

DIVISION 15

MECHANICAL

SECTION 15001

WATER SERVICES AND MISCELLANEOUS FITTINGS

PART 1 - GENERAL

1.01 SCOPE

- A. This Section consists of furnishing water, sewer, storm water piping complete with fittings, couplings, adapters, valves, and other appurtenances required during construction due to piping relocation or replacement. The Appendix contains the approved manufacturer's listing which shall supersede all references herein. It shall however remain the City's prerogative to modify or require additional standards be followed to meet their specifications.
- B. In accordance with the "Reduction of Lead in Drinking Water Act" (Act) enacted by the USEPA on January 4, 2011, effective January 4, 2014 all piping, fittings, fixtures, valves, and other appurtenances used in potable water supply and distribution systems shall be "lead free" as defined in Section 1417(d) of the Safe Drinking Water Act (SDWA). All requirements of the Act as it relates to products under this section shall be strictly adhered to.

1.02 GENERAL INFORMATION AND DESCRIPTION

- A. The pipe and fittings shall be furnished by fully qualified manufacturers experienced in the fabrication, casting and manufacture of the pipe materials specified herein. The pipe and fittings shall be designed, fabricated and installed in accordance with the best practice of the trade and the standards specified herein.
- B. Pipe materials shall be the same as the existing pipe being replaced or relocated. Unless otherwise shown on drawings.
- C. No material furnished under this specification shall be shipped to the job site until all submittals have been reviewed.
- D. All new domestic services shall be Polyethylene tubing per City of North Miami Standards.
- E. Contractor shall coordinate all work with City of North Miami Public Works staff.

1.03 RELATED WORK

- A. Section 02222 – Excavation and Backfill for Utilities and Structures

B. Section 02515 – Water Services Connections and Transfers

1.04 SUBMITALLS

- A. The Contractor shall submit Shop Drawings in accordance with the procedures and requirements set forth in Section 01340.
- B. The Contractor shall submit to the Engineer certified shop tests and certified letters of compliance in accordance with the Section 01340.

PART 2 - PRODUCTS

2.01 FITTINGS

- A. All fittings shall be marked with the manufacturer's name or trade mark, size, class or pressure rating, and the date of manufacture in accordance with the standards specified herein. All ductile iron fittings must be manufactured in the U.S.A. (no substitution).

2.02 POLY VINYL CHLORIDE (PVC) FOR USE IN POTABLE WATER SERVICES 2-INCH NOMINAL DIAMETER AND LESS (SCHEDULES 40 AND 80)

- A. Poly vinyl chloride (PVC) pipe and fittings specified herein are small diameter PVC with threaded, flanged and solvent cemented joints. All poly (vinyl chloride) (PVC) pipe and fittings shall be made from high impact, rigid poly (vinyl chloride) compounds. Pipe and fittings shall be marked indicating size, type and schedule, ASTM Designation, manufacturer or trade mark, and shall bear the NSF (National Sanitation Foundation) seal of approval. Wherever the abbreviation PVC is used in these Specifications in relation to pipe and fittings, it shall mean poly (vinyl chloride) plastic pipe and fittings as specified herein.
- B. PVC pipe shall be Schedule 80 as called for on the Plans or by the Engineer, Type I, Grade I, or Class 12454B with socket ends, and shall comply with ASTM Standard D1785, "Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120."
- C. Schedule 80 socket-type fittings shall comply with ASTM Standard D2467, "Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80" and D2464 "Specification for Threaded Poly Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80, for threaded fittings.
- D. Joining cement for PVC pipe and fittings shall comply with ASTM Standard D2564, "Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings". Cemented joints shall be made in accordance with ASTM Standard

D2855, "Recommended Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings."

- E. Flanges: One piece molded hub type flat face flanges, 125 pound standard as specified under fittings hereinbefore.
- F. Gaskets: Full faced, 1/8-inch thick, neoprene (for sewer) or SBR (for water).
- G. AISI Type 316 stainless steel, ASTM A193, Grade B8M hex bolts and ASTM A194 Grade E8 hex head nuts. Bolts shall be fabricated in accordance with ANSI B 1812 and provided with washers of the same materials as the bolts. Bolts to be installed west of U.S. 1 shall be carbon steel.

2.03 HIGH DENSITY POLYETHYLENE (HDPE) FOR USE IN POTABLE WATER SERVICES 2-INCH NOMINAL DIAMETER AND LESS

- A. 2-inch high density polyethylene (HDPE) pipe used for services shall be IPS-O.D. Controlled with Standard Outside Dimension Ratio (DR) of 9, pressure rating of 200 psi, nominal outside diameter of 2.375-inches, minimum wall thickness of 0.264-inches, PE 3408, all in conformance with ASTM D3035-95 "Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter". Pipe shall be in conformance with ANSI/AWWA C901-96 "Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service" as modified herein. Pipe shall have a (natural) inner core with a blue colored outer shell. Pipe shall have footage marks at a maximum interval of every two feet.
- B. Polyethylene material shall have a minimum cell classification in accordance with ASTM D3350-00 "Polyethylene Plastics Pipe and Fitting Materials" of 345444D for the core, which shall be 100% virgin material, and 345444E for the outer shell. Note that both of these materials are UV stabilized as signified by the "D" for natural colored and "E" for the colored shell. Pipe shall be in conformance with NSF 61 or 14. Manufacturer shall supply certification of compliance with all of the above requirements. Certification shall ship with the pipe on material sold to the City and shall always be submitted with shop drawings and catalog cuts. When required by the Director of the Department of Public Utilities and/or the Engineer of Record, certification shall be signed and sealed by a professional engineer licensed to practice in the state in which the manufacturer is located or in the State of Florida.
- C. All mechanical fittings utilized with HDPE pipe and tubing services shall:
 - 1. Conform with ANSI/AWWA C800-01 "Underground Service Line Valves and Fittings" as modified herein

2. Utilize AWWA Standard (Mueller) threads on tapped pipe and tapping saddles
3. Be designed and manufactured to withstand a sustained working pressure of 150 psi and to restrain the pipe against pull-out under loading beyond the tensile yield of the HDPE pipe or tubing to which it is connected.
4. Be supplied by the manufacturer with a certification of these capabilities and fittings shall not be accepted or installed without said certification. If fittings are being supplied to the City, the certification shall ship with the fittings and payment will not be made without this certification. At the discretion of the Engineer, this certification may be required to be signed and sealed by a professional engineer licensed to practice in the state where the supplying firm is located, or in the State of Florida. His decision in this regard shall be final. In all cases, fittings shall be installed in strict accordance with the manufacturer's instructions.

2.04 BACKFLOW PREVENTION DEVICES

- A. Backflow prevention devices shall be installed on all metered water services to non-residential properties, and on all residential services where the meter is larger than 5/8-inch in diameter. They shall be installed on private property between the meter and the building connection. The actual location of the assembly shall be coordinated with the Department of Public Utilities and the property owner.
- B. Backflow prevention devices for metered services between 1-inch and 3-inch diameter shall be Model 975XL2U Reduced Pressure Principle Assembly with Union Ball Valves as manufactured by Zurn/Wilkins, or City approved equal. For other diameters, Contractor to submit shop drawings for approval.

2.05 BALL METER VALVES

3/4", 1", 1-1/2" and 2" (B43-342W, B43-444W, BF43-666W & BF43-777W) ball meter valves shall be manufactured by Ford Meter Company or City approved equal.

- 2.06 Control gate valves two inches and smaller in diameter shall be NIBCO T-113-LF. No substitutions.

2.07 PACK JOINT COUPLINGS:

3/4", 1", 1-1/2" and 2" Pack joint couplings for cooper or plastic tubing (C44-33, C44-44, C44-66 & C44-77) and for male iron pipe threads (C84-33, C84-44, C84-66 & C84-77) shall be manufactured by Ford Meter Company or City approved equal. No substitutions.

2.08 INSERT STIFFENERS AND ACCESSORIES:

1", 1-1/2" and 2" (INSERT-52, INSERT-74-DR11 & INSERT-75-DR11) insert stiffeners and accessories be manufactured by Ford Meter Company or City approved equal. No substitutions.

2.09 BALL VALVE CURB STOPS:

3/4" (B11-333 & BL11-344-4.5) Curb stops shall meet AWWA C800, latest revision, and shall be ball valve curb stops with iron pipe threads shall be manufactured by Ford Meter Company or City approved equal. No substitutions.

2.10 METER FLANGES:

1-1/2" and 2" (CF31-66 & CF31-77) Outlet meter flanges shall be manufactured by Ford Meter Company or City approved equal. No substitutions.

2.11 STRAIGHT METER COUPLINGS:

3/4" and 1" (C38-23-2.5 & C38-44-2.625) straight meter couplings shall be manufactured by Ford Meter Company or City approved equal. No substitutions.

2.12 "U" BRANCH PIECES:

1" and 1-1/2" (U48-43-spacing & U48-64-9-spacing) "U" branch pieces shall be manufactured by Ford Meter Company or City approved equal. No substitutions or City approved equal.

2.13 ANGLE "U" BRANCH PIECES:

1" (UA48-43-65) Angle "U" branch pieces shall be manufactured by Ford Meter Company. No substitutions.

2.14 LINESETTERS:

3/4" and 1" (LSVB18-133W & LSVB21-444W) optional linesetters shall be manufactured by Ford Meter Company or City approved equal. No substitutions.

2.15 CALIBRATED PRESSURE RELIEF VALVES:

Use 1/2" and 3/4" WATTS 530C calibrated pressure relief valves or City approved equal or City approved equal or City approved equal.

2.16 CHECK VALVES:

Refer to Section 15115, "Check Valves", as applicable

2.17 DOUBLE CHECK VALVE ASSEMBLIES:

Refer to Section 2.04 above.

2.18 CORPORATION STOPS:

- A. Corporation stops for one (1) inch services shall have AWWA thread inlet and a compressive connection outlet suitable for service pipe. Corporation stops for two (2) inch services shall be ball valves and have outside iron thread inlet and a compression connection outlet suitable for service pipe. Corporation stops shall meet AWWA C800, latest revision.
- B. Corporation Stop Manufacturers or Equal:
 - 1. Mueller
 - 2. Ford
 - 3. Hays Manufacturing Company

2.19 FLEXIBLE COUPLINGS:

Flexible couplings shall be straight cast couplings and shall be Rockwell International No. 431, or equal.

2.20 UNION

- A. Copper to copper union.
- B. Union Manufacturers or equal:
 - 1. Mueller H 15400
 - 2. Hays Manufacturing Company 5615

2.21 ANGLE VALVES:

Angle globe valves one (1) inch and two (2) inch diameter shall be Nibco or approved equal.

2.22 CASING PIPE:

Casing pipe shall be 3-inch minimum diameter (I.D.) Schedule 80 PVC or black iron, as determined by Engineer.

2.23 METER BOXES AND VAULTS FOR WATER SERVICE

- A. The Contractor shall furnish and install all meter boxes and vaults required for new and/or relocated water services. All concrete meter vaults shall be manufactured in accordance with the applicable provisions of ASTM C858, "Underground Precast Concrete Utility Structures", in accordance with the City's

Standard Details and as specified herein. All materials used in the production of the concrete meter boxes and vaults shall be new and of recent manufacture. Aggregates shall not originate in salt or brackish water areas and no calcium chloride containing admixtures shall be used.

