections of AWWA C-905. All fittings shall include the following markings: nominal size, PVC pressure rating, pressure class and manufacturer name and/or trademark. Fittings color shall be green or white.

### II.2.2.3. PVC 1120, SCHEDULE 40 AND SCHEDULE 80 FITTINGS

Schedule 40 and Schedule 80 fittings shall have solvent weld joints and shall be in accordance with ASTM D2672 and white, grey or green color.

#### II.2.2.4. HDEP FITTINGS

See "Horizontal Directional Drilling", (Chapter VI. 2. - Section 750 and 755), for technical specifications for this product and associated construction standards.

#### II.2.3. NON-STANDARD FITTINGS AND WALL CASTINGS

Fittings having nonstandard dimensions and cast specifically for this project shall be of approved design. They shall be manufactured to meet the requirements of the same specifications and shall have the same diameter and thickness as standard fittings, but their laying lengths and types of ends shall be determined by their positions in the pipelines and by the particular piping to which they connect. Wall castings shall be of the size and types indicated on the drawings. Flanges, facing, and drilling shall conform to the 125-pound American National Standard. Flanges shall be drilled and tapped for studs. Other dimensions shall be substantially equal to corresponding parts of standard bell and spigot fittings.

#### II.2.4. STAINLESS STEEL FITTINGS

Fittings may be 316 stainless steel butt weld or flanged type manufactured in accordance with ASTM-A-774 of the same raw material and in the same thicknesses as the pipe. Fittings may also be flanged ductile iron with specialty inside coating. The fittings utilized at wastewater pump station sites shall only be flanged stainless steel (no butt weld fittings) or flanged ductile iron with specialty inside coating.

### II.3. JOINTS

Type of joint used shall meet the following specifications or be approved by the Engineer prior to installation. Joints shall be made in accordance with approved printed instructions of the manufacturer, and shall be absolutely watertight.

#### II.3.1. MECHANICAL JOINTS

All jointing materials for mechanical joints shall be provided by the pipe and/or fitting manufacturer. Material assembly and bolting shall be in accordance with ANSI Specification A21.11 (AWWA C111). All glands shall be made of ductile iron only.

#### II.3.2. PUSH-ON JOINTS

##### II.3.2.1. POLYVINYL CHLORIDE (PVC)

PVC pipe joints shall be the manufacturer's standard push-on bell type with rubber sealing ring in accordance with ASTM D3139. Elastomeric gaskets shall conform to ASTM F477.

#### II.3.3. BALL AND SOCKET JOINTS

Where subaqueous joints are indicated, joints shall be bolted or boltless flexible ball and socket joints conforming to the pressure and thickness requirements of ANSI A21.10 (AWWA C110) and ANSI A21.51 (AWWA C151) and shall be capable of providing a maximum deflection of fifteen degrees at each joint. Joints and gasket material shall be manufacturer's standard. The specific type joint shall be as shown on the drawings and/or as approved by the Engineer. Installation shall be in accordance with the manufacturer's recommended practice.

#### II.3.4. FLANGED JOINTS

##### II.3.4.1. STAINLESS STEEL FLANGES

Flanged pipe and fitting ends shall be made up of type 316L stainless steel welded on flanges drilled to ANSI 16.1 class 125 standard. The flange shall be continuously welded on both sides to the pipe or fitting. Bolts and other hardware shall be 316L stainless steel. Gaskets shall be 1/8" full face SBR Rubber.

##### II.3.4.1.1. FLANGED COUPLE ADAPTER

A restrained ductile iron flanged coupling adapter (flanged X MJ) with special interior coating may be utilized to transition between different pipe materials (PVC to S/S). Acceptable is a Romac PVC-RFCA restrained flange coupling adapter or JEA approved equal.

##### II.3.4.1.2. THREADED CONNECTIONS

Threaded pipe (2" size and smaller), gauge or instrument connections shall be 316 stainless steel 150-pound threaded conforming to ASTM A-182 or ASTM A-276.

#### II.3.5. MACHINED SURFACES

Machined surfaces shall be cleaned and coated with a suitable rust preventive coating at the shop immediately after being machined.

#### II.3.6. STEEL CASING PIPE JOINTS

Steel casing pipe joints shall be electric fusion (arc) welded by operators whose qualifications meet the requirements of the American Welding Society Standard procedures and in conformance with AWWA C206. For field welds, the joints to be welded shall be tapered (approximately 45 degree taper).

#### II.3.7. POLYVINYL CHLORIDE SOLVENT WELD JOINTS

Pipe joints for schedule 40 or schedule 80 pipe shall be solvent weld joints. The solvent cement shall comply with ASTM D2564. The joint shall be made in accordance with ASTM D2855. The joint shall conform to ASTM D2672.

#### II.3.8. RESTRAINED JOINTS

##### II.3.8.1. RESTRAINERS

The restrainer shall be manufactured of ductile iron and shall meet or exceed all the requirements of ANSI A21.11 (AWWA C111) and ASTM A536. The restrainer system shall provide anchoring ductile iron pipe and fittings, valves and PVC pipe to mechanical joint pipe or fittings, or bell to spigot PVC pipe joints. The restrainer shall accommodate the full working pressure rating of the pipe plus surge allowance. In the assembly of the restraint device, the contractor shall tighten the bolts to the correct torque range as recommended by the restraint manufacturer. The restrainers shall be painted black for ductile iron pipe and painted red for PVC pipe applications.

Restrainers shall be properly stored to minimize sand and debris build-up. Specifically the twist-off-screws and associated threads shall be clean (free of sand) prior to installation.

II.3.9. FLANGE ADAPTERS

Flanged adapters shall only be utilized if no other method is possible. Flange adapters shall be ductile iron manufactured to ASTM A536 standards. Bolt circles and bolt holes shall meet ANSI B16.1 for 125 pounds. Adapter flanges shall meet or exceed all test requirements of AWWA C900, ASTM D2241 and ASTM D1599.

II.3.10. PIPE COUPLINGS

The Contractor shall furnish and install pipe couplings as required to complete the work. Pipe couplings used to join two pieces of PVC pipe shall be sized to match the outside diameter of the pipeline. Transition couplings shall be used to join pipes of different outside diameters. The coupling sleeve shall be manufactured of ductile iron conforming to ASTM A536 and shall be coated with nominal 14 mils of epoxy as set forth in Section II.4. The bolts shall be manufactured of a metal of high corrosion resistance and shall conform to ANSI 21.11 (AWWA C111). Gaskets shall be wedge-type and manufactured of virgin SBR for water and wastewater service. The installation of all couplings shall be in accordance with manufacturer's recommendations. Couplers and adapters for polyethylene pipe shall be brass conforming to AWWA C800 and shall be female IPT, pack joint or compression nut.

II.3.11. FULL CIRCLE REPAIR CLAMPS

Full circle repair clamps shall have type 304 stainless steel shells, lugs, bolts, nuts and washers as per ASTM A193, A194, A240, or shall have type 304 stainless steel shells per ASTM A240, ductile iron lugs as per ASTM A536, and 304 stainless steel bolts, washers and nuts. Gaskets for both types shall be virgin SBR as per ASTM D2000 for water service. Minimum lengths shall be 7½" long for 6" nominal and smaller pipe, 12" long for 8" – 12" nominal pipe and 20" long for pipes larger than 12" nominal pipe.

II.3.12. STAINLESS STEEL FLEXIBLE JOINT

Flexible joints are intended for use in joining stainless steel pipe in a piping system where axial movement due to thermal expansion and contraction is required. The design engineer shall provide summary of design axial movement calculations on the construction plans and specific installation instructions for the contractor regarding the impact of outdoor temperature during the construction period. The actual construction shall be in accordance with the flexible joint manufacturer. Flexible Joints shall be flexible expansion joint type manufactured of ductile iron conforming to ASTM A-536. Flexible Joints shall have flanged ends meeting ANSI Class 125. Each flexible expansion joint shall consist of an expansion joint designed and encast as an integral part of a ball and socket type flexible joint with deflection capability. All integral surfaces (wetted parts) shall be lined with 12 mils (min) of fusion bonded epoxy. The exterior surfaces shall be lined with 6 mils (min) of fusion bonded epoxy. Sealing gaskets shall be constructed of EPDM. Bolts and other hardware shall be 316L stainless steel. Acceptable flexible joint shall be EBAA Flex-Tend, EBAA Forced Balanced Flex-Tend, Romac FlexiJoint or JEA approved equal.

II.3.13. STAINLESS STEEL AIR RELEASE VALVES

Air Release Valves: All ARVs installed on the stainless steel pipe shall be Stainless steel body type meeting JEA approved materials (see specification section 430).