- B. Fine aggregate for concrete mixes shall consist of sand or stone screening, composed of hard durable grains, free of foreign matter such as loam, clay, dirt, organic matter or other impurities. Fine aggregate shall conform to the following gradation requirements:

| <u>Size Sieve</u> | <u>Percent Passing</u> |
|-------------------|------------------------|
| 3/8" | 100 |
| No. 4 | 90 to 100 |
| No. 8 | 70 to 95 |
| No. 16 | 50 to 85 |
| No. 30 | 30 to 70 |
| No. 50 | 10 to 45 |
| No. 100 | 0 to 10 |

- C. Coarse aggregate for concrete mixes shall consist of gravel, broken stone or local limerock. Coarse aggregate shall be hard, durable and free of foreign matter such as loam, clay, dirt, organic matter or other impurities. It shall be free of adherent coatings. Coarse aggregate shall conform to the following gradation requirements:

Meter Boxes

| <u>Size Sieve</u> | <u>Percent Passing</u> |
|-------------------|------------------------|
| 3/4" | 100 |
| 1/2" | 90 to 100 |
| 3/8" | 40 to 70 |
| No. 4 | 0 to 85 |
| No. 8 | 0 to 5 |

Meter Vaults

| <u>Size Sieve</u> | <u>Percent Passing</u> |
|-------------------|------------------------|
| 1-1/2" | 100 |
| 1" | 95 to 100 |
| 1/2" | 25 to 60 |
| No. 4 | 0 to 10 |
| No. 8 | 0 to 6 |

- D. Cement shall be a standard brand of Portland cement meeting the requirements of ASTM C150-86, "Portland Cement", Type I. Different brands of cement, even if tested and approved, shall not be used.
- E. The forms shall be made from of a non-porous material with smooth surfaces and shall be accurate and strong enough to maintain the structure's dimensions within one half of the allowable tolerances given in Section 3.4 of ASTM C858. Forms shall be cleaned before each use, and shall be free of paint or other protective coatings that might cling to the surface of the concrete. Releasing agents applied to the form to aid in breaking the bond shall not be injurious to the concrete. Steel reinforcing shall be securely positioned in the form to maintain the concrete cover shown on the Standard Details.
- F. All reinforcing steel shall be free of rust, grease, dirt or mortar and shall be thoroughly cleaned of any such foreign matter or loose mill scale before being placed in position.
1. Wire reinforcement shall conform to ASTM A82, "Steel Wire, Plain, for Concrete Reinforcement."
 2. Wire mesh reinforcement shall conform to ASTM A185, "Steel Welded Wire, Fabric, Plain for Concrete Reinforcement."
 3. Bar reinforcement shall conform to ASTM A615-7a, "Deformed and Plain Billet-Steel Bars for Concrete Reinforcement", Grade 60, deformed, except that steel manufactured by the Bessemer process will not be accepted.
- G. Concrete mix for meter vaults:
1. The aggregates shall be sized, graded, proportioned and thoroughly mixed in a batch mixer with proportions of cement and water that will produce a homogeneous concrete having a compressive strength of 3500 psi at 28 days of age for the boxes and plates and 3000 psi for the vaults after the same curing period.
 2. Batched concrete shall be made in standard concrete mixers only, and not in mortar boxes, wheelbarrows or similar equipment.
 3. Mixers shall be standard mechanical (power-driven) rotary type for concrete. Mixers normally used for mortar or plaster mixing will not be permitted.
 4. Concrete shall be placed either by gravity into the form at a rate such that the concrete is plastic at all times and flows readily into all parts of the form and around all reinforcement steel without segregation of materials, or by high speed pneumatic rammer resulting in dense, evenly compacted

concrete without disturbing the reinforcement. The surfaces from top to bottom shall show uniform compaction.

5. The top surface of the molded items shall be flat and finished smooth while in the mold. Capping will not be permitted. Where required by the City, corners shall be rounded.
 6. Curing shall be by any method or combination of methods that will develop the required compressive strength within 28 days or less.
- H. Water used in mixing concrete that is not in the form of surface moisture on the aggregate shall be from the City's water supply or other approved source.
- I. The precast units may not be repaired without specific approval by the City.
- J. The quality of materials, manufacturing process, and the finished units shall be subject to inspection at any time by the City, and the supplier shall afford access for this purpose, if so required.
- K. Prior to installation of any of the above mentioned units, the Contractor shall furnish the Engineer, upon his request, a statement giving the following information:
1. Name of manufacturer.
 2. The source and type of cement.
 3. The source and specific gravities of the aggregates.
 4. The concrete mix proportions, and strength at 28 days.
 5. Name of admixtures, if any.
 6. Mill certificates for the reinforcement steel.
 7. Source of water.
- L. The precast units shall be subject to reject, either at the manufacturing plant or at delivery, upon failure to conform to any of the specified requirements herein. The following imperfections shall also be cause for rejection:
1. Defects that indicate any imperfect concrete mixing and molding.
 2. Surface defects such as honey-combed or open textured and damaged area which would affect the structural adequacy.
 3. Repaired areas or capping.
 4. Improper radius at corners or improper tolerances.
- M. Water meter boxes shall be concrete, as manufactured by Oldcastle or City-approved equal, and be either FL12 or FL36 models as applicable for size of meter(s) to be housed.

2.24 METER BOX COVERS:

- A. Water meter covers shall be manufactured of recycled composite plastic, RHC Rubber and a UV stabilizer material. Covers shall be ROHS compliant (Restrictions pertaining to the use of certain Hazardous Substances) not to exceed the maximum allowed levels of the following substances: lead, Mercury, Cadmium, Hexavalent Chromium, PBB and PBDE.
- B. The Water Meter Covers shall be H-20 load rated, ADA compliant, non-metallic suited for radio read, and constructed with a non-skid black surface pattern. The Covers shall be sized to fit all meter boxes of the appropriate type (refer to Section 2.26 above) and be of the drop-in lid type.
- C. The covers for the meter boxes shall have the words "WATER METER", plus the manufacturer's name and country of origin permanently marked on the top surface of the lid or cover for ease of identification. The letter size may range from 3/8" to 3/4" with the larger size lids or covers having the larger size letters. The letters on the lids or covers shall be slightly raised.
- D. Covers shall have mating surfaces so that mating parts will not rattle or rock under traffic. The lifting eye in lids shall be 1/2" wide by 2 1/2" long x 1" deep with the longest dimension parallel to the longest axis. Lifting pin shall be stainless steel 1/4" in diameter.
- E. The Water Meter Covers shall have a recessed cavity and a through hole for the installation of the electronic radio transmitters (ERT). The recessed cavity on top of cover shall have an outside diameter of 4 1/16" While the through hole shall measure 1 3/4" inches in diameter. ERT unit shall sit flush on top of lid after installation to prevent tripping.
- F. The Covers shall come with a ten (10) year warranty and shall be replaced at no cost by the manufacturer if lid fails during the warranty period. All standard Water Meter Box Covers shall be similar to "Pentek Access Boxes" or approved equal. The above standards shall be certified by the manufacturer prior to installation. The City reserves the right to limit the weights of the items to be furnished for ease in handling. The thickness of covers shall be consistent throughout, so that when the covers are in place the top surfaces are level with the frame of the box.
- G. Contractor should be aware the City periodically checks materials supplied for conformance to these specifications, which shall include materials testing, dimensions and tolerances, component weights, markings, finish, fit and such other matters as are necessary to assure supply of products meeting City requirements. Sample tests performed during shop drawing submittals will be at the Contractor's expense. If passed, it will be at the City's expense. Any re-testing due to materials not passing the tests shall be at the Contractor's expense.

H. Contractor shall provide test-based certifications from the manufacturer that Water Meter Covers are not buoyant or near neutral buoyancy and that their specific gravity is 1.10 or greater. Documentation certifying the water meter box covers meets the specific buoyancy and gravity requirements must be submitted along with the six copies of shop drawings. The City shall conduct buoyancy testing procedures verifying that covers will meet the no floating and specific gravity requirements set forth in these Specifications. During the testing procedure Water Meter Covers shall sink immediately and remain submerged at the bottom of any testing reservoir filled with salt water. Samples of all water meter box covers stipulated in this bid shall be submitted upon written notification by the Department of Public Utilities. Samples will be sent for examination and testing by Department of Public Utilities and/or testing laboratory retained by the Department of Public Utilities.

2.25 TAPPING SADDLES:

Double strap tapping saddles shall be constructed of 316 stainless steel, with neoprene gaskets cemented to the saddle body, and iron pipe threads designed to withstand a working pressure of five hundred (500) psi and accurately fit the pipe for which it is intended. The straps shall be forged steel with curvature accurately designed to fit pipe. All nuts and straps including threads shall be 316 stainless steel. Tapping saddles shall be Mueller K-10509, Clow F-1280, Smith Blair, or approved equal. Restraining Rods for mechanical joint fittings shall be A-316 stainless steel.

2.26 DRESSER COUPLINGS:

Dresser couplings shall be regular black couplings with plain gaskets. They shall be Dresser Style 90 with no substitutions allowed. Polyethylene liner shall be used to fully encase the dresser couplings.

2.27 LINE STOP FITTING:

Valve cut-in on the existing water main shall be performed under pressure using line stop fittings. The body of the fittings shall be carbon steel conforming to ASTM A-36. The flange shall be steel flanges Class D, conforming to AWWA C207 with stainless steel bolts and nuts. Restraining Rods for mechanical joint fittings shall be A-316 stainless steel. The line stop fitting shall be manufactured by International Piping Services Company (1-407-843-2800), or approved equal.

2.28 FIRE HYDRANTS:

A. All fire hydrants shall be of the dry-barrel type and shall conform in design, material and workmanship to AWWA C502. Hydrants shall have five and one quarter inch main valve opening and a three way nozzle arrangement. The connection pipe shall be ductile iron pipe conforming to AWWA C151, Class 52.

- B. The depth of bury, measured from the bottom of the connecting pipe to the ground line of the hydrant shall be three feet six inches minimum. Exact depth at each location shall be determined by depth of line to which the hydrant is connected.
- C. Inlet connection shall be six-inch mechanical joint. Typical installation detail is shown in the Contract drawing.
- C. Two - 2-1/2 inch hose nozzles and one - 4-1/2 inch pump nozzle connection threads shall conform to NFPA No. 194 (ANSI B26) Standard for Screw Threads and Gaskets for Fire Hose Couplings.
- D. Hydrants shall be furnished with accessories to include mechanical joint follower rings with set screws and at least one adjustable hydrant wrench with spanner included with every ten hydrants supplied. Barrel extension sections shall not be allowed on new fire hydrants, except by special permission from the ENGINEER.
- F. There shall be no shrubbery planted within 6 feet of any fire hydrant.
- H. All fire hydrants shall be Mueller Super Centurion Model A-423 or American Darling Model B84B, with no substitutions allowed.

2.29 BACTERIOLOGICAL SAMPLE POINTS:

- A. Bacteriological sample points shall be provided in accordance to the Miami-Dade County Department of Health Standard Details, Specifications Policies and Procedures for Water Distribution.
- B. Sampling point shall not be removed until approval is obtained from Miami-Dade County Department of Health.

2.30 FITTINGS

- A. Refer to Section 15050 – Utility Piping, Fittings, Valves and Accessories.

PART 3 - EXECUTION

3.01 GENERAL

- A. Proper and suitable tools and appliances for the safe convenient handling and laying of pipe shall be used and, in general, conform to manufacturer's recommendations. At the time of laying, the pipe shall be examined carefully for defects, and should any pipe be discovered to be defective after being laid, it shall be removed and replaced with sound pipe by the Contractor at his expense.

- B. Pipe and fittings shall, at all times, be handled with great care to avoid damage. In loading and unloading, they shall be lifted with cranes or hoists or slid or rolled on skidways in such manner as to avoid shock. Under no circumstances shall this material be dropped or allowed to roll or slide against obstructions. Pipe and other material shall be distributed along the right-of-way in advance of installation only to the extent approved by the Engineer. Such materials shall be so placed as to keep obstruction to traffic minimum.
- C. Upon satisfactory completion of the pipe bedding, a continuous trough for the pipe barrel and recesses for the pipe bells, or couplings, shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support with no pressure being exerted on the pipe joints from the trench bottom.
- D. Pipe shall be installed in accordance with the manufacturer's recommendation. Before being lowered into the trench, the pipes and accessories shall be carefully examined and the interior of the pipes shall be thoroughly cleaned of all foreign matter by methods acceptable to the Engineer. During suspension of work, for any reason, at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe. Any pipe which is disturbed or found defective shall be immediately removed and replaced with sound pipe.
- E. Lines shall be laid straight.
- F. Any work within the pipe and fittings shall be performed with care to prevent damage to the interior wall of the pipe. Damaged interior walls shall be repaired or the pipe section or fitting replaced as required by the Engineer. No cables, lifting arms, hooks or other devices shall be inserted into the pipe or fitting. All lifting, pulling or pushing mechanisms shall be applied to the exterior of the pipe or fitting.
- G. After pipe has been laid, reviewed and found satisfactory, sufficient backfill shall be placed along the pipe barrel to hold the pipe securely in place during the conduction of the required tests.

3.02 HYDRANT INSTALLATION

- A. All fire hydrants shall be installed in strict accordance with the manufacturer's published recommendations, AWWA Standards, and all applicable codes, and the applicable provisions of this Section. All installations shall be to the satisfaction of the local fire and building department.

- B. New fire hydrants and branch runs shall be installed by the Contractor where shown on the Plans and in accordance with the Standard Details herein. Installation of a new fire hydrant shall include excavation, installation of the branch run, installation of the hydrant on the branch run, the concrete anchor at the hydrant elbow, protective concrete slab in non-sidewalk areas, replacing concrete sidewalk when in sidewalk area; steel posts filled with concrete, where required; plastic warning posts where required in FDOT right of way; backfilling and compaction. Fire hydrants shall be touched up or repainted with paint, as specified, where necessary, and the same type of paint shall be used to paint the guard posts after treating the galvanized surface with a neutralizer.
- C. All hydrants isolating valves with slip joints, friction type, or caulked joint connections shall be harnessed to the main pipe by means of welded steel harness sets, or clamps and steel rods, designed for this purpose. Dry barrel fire hydrants shall be set on a bed of pea gravel not less than 18 inches deep and 3 feet square, for drainage, or as required by local regulations and conditions.
- D. All 6-inch valve additions can be performed with partial-localized system isolation with the approval of the Engineer and proper notifications/coordination with the City (i.e. 48 hours minimum prior notice).
- E. Existing concrete thrust blocks shall be removed.
- F. Restrained joints shall be placed at all joints of fire hydrant and pipe connections.

3.03 INSTALLATION OF WATER SERVICES

High Density Polyethylene (HDPE) Pipe with Standard Outside Dimension Ratio (DR) of 9 shall be used for water services ≤ 3 ."

- A. Up to 2-inch diameter (galvanized steel is no longer used). Water services (single and dual) are going to be provided to connect proposed water meters and also to reconnect the existing water meters that remain in place. All HDPE services require the use of a 10 gauge stranded copper blue tracer wire.
- B. 2-Inch Services: Services from the new WMs shall consist of corporation stops, 2-inch HDPE tubing, curb stops and terminal fittings as shown in the City of North Miami Standards. The services shall be installed where designated in the field by the Engineer, and will be determined as soon as possible in order that the Contractor may tap the mains as they are installed. All meter boxes shall be installed in non-traffic and non-parking areas.
- C. Where meter boxes are located in existing sidewalks, the whole flag of sidewalk shall be removed and replaced with new concrete. The concrete walk shall be 4 inches thick and finished with the proper tools and techniques to resemble the

existing walk. The concrete support for meter boxes shall be eliminated when the box is installed in an existing sidewalk. Where meter boxes are located out of sidewalk areas, a concrete support is required. Concrete supports shall be to the established line and grade. Construct a 3'x3'x6"-thick concrete slab for non-sidewalk conditions. Meter boxes shall be set flush with the finished grade if inside walks, or with the top of the ground if out of sidewalk areas. All bends in copper tubing shall be made with an approved type tube bender to the satisfaction of the Engineer. Flattened, out of round or kinked tubing will not be permitted. Each 1-inch service connection to be installed on this Project will be one of the following:

- D. Short Single - Consisting of a short run of 1-inch HDPE tubing from the main on the same side of the street as the proposed meter, to the meter installation approximately 2 1/2 feet from property line. Single meter box installation included.
- E. Long Single - Consisting of 2-inch diameter HDPE tubing connected to a main on the opposite side of the street from the proposed/existing meter, requiring additional HDPE tubing to cross the street to the meter installation, and requiring a 3-inch (min. I.D.) Schedule 80 PVC or black iron casing pipe, to be installed under the street pavement 1 & 18" past EOPON both sides. Single meter box installation included.
- F. Short Dual - Consists of a run of 2-inch HDPE tubing from the main on the same side of the street as the proposed meter, to the meter about 2 1/2 feet from property line. Includes installation of two (2) single meter boxes or double meter box with brass yoke, and all fittings needed to split the service line.
- G. Long Dual - Same as above but from a main on the opposite side of the street from the meter, requiring additional HDPE tubing to cross the street to the meter installation, and requiring a 3-inch (min. I.D.) Schedule 80 PVC or black iron casing pipe, to be installed under the street pavement & 18" past the edge of pavement on each side. Includes installation of two (2) single meter boxes or double meter box with brass yoke.

3.04 INSTALLATION OF METER BOXES AND METERS

- A. Meters and meter boxes or vaults shall be installed by the Contractor at the direction of the City or Engineer. Finish grade of completed meter enclosure shall be flush with existing ground or as shown otherwise. Meter boxes or vaults shall be set or constructed plumb with the top set to conform to the slope of the finish grade. Lightly compacted earth backfill shall be placed inside of the meter boxes to depth indicated. Grade adjustment of the meter boxes or vaults shall be by using standard extension sections for the box or vault specified. Install meter in a

horizontal position with the meter dial or dials at a depth below the cover as shown on the plans. Backfill around meter vaults as specified for adjoining pipe.

- B. Water meters shall be reinstalled by the Contractor. Corporation stops shall be in the open position and angle stops shall be closed, prior to reinstallation of the meter.
- C. Withhold reinstalling meters until the new water system is ready for operation. The remainder of the service connection, excluding the meter, may be installed at any time during or after construction of the main.
- D. Where existing meters are designated for relocation, Contractor shall read, record, and submit existing meter readings on the form supplied by the City prior to removal of meters, and after completion of relocation work. Contractor shall furnish Engineer and City with copies of all meter readings on a monthly basis or as requested by the Engineer.

3.05 TESTING AND DISINFETION OF WATER MAIN LINES

Refer to Section 15995 - Pipeline Testing and Disinfection.

3.06 TESTING AND DISINFETION OF WATER SERVICE LINES

Refer to Section 02515 - Water Service Connections and Transfers.

END OF SECTION

SECTION 15050

UTILITY PIPING, FITTINGS, VALVES, AND ACCESSORIES

PART 1-GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The Work included in this Section consists of furnishing all labor, equipment, and materials and in performing all operations necessary for the construction or installation of all utility piping, valves, and appurtenances complete and ready for operation as shown on the Drawings and specified herein.
- B. Related Work Described Elsewhere:
 - 1. Section 15995: Pipeline Testing and Disinfection

1.02 QUALITY ASSURANCE

- A. Construction Requirements:
 - 1. All the lines shall be installed with at least 36 inches of cover, unless otherwise shown or indicated on the Drawings.
 - 2. For ductile iron pipelines, changes in alignment of less than 11-1/4 degrees may be achieved through the use of allowable pipe deflection in lieu of fittings. Deflection shall not exceed 50 percent of the maximum allowable deflection as stated in the pipe manufacturer's installation instructions.
- B. Pipe Inspection: The Contractor shall obtain from the pipe manufacturers a certificate of inspection to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant by a third party inspector and that they meet the requirements of these Specifications. All pipe and fittings shall be subject to visual inspection at time of delivery by rail or truck and also just before they are lowered into the trench to be laid. Joints or fittings that do not conform to these Specifications will be rejected and must be removed immediately by the Contractor.

The entire product of any plant may be rejected when, in the opinion of the Engineer, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

- C. All materials specified herein shall be from one of the manufacturers specified in the approved manufacturer's listing located in the Appendix unless specified otherwise.
- D. All materials that come into contact with potable water shall be in conformance with NSF 61 as adopted by Rule 62-555.335, F.A.C. Manufacturers shall submit proof of conformance with Shop Drawings.

1.03 SUBMITTALS

A. Shop Drawings:

1. In general, the following Shop Drawings shall be submitted to the Engineer for approval prior to construction and shall comply with Section 01340:
 - a) Mill test certificates or certified test reports on pipe and fittings.
 - b) Details of restrained and flexible joints.
 - c) Valve boxes.
 - d) All valves.
 - e) Couplings.
 - f) Service saddles.
 - g) Joint lubricant.
 - h) Detailed piping layout drawings and pipe laying schedule (see below).
 - i) Temporary plug and anchorage system for hydrostatic pressure test.
2. Tabulated layout schedule for each pipe system including:
 - a) Pipe invert station and elevation at each change of grade and alignment.
 - b) The limits of each reach of pipe thickness class and of restrained joints.
 - c) Locations of valves and other mechanical equipment.
 - d) Methods and locations of supports.
 - e) Details of special elbows and fittings.

3. A separate Shop Drawing submittal will be required for each major item listed above and for each different type of an item within a major item. For example, separate submittals will be required for each valve type. All submittals shall be in accordance with the General and Special Conditions and Section 01340: Shop Drawings.

B. Acceptance of Material:

1. The Contractor shall furnish an Affidavit of Compliance certified by the pipe manufacturer that the pipe, fittings, and specials furnished under this Contract comply with all applicable provisions of current AWWA and ASTM standards and these Specifications. No pipe or fittings will be accepted for use in the Work on this project until the Affidavit has been submitted and approved by the Engineer.
2. The City reserves the right to sample and test any pipe or fitting after delivery and to reject all pipe and fittings represented by any sample which fails to comply with the specified requirements.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Pipe, fittings, valves, and accessories shall be handled in such manner as to ensure a sound undamaged condition during shipping, delivering and installing.
- B. Particular care shall be taken not to injure the pipe coating and linings.
- C. Insides of valves and piping shall be kept free of dirt and debris.