II.4. CORROSION PROTECTION FOR DUCTILE IRON PIPE AND FITTINGS

II.4.1. INTERIOR LINING

The interior of all ductile iron pipe and fittings shall be furnished with an approved amine cured novalac epoxy coating. Acceptable coatings Permax-CTF and Protecto 401 ceramic epoxy.

II.4.1.1. LINING MATERIAL

The material shall be an amine cured novalac epoxy containing at least 20% by volume of ceramic pigment. The lining material shall comply with the following properties:

II.4.1.1.1. ASTM D-1653 Permeability, Method A 40-mils free cast film 30-day duration. 0.00 perms.

II.4.1.1.2. The following test must be run on coupons from factory lined Ductile Iron Pipe.

II.4.1.1.2.1. ASTM B 117-85 Salt Spray (scribed panel) – Results to equal 0.0 undercutting after two years.

II.4.1.1.2.2. ASTM D-4541 Adhesion 700 psi minimum.

II.4.1.1.2.3. ASTM G-95 Cathodic Disbondment shall be not greater than 0.5mm disbondment, 30 days duration.

II.4.1.1.2.4. Immersion Testing rated using ASTM D-1308 evaluated by ASTM D-714

II.4.1.1.2.4.1. 20% Sulfuric Acid @ 77° F with no effect after 2 years.

II.4.1.1.2.4.2. 140°F-25% Sodium Hydroxide – No effect after two years.

II.4.1.1.2.4.3. 160°F Distilled Water – No effect after two years.

II.4.1.1.2.4.4. 5% Sodium Chloride Solution @ 77° F No-effect after 2 years

II.4.1.1.3. ASTM D-4060 Abrasion Resistance shall not exceed a weight loss of more than 0.30 grams (CS17 Wheel, 1000-gram load, 1000 cycles).

II.4.1.1.4. ASTM G-53-77 Moisture/UV Light. UVB-313 Bulb. Cycle-8 hrs. UV @ 60° C followed by 100 % Humidity @ 40° C. 1 year – pass, no crazing, cracking, or loss of adhesion.

II.4.1.1.5. ASTM D-2794 Direct Impact Resistance 140 in./lbs. minimum.

II.4.1.2. APPLICATION

II.4.1.2.1. APPLICATOR

The lining shall be applied by a competent firm, who has been certified acceptable by the lining manufacturer

with a successful history of applying linings to the interior of ductile iron pipe and fittings.

II.4.1.2.2. SURFACE PREPARATION

Prior to abrasive blasting, the entire area to receive the protective compound shall be inspected for oil, grease, etc. Any areas where oil or grease is present, or any substance which can be removed by solvent, shall be solvent cleaned using the guidelines outlined in DIPRA- 1 Solvent Cleaning, NAPF 500-03-01. Per guidelines outlined in NAPF 500-03-04 or NAPF 500-03-05. After the surface has been made free of grease, oil or other substances, all areas to receive the protective compounds shall be abrasive blasted using compressed air nozzles with sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc, are removed from the surface. Only slight stains and tightly adhering annealing oxide may be left on the surface. Any area where rust reappears before lining must be re-blasted. Abrasive blasting of previously lined pipe or fitting (including cement lined materials), is not acceptable. Only virgin metal materials will be utilized in the lining process.

II.4.1.2.3. LINING

Within eight (8) hours of surface preparation, the interior of the pipe and fittings shall receive nominal 40 mils (minimum), couplings/sleeves shall receive nominal 14 mils, and bell and spigot shall receive 6-10 mils maximum of joint compound, normal dry film thickness of the approved lining. No lining shall be applied when the substrate or ambient temperature is below 40 degrees Fahrenheit. The surface also must be dry and dust free. If flanged pipe or fittings are included in the project, the lining shall not be used on the face of the flange. Upon completion of the blast cleaning operation, the lining material should be applied to the interior of the pipe within 12 hours in order to avoid any possible post blast surface contamination. Any area found to have rust bloom prior to application must be re-blasted.

II.4.1.2.4. NUMBER OF COATS

The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The maximum or minimum time between coats shall be that time recommended by the lining manufacturer.

II.4.1.2.5. ROUGH-UP & REPAIR

JEA will not accept damaged or touched-up epoxy lined materials nor will JEA allow field repairs. Field touch-up exceptions may be allowed for field cutting only. Touch-up shall be performed by a certified epoxy-trained applicator with a valid certification card. Touch-up shall be performed in accordance with the lining manufacturer's recommendations.

II.4.1.3. INSPECTION AND CERTIFICATION JEA MAY REQUIRE THE CONTRACTOR TO PROVIDE THE FOLLOWING INSPECTION IF A QUALITY CONCERN EXISTS IN THE FIELD

- II.4.1.3.1. Epoxy lined ductile pipe and fittings shall be inspected for foundry defects. If any defects are found, the pipe or fitting shall be replaced with a new pipe or fitting.
- II.4.1.3.2. Ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be performed using the method outlined in SSPCPA-2 Film Thickness Rating.
- II.4.1.3.3. The interior lining of all pipe and fittings shall be tested for pinholes with a nondestructive 2,500 volt test. If any defects are found, the pipe or fitting shall be replaced with a new pipe or fitting
- II.4.1.3.4. Each pipe, pipe joint and fitting shall be marked with the date of application of the lining system along with its numerical sequence of application on that date, the manufacturer date of the pipe or fitting and the applicator's certification number. All records of the work shall be maintained by the applicator.

Example:

Date of lining (L)                      Applicator's Number (A)  
 Date of Manufacturing (M)          Manufacturer's Name  
 Sequence Number (S)

L-08-19-17	A-4
M-06-19-17	USP
S-1-4	

- II.4.1.3.5. No pipe, pipe joint, or fitting shall be accepted if the date of application of the lining system and the date of manufacture of the pipe, pipe joint, or fittings differs by more than two (2) years.

II.4.1.4. HANDLING (AT THE FACTORY AND IN THE FIELD)

The lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. If damaged, the pipe or fittings shall be replaced.

II.4.1.5. WARRANTY

A minimum three (3)-year above ground storage replacement warranty and a two (2)-year in-ground warranty, on the serviceability of the lining, shall be furnished by the lining manufacturer on the serviceability of the liner. The lining manufacturer shall provide annual inspections, within the JEA service area, to assure above ground serviceability of the lining and provide documentation of such to the JEA Water Wastewater Standards. This warranty shall include but not be limited to, statements that at any time up to the end of the year from the date of project acceptance:

- II.4.1.5.1. The lining shall not have disbonded.
- II.4.1.5.2. The lining shall not have suffered any appreciable underfilm migration.

II.4.1.5.3. The interior pipe metal, at points of pinholes or holidays, shall not have suffered detrimental deterioration.

II.4.1.5.4. The lining shall have maintained its smooth surface characteristics. The Contractor and/or lining manufacturer shall not make any exemption or exception to the above stated conditions or warranty within the limits as stated in this section of these specifications.

II.4.2. EXTERIOR COATING

All ductile iron pipe and fittings, except as otherwise noted, shall receive an exterior bituminous coating as specified in ANSI A21.51. The finish coating shall be continuous smooth, neither brittle when cold nor sticky when exposed to the sun, and be strongly adherent to the fitting. If the pipe is installed in corrosive soils, then all bolts, nuts, studs and other uncoated parts of joints for underground installation shall be coated with asphalt or coal-tar prior to backfilling. Corrosive soil shall be defined as described in AWWA C105, appendix "A".

II.4.3. POLYETHYLENE WRAP

In areas where soils are corrosive in nature, ductile iron pipe, fittings, valves and other appurtenances shall be protected with polyethylene wrap or tubing. Corrosive soil shall be defined as described in AWWA-C105, appendix "A". The Contractor shall furnish and install polyethylene tube or wrap for ductile iron pipe at the locations shown on the construction drawings or as directed by JEA.

II.4.3.1. MATERIAL

The polyethylene material shall meet or exceed the requirements of AWWA C105 in all respects. The wrap shall be virgin, high density polyethylene, 4 mils thick minimum cross laminated type or 8 mils linear low density tape. The polyethylene wrap shall include industrial standard repeatable message (green color).

II.4.3.2. INSTALLATION

Although not intended to be a water-tight enclosure, the polyethylene shall prevent contact between the pipe and the surrounding backfill. Installation shall be done according to one of the methods described in Section 5.4 of AWWA C105, subject to approval by the engineer and the manufacturer.