1.05 JOB CONDITIONS

- A. Water in Excavation: Water shall not be allowed in the trenches while underground pipes are being laid and/or tested. The Contractor shall not open more trench than the available pumping facilities are able to dewater to the satisfaction of the Engineer. The Contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the territory in which he is working. In no case shall the pipelines being installed be used as drains for such water, and the ends of the pipe shall be kept properly and adequately plugged during construction by the use of approved stoppers and not by improvised equipment. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other obstructing matter into the pipelines. If on completion of the work any such materials has entered the pipelines, it must be cleaned as directed by the Engineer so that the entire system will be left clean and unobstructed. Dewatering requirements per Section 02140 are to be met at all times.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE

A. Ductile Iron Pipe

1. Standards: ANSI A-21.50, AWWA C150 and ANSI A-21.51, AWWA C151
2. Thickness
 - a. Below ground piping: Pipes shall be the following minimum thickness class unless otherwise noted or specified.
 - 1) 12-inch or smaller (unless otherwise specified) Class 350
 - 2) 16-24 inch diameter Class 250
 - 3) 30 to 64-inch diameter Class 200
 - b. Above Ground Piping
 - 1) Flanged, Class 53 (Minimum)
3. Joints
 - a. Push-on or Mechanical Joints (below ground piping):
 - 1) Standards: ANSI A21.11/AWWA C111
 - 2) Class: The working pressure of the joint shall be equal to or exceed the rated working pressure of the pipe.
 - b. Flanged (above ground or inside below ground vaults):
 - 1) Standards: ANSI A21.15, ANSI B16.1 – 125 lb
 - 2) Class: 125 lb factory applied screwed long hub flanges, plain faced without projection.
 - 3) Gaskets
 - (a) Spans less than 10 feet: full face 1/8-inch thick neoprene rubber
 - (b) Spans greater than 10 feet: Toroseal gaskets as manufactured by American Cast Iron Pipe or equal.
 - c. Restrained Joints
 - 1) "Manufactured": Restrained joint systems provided by DIP pipe manufacturer to be compatible with pipe.
 - 2) For 16-inch and larger diameter DIP pipe, restraints shall have a split back-up ring for the bell and a serrated or wedge-action gland for the spigot end shall have restraint gaskets or locking bells.
 - 3) "Mechanical" Restraining Devices: Mechanical joint wedge-action restraining gland, epoxy coated.
 - 4) Class: 250 psi (minimum) design pressure rating
 - 5) Standard mechanical joint retainer glands will not be acceptable.
 - 6) Paint red stripe on all restrained joint bolts.
 - d. Joint Accessories
 - 1) Mechanical joint bolts, washers and nuts: Ductile iron or Corten steel.
 - 2) Flanged joint bolts, washers and nuts:
 - (a) Above Ground: Hot dipped galvanized, Grade B, ASTM A-307
 - (b) Below Ground: 304 stainless steel

- e. Pipe Length (below ground installation): 20 feet maximum nominal length.
- B. Fittings
- 1. Materials: Ductile iron or grey cast iron, AWWA C 110
 - 2. Pressure Class
 - a. Mechanical Joint, Restrained Joint: Minimum 250 psi pressure rating.
 - b. Flanged Joint: Class 125, plain
 - 3. Compact Fittings: ANSI/AWWA A21.53/C153 (4-inch through 24-inch diameter only)
- C. Exterior Coatings (Pipe and Fittings)
- 1. Below ground or in a casing pipe
 - a. Type: Minimum 1 mil thick of asphaltic coating in accordance with ANSI/AWWA A215/C151.
 - b. Markings: All ductile iron pipe shall be marked with a continuous minimum 2-inch blue color tape stripe located at the top and on each side of the pipe within the top 90 degrees of the pipe. For pipe less than 24 inches in diameter, a single tape may be used along the top of the pipe. Paint red stripe on all restrained joint bolts.
- D. Interior Lining (Pipe and Fittings) (Applied by pipe manufacturer)
- 1. Potable Water: Cement-mortar lining with a seal coat of asphaltic material for ductile iron pipe and ductile and gray iron fittings for water service is in accordance with ANSI/AWWA C104/A21.4, and is listed by ANSI/NSF Standard 61 for potable water contact.
- E. Polyethylene Encasement (required for all below ground piping, fittings and appurtenances located less than 50 feet from a gas main and as indicated on the Drawings):
- 1. Standard: ANSI A 21.5/AWWA C105, 8 mil minimum thickness.
 - 2. Color: Blue.

2.02 HIGH DENSITY POLYETHYLENE PIPE

A. HDPE Pipe:

- 1. Pipe: HDPE pipe for nominal diameters 4-inch through 42-inch in size shall conform to ASTM F714 and AWWA C906, Latest Edition, NSF 61 Standard. Pipe shall be DIPS.
 - a. 16-inch shall be SDR 11 with a minimum pressure rating of 202 psi.
 - b. 42-inch shall be SDR 13.5 with a minimum pressure rating of 161 psi.

2. Pipe Material: Materials used for the manufacturing of polyethylene pipe shall be PE 4710 High Density Polyethylene (HDPE) with a minimum ASTM D3350 cell classification of PE445474C or higher (for color stripes). The material shall have a minimum Hydrostatic Design Basis (HDB) of 1600 psi at 73°F when tested in accordance with Plastics Pipe Institute (PPI) TR-3 and shall be listed in the name of the pipe and fitting manufacturer in PPI TR-4.
3. Joints: HDPE pipe shall have fusion-bonded joints.
4. Pipe Installation: Installation shall be in accordance with ASTM D2774 and manufacturer's recommendation. Installation and thermal fusing shall be performed by personnel trained and experienced in the use of fusion equipment recommended by the pipe supplier. Installer shall have the necessary information relative to fusion such as, but not limited to, fusion temperature, interface pressure, and cooling time before fusing begins. Fusing shall be performed in accordance with ASTM D2657.
5. Pipe Markings: Permanent identification of piping service shall be provided by co-extruding longitudinal stripes (color coded per service type) into the outer surface of the pipe. The stripping material shall be the same material as the pipe material except for color. Stripes printed or painted on the outside surface shall not be acceptable. Markings on the pipe shall include the following:
 - a) Nominal size and OD base.
 - b) Standard material code designation.
 - c) Dimension Ratio.
 - d) Pressure Class.
 - e) AWWA designation (AWWA C906)
 - f) Material test category of the pipe.
 - g) Continuous stripes, 90 degrees apart, color coded per service.
6. Fittings:
 - a) Ductile iron mechanical fittings used with polyethylene pipe shall be specifically designed for, or tested and found to be acceptable for use with polyethylene pipe. Mechanical fittings designed for other materials shall not be used unless authorized by the mechanical fitting manufacturer. Special precautions may exist with certain mechanical fittings or additional components may be required. Consult the manufacturer of the fitting prior to its use.
 - b) Mechanical joint (MJ) adapters shall be used for connections between HDPE pipe and ductile iron pipe. HDPE mechanical joint adapter shall be jointed to the HDPE pipe by butt fusion. HDPE mechanical joint adapter shall be molded or fabricated conforming to AWWA C906. Molded

fittings shall conform to ASTM D2683 for socket-type fittings, ASTM D3261 for butt-type fittings or ASTM F1055 for electro fusion-type fittings. MJ adapter shall match pressure rating and dimension ratio of HDPE pipe.

2.03 RESILIENT SEAT GATE VALVES:

A. General:

1. Gate Valves shall be for 36-inch and smaller valves only.
2. Gate valves shall be of the resilient seated wedge type. Valves shall comply with the American Water Works Association Gate Valve Standard C-515, latest revision.
3. Valves shall open left or counter-clockwise.

B. Rating:

1. Valves shall be rated for zero leakage at 150 psi minimum pressure rating and have a 400 psi hydrostatic test for structural soundness in accordance with AWWA C-509.
2. The resilient sealing mechanism shall provide zero leakage at test and normal working pressure when installed with the line flow from either direction.

C. End Configurations:

1. Buried Service: Mechanical joint ends in accordance with AWWA C-111.

D. Stem:

1. Valves shall be of the non-rising stem type made of cast, forged, or rolled bronze meeting the requirements of AWWA C-509.
2. Stem collars shall be cast integral with the stem and machined to size. The housing for the valve stem collar shall be machined. A thrust bearing shall be incorporated, as required, to optimize operating torques. The stem nut must be independent of the gate.
3. Valves shall be furnished with O-ring stem seals using two O-rings located above the thrust collar. O-rings shall be set in grooves in the stem. The valve design shall permit replacement of the o-ring seals while in service without undue leakage.

E. Body:

1. The valve body, bonnet, and bonnet cover shall be cast iron to ASTM A126, Class B.

F. Gates:

1. Gates shall be field replaceable and provide a dual seal on the mating body seat.
2. Valve shall be installed in vertical position with rated sealing in both directions.
3. Rubber seats of specially compounded EPDM elastomer shall be utilized and be capable of sealing under conditions of normal wear.

G. Operator:

1. Valves are to be supplied with standard 2" operating nut for buried service and handwheel operators for above ground service. Valves 24" and larger shall be installed vertically with a spur gear actuator.

H. Coatings:

1. All ferrous surfaces inside and outside of all valves shall be coated, minimum 3-5 mils, with epoxy fusion-bonded meeting AWWA C-550 latest revision and in accordance with the list of approved manufacturers as presented in an Appendix of these Technical Specifications, or approved equal. The gate shall be totally encapsulated in rubber where exposed to line velocity, and protected from corrosion where not encapsulated.

I. Markings:

1. Markings shall be in accordance with AWWA C-509 or C-515 Standards and shall include the name of manufacturer, the year of manufacture, maximum working pressure and size of valve.

2.04 BUTTERFLY VALVES

A. General:

1. Butterfly Valves shall be used for 42-inch valves only.
2. Butterfly valves shall be Class 150 in conformance with "AWWA Standard Specifications for Rubber Seated Butterfly Valves" ANSI/AWWA C504, latest revision. Butterfly valves shall be of the tight closing rubber seat type.

B. Rating:

1. Valves shall be rated for a minimum working pressure of 150 psi. Valves shall be bubble tight with 150 psi on the upstream side of the valve and 0 psi on the downstream side and shall be satisfactory for applications involving valve operation after long periods of inactivity, throttling service, or frequent operation.

C. End Configuration:

1. Buried Service: Mechanical Joint ends in accordance with AWWA C-111.

D. Valve Bodies:

1. Valve bodies shall be constructed of close grain cast iron conforming to ASTM A126, Class B.
2. The face-to-face dimensions of valves shall be in accordance with AWWA C504 short-body valve.
3. Valves shall have the manufacturer's name and valve rating cast in body.

E. Valve Seats:

1. Valve seats shall be EPDM bonded to a high grade stainless steel retaining ring and secured to the valve disc by Type 304 stainless steel set screws or shall be molded in, vulcanized, and bonded to the body. Seats bonded to the body shall withstand a 75-pound pull tested in accordance with ASTM D429, Method B.
2. The valve seat shall be adjustable and replaceable in the field without dismantling operator, disc, or shaft and without removing the valve from the line. No metal to metal seating surfaces shall be permitted. All retaining segments and adjusting devices shall be of corrosion resistant material.

F. Valve Discs:

1. Discs shall be constructed of ductile iron ASTM A536, Grade 65-45-12. Valve disc shall be of the offset design to provide 360 degree uninterrupted seating. Valve discs shall rotate 90 degrees from the fully open position to the fully closed position.
2. Discs shall be designed to withstand full differential pressures across the closed valve disc without exceeding a stress level equivalent to one fifth of the tensile strength of the material.

G. Valve Shafts:

1. Valve shafts may consist of a one piece unit extending completely through the valve disc bearings and into the operating mechanism or may be of the "stub shaft" type, which comprises two separate shafts inserted into the valve disc hubs. If used, stub shafts shall extend a minimum of 1 1/2 shaft diameters into the valve disc hubs.
2. Valve shafts shall be constructed of ASTM A276, Type 18-8 stainless steel. The minimum shaft diameter shall conform to ANSI/AWWA C504, latest revision for

Class 150 valves. The valve disc shall be attached to the shaft by means of "O" ring sealed taper pins. The valve shaft seal shall consist of "O" rings in bronze cartridge or self-adjusting nitrile Vee-type ring seals.

3. Shafts shall be designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque.

H. Valve Bearings:

1. Valve shafts shall be fitted with sleeve-type bearings. Bearings shall be corrosion resistant and self-lubricating (Nylon or Teflon). Bearings shall be designed for a pressure not exceeding the published design load for the bearing material, or 1/5 of the compressive strength of the bearing or shaft material.

I. Valve Operators:

1. All butterfly valves shall open left or counter-clockwise when viewed from the stem. A ground level position indicator and extension stem or shaft for the 2-inch nut shall be provided for buried valves.
2. Actuators shall be designed for input torques based on 150 psi valve pressure and 16 ft/s velocity with a maximum input of 80 ft-lb on 2-inch nuts and shall withstand 250 ft-lbs.

J. Valve Coating:

1. Interior of valve body and valve disc except for valve seat and stainless steel valve seat ring shall be coated with a fusion bonded or thermosetting epoxy coating in accordance with AWWA C550, latest revision. Coating shall be holiday-free, NSF approved, with a minimum thickness of 16 mils. Surfaces shall be clean, dry, and free from rust and grease before coating.
2. Exterior Valve Coating: All exterior surfaces of butterfly valves shall be clean, dry, and free from rust and grease before coating. For buried or submerged service, the exterior ferrous parts of all valves shall be coated at the factory with coal tar epoxy with a minimum total finish dry film thickness of 20 mils. Prior to backfilling, all uncoated nuts, bolts, glands, rods, and other parts of joints shall be coated in the field with coal tar epoxy equal to Koppers Bitumastic No. 300-M.

K. Valve Testing:

1. Prior to shipment from the factory, hydrostatic and leakage tests shall be conducted for each butterfly valve. Hydrostatic and leakage tests shall be conducted in strict accordance with ANSI/AWWA C504, latest revision, and results shall be submitted to the Engineer. All valve and actuators shall be installed, adjusted and tested as an assembly by the valve manufacturer.

2.05 TAPPING SLEEVES AND VALVES

A. Mechanical Joint Sleeves:

1. Sleeves shall be cast of gray-iron or ductile-iron and have an outlet flange with the dimensions of the Class 125 flanges shown in ANSI B16.1 and properly recessed for tapping valve. Glands shall be gray-iron or ductile iron. Gaskets shall be vulcanized natural or synthetic rubber. Bolts and nuts shall comply with ANSI/AWWA C111/ANSI A21.11. Sleeves shall be capable of withstanding a 200 psi working pressure.

B. Fabricated Mechanical Joint Tapping Sleeves:

1. Sleeves shall be of split mechanical joint design with separate end and side gaskets. Sleeves shall be fabricated of high strength steel, meeting ASTM A283 Grade C or ASTM A-36. Outlet flange shall meet AWWA C-207, Class "D" ANSI 150 pound drilling and be properly recessed for the tapping valve. Bolts and nuts shall be high strength low alloy steel to AWWA C111 (ANSI A21.11). Gasket shall be vulcanized natural or synthetic rubber. Sleeve shall have manufacturer applied fusion bonded epoxy coating, minimum 12 mil thickness.

C. Tapping valves with alignment lip shall be resilient seat gate valves as specified above except as modified herein.

1. End Configurations:

- a. Tapping sleeve side: Flanged meeting MSS SP-60 ANSI 16.1 drilling and AWWA C-110 with centering ring.
- b. Outlet side: Mechanical joint conforming to AWWA C-111.

2. Valves 24-inch in diameter and smaller do not require gearing. Valves larger than 24 inches shall be installed vertically with a spur gear actuator and shall be furnished with NPT pipe plugs for flushing tracks.

2.06 COMBINATION AIR RELEASE VALVES

A. The air release valves for use in water mains shall be single body combination air release valves designed to release large quantities of air at start up, admit air on shut down and release air in operation.

B. The valves shall be made of either high strength plastic with corrosion resistant polymer materials or have a cast iron body, cover and baffle, stainless steel float, bronze water diffuser Buna-N or Viton seat and stainless steel trim.

- C. Air release valves must be installed in an above ground enclosure per detail sheet. Enclosure shall be vented and have a tamper proof locking device.
- D. Fittings from the main to the air release valve in the enclosure shall be threaded and made of brass.

2.07 VALVE BOXES

A. Standard Two-Piece Cast Iron Valve Box:

Cast-iron two-piece valve boxes are required for mains less than six feet below finished grade and less than or equal to 12 inches in diameter. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by City. The barrel shall be screw type only, having 5-1/4-inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with locking cast iron covers. Covers shall have "WATER" cast into the top for all water mains.

B. Valve Box Assembly:

Valve box assemblies are required for any size main that is six feet or greater below finished grade or if mains are greater than 12 inches in diameter. Valve boxes shall be one complete assembled unit composed of the valve box and extension stem that attaches and locks to the two-inch wrench nut. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. Valve box assembly shall be adjustable to accommodate variable trench depths six feet and greater as shown in the drawings.

- C. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The material shall be galvanized square steel tubing. The stem assembly shall have a built-in device that prevents the stem assembly from disengaging at its fully extended length. The extension stem must be capable of surviving a torque test to 1,000 ft-lb without failure.
- D. Valve boxes shall have locking lids utilizing a five sided nut with a special wrench needed to open. Valve lids to be made as shown in the drawings.
- E. Valve collars shall be made out of a fiberglass re-enforced concrete polymer material manufactured to the specifications as shown in the drawings utilizing a test station box made into the valve collar for placement of the locating wire.
- F. Locating wire shall be per Section 15200.

- G. Valve markers are to be made of schedule 80 PVC and have a decal applied containing information as shown in the drawings. The marker must be the same color as the pipe being marked.

2.08 MISCELLANEOUS ITEMS

- A. Other items necessary for the complete installation and not specified herein shall conform to the details and notes shown on the Drawings. All minor items implied, usually included, or required for the construction of a complete operating system shall be installed whether shown on the Drawings or not.

PART 3 - EXECUTION

3.01 INSPECTION

- A. All pipe, fittings, valves, and other material shall be subject to inspection and approval by the Engineer after delivery, and no broken, cracked, imperfectly coated, or otherwise damaged or unsatisfactory material shall be used. When a defect or crack is discovered, the pipe shall be rejected.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Staging for Construction: Contractor shall submit a staging schedule for approval identifying staging areas and time frame. Pipe and fittings shall be strung out along the route of construction with the bell joints in the direction of construction. Pipe shall be placed where it will cause the least interference with traffic. All pipe shall not be stored along the route for entire project duration. Pipe shall be stored off-site and then transported to project site in phases as approved by City and Engineer.
- B. Excavation, backfill, and compaction shall conform to the provisions of Section 02222. Upon satisfactory installation of the pipe bedding material as specified in Section 02222, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.
- C. Cover for underground piping shall not be less than that indicated on the Drawings. The minimum cover for pipe shall be 48 inches. In areas where other piping conflicts preclude the maximum cover desired, the piping shall be laid to provide the maximum cover obtainable.

- D. Pipe, fittings, valves, and accessories shall be installed as shown or indicated on the Drawings.
- E. All connections to existing piping systems shall be made as shown or indicated on the Drawings after consultation and cooperation with authorities of the City. Some such connections may have to be made during off-peak hours (late night or early morning).
- F. In preparation for pipe installation, placement (stringing) of pipe should be as close to the trench as practical on the opposite side of the trench from the excavated material. The bell ends of the pipe should point in the direction of the work progress.
- G. Pipe and fittings shall be laid accurately to the lines and grades indicated on Drawings or required. Where grades for the pipeline are not indicated on the Drawings, maintain a uniform depth of cover with respect to finish grade. Care shall be taken to insure a good alignment both horizontally and vertically and to give the pipe a firm bearing along its entire length. Any pipe which has its grade or joint disturbed after laying shall be taken up and relayed.
- H. All pipe and fittings shall be cleared of sand, dirt, and debris before laying. All precautions shall be taken to prevent sand, dirt, 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 sand, dirt, or other foreign material that enters the pipe shall be removed from the pipe immediately. Interior of all pipe and fittings shall be kept clean after installation until accepted in the complete Work.
- I. Any time that 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. No pipe shall be installed when trench conditions are unsuitable for such work, including standing water, excess mud, or rain.
- J. After pipe has been laid, inspected, and found satisfactory, sufficient backfill shall be placed along the pipe barrel to hold the pipe securely in place and over the joints in order to fill the trench with backfill prior to conducting preliminary and final hydrostatic tests.
- K. Above-ground and Exposed Piping: Piping shall be cut accurately to measurements established at the job site and shall be worked into place without springing or forcing, properly clearing all equipment access areas and openings. Changes in sizes shall be made with appropriate reducing fittings. Pipe connections shall be made in accordance with the details shown and

manufacturer's recommendations. Open ends of pipe lines shall be properly capped or plugged during installation to keep dirt and other foreign material out of the system. Pipe supports and hangers shall be provided where indicated or as required to insure adequate support of the piping.

3.03 INSTALLATION OF DUCTILE IRON PIPE AND FITTINGS

1. Bedding for Ductile Iron Pipe: Minimum bedding requirements shall be Type 4 as defined in ANSI/AWWA C600, latest revision. Provide proper bedding required, in accordance with thickness class of pipe being laid and depth of cover. Property pipe laying conditions shall be in accordance with ANSI/AWWA C150 and C151, latest revisions, and ANSI/AWWA C600, latest revision.
2. Placement
 - a. Alignment: In accordance with lines and grades shown on the Drawings. Deflection of joints shall not exceed 50 percent of that recommended by the manufacturer.
 - b. Polyethylene encasement: Provide polyethylene wrap around piping, fittings and appurtenances located less than 50 feet from a gas main and as indicated on the Drawings.
3. Cutting: When required, cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of the pipe to be used with a push-on bell shall be beveled.
4. Joints
 - a. Joint Placement
 - 1) Push on joints: Pipe shall be laid with the bell ends facing upstream. The gasket shall be inserted and the joint surfaces cleaned and lubricated prior to placement of the pipe. After joining the pipe, a metal feeler shall be used to verify that the gasket is correctly located.
 - 2) Mechanical Joints: Pipe and fittings shall be installed in accordance with the "Notes on Method of Installation" under ANSI A21.11/AWWA C111. The gasket shall be inserted and the joint surfaces cleaned and lubricated with soapy water before tightening the bolts to the specified torque.

3.04 INSTALLATION OF VALVES

- A. Valves of the size and type shown on the Drawings shall be set plumb and installed at the locations indicated on the Drawings. Valves shall be installed in accordance with manufacturer's installation instructions and with the details shown on the Drawings.