II.4.4. MARKING FOR 2" PVC PIPE

All 2" PVC pipe below ground shall be marked with a 3 inch wide (minimum), non-detectable utility marking tape (tape with an adhesive backing). The utility marking tape shall be installed on the pipe at the 12:00 o'clock position. Tape shall be 4 mil (minimum) ASTM D2103 thickness constructed for prolonged use underground, meet the industry standards (APWA) color code, tensile strength of 2750 psi (ASTM D882), and industrial standard repeatable message. All pipe above ground (including bridge crossing) shall be color labeled "WASTEWATER" stenciled in the center of each joint of pipe utilizing an oil-based paint. Stenciled lettering shall be 4" (minimum), high lettering and be green color. All fittings (above ground or below ground) shall be labeled "WASTEWATER", or marked with green paint (6 inch diameter solid circle, minimum), within 48 hours after site delivery. By properly marking the ductile fittings, this will assure that only wastewater fittings will be utilized on the force main system.

II.5. PIPING SUPPORTS

The Contractor shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades indicated on the drawings or as specified.

Piping within pumping stations shall be adequately supported from floors, walls, ceilings or beams. Supports from the floor shall be by approved saddle stands or suitable concrete piers as indicated

or approved. Pipe saddles shall be shaped to fit the pipe with which they will be used and shall be capable of screw adjustment. Concrete piers shall conform accurately to the bottom one-third to one-half of the pipe. Piping along walls shall be supported by approved wall brackets with attached pipe rolls or saddles or by wall brackets with adjustable hanger rods. For piping supported from the ceiling, approved rod hangers of a type capable of screw adjustment after erection of the piping and with suitable adjustable concrete inserts or beam clamps shall be used. If required, piping supports shall be placed so as to provide a uniform slope in the pipe without sagging. Supports shall be located wherever necessary, and in no case shall they exceed 8 feet on centers for stainless steel pipe and 4 feet on centers for PVC pipe.

II.5.1. STAINLESS STEEL PIPE SUPPORT

Pipe Supports: Pipe supports shall be in accordance with JEA Water and Wastewater Standards Manual, but modified to match the outside diameters (OD) of stainless steel pipe. The design engineer shall also provide base support to handle the weight of the flexible joint, if required (especially for couplings larger than 8" size). Other pipe support systems must be approved by JEA prior to construction.

II.5.2. CASING SPACERS

Casing spacers shall be a two piece prefabricated unit by a single manufacturer. All casing spacers in a single casing pipe crossing shall be by the same manufacturer. Casing spacers shall have a shell made from either 304 stainless steel, 14-gauge mild steel which has been heat fusion coated with PVC plastic, (PVC coating shall be .01 inch thick over the entire band including the runner studs) or high density polyethylene. Casing spacers on 16 inch and smaller carrier pipe shall have 8-inch wide steel bands and casing spacers on 18-inch and larger carrier pipe shall have 12-inch wide steel bands, except high density polyethylene spacers shall have high density polyethylene bands. All casing spacers for 14-inch and smaller pipe size shall have four 10- gauge or 14-gauge steel risers with runners and casing spacers for 16-inch and larger pipe shall have six 10-gauge or 14-gauge steel risers with runners (two top and four bottom), except high density polyethylene spacers shall have one riser for every diameter inch of carrier pipe. The runners (risers) shall be either glass reinforced plastic, UHMW polymer or high density polyethylene. All nuts, bolts and washers shall be 304 stainless steel. All risers over 2 inches in height shall be reinforced. Wooden skids are not an acceptable alternate.

II.6. LOCATE WIRE

- II.6.1. Locate wire shall be installed on all wastewater force main piping, potable water main piping, reclaimed water main piping, potable water services 10-LF or greater in length, and reclaimed water services 10-LF or greater in length.
- II.6.2. No locate wire shall be installed on above ground installations.
- II.6.3. Refer to details for minimum installation requirements.
- II.6.4. Locate wire shall be 12 gauge, copper wire with .03 inches (minimum) HDPE insulation thickness, .141 inches (minimum) O.D. rated break load 250 lbs., 30 volt, and 21% IACS.
- II.6.5. The outside color of the wire shall be as follows:
  - II.6.5.1. Green for wastewater force mains
  - II.6.5.2. Blue for potable water mains and services

- II.6.5.3. Purple for reclaimed water mains and services
- II.6.5.4. White for Chilled water lines
- II.6.6. LOCATE WIRE MANUFACTURERS SHALL BE
  - II.6.6.1. Copperhead
  - II.6.6.2. Protrace; or,
  - II.6.6.3. JEA approved equal.

## II.7. MATERIAL TESTING

JEA will perform random testing of all materials furnished for Conformance to the following standards. The entire product of any manufacturer or of any one plant may be rejected when, in the opinion of JEA, the methods of manufacture fail to secure uniform results acceptable to the requirements of these specifications. Pipe and materials shall be tested in, and for conformity with, the latest editions of the following:

Item	Specifications
Ductile Iron Fittings	ANSI A21.50 (AWWA C150)
	ANSI A21.51 (AWWA C151)
	ANSI A21.53 (AWWA C153)
	ANSI A21.40 (AWWA C104)
	ANSI A21.50 (AWWA C105)
	ANSI A21.10 (AWWA C110)
	ANSI A21.15 (AWWA C115)
Polyvinyl Chloride Pipe and Fittings	ASTM D1598
	ASTM D1599
	ASTM D1784
	ASTM D1785
	ASTM D2122
	ASTM D2241
	ASTM D2564
	ASTM D2672
	ASTM D2837
	ASTM D2855
	ASTM D3139
	ASTM F477
	AWWA C900
	AWWA C905
AWWA C907	
Polyethylene Tubing	ASTM D1248
	ASTM D2239
	ASTM D2737
	ASTM D3350
	AWWA C901

### III. INSTALLATION

#### III.1. REFERENCE POINTS AND LAYOUT

The Contractor shall be responsible for setting all grade, lines and levels. The Contractor or Contractor's Surveyor will provide centerline of construction and will establish a bench mark. Any reference points, points of intersection, property corners, or bench marks, which are disturbed during construction, shall be restored by a Land Surveyor registered to practice in the State of Florida, and all costs thereof shall be borne by the Contractor. The Contractor shall assume all responsibility for the correctness of the grade and alignment stakes.

#### III.2. HANDLING AND CUTTING PIPE

Transport, handle and store pipe materials and other products specified herein in a manner recommended by the respective manufacturers to prevent damage and defects. Handling and storage shall be in accordance with Chapter 6 of AWWA Manual M23 and AWWA C605. Procedures "recommended" in these AWWA publications shall be mandatory. Every care shall be taken in handling and laying pipe and fittings to avoid damaging the pipe, scratching or marring machined surfaces, and abrasion of the pipe coating. The lined Pipe and Fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. If damaged, the material shall be repaired in accordance with the liner manufacturer's recommendations. Any fitting showing a crack and any fitting or pipe which has received a severe blow that may have caused an incipient fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. In any pipe showing a distinct crack in which it is believed there is no incipient fracture beyond the limits of the visible crack, the cracked portion, if so approved by JEA, may be cut off before the pipe is laid so that the pipe used shall be perfectly sound. The cut shall be made in the sound barrel at a point at least 12 inches from the visible limits of the crack. Except as otherwise approved, all cutting shall be done with a power driven cut off saw. All cut ends shall be examined for possible cracks caused by cutting. All PVC pipe shall be inspected by the JEA Representative prior to installation.

#### III.3. PIPE INSTALLATION

##### III.3.1. GENERAL REQUIREMENTS

The JEA Representative will perform supplemental inspection as described herein for all PVC pipe sections (each 20-ft or less pipe length) installed by the Contractor for the following tasks: unloading, storage, pipe stringing, joint preparation, lowering pipe in trench, assembly, installation of joint restraints, and testing. Any damaged pipe shall be replaced at no additional cost to the JEA. Force mains shall be constructed of the materials specified and as shown on the drawings. All PVC C900/C905 pipe shall be laid in accordance with AWWA C605. Pipe and fittings shall be carefully handled to avoid damage, and if feasible, while they are suspended over the trench before lowering, they shall be inspected for defects and to detect cracks. Defective, damaged or unsound pipe or fittings shall be rejected. Each section of the pipe shall rest upon the pipe bed for the full length of its barrel, with recesses excavated to accommodate bells and joints. Any pipe which has its grade or joint disturbed after laying shall be taken up and re-laid. Only suitable soils (no heavy clay) shall be utilized in the backfill operation up to 12 inches above

the pipe. The maximum joint deflection shall be limited to 80% of the pipe manufacturer's recommendation. All precautions shall be taken to prevent sand or other foreign material from entering the pipe during installation. If necessary, a heavy, tightly woven canvas bag of suitable size shall be placed over each end of the pipe before lowering into the trench and left there until the connection is made to the adjacent pipe. Any time the pipe installation is not in progress, the open ends of pipe shall be closed by a watertight plug or other method approved by the Engineer. Plugs shall remain in pipe ends until all water is removed from the trench. Any sand or foreign material that enters the pipe shall be removed from the pipe immediately. No pipe shall be installed when trench conditions (standing water, excess mud, etc.) or the weather (rain, etc.) is unsuitable for such work, except by permission of the JEA. If, in the opinion of the JEA representative, significant quantities of sand or foreign materials enter the new sewage force main during the construction period, the contractor will be required to flush the system with clean water. The flushing operation, if required, shall be as directed by JEA and shall be accomplished at no additional cost to JEA. The water utilized in the flushing operation shall be provided and paid for by the contractor. Any section of pipe already laid which is found to be defective or damaged shall be replaced with new pipe. The contractor shall coordinate utility locate with Sunshine State One-Call of Florida, Inc. (#811 or website [www.callsunshine.com](http://www.callsunshine.com)), at a minimum. The use of 90 degree bends 24-inch and larger size shall be avoided if possible (two 45 degree bends or other method is preferred).