- B. Valves shall be installed such that they are supported properly in their respective positions, free from distortion and strain. Valves shall be installed such that their weight is not borne by pumps and equipment that are not designed to support the weight of the valve.
- C. Valves shall be carefully inspected during installation; they shall be opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat. Check and adjust all valves for smooth operation.
- D. Install valves with the operating stem in the vertical position.
- E. Allow sufficient clearance around the valve operator for proper operation.
- F. Curbs shall be cut indicating a "V" at all valve locations.
- G. Clean iron flanges by wire brushing before installing flanged valves. Clean carbon steel flange bolts and nuts by wire brushing, lubricate threads with oil or graphite, and tighten nuts uniformly and progressively. Clean threaded joints by wirebrushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.
- H. Valve box insert shall be one complete assembled unit with a self-adjusting extension stem system that fits inside a standard valve box that will accommodate variable trench depths six-feet and greater as shown in the drawings.
- I. Valve boxes shall have locking lids utilizing a five sided nut with a special wrench needed to pen. Valve lids to be made as shown in the drawings.
- J. Valve collars shall be 24" x 24" round or square and poured in place with 3,000 psi concrete or made out of a fiberglass reinforced concrete polymer material manufactured to the specifications as shown in the drawings.
- K. Locating wire shall be per Section 15200.
- L. Valve markers are to be made of Schedule 80 VC and have a decal applied containing information as shown in the drawings. The marker must be the same color as the pipe being marked.
- M. Valves shall be tested hydrostatically, concurrently with the pipeline in which they are installed. Protect or isolate any parts of valves, operators, or control and instrumentation systems whose pressure rating is less than the pressure used for the pressure test(s). If valve joints leak during pressure testing, loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts, and hydrostatically retest the joints.

N. Painting:

All exterior surfaces of iron body valves shall be clean, dry and free from rust and grease before coating and coated per attached list of approved products in the Appendix.

3.05 INSTALLATION OF TAPPING SLEEVE AND VALVE

A. General:

The Contractor shall furnish and install the tapping sleeves and valves to existing mains. Taps are not permitted for single connections or distribution systems smaller than six inches or on transmission mains 30 inches or larger.

B. Excavation, Backfill, Compaction and Grading: As per Section 02222.

C. Pressure Connections:

Sufficient length of main shall be exposed to allow for installation of the tapping sleeve and valve and the operation of the tapping machinery. The main shall be supported on concrete pedestals or bedding rock at sufficient intervals to properly carry its own weight, plus the weight of the tapping sleeve, valve and machinery. Any damage to the main due to improper or insufficient supports will be repaired at the Contractor's expense.

1. Prior to the tap, the Contractor shall assemble all materials, tools, equipment, labor and supervision necessary to make the connection.
2. The Contractor shall excavate a dry and safe working area pit of sufficient size to enable the necessary work. Tap shall be a minimum of five (5) feet away from the nearest pipe joint and it is preferred to center between joints. Contractor shall coordinate with the Owner's representative.
3. The inside of the tapping sleeve and valve, the outside of the main and the tapping machine shall be cleaned and swabbed or sprayed with one percent liquid chlorine solution prior to beginning installation for water system pressure connections and must comply with AWWA C-651-99 or most current version.
4. After the tapping sleeve has been mounted on the main, the tapping valve shall be bolted to the outlet flange, making a pressure tight connection. Prior to beginning the tapping operation, the sleeve and valve shall be pressure tested under the observation of City's/Engineer's personnel to 150 psi for a 30-minute duration to ensure that no leakage will occur.
5. For pressure connections 4-inch through 20-inch installations, the minimum diameter cut shall be 1/2 inch less than the nominal diameter of the pipe to be attached. For larger taps, the allowable minimum diameter shall be two to three inches less than the nominal diameter of the pipe

being attached. After the tapping procedure is complete, the Contractor shall submit the coupon to City/Engineer.

6. The tapping valve shall be placed horizontally for pressure connections to wastewater force mains. A plug valve shall be attached to the tapping valve after the tapping procedure is complete. The tapping valve shall be left in the open position prior to backfilling.
7. Adequate restrained joint fittings shall be provided to prevent movement of the installation when test pressure is applied. See the restrained joint table in the Construction Drawings detail sheet.
8. The Contractor shall be responsible for properly backfilling the work area pit after the work is completed.

3.06 INSTALLATION OF AIR RELEASE VALVES

- A. Piping, fittings, and valves shall be installed as shown on the Drawings and recommended by Manufacturers.
- B. The air release valve assemblies shall be installed so that they are properly supported and so that they will function properly and freely and no parts shall be strained.
- C. Air release valve testing shall be performed during the testing of pipeline which air release is attached.

3.07 HYDROSTATIC PRESSURE AND LEAKAGE TESTING - See Section 15995

3.08 OBTAINING POTABLE WATER FOR TESTING AND FLUSHING

- A. The potable water supply shall be protected with an air gap or a reduced pressure principle backflow preventer approved by the City, if potable water is used for testing and flushing.
- B. To obtain potable water service during construction, the Contractor shall be required to install a temporary water meter. The piping, fittings, backflow preventer, and appurtenances required for the temporary construction water service shall be supplied by the Contractor.
- C. The Contractor shall coordinate with the City for temporary construction water service connection, usage, and flushing.

3.09 MAIN CLEANING AND FLUSHING

- A. Swabbing
 1. New water mains shall be hydraulically cleaned with a polypropylene swabbing device to remove dirt, sand and debris from main.

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.
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.
4. Cleaning of the system shall be done in conjunction with the initial filling of the system for its hydrostatic test.
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.
6. The line to be cleaned shall only be connected to the existing distribution system at a single connection point.
7. Locate and open all new in-line valves beyond the point of connection on the pipeline to be cleaned during the swabbing operation.
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.
9. Only City personnel shall operate the supply valve from the existing distribution system. 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 is retrieved.
 - (a) Re-apply a series of individual swabs in varying diameters and/or densities as required, to attain proper cleanliness of pipeline.
 - (b) Swabbing speed shall range between two and five feet per second.
10. After the swabbing process, pressure testing and disinfection of the pipe shall be completed in accordance with Section 15995.

- B. Temporary blowoffs may be required for the purpose of flushing mains. Temporary blowoffs shall be installed as close as possible to the ends of the main being flushed. Blowoffs installed on the main shall be the same diameter as the

main. Temporary blowoffs shall be removed and plugged after the main is flushed. All costs for installing and removing temporary blowoffs shall be at no additional cost to the City.

- C. The City shall be notified at least 72 hours prior to swabbing mains.
- D. Blowoffs and temporary drainage piping used for flushing shall not be discharged into any gravity sewer or pumping station wetwell. The Contractor shall obtain prior approvals from the Engineer and the City as to the methods and locations of flushing water discharge.

3.10 FINAL DISINFECTION FOR POTABLE WATER

- A. Before any portion of the potable water piping systems is to be placed in service, it shall be disinfected; and its disinfection shall be demonstrated by bacteriological tests conducted in accordance with "Standard Methods for Examination of Water and Sewage" for the coli-aerogenes group, by an approved laboratory, acceptable to the Engineer and the County Health Department/FDEP.
- B. All pipe, fittings, valves, and all other appurtenances installed for potable water lines shall be disinfected prior to being placed in service. Disinfection procedures shall be approved by the Engineer and shall be in conformance with ANSI/AWWA C651, latest revision.
- C. Pipe subjected to contaminating materials shall be treated in a manner approved by the Engineer. Should such treatment fail to remove contaminants from the pipe, contaminated sections of pipe shall be replaced with new uncontaminated pipe at no additional cost to the City.
- D. Disinfection of a completed line shall be accomplished using the following procedure:
 - 1. All potable water piping, fittings, valves, and appurtenances shall be disinfected with a chlorine solution with a sufficient concentration such that the initial chlorine concentration in the water line shall be a minimum of 50 mg/l available chlorine, at any point in the line.
 - 2. Chlorine used for the purpose of disinfection shall be high test granular calcium hypochlorite which contains approximately 65 to 70 percent available chlorine by weight. The calcium hypochlorite shall be stored in a cool, dry, and dark environment, prior to its use, to minimize deterioration. The dry calcium hypochlorite will be used to makeup a high concentration chlorine solution which will be used for disinfection. Under no circumstances will undiluted, dry calcium hypochlorite be placed in the pipeline to be disinfected.

3. Water from the existing, in-service water line shall be made to flow at a constant, slow rate into the water line to be disinfected. Chlorine solution shall be injected or pumped at a regulated rate into the new main, at a point not more than 10 feet downstream from the beginning of the new water main. The method of tapping the water main for the chlorine injection point and the location of the tap shall be approved by the Engineer.
 4. Chlorine solution shall be circulated in the water main by opening the water control valve and systematically manipulating valves and blowoffs.
 5. Water service lines shall be disinfected in a similar manner as that for water mains, including corrective measures, by methods acceptable to the Engineer.
 6. Chlorine solution shall remain in the water lines for no less than 24 hours, but longer than 24 hours if directed by the Engineer.
 7. Extreme care shall be exercised at all times to prevent concentrated chlorine solution from entering existing water mains.
- E. After 24 hours, the free residual chlorine concentration in the water line at the pipe extremities shall be at least 10 mg/l; if not, the water lines shall be redisinfected as described above.
- F. Final flushing of lines may proceed after 24 hours, provided the free residual chlorine analysis is satisfactory. Flushing shall be continued until a chlorine residual test shows that lines contain only the normal chlorine residual. Prior to flushing water with high chlorine concentrations, obtain approvals from the Engineer and the City as to the methods and locations of discharge.
- G. Following disinfection and thorough flushing of the water lines, as specified herein, the Contractor shall furnish all labor and materials required to obtain samples of water from established points of the water line in suitable sterilized containers obtained from a FDEP approved analytical laboratory. Two (2) series of successive samples shall be obtained at each established sampling points. Each test series will require two samples at each sampling point. The period between each series of samples shall be a minimum of 24 hours. Samples shall be delivered by the Contractor to the FDEP approved analytical laboratory for bacteriological examination. Samples shall be collected in conformance with FDEP standards and lab testing schedule. Prior to collecting samples, the Contractor shall notify the Engineer and the City who will have representatives present during sample collection.
- H. Bacteriological test results will be available approximately 48 to 72 hours after samples are submitted. If tests results are unsatisfactory, the Contractor shall immediately rechlorinate and retest the water lines and proceed with such

corrective measures as are necessary to secure disinfected lines. All services shall be rechlorinated if the lines are rechlorinated. The water lines shall be reinfected and retested, at the Contractor's expense, until approved by the Engineer, and the FDEP.

- I. At satisfactory completion of the bacteriological test requirements, potable water lines shall be placed in service in a manner approved by the Engineer and the City and the Health Department. Contractor shall notify the Engineer and the City 72 hours prior to placing lines in service.

3.11 CONNECTION TO EXISTING WATER SYSTEMS

- A. The Contractor shall coordinate making connection of the new mains to mains, which are in service at the time of construction with the City. The Contractor shall not connect to existing facilities unless the Engineer and a representative of the City are present. The Engineer and the City shall be notified at least 48 hours prior to the time connection is desired.
- B. Operation of all system valves shall be the responsibility of the City's personnel only. At no time shall the Contractor operate any system valves. System valves shall be defined as any valve which has main pressure against either side of the valve. The Contractor shall notify the City to request that a valve be operated, at least 48 hours prior to the time operation is required.

END OF SECTION

SECTION 15065

MISCELLANEOUS MATERIALS

PART 1 - GENERAL

- 1.01 Miscellaneous materials necessary for a complete installation, not specified herein, shall be equal in quality to the specified materials suitable for the intended use, and shall conform to the details and notes shown on the Plans. All minor items implied, usually included or required for the construction of a complete operating system, shall be installed whether specified or shown on the Plans, or not.
- 1.02 The Contractor shall furnish and install where shown on the Plans or stated herein, the following materials or equals:

PART 2 – PRODUCTS

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| 2.01 | Anchors, chemical adhesive | Stainless Steel HVA type by Hilti Co, or approved equal |
| 2.02 | Anchor bolts, eyebolts, nuts washers-steel, including anchor bolts and tie-rods carbon steel | ASTM A325-88a, hot-dip galvanized |
| 2.03 | Anchor bolts, nuts, washers and screws-stainless steel | AISI Type 316 stainless steel |
| 2.04 | Anchor straps | 1-1/2-inch by 1/8-inch hot dip galvanized each with two 1/2-inch by 3-inch anchor bolts and nuts (galvanized) |
| 2.05 | Angle Meter Stops | Conform with AWWA C800, 85-5-5-5 Brass, Inlet Type K Copper Tube, Outlet Meter swivel nut, Lock Wing, NSF 61 Certified, Mueller 14255W, Ford KV23-W, or approved equal. |
| 2.06 | Angle Meter Stops | Conform with AWWA C800, 85-5-5-5 Brass, Inlet Inside Iron Pipe Thread, Outlet Meter swivel nut, Lock Wing, NSF 61 Certified, Mueller 14265W, Ford KV13-W, or approved equal. |
| 2.07 | Angle valves (for air release valve and flushing valve outlet) | 2-inch threaded inlet and outlet valves with hand wheel, bronze body and composition disc, replaceable disc and seat, screwed-in bonnet Nibco T-311Y, or approved equal. |
| 2.08 | Backflow preventer | Pressure reducing 2-inch Series 909 manufactured by Watts Regulator, |

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| 2.09 | Backflow preventer (hose) | Co. (or other Department approved model for size and application) |
| 2.10 | Ballast rock | 3/4" bronze hose bibbs Watts No. 8 Washed and graded limerock obtained from local sources. Aggregate size shall be 1-1/2 inch to 2-inches in diameter. |
| 2.11 | Banding straps for pipe skids | Hot-dip galvanized steel or stainless steel, 1/32-inch thick by 1-1/4 inch wide, minimum with banding clamps of same material. Clean white masonry sand. |
| 2.12 | Bedding for copper tubing | Baroid Bentonite Mix as supplied by Southwest Florida Service and Supply, or Tony's Drilling Supply (Opa-Locka, FL). |
| 2.13 | Bentonite | AISI Standard B16.1, Class 125, plain-faced and drilled. "Hollow Back" flanges not acceptable. |
| 2.14 | Blind flanges, cast iron | |
| 2.15 | Bolt, nuts and washers, Aluminum (where required on the Plans) | Aluminum bolts shall conform with AA 2024-T4 Alloy designation, anodized |
| 2.16 | Bolts and nuts for flanged pipe joints | Hot-dip galvanized steel, sized pipe joints per ANSI specifications. If in contact with aluminum or stainless steel, AISI Type 316 stainless steel, sized per ANSI specifications. |
| 2.17 | Bonding Agent for concrete | High polymer resin dispersed in water "Daraweld-C" by W.R. Grace Co. |
| 2.18 | Bore or bell donut adapters for tailpieces | Fernco, Inc. |
| 2.19 | Brackets and Pipe Support Clamps | ASTM A36, hot dip galvanized after fabrication |
| 2.20 | Branch Assembly (Meter) | Copper inlet with 2 meter swivel nut outlets, NSF 61 Certified, 85-5-5-5 brass, 7 1/2 -inch spacing between outlets, Mueller 15362 Ford UV23-42W, James Jones A.Y. McDonalds 0802M or approved equal. |
| 2.21 | Caulking Compound | Hornflex-L (two component compound based on Thiokol polysulfide liquid polymers), W.R. |

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| | | Grace & Co. Apply per manufacturer's recommendation. See Metropolitan Dade County Public Works. |
| 2.22 | Catch Basins | Department Std. Detail SD 2.3, unless shown otherwise on Plans or detailed on specified herein. |
| 2.23 | Chain Rail | Chain shall be straight-link machine chain, Type 316L Stainless Steel with approx. 15 links per foot. Each chain section shall be fitted with Type 316L Stainless Steel snap fittings and eye bolt at both ends. Eye bolts shall be affixed to end posts. |
| 2.24 | Check valves in meter hook-ups | 1-1/2 inch to 2-inch brass with neoprene poppet by Stataflo Products, Inc., or approved equal. |
| 2.25 | Clean-Outs (toilet area) | Josam 58020, adjustable, with Nikaloy top, or approved equal. |
| 2.26 | Concrete louver ventilator blocks | 16-inch by 16-inch with bird screen, Denmark's Artstone Co., Miami or approved equal. |
| 2.27 | Copper tube straps | Chase No. 1019, 1019R, 1019S. Copper straps for 1-inch tubing, Grinnel Fig. 9124 |
| 2.28 | Concrete pipe support saddle liner | Neoprene rubber sheet, ¼ inch thick w/ 4-ply fabric reinforcement durometer grade 70, cut width ½ inch less than saddle width. |
| 2.29 | Concrete protecting coating (interior of fuel tank containment top of bottom slab and interior walls from bottom slab up to 3-1/2 feet). | Base: Strongcote WB-114, 1/32-inch by Strongwall Systems Inc. or approved equal. Top: Strongcote SC-112, by 1/32-inch thick Strongway Systems, Inc. or approved equal. |
| 2.30 | Copper Tubing | ASTM Standard B-88, Type K annealed and coiled |
| 2.31 | Corporation Stops | 1-inch Mueller H-15000 (for chlorination, testing and 1-inch service connection). 1-1/2 inch Mueller H-10003, (for air release assembly and 2-inch service connection). |
| 2.32 | Coupling Adapters | Flanged, cast iron, Type 912 by Rockwell International, or approved equal. |

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| 2.33 | Coupling, Flexible (Groove type) | Cast iron Victaulic Style 31 or approved equal, complying with AWWA C606-87. Compatible with pipe material, dimensions and service, and furnished with neoprene gaskets and stainless steel bolts and nuts. |
| 2.34 | Coupling, Flexible | Vibration and noise insulating expansion joint, design pressure 150 psi, acceptable for drinking water shall be Style 110-A by Unaflex Rubber Corp., distributed by H.S. White Co., Inc., Ft. Lauderdale, or approved equal. |
| 2.35 | Coupling, No. Hub | Flexible PVC body conforming with ASTM D5926 and C1173. Stainless steel bands. Fernco or approved equal. |
| 2.36 | Coupling, Transition (Ductile Iron) | Center sleeve and end rings of ductile iron conform with ASTM A536 grade 65-45-12; Gaskets NBR (Sewage) SBR (Water). High strength low alloy steel bolting. Coupling conforms with AWWA C219. |
| 2.37 | Coupling, Transition (Steel) | Center Sleeve of ASTM A536 grade 65-45-12; Gaskets NBR (Sewage) SBR (Water). High strength low alloy steel bolting. Coupling conforms with AWWA C219. |
| 2.38 | Disinfectant | As specified in Section UC-175, herein |
| 2.39 | Dowel Bars | Continuous threaded, w/ splicer, Type DBT by Richmond Screw Anchor Co. |
| 2.40 | Duct caps (Grab Sample Ports) | 6" Bronze Andrew industrial Type "DC", Kamlock or equal with 6-inch NPT bronze adaptor Andrews Industrial Type "A", Kamlock or approved equal. |
| 2.41 | Electronic Marker System | Separate frequency for Water, Sewer and Re-Use. Any "approved equal" must be able to communicate with the markers called out below. Search and read mode range of five feet. Each ball to have a separate readable |

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| | | ID number. Ball diameter 4 to 6 inches or less. Filling of ball to be mixture of propylene glycol and water and shall be environmentally harmless if container is ruptured. Shell to be HDPE or other corrosion proof material and completely water tight. 3M 1400 series or approved equal. |
| 2.43 | Epoxy grout, non-shrinking (for setting equipment) | See Specifications Section 03600 |
| 2.44 | Epoxy grout, non-shrinking (for setting handrails) | "Wall-Nu" (Trowel Mix), by Steelcote Mfg. available locally at Florida Wire and Rigging Works, Inc., "Five Star" by U.S. Grout Corp., or equal, available from Coastal Construction Products. |
| 2.45 | Exhaust fan (for dry wells) | N/A |
| 2.46 | Expansion anchors and shields | Redhead by ITT Phillips Drill Division or approved equal. |
| 2.47 | Fiberglass bar grating | Polyester I-beam, 1-1/2 inch bars for 24-inch span with uniform loading, spaced 1-3/16 inch O/C. Cross bars spaced 6-inch O/C. As manufactured by McNichols Fiberglass Co., or approved equal. |
| 2.48 | Fill Cap (emergency pump out connection to force main) | 4", lock type, OPW 634-TT with 4x4 inch adaptor, OPW 633-T, by Dover Corp., or equal. |
| 2.49 | Flange coupling adapters | Smith-Blair, Dresser. |
| 2.50 | Flanged joint material | ANSI sized and approved, full faced 1/8 inch thick neoprene (for sewer) SBR (for water) gaskets and hot-dip galvanized bolts and nuts (except as otherwise specified for a particular service). Properties of gaskets to conform with ANSI/AWWA C111/A221.11. Bolts and nuts hot dip galvanized steel properly sized for ANSI Standard Class 125 flanged joints. |
| 2.51 | Flexible couplings (Compression type, if required during installation). | Compression type sleeve Dresser Style 38, Baker, or equal, compatible with pipe dimensions and service, and furnished complete with grade 27 |

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| | | gaskets and 316 stainless steel bolts and nuts. |
| 2.52 | Flexible connections, (stainless steel) | Stainless steel bellows type with flanged connections as manufactured by Ram-Tech Sales, Inc., Shreveport, LA, or approved equal. |
| 2.53 | Floor drain with strainer 4-inch (if required) | Adjustable body 30604-64 Josam with adjustable Super-Flow strainer, Bronze Top finish. |
| 2.54 | Gasket lubricant | Vegetable soup lubricant as recommended by the pipe, valve or gasket manufacturer for installation of pipe in subaqueous trench. |
| 2.55 | Gauges – pump discharge | 0-60 psi range, Kunkle, Style G1110, case type N or equivalent by John C. Ernst, or Ashcroft with diaphragm seal. |
| 2.56 | Gauges – pump suction | 0-15 psi range, Kunkle, Style G1130, case type N with diaphragm seal, 4-1/2 inch dial size. Gauges shall be furnished by the manufacturer supplying the diaphragm seals assembled as a unit. |
| 2.58 | Gauge cock | Bronze gauge cock Crane No. 744 equivalent by Stockam. |
| 2.59 | Gravel for venturi, valve or other pit (where required on Plans or herein) | Gravel shall be locally obtained from a fresh water source, of deleterious matter and graded from 3/4 to 2-1/2 inches in size. |
| 2.60 | Grout for sealing between pipe and wall | Non-shrink, hydraulic cement grout. "Waterplug" by Thoro System Products. |
| 2.61 | Grout for boring and jacking | Portland cement-sand mixture. Type I (for water) Type II (for sewer) Portland cement and sand fineness that 100 percent will pass a standard 40-mesh sieve. Grout shall not contain greater than one part sand to one part cement. |
| 2.62 | Guard Post for hydrants | Galvanized steel pipe, Sch. 40, concrete filled. See Std. Detail 4.5 |
| 2.63 | Hose bibbs | 3/4" bronze, w/vacuum breakers where required by S. Fla. Building Code, American Valve Co., Fig. 76 |