III.3.2. SPECIAL CONSTRUCTION REQUIREMENTS FOR 24-INCH AND LARGER PVC PIPE

III.3.2.1. EXPERIENCE

The Contractor shall provide an experienced PVC pipe Superintendent/Foreman and submit to the JEA Representative their experience record.

III.3.2.2. TRENCHES

The laying of PVC pipe, fittings, specials, closures and appurtenances (called pipe hereinafter) in trenches shall be to the lines and grades shown on the Drawings and in accordance with the applicable requirements JEA Water and Wastewater Standards Manual:

III.3.2.2.1. CLEAN

All pipes shall be checked and cleaned of all dirt, dust, grease, oil, water, debris, etc. before it is lowered into the trench. It shall be placed directly into position. If any dirt enters the pipe during placement operations, it shall be immediately removed. In no case shall the pipe be allowed to slide along the bottom of the trench. It shall be placed directly into position.

III.3.2.2.2. DETAILS

All trenching and backfill operations shall be in accordance with the details on the Drawings and JEA Water and Wastewater Standards Manual: Excavation and Earthwork-Section 408.

III.3.2.2.3. LAY SCHEDULE

The open trench shall be no more than the footage of pipe that can be laid in a day. All pipe shall be assembled

in the pipe trench to predetermined lines and grades as indicated by the Drawings or established in the field by the JEA Representative with an absolute minimum of three feet of cover, unless shown differently on the Drawings or approved in isolated areas by the JEA Representative.

III.3.2.2.4. LINE AND GRADE

The trench bottom shall be brought to specified and indicated line and grade as outlined in JEA Water and Wastewater Standards Manual: Sewage Force Mains-Section 429, and Excavation and Earthwork-Section 408 and as shown on the Drawings. Holes on the bottom and side of the trench shall be dug at no additional cost to the JEA to accommodate joint assembly (pipe bells, mechanical couplings, or mechanical restraints as specified). Final line and grade shall be accomplished through the excavation or the addition of approved material adequately compacted. In no case shall pressure be applied directly to the pipe by mechanical means, such as the use of backhoe buckets, to accomplish final line and grade.

III.3.2.2.5. TRENCH WIDTH

Trench width shall be in accordance with the details on the Drawings and JEA Water and Wastewater Standards Manual: Excavation and Earthwork-Section 408, except that the minimum width shall be wide enough to accommodate the compaction equipment within the haunch zone between the pipe wall and trench side.

III.3.2.2.6. BEDDING AND BACKFILL

Pipe embedment and backfilling shall closely follow the installation and jointing of PVC pipe in the trench, to prevent flotation of the pipe by water which may enter the trench and to prevent longitudinal movement caused by thermal expansion or contraction of the pipe.

III.3.2.2.7. REMOVAL

Any pipe that has its grade or joint disturbed after laying shall be taken up and re-laid. The joint gasket shall be removed and a new one installed. Any section of pipe already laid and found to be defective shall be taken up and replaced with new pipe at no additional cost to the JEA.

III.3.2.2.8. PLUGS

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by gasketed watertight plugs. Plywood is not acceptable for this purpose.

III.3.2.3. STRINGING PIPE

The Contractor shall place the pipe near the trench on the opposite side of the excavated earth. Point the bell end in the direction of work progress.

III.3.2.3.1. PIPE OVALITY CHECK

Prior to placing the pipe in the trench, the JEA Representative shall inspect the pipe segment at both ends to check for pipe

ovality. If the pipe reflects this condition, it is defective and shall be removed from the Work, and replaced with a new section at no additional cost to JEA.

III.3.2.3.2. SPIGOT INSPECTION MARK

Prior to placing the pipe in the trench, the Contractor shall place a permanent mark at the spigot end around the circumference of the pipe at the distance specified by the manufacturer for insertion into the bell end. This must be done in the presence of the JEA Representative, who will verify the distance specified by the manufacturer. If the insertion mark is incorrect, the JEA Representative will place an "X" over the mark, and the Contractor shall completely remove it, and repeat the procedure to place a new mark at the correct location.

III.3.2.4. GASKETS

Before assembly of the pipe in the trench, the JEA Representative shall inspect every gasket to confirm that it is positioned properly. If it is twisted or pushed out of its seat ("fish mouthed"), the Contractor shall reinsert the gasket so that it is positioned properly. If the gasket cannot be reinserted, then it shall be replaced at no additional cost to the JEA.

III.3.2.5. LUBRICATION

Prior to lubrication, the pipe gasket, and spigot and bell ends, shall be checked and cleaned of all dirt, dust, grease, oil, water, debris, etc. before applying lubricant. Once cleaned, an even, uniform application of gasket lubricant must be applied to the bevel and spigot to the insert reference mark as well as the contact surface of the gasket. Gasket lubricant may be applied with a swab, brush, or roller. The joint lubricant must be supplied by the pipe manufacturer. Application of lubricant shall be as recommended by the manufacturer. Lubrication must be done in the presence of the JEA Representative for every pipe joint.

III.3.2.6. CONSTRUCTION EQUIPMENT

During pipe assembly, if construction equipment will be used to "push" the spigot end into the pipe bell, it must be approved by the JEA Representative prior to use. In no case, shall the equipment be of such a size as to cause the spigot end to be over inserted beyond the reference mark.

III.3.2.7. PIPE ASSEMBLY

Assembly of the pipe is made by sliding the lubricated spigot end into the gasketed bell end. Assembly of all pipe sections, fittings, specials and valves must be done in the presence of the JEA Representative.

III.3.2.7.1. STEP 1

Align the spigot and bell ends and insert the spigot end into the bell so that it is in near contact with the gasket. Keep the pipe lengths in proper alignment. Do not allow the lubricated section touch the dirt or backfill as foreign material could adhere to the surface and compromise joint integrity.

III.3.2.7.2. STEP 2

Brace/Anchor the pipe bell while the spigot end is pushed through the gasket so that previously completed joints in the line will not be "stacked," "over-belled", or inserted past the reference mark. The method of bracing/anchoring the pipe bell shall be approved by the JEA Representative prior to use.

III.3.2.7.3. STEP 3

Push the spigot end in until the reference mark on the spigot end is flush with the end of the bell and is clearly visible outside the entry lip of the socket.

III.3.2.7.4. STEP 4

If the pipe joint requires barring to seat the joint, use a wood block to protect the end of the pipe. A come-a-long is recommended to seat the joint. The method of using a swinging stab is not allowed.

III.3.2.8. OVER-INSERTION OF SPIGOT END

If the insertion mark is not visible after assembly, the pipe was over-inserted. The Contractor shall disassemble the joint, and the JEA Representative shall inspect both the spigot and bell ends to verify the interiors are clean and that no damage was done to the pipe or gasket. If the gasket is twisted or pushed out of its seat ("fish mouthed"), determine if it can be repaired, and if not, replace with a new one. If the pipe is damaged, the Contractor shall remove the damaged section and replace with a new one at no additional cost to the JEA. If there is no damage to the pipe, the Contractor shall reassemble the joint in accordance with the procedures described herein.

III.3.2.9. PIPE RESTRAINTS

Restraints for pipe joints (bell/spigot), fittings, couplings, specials, and valves shall be installed per the manufacturer's recommendations. The Contractor shall provide a calibrated torque wrench/gauge for accurately measuring the torque on all bolts and threaded rods used to secure the restraints. Assembly of all restraints must be done in the presence of a JEA Representative.

III.3.2.9.1. PIPE JOINTS (BELL/SPIGOT)

The split retainer ring or non-split retainer ring type of restraint must be installed on the assembled pipe bell and spigot ends per the manufacturer's recommendations. If the restraint uses machined serrations for positive restraint, it must be oriented in the proper direction to resist pullout of the joint or fitting. Do not exceed the maximum distance between the retainer rings on each side of the joint. The threaded rods used to connect the restraints must contain two (2) nuts on each end of the rod. One nut on each rod shall be installed on the "inside" of each retainer ring to insure proper spacing and alignment and to provide a "stop" when torquing the "outside" nut, thereby preventing over homing of the pipe joint. The second nut ("outside" one) on the threaded rod must be tightened to the "seating" torque value for the size of rod used as shown in Table 1 herein. The "inside" nuts may be "hand" tightened. Tighten all "outside" nuts on threaded rods evenly using a calibrated torque wrench/gauge to recommended torque values. Locking washers shall be used on both "inside" and "outside" nuts. Loctite or equal shall be applied to both the "inside" and "outside" threaded rods.

III.3.2.9.2. FITTINGS, COUPLINGS, SPECIALS AND VALVES

Mechanical joint restraining glands at fittings, couplings, specials and valves must be installed per the manufacturer's recommendations. Tighten all bolts and threaded rods evenly using a torque wrench/gauge to recommended torque values.

III.3.2.9.3. SEATING TORQUE FOR THREADED RODS

The table below gives values for "seating" torque for rods to be used for securing the restrainer ring on each side of a pipe joint. Tighten all bolts and threaded rods evenly using a calibrated torque wrench/gauge to "seating" torque values.

**Table 1 Seating Torque for Threaded Rods**

Threaded Rod Dia. (inch)	Seating Torque (ft-lbs)
1 x 40	75
1-1/4 x 32	90

III.3.2.10. FIELD-CUTTING PIPES AND ENDS

III.3.2.10.1. FIELD CONDITIONS

Closures and short sections of pipe shall be installed by the Contractor as found necessary due to deviating field conditions at no additional cost to the JEA

III.3.2.10.2. FIELD-CUT

If the pipe must be field-cut to achieve the proper pipe length or closure piece, the Contractor shall use the proper equipment for making square cuts and bevels (if necessary). Prior to cutting the pipe, the Contractor shall mark the entire circumference of the pipe to ensure a square cut. After the cut is completed and the bevel cut or rounded, the Contractor shall place a permanent mark at the spigot end around the circumference of the pipe at the distance specified by the manufacturer for insertion into the bell end. All work shall be done per the manufacturer's recommendations.

III.3.2.11. BACKFILL

Backfill shall be done in accordance with the applicable requirements of the JEA Water and Wastewater Standards Manual: Excavation and Earthwork-Section 408. The JEA Representative must be present throughout the entire backfill operation and at all density testing.

III.3.2.12. PVC PIPE 20-INCH AND LARGER

For PVC pipe 20-inch and larger, unless approved otherwise by JEA, a foundation bed of granular material (57 stone) shall be placed under and around all ductile iron fittings and valves for additional support of heavy system components. A foundation bed of granular material shall be provided for all valves 20-inch size and larger. For granular materials, the minimum vertical limit is 12 inches under the fitting or valve, up to 1/3 the overall height of the fitting or valve. The minimum horizontal limits of the granular material shall be 12 inches in all directions beyond the outer edges of the fitting or valve. The compaction of soils below the granular material shall be at 98% of the maximum density. Payment for this work shall be included in the associated fitting or valve unit cost.

All spool pieces between 20-inch and larger stainless steel fittings and valves shall be at least 5 feet long. Where possible, a full joint of pipe (no short pipe lengths) shall be connected to all fittings and valves. No joint deflection shall be allowed at the fittings or valves.

III.3.2.13. CONSTRUCTION SEQUENCE

The Contractor shall install the force main pipe and complete all testing in lengths no longer than allowed in the JEA Water and Wastewater Standards. Contractor shall not install sleeves in the pipeline that are not shown on the drawings. Pipeline segments consist of a gate valve on each end with the connecting pipe in-between. In some cases, the Contractor shall furnish and install temporary plugs/caps, pipe end (stub-outs) sections, and other items as necessary to accommodate the testing sequence at no additional cost to the JEA.

III.3.2.14. PIPELINE TESTING

Following the installation and completion of each pipeline segment, including trench backfill, the Contractor shall immediately test that segment of pipeline. The Contractor may continue to install pipe in the next segment during the testing phase. If the pipe segment undergoing testing fails any one test, then the pipe laying in the next segment shall be immediately stopped. No further pipe laying shall be allowed until the pipeline segment undergoing testing passes all three tests. Pipeline testing consists of pressure and leakage; locate wire; and density tests. The tests shall be done in accordance with the JEA Water & Wastewater Standards Manual: Excavation and Earthwork-Section 408, and Sewage Force Mains-Section 429, latest edition. All tests shall be done in the presence of a JEA Representative."

III.3.3. PIPE COVER

The cover over all piping less than 24-inch size shall be a minimum of 30 inches in unpaved areas and 36 inches in paved areas with a maximum of 60 inches, unless approved otherwise by JEA. The cover over all piping 24-inch size or greater shall be 36 inches (paved or unpaved areas), with a maximum of 84 inches, unless approved otherwise by JEA. Cover for pipe under pavement shall be measured from the finished grade. Any reduction in pipe cover will require approval from JEA and the Engineer. Greater depths will be permitted where required to miss obstructions only. Lines shall be located as shown on the drawings. The Contractor shall investigate well in advance of pipe laying any conflicts which may require readjustments in planned locations and advise the Engineer of the results of these investigations so that the Engineer may give instructions as to the modifications required. Refer to Chapter II. 3. - Section 408 for backfill and compaction requirements.

III.3.4. THRUST RESTRAINT

All non-flanged fittings and valves shall be restrained using one of the following methods:

- III.3.4.1. Mechanical restraint at fittings and valves and mechanical restraint along adjacent joints of pipe to a length as specified in the Restraint Joint Schedule (see Plate No. S-38A), at a minimum.
- III.3.4.2. Mechanical joint fittings and valves shall be restrained using an approved restraining device and/or tie rods along adjacent joints of pipe to a length as specified. Tie rods shall be as follows, at a minimum:

PIPE SIZE	NO. OF RODS	ROD SIZE
4	2	3/4
6	2	3/4
8	2	3/4
10	4	3/4
12	4	3/4
14	6	3/4
16	6	3/4
18	8	3/4
20	8	3/4
24	12	3/4
30	14	1
36	14	1
42	16	1 1/4
48	16	1 1/4
54	18	1 1/4

To connect tie rods to fitting, offset eyebolts shall be used. Tie rods shall be (core 10 steel or 316 S.S.) threaded as required, installed with a washer and nut (same material as the rod) on either side of the joint.

III.3.4.3. The use of thrust blocks shall be limited to situations such as point repair where exposing several joints of pipe is not feasible due to existing ground conditions and also must be used with mechanical joint restraining devices when, in the judgment of the Engineer, the nature and criticality of an installation is such as to require positive assurance of stability. Concrete collars with tie rods may be used on dead end lines at the Contractor's discretion. Concrete used for this purpose shall be 2,500 psi minimum. When applicable, schedule and details for the required thrust blocks are included on the drawings (see Plate No. S-45). The JEA Standard Details show minimum size thrust blocks for use in good soil. Poor soils will require larger thrust blocks.

III.3.5. JOINT RESTRAINTS WITHIN CARRIER PIPE

All joints within steel casing pipe shall be restrained with mechanical restraining devices. End joints shall be tie rodded, with the ends of the rods welded to the end of the casing.

III.3.6. CASING SPACER INSTALLATION

All carrier pipes in casings shall utilize casing spacers installed on the carrier pipe, inside the casing pipe. Casing spacers shall be installed one foot on both sides of each carrier pipe joint, and at ten feet intervals along the carrier pipe for pipe up to 48 inches. For carrier pipes larger than 48 inches, casing placement shall be as recommended by the casing spacer manufacturer. A casing spacer shall also be installed within two feet of each of the ends of the casing pipe.

III.4. SEWAGE FORCE MAIN AND WATER MAIN SEPARATION REQUIREMENTS

III.4.1. The minimum separation requirements between sewage force mains and water mains shall be as outlined in specification Chapter III. 4 - Section 350 and Detail Nos. S-26 and S-27.

III.4.2. The table below provides the minimum horizontal separation requirements between the proposed utility and structures (see notes).

Pressure Main (water & wastewater) Nominal Size (inches) (See note 1)	Horizontal Separation Requirements (min)
up to 6"	10 feet
8"	14 feet
10"-12"	18 feet
14" and larger	See note 4
For gravity wastewater mains, see note 2.	

Notes:

1. The table above provides the minimum horizontal separation requirements between the proposed JEA maintained utilities (including water mains, reclaimed water mains, water service laterals, meter boxes and wastewater force mains) and existing, proposed and future structures (including above ground structures, concrete footers and top of bank of ponds).
  2. For gravity wastewater mains, the horizontal separation from existing, proposed and future structures (including above ground structures, concrete footers and top of bank of ponds) shall be a minimum of 3 times the vertical depth of the deepest portion of the manhole to manhole wastewater run.
  3. Pressure mains with pipe cover greater than 36 inches will require additional horizontal separation as reviewed and approved by a JEA O&M Manager.
  4. Pressure mains 14 inch and larger will require additional horizontal separation as reviewed and approved by a JEA O&M Manager.
  5. All depth measurements will be based upon final finished grade elevations, unless approved otherwise by JEA.
- III.4.3. The planting of hardwood trees (see listing below) within 36 inches (horizontal clearance) of the outside surface of the pressure main and the tree trunk or the installation of a pressure main within 36 inches (horizontal clearance) shall be prohibited. Service lines are excluded from this requirement. The planting of hardwood trees with a horizontal clearance between 3 and 6 feet or the installation of a pressure main between 3 and 6 feet from the outside surface of the tree trunk shall require root barrier material to isolate the main from future root growth. The root barrier (cut-off wall) shall be solid plastic or HDPE (0.0276" or 0.7 minimum thickness). The root barrier shall be installed/extended to all areas where the above clearances cannot be met. The root barrier shall extend vertically from the bottom of the pressure main to within 6 inches from top of finished grade, at a minimum.

NOTE: The list of hardwood trees include the following, at a minimum:

Ilex Attenuata, East Palatka/Savannah Holly, Magnolia Spp., Magnolia Family, Pyrus Calleryana, Bradford Pear, Juniperus Silicicola, Red Cedar, Gordonia Lasianthus, Loblolly Bay, Quercus Stellata, Post Oak, Palmacea Spp., Palm Family, Quercus Leavis, Turkey

Oak, Pinus Spp., Pine Family, Nyssa Sylvatica, Blackgum, Salix Babylonia, Weeping Willow, Prunus Spp., Cherry Family, Liriodendron Tulipifera, Tulip Poplar, Betula Nigra, River Birch, Cupressocyparis Leylandii, Leyland Cypress, Taxodium Distichum, Bald Cypress, Quercus Spp., Oak Family, Acer Spp., Maple Family, Liquidambar Styraciflue, Sweetgum, Platanus Occidentalis, Sycamore

### III.5. SYSTEM CONNECTIONS

All connections and ties to the JEA Wastewater System and transfer of services will be performed by the contractor under supervision of the JEA's representative.

### III.6. FORCE MAIN CONNECTION TO EXISTING MANHOLE

Where a new force main is connected into an existing manhole the manhole shall be properly prepared to receive the new force main and repaired or replaced as indicated or specified. Replacement manhole shall be Polymer Concrete. Manhole inverts shall be reshaped as required by the new connection to provide a smooth flowing channel of the exact shape of the wastewater to which it connects. Manholes shall receive a protective coating as specified in Chapter IV. 6. - Section 446 of these specifications. An approved gate valve or plug valve must be installed immediately prior to the 45° bends going into the manhole and shall be constructed in accordance with Detail S-18.

### III.7. TAPPING SLEEVE AND VALVE CONNECTIONS

Unless approved otherwise by JEA, tapped connections in the barrel of a pipe shall be less than the diameter of pipe being tapped except 4 inch pipe which may be tapped with a 4 inch tapping sleeve and valve. No taps shall be made within 5 feet of a joint.

### III.8. PRIVATE WASTEWATER PUMP STATION

III.8.1. If the wastewater force main is constructed per JEA standards (i.e.: 4" minimum pipe size, PVC DR-18 Pipe, D.I. Fittings, Iron Valves, etc.) and if these utilities are dedicated and accepted by JEA, all piping within the City R/W will be O&M by JEA. A JEA approved gate valve (4" minimum) shall be provided at the R/W line (just outside the pump-out box) for all force main piping which exceeds 15 linear feet within the City R/W area. The gate valve at the R/W line is not required on force main piping where the connection (connection at JEA main) is located on the same side of the street as the pump-out box (short side service connection) and consist of 15 linear feet or less within the City R/W area. The gate valve or, if no gate valve exist, the R/W line will define the "JEA Point of Service".

III.8.2. Wastewater Pump-Out Box shall be constructed on private property and located at the R/W line. The Pump-Out box shall provide a pump-out connection including a 4" isolation valve and 4" hose connection (quick disconnect with cap). The preferred construction layout is as shown on JEA plate #S-46. The box may be utilized by JEA or the private owner for maintenance or emergency use. JEA shall have access to the pump-out box at all times. O&M of this box (located on private property) shall be by the private owner.

III.8.3. Low pressure wastewater station connections to a standard force main larger than 4 inches are not allowed. Connection must be either a gravity point or a force main designed and permitted for low pressure wastewater systems.

### III.9. PRESSURE AND LEAKAGE TESTS

The Contractor shall test pipelines installed in accordance with these specifications prior to acceptance of the pipeline by JEA or connecting pipeline to any existing pipeline or facility. All field tests shall be made in the presence of a JEA representative. Except as otherwise directed, all pipelines shall be tested. Pressure testing of PVC and stainless steel pipe shall not include HDPE main piping. Pressure testing of HDPE main piping shall be completed separately with no PVC or stainless steel pipe included in the HDPE test section. Testing of HDPE main piping is detailed in the specification section entitled, "Horizontal Directional Drilling", (Chapter VI. 2. - Section 750 and 755). Pipelines laid in excavation (other than trench excavation), shall be tested prior

to the backfilling of the excavation. All piping to operate under liquid pressure shall be tested in sections of approved length. For these tests, the Contractor shall furnish clean water, suitable temporary testing plugs or caps, and other necessary equipment, and all labor required. If the Contractor chooses to pressure test against an existing JEA water main/valve, the new water main must be disinfected prior to connection to the JEA line. JEA will not be responsible for failure of the pressure test due to the existing valve leaking. If positive test results cannot be obtained because the JEA valves will not hold the test pressures, the Contractor shall be required to disconnect from the JEA System and re-test independent of the JEA System and at the Contractor's expense. JEA may elect to furnish suitable pressure gauges. If not, the contractor will provide the pressure gauges. The gauges shall be calibrated by an approved testing laboratory, with increments no greater than 2 psi and a 4 inch diameter face. Gauges used shall be of such size that pressures tested will not register less than 10% no more than 90% of the gauge capacity. Leakage and pressure testing shall be in accordance with applicable AWWA C600 or AWWA C605 and as outlined below.

### III.9.1. SWABBING

The purpose of swabbing a new pipeline is to conserve water while thoroughly cleaning the pipeline of all foreign material, sand, gravel, construction debris and other items not found in a properly cleaned system. Prior to pressure testing of a new pipeline swabbing shall be utilized as specified on the construction plans for each project. Swabbing details, Chapter IX, Plates S-54, S-54A, S-54B, S-54C and S-54D.

- III.9.1.1. New water, wastewater force, and reclaim mains greater than 12" I.D. (with exceptions to smaller pipe lines as deemed necessary by JEA) shall be hydraulically cleaned with a polypropylene swabbing device to remove dirt, sand and debris from main.
- III.9.1.2. If swabbing access and egress points are not provided in the design drawings, it will be the responsibility of the CONTRACTOR to provide temporary access and egress points for the cleaning, as required.
- III.9.1.3. Passage of cleaning poly swabs through the system shall be constantly monitored, controlled and all poly swabs entered into the system shall be individually marked and identified so that the exiting of the poly swabs from the system can be confirmed.
- III.9.1.4. Cleaning of the system shall be done in conjunction with, and prior to, the initial filling of the system for its hydrostatic test.
- III.9.1.5. The CONTRACTOR shall insert flexible polyurethane foam swabs (two pounds per cubic foot density) complete with rear polyurethane drive seal, into the first section of pipe. The swabs shall remain there until the pipeline construction is completed. A JEA representative shall be present for the swabbing process including swab insertion and retrieval.
- III.9.1.6. The line to be cleaned shall only be connected to the existing distribution system at a single connection point.
- III.9.1.7. Locate and open all new in-line valves beyond the point of connection on the pipeline to be cleaned during the swabbing operation.
- III.9.1.8. At the receiver or exit point for the poly swab, the CONTRACTOR is responsible for creating a safe environment for collection of debris, water and the swab. Considerations shall be made for protecting surrounding personnel and property and safe retrieval of the swab.

- III.9.1.9. Only with JEA personnel on-site shall the supply valve from the existing distribution system be operated. Cleaning and flushing shall be accomplished by propelling the swab down the pipeline to the exit point with potable water. Flushing shall continue until the water is completely clear and swab(s) is/are retrieved.
  - III.9.1.9.1. Re-apply a series of individual swabs in varying diameters and/or densities as required, to attain proper cleanliness of pipeline.
  - III.9.1.9.2. Swabbing speed shall range between two and five feet per second.
- III.9.1.10. After the swabbing process, pressure testing and disinfection of the pipe shall be completed in accordance with this MANUAL.
  
- III.9.2. Unless it has already been done, the section of pipe to be tested shall be filled with domestic water of approved quality and all air (or most of the air) shall be expelled from the pipe. Unlike water, entrapped air is compressible and is, therefore, very "explosive" and represents a very high risk of potential damage or even fatalities. Unless approved otherwise by JEA, the contractor shall be responsible for providing and paying for the domestic water utilized in filling the main and, if required, any flushing of the system. If blow offs or other outlets are not available at high points for releasing air, the Contractor shall make the necessary taps at such points and shall plug said holes after completion of the test. The table below is a convenient method to determine the approximate water addition that is required to raise the pressure in the test section from 0 psi to 150 psi with 0% air entrapment. Obviously, the test section will include some amount of air entrapment. The table below will indicate the severity of the amount of air entrapment in the test section. If the actual field test quantities (additional water amount) is over 4 times greater than the listed amounts, the test section may have severe air entrapment. In this case, the contractor should make additional effort to remove the entrapped air.
- III.9.3. For mains larger than 20 inch size, it is highly recommended that the contractor profile (line and grade) the main after installation and prior to pressure and leakage test to accurately locate all high points. Field survey instrument (Level equipment) shall be utilized for this task. Blow off valves shall be installed at all high points which offset vertically more than two pipe diameters in length (at a minimum). The contractor shall consult the design engineer on any technical questions or concerns. The table below lists the approximate amount of water which must be added to the pipe to raise the line pressure from 0 psi to 150 psi when no air is present in the pipe.

Pipe Diameter (inch)	Gallons/1000 L.F.
6	0.73
8	1.31
10	2.04
12	2.94
14	4.00
16	5.22

18	6.61
20	8.16
24	11.75
30	18.36
36	26.44
42	35.98

- III.9.4. Hydrostatic testing shall consist of a combined pressure test and leakage test. Specified test pressures, based on the elevation of the highest point of the line or section under test, and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The pump, pipe connection and all necessary apparatus shall be furnished by the Contractor and shall be subject to the approval of the Engineer. All valved sections shall be hydrostatic tested to insure sealing (leak allowance) of all line valves.
- III.9.5. All piping shall be pressure and leakage tested for a minimum of two hours duration at 150 psi minimum or 2 times the operating pressure. Pressure tests shall be conducted simultaneously with the leakage test. During the 2 hour test, no pipe will be accepted if pressure loss is greater than 5 psi regardless of the leakage test results. All exposed pipe, fittings, valves and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings or valves that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory. For new installations, the contractor shall be limited to the number of repair couplings utilized to repair pipe joint leaks. Unless approved otherwise by JEA, the contractor is limited to two repair couplings (i.e., one joint leak) per 1,000 LF installed (same pipe size). Should the actual number of joint leaks exceed the above limit, then JEA may require the contractor to remove and re-install the entire associate main or certain sections of the main at the contractor's expense. Repairing, replacing and retesting shall be done at the Contractor's expense. For new work, "bell joint leak clamps" or similar devices are not acceptable for the repair of leaks at the joint.
- III.9.6. Leakage tests shall be conducted simultaneously with the pressure tests. At the end of the pressure test, the line will be pumped back to initial test pressure. The quantity of water used to re-pump the line shall be measured and compared to the limitations calculated using the allowable leakage equations below.
- III.9.6.1. Formula No. 1: shall be utilized to determine the allowable leakage amount for the test section constructed with PVC pipe (based upon the number of rubber gaskets). Pressure and Leakage Test form for the formula is provided in the back of Chapter III. 1. - Section 350.

In which Formula No.1: (PVC only)                       $L = \frac{ND P^{1/2}}{7,400}$   
 L is the

$P^{1/2} = 12.25$ , where  $P = 150$  psi

allowable leakage amount in gallons per hour; S is the length of pipeline tested, in feet (5,000 L.F. Max); D is the nominal diameter of the pipe, in

inches; P is the average test pressure during the leakage test, in pounds per square inch, and N is equal to the number of joints (rubber gaskets) in the PVC pipe test section. The total length of pipe within the test section shall not exceed 5,000 linear feet, unless approved otherwise by JEA.

- III.9.7. In the event a section fails to pass the tests, the Contractor shall do everything necessary to locate, uncover (even to the extent of uncovering the entire section), and replace the defective pipe, valve, fitting or joint. Visible leaks shall be corrected regardless of total leakage. Lines which fail to meet these tests shall be retested as necessary until test requirements are complied with. All testing shall be performed at the Contractor's expense.
- III.9.8. If, in the judgment of JEA, it is impracticable to follow the foregoing procedures exactly for any reason, modifications in the procedure shall be made with approval; but, in any event, the Contractor shall be responsible for the ultimate tightness of the piping within the above requirement.
- III.9.9. HDPE: For leakage and pressure testing for high density polyethylene (HDPE, PE), Pipe and fittings, see "Horizontal Directional Drilling" (Chapter VI. 2. - Section 750 and 755), for technical specifications for testing HDPE products. Due to the expansion of HDPE pipe, the pressure testing of HDPE pipe sections must be tested separately from PVC pipe sections (see Chapter VI. 2. - Section 750 and 755 for clarification).

### III.10. LOCATE WIRE

#### III.10.1. LOCATE WIRE INSTALLATION

- III.10.1.1. Contractor shall furnish and install locate wires on all force mains (see Detail S-49 for other locate wire requirements), water mains, chilled water lines, reclaimed water mains, hydrants, branches, and services (see Detail W-44 for other locate wire requirements).
- III.10.1.2. Locate wire must be attached to mains and services with duct tape or plastic ties at each side of bell joint or fitting and at 10 foot intervals along pipeline (at a minimum).
- III.10.1.3. Locate wire shall be brought to 4 foot above grade within a valve box or Locating Station box, as required, at 475 foot intervals (maximum).
- III.10.1.4. Locate wire shall not terminate in an air release valve (ARV) vault. ARV vaults may be corrosive environments for locate wire materials and the vaults are defined as confined spaces.
- III.10.1.5. Locate wire shall be installed in either the 1:00 or 11:00 position on the pipe.
- III.10.1.6. Connections and splices shall be made at grade within a Valve Box or a Locate Wire Box. Underground connections and splices are not allowed and shall be prohibited. If an underground connection is unavoidable, contact locates before proceeding. Once approved, the spliced tracer-wire joint shall be a waterproof connector, each connection shall be photographed showing a specific identification number (the station and off-set location) written on each waterproof connector. The connector manufacturer shall be: DRYCONN, P/N 90120 - DB Lug Yellow, 5pc. Bag or JEA approved equal.

#### III.10.2. LOCATE WIRE TESTING REQUIREMENTS

- III.10.2.1. Each installed locate wire within the JEA service area shall be tested by the contractor as part of the final inspection procedure, using an approved tester and approved testing equipment.

- III.10.2.2. DEFINITIONS
- III.10.2.2.1. Approved Tester: A person approved by JEA as proficient in the use of the equipment and who has 12 months experience in the use of the equipment including documented proof of past performance.
- III.10.2.2.2. Approved Testing Equipment: The following is a list of approved equipment:
- III.10.2.2.2.1. Dynatel (3M)-2273 Cable /Fault Locator;
  - III.10.2.2.2.2. Metrotech 9800XT;
  - III.10.2.2.2.3. Ditch Witch 950 R/T; or,
  - III.10.2.2.2.4. JEA pre- approved equal.
- III.10.2.3. The approved tester shall be listed on the JEA Responsible Bidder List (RBL) for, at minimum, work category GC11 - Line locate services / Wire testing.
- III.10.2.4. The contractor shall prepare the following:
- III.10.2.4.1. A set of project site drawings showing the stationing and offset for each locate wire box.
  - III.10.2.4.2. A locate wire field testing schedule.
- III.10.2.5. The contractor shall submit the project site drawings and the field testing schedule to the JEA field representative (inspector) for approval. The JEA field representative may elect to be present during the testing period.
- III.10.2.6. The contractor shall provide the approved tester a copy of the project site drawings showing the stationing and offset for each locate wire box.
- III.10.2.7. The approved tester shall place a tone on the locate wire and trace the entire length of the installed wire, spot painting the location at least at 200-foot intervals along the route.
- III.10.2.8. The approved tester shall test the wire depth at 200-foot intervals.
- III.10.2.9. The approved tester shall report (show on project site drawings), where the pipe/wire has less than the allowable minimum cover or more than the maximum allowable cover (see Pipe Cover Section above for pipe cover limits). For pipe/wire which are installed within the acceptable cover limits, no remarks are required. All lateral stub-outs shall be marked and recorded.
- III.10.2.10. The approved tester shall prepare a Locate Wire Box checklist for each locate wire box.
- III.10.2.11. The approved tester shall prepare a final Locate Wire Report. The Locate Wire Report shall be submitted to the JEA field representative for review and approval. The report shall include the following:
- III.10.2.11.1. A signed statement from the approved tester certifying that all installed wire (where shown on the project site drawings), was successfully (sounded), traced with no open breaks.
  - III.10.2.11.2. A copy of the project site drawings which indicate all field notes, breaks found/repared, depths (if installed outside the acceptable cover limits), and other applicable field remarks by the approved tester.

III.10.2.11.3. Copies of the Locate Wire Box checklist for each locate wire box shown on the project site drawings.

III.10.2.12. A final Locate Wire Report shall be furnished prior to final acceptance of the project or as approved otherwise by JEA.

III.11. INSPECTION

All pipe and fittings shall be subject to inspection at time of delivery and also in the field just prior to installation. All pipe and fittings which in the opinion of the Engineer do not conform to these specifications will be rejected and shall be removed by the Contractor at the Contractor's expense. An authorized JEA representative must be present for all pressure and leakage testing, connections to JEA's existing lines.

III.12. STATE HIGHWAY CROSSINGS

Permits for all work within the right-of-way of a State Highway will be obtained by the Engineer. The Contractor shall, however, verify the existence of the permit before commencing work in this area. All work related to the State Highway crossing shall be in full compliance with the requirements of the Florida Department of Transportation permit and in accordance with the Florida Department of Transportation Utility Accommodation Guide and standard specifications. Unless otherwise shown on the drawings or specified herein, State Highway crossings shall be made by jacking a steel pipe casing, of the size shown on the drawings and shown in JEA Standard Details, under the highway at the elevations and locations shown. The force main shall then be placed in the casing with approved casing spacers as specified in this section. All joints within carrier pipe shall be mechanically restrained joints. After inspection, the ends of the casing shall be filled with 2500 psi concrete not less than 8-inches thick.

III.13. RAILROAD CROSSINGS

Permits for all work within the railroad right-of-way will be obtained by the Engineer. The Contractor shall, however, verify existence of the permit before commencing work in this area. All work related to the railroad crossings shall be in full compliance with the terms of the permit and AREA Specifications for Pipeline Crossings Under Railway Tracks for Non-Flammable Substances. The force main shall be placed in steel casing pipe under all railroad crossings whether installed by open cutting or jacking and boring. The force main shall then be placed in the casing with approved casing spacers as specified in this section. All joints within carrier pipe shall be mechanically restrained joints. After inspection by the Engineer, the ends of the casing shall be sealed with 2,500 psi concrete not less than 12 inches thick. Upon completion and prior to final acceptance, the Contractor shall place crossing markers of a type acceptable to the Railroad Company at each end of the crossing at the railroad right-of-way.

**LOCATE WIRE BOX (utilizing co-polymer meter box)****JEA Final Inspection Checklist**

Project Name: \_\_\_\_\_

Street/Intersection/Address Location: \_\_\_\_\_

Sta: \_\_\_\_\_

Offset: \_\_\_\_\_

Check the following as applicable:Wastewater: Curb Stamp w/Color coding: 

Cover at Finish Grade:

Cover above finish grade--adjust per spec.

Cover below finish grade--adjust per spec.

Locate wire accessible in box

Yes

No, full of debris - excavate debris

Locate wire properly color coded

Yes

No--replace per spec

Locate wire signal verified

Yes

No--repair per spec

Comments: \_\_\_\_\_

Contractor Representative: \_\_\_\_\_

Signature &amp; Printed Name

JEA Inspector: \_\_\_\_\_

Signature &amp; Printed Name

JEA O&amp;M representative: \_\_\_\_\_

Signature &amp; Printed Name

Commissioned this date: \_\_\_\_\_



## RECORD of PRESSURE and LEAKAGE TEST (HDPE PIPE)

PROJECT: \_\_\_\_\_

TEST SECTION: \_\_\_\_\_

JEA REPRESENTATIVE: \_\_\_\_\_ SIGNATURE \_\_\_\_\_

TEST DATE: \_\_\_/\_\_\_/\_\_\_ TEST TIME: \_\_\_\_\_ BEGIN \_\_\_\_\_ END \_\_\_\_\_

OTHER TEST PHASE ATTENDEE'S:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

PRESSURE AND LEAKAGE TEST CALCULATIONS: \_\_\_\_\_ WASTEWATER FORCE MAIN

Line Pressure Test:

Start: \_\_\_\_\_ PSI (Minimum of 150 PSI or 2 x operating pressure) End: \_\_\_\_\_ PSI

PSI Difference: \_\_\_\_\_ PSI (IF GREATER THAN 5 PSI, THE TEST FAILS)

TYPE OF HDPE PIPE (DR RATING) (1)	DIAMETER OF PIPE (INCHES) (2)	LINEAR FEET (3)	2-HOUR TEST FACTOR (see JEA TABLE) (4)	TOTAL ALLOWABLE LEAKAGE (3x4) (5)
<b>Total Allowable Leakage Amount (Gallons):</b>				

Allowable Leakage Amount \_\_\_\_\_ Gal \_\_\_\_\_ Oz. (32 oz per qt; 128 oz per gal)

Actual Leakage Amount \_\_\_\_\_ Gal \_\_\_\_\_ Oz.

Pressure and Leakage Test Results (Pass or Fail:) \_\_\_\_\_

The above is based on the average pressure test of 150 PSI, 2 hour test period. If the actual leakage amount is equal or less than the allowable leakage amount, the leakage test is acceptable.

JEA 2-HOUR TEST FACTORS						
NOMINAL PIPE SIZE (inches) – ALLOWABLE LEAKAGE AMOUNT (Gallons/Linear Feet of Pipe)						
4" – 0.0020	6" – 0.0030	8" – 0.0050	10" – 0.0065	12" – 0.0115	14" – 0.0140	16" – 0.0165
18" – 0.0215	20" – 0.0275	22" – 0.0350	24" – 0.0440	26" – 0.0500	28" – 0.0500	30" – 0.0635
32" – 0.0715	34" – 0.0810	36" – 0.0900	42" – 0.1155	48" – 0.1350	54" – 0.1570	

FILE No. \_\_\_\_\_



RECORD of PRESSURE and LEAKAGE TEST
Based on Formula for PVC Material Only

PROJECT: \_\_\_\_\_

TEST SECTION: \_\_\_\_\_

JEA REPRESENTATIVE: \_\_\_\_\_ SIGNATURE \_\_\_\_\_

TEST DATE: \_\_\_/\_\_\_/\_\_\_ TEST TIME: \_\_\_\_\_ BEGIN \_\_\_\_\_ END \_\_\_\_\_

OTHER TEST PHASE ATTENDEES:
\_\_\_\_\_
\_\_\_\_\_

Pressure and Leakage Test Calculations: \_\_\_\_\_ WASTEWATER FORCE MAIN

Line Pressure Test:

Start: \_\_\_\_\_ PSI (Minimum of 150 PSI or 2x operating pressure) End: \_\_\_\_\_ PSI

Difference: \_\_\_\_\_ PSI (IF GREATER THAN 5 PSI, THE TEST FAILS)

Table with 5 columns: TYPE OF PIPE PVC (1), DIAMETER OF PIPE (INCHES) (2), NUMBER OF JOINTS (3), 2-HOUR TEST FACTOR (4), TOTAL ALLOWABLE LEAKAGE (2x3x4) (5). Rows include PVC entries and a summary row for PVC (Sum of Above).

Allowable Leakage Amount \_\_\_\_\_ Gal \_\_\_\_\_ Oz. (32 oz per qt; 128 oz per gal)

Actual Leakage Amount \_\_\_\_\_ Gal \_\_\_\_\_ Oz.

Pressure and Leakage Test Results (Pass or Fail): \_\_\_\_\_

The above is based on the average pressure test of 150 PSI, 2 hour test period and utilizing formula as given below ("L" is the allowable leakage amount in gallons per hour, "N" is the number of joints (rubber gaskets) in the test section; "D" is the diameter of the pipe and "P" is the average test pressure):

L = (ND P 1/2) / 7,400

Formula may be used to determine an allowable leakage amount for PVC Pipe only. If the actual leakage amount is equal or less than the allowable leakage amount, the leakage test is acceptable (test passes). If the actual leakage amount is greater than the allowable leakage amount, the leakage test fails. The above formula meets and exceeds the requirements of AWWA C600 and AWWA C605. The total length of pipe within the test section shall not exceed 5,000 linear feet, unless approved otherwise by JEA.

FILE No. \_\_\_\_\_

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