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| 2.64 | Hose Clamps | All stainless steel, worm-gear type, Nos. 30032, 300188, by Breeze Corp, Inc. Hex head Type 316 Stainless Steel Series "68" Hy-Gear by Idea |
| 2.65 | Hose, sump pump | 2-inch I.D. Buna-N, "Plant Master" No. 119B by Gates. |
| 2.66 | Insulation roll support | Pipe covering protection saddle shall be ITT Grinnel, Fig. 164, or approved equal. 20- inch adjustable roller stand with base plate shall be ITT Grinnell, Fig. 274, or approved equal. |
| 2.68 | Meter Box for Water Service | Per Department Standard Detail WS 2.10, by U.S. Precast, or approved equal |
| 2.69 | Meter Couplings | 1-inch brass, NSF 61 Certified, Brass, straight, meter nut x pack joint or grip joint, Ford, Mueller or approved equal. |
| 2.70 | Meter Couplings | 1-1/2 inch & 2-inch brass "Loc-Pak" by Ford Meter Box Co. |
| 2.71 | Neoprene pad (60 Durometer) | Neoprene Bearing Pad "Servicized" by W.R. Grace Co. Code No. 3340. |
| 2.72 | Neoprene (compressible pad) | Acmaseal by Acme Highway Products, Corp., Amherst, N.J. |
| 2.73 | Oils and Lubricants | Type, quality and quantity as recommended by manufacturer of machinery or equipment. |
| 2.74 | Paint - Zinc rich for galvanized items with minor damage (if approved by the Engineer) | Dry galve by Force Chemical Division, American Soldering and Flux Co. |
| 2.75 | Paint, for guard post and fire hydrant repairs if necessary | Neutralizer – 1 coat Sherwin Williams Galvanized iron primer, B50 WZ1. Finish paint - 2 coats Sherwin Williams Industrial Enamel OSHA yellow B54 Y 37 |
| 2.76 | Paint, bituminous | Bitumastic No. 300M and Bitumastic No. 50, Kop-Coat Co. |
| 2.77 | Pea Rock | Local washed rock, 100% passing 1- inch mesh and retained on 1/4-inch mesh. |
| 2.78 | Pipe clamps | Hot-dipped galvanized steel. |
| 2.79 | Pipe straps (2-inch by 3/8-inch) | AISI Type 316 stainless steel with 3/8-inch diameter stainless steel bolts. |

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| 2.80 | Pipe straps for Vent Pipe | Galvanized 2-inch No. 3039T19 by McMaster-Carr |
| 2.81 | Pipe supports (where required) | Aluminum Strut Channel 1 5/8-inch X 1 5/8-inch unistrut, |
| 2.82 | Pipe supports (other types) | Fabricated as shown on the Plans, ASTM A36/A36M-90 steel, hot dip galvanized after fabrication. |
| 2.83 | Pipe Hanger, Clevis Type (where required) | Adjustable clevis, carbon steel, galvanized, ITT Grinnel Fig. 260. |
| 2.84 | Pipe Support, Rod Attachment (where required) | Forged Steel Clevis Type with pins. ITT Grinnell Fig. 299. |
| 2.85 | Polyethylene encasement material for main and line valves | Virgin polyethylene material for ductile iron conforming to ANSI/AWWA C-105/A21.5-88, Type I Class C, extruded tube formed with approved polyethylene adhesive tape. Shall be 0.008-inch (8-mil) thick minimum and conform with WASD Std. Detail A-9. |
| 2.86 | Polyethylene sheet for vapor barrier and for use with concrete anchors | .060-inch (6-mil), "Visqueen" by Ethyl Corp., or approved equal. (See Std. Detail GS 1.1) |
| 2.87 | Polysulfide Rubber Sealant | Hornflex-L by W.R. Grace and Co. |
| 2.88 | PVC double bell repair couplings, No-stop (sleeves) | ASTM Standard D3034 |
| 2.89 | PVC pipe and fittings (for sewer lines and service laterals) | SDR35, > 15' deep use SDR26 PVC |
| 2.90 | PVC double bell transition couplings or adapters PSM SDR-35 PVC Sewer Pipe to ductile-iron or AWWA C900 CI-PVC Pressure Pipe | ASTM Standard D3034 for fittings. |
| 2.91 | Riprap | Sand-cement in burlap sacks, well mixed, in the proportion of 5:1. The sacks shall absorb moisture to set-up in the position placed. |
| 2.92 | Roofing felt (miscellaneous) | Standard 30-pound asphalt impregnated felt, ASTM Standard D226-88. |
| 2.93 | Restrained Joint Connectors | "Megalug" or approved equal |
| 2.94 | Sand for bedding – copper tubing | Clean white masonry sand. |
| 2.95 | Sand for Casing | Such fineness that 100% will pass a standard 4-mesh sieve. |
| 2.96 | Sealant for concrete joints | Dow Corning 888 Silicon Joint Sealant with |

- 3/8-inch Dia. Expanded closed-cell polyethylene foam backer rod or approved equal.
- 2.97 Service Insulator Assembly Nylon dielectric bushing with bronze coupling-female I.P. thread by flared copper Ford Meter Co, Inc.
- 2.98 Service Saddle – Double Strap Conform with AWWA C800, NSF 61 Certified, Copper alloy 85-5-5-5 body per ASTM B62 & B584, Gasket Buna N, Straps of silicon bronze. Ford Meter Box Co. 202B, James Jones #J-979 or approved equal.
- 2.99 Service Saddle – Single Strap Conform with AWWA C800, NSF 61 Certified, Copper alloy 85-5-5-5 body per ASTM B62, Gasket Nitrile, Straps of silicon bronze. Mueller Co. H-10475 H-10480 or approved equal.
- 2.100 Service terminal fittings - single One inch lock wing style valve, drilled for wire sealing, Cat. No. KV23-444W Ford Meter Box Co. or Cat. No 14255, Mueller Co.
- 2.101 Service terminal fittings – dual One-inch branch valve assembly, with standard 71/2-inch spacing between outlet centers, drilled for wire sealing, Cat. No. UV23-42W Ford Meter Box Co. or one inch branch connection with standard 71/2-inch spacing between outlet centers Cat. No. H-15362, fitted with angle stops for 5/8-inch meters, drilled for wire sealing, Cat. No. H-14265, (3/4” Inlet) Mueller Co.
- 2.101 Service terminal fittings – dual One-inch branch valve assembly, with standard 71/2-inch spacing between outlet centers, drilled for wire sealing, Cat. No. UV23-42W Ford Meter Box Co. or one inch branch connection with standard 71/2-inch spacing between outlet centers Cat. No. H-15362, fitted with angle stops for 5/8-inch meters, drilled for wire sealing, Cat. No. H-14265, (3/4” Inlet) Mueller Co.
- 2.102 Solder, potable water copper tubing ASTM B32-89 Alloy grade Sn 94 or Sn 95

- 2.103 Strainer 3/4-inch with screwed connections and 20 mesh 18-8 stainless steel straining element. Type SY-70, as manufactured by Cash Acme or approved equal.
- 2.104 Stainless steel screws for ladders AISI Standard Type 316.
- 2.105 Stainless steel cable AISI Type 316 wire rope.
- 2.106 Stainless steel repair clamps, with stainless steel bolts, PSM SDR-35 PVC sewer pipe to ductile-iron or AWWA C900 CI-PVC pressure pipe Wide range, single or multiple panel, Style 3121 or 3122, Clow Corporation. Coat with bituminous paint after installation.
- 2.107 Street elbow (90 Degrees) 150 psi, galvanized, malleable iron, screwed, ANSI Standard B2.1 threaded (NPT).
- 2.108 Stop, Angle Meter For type K copper inlet. START HERE
- 2.109 Stop, Corporation, 1-inch For chlorination, testing and 1-inch service connection, AWWA taper thread inlet, copper service thread outlet (Type K copper tubing), 85-5-5-5 brass alloy, Mueller H-15000, Ford F-600 or approved equal.
- 2.110 Stop, Corporation, 1 1/2 x 2-inch For 2-inch services, ARV's, AWWA taper thread inlet, Iron Pipe Thread Outlet, 85-5-5-5 brass alloy, Mueller H-10003, Ford FB-800-6, or approved equal. For copper thread one side, inside iron pipe thread other side, 85-5-5-5 brass alloy, Mueller H-15175, Ford B21-333W or approved equal.
- 2.111 Stop, Curb, 3/4- inch For copper thread one side, inside iron pipe thread other side, 85-5-5-5 brass alloy, Mueller H-15175, Ford B21-333W or approved equal.
- 2.112 Stop, Curb, 1-inch For inside iron pipe thread both sides, or flare copper 1 side and inside Iron Pipe Thread other side. 85-5-5-5 brass alloy, Mueller H-15175, Ford B21-444 (copper x iron pipe), Mueller H-10201, Ford B11-444 (inside iron pipe thread both sides) or approved equal.
- 2.113 Stop, Curb, 1 1/2-inch For inside iron pipe threads both sides, 85-5-5-5 brass alloy, Mueller H-10255, Ford B11-666, or approved equal
- 2.114 Stop, Curb, 2-inch For inside iron pipe threads both sides, 85-5-5-5 brass alloy, Mueller H-10255, Ford B11-666, or approved

| | | |
|-------|---|--|
| 2.115 | Suction Bend | equal. Mueller H-10255, Ford B11-777 or approved equal. Cast iron, flange and flare, long radius 90-degree bend, US Pipe and Foundry Co. |
| 2.116 | Tread Plate | 1/4-Inch galvanized steel (raised checkered design) |
| 2.117 | Threaded rods | 1/2-inch, 5/8-inch and 3/4-inch hot-dip galvanized steel |
| 2.118 | Tie rods | Threaded each end, hot-dip galvanized steel, with galvanized nuts, washers and eye bolts. The eyebolts shall be Star National Products, Figure No. 7. |
| 2.119 | Timber skids and block | Wolmanized pressure-treated Southern Pine at 2.5 pounds per cubic foot retention. Skids and blocking shall be size so that the top of the bells or restrained joints of the carrier main will be two inches or less below the inside top of the casing pipe. |
| 2.120 | Turnbuckles | Grinnell Fig. 230, hot-dip galvanized |
| 2.121 | U-bolts (galvanized) | Hot-dip galvanized steel |
| 2.122 | U-bolts (stainless) | AISI Type 316 stainless steel. |
| 2.123 | Vent Cap | 2-inch, OPW-63, by Dover Corp. |
| 2.124 | Valve (Foot) | 1-inch, double poppet, bronze, OPW 92 by Dover Corp. |
| 2.125 | Valve boxes and covers | See Standard Details |
| 2.126 | Wall pipes (cast iron) | Clow F-1400 series, American Cast Iron or equal, flange and flange or flange and plain end, or bolted mechanical joint, as required or as shown on the plans. Length to fit wall thickness. |
| 2.127 | Wall Sleeves for Pipe 4" and Smaller | Schedule 40, hot-dip galvanized steel pipe, cut flush with face of wall or floor and reamed. |
| 2.128 | Wall Sleeves for Pipe larger than 4-inches | Cast iron, sized as shown on the Plans, conforming to AWWA Standards, Class "D" pattern, with intermediate flange. |
| 2.129 | Water proofing system (where required by the Plans) | "Penecrete" cementitious water proofing system at joint and 2-inches of "Penetron" all around joint area, mixed and applied as required by the |

product manufacturer, International Coating Systems, Inc. - Danko Sales, Inc. (404)922-3351 or approved equal.

Note: All metal underground piping for this project shall be encased in virgin polyethylene.

2.130 CASTINGS

A. General:

1. Materials used in the manufacture of the castings shall conform to ASTM Standard A48, "Gray Iron Castings", for Class 30 iron. Manhole and valve box covers shall have a roadway or pedestrian type surface as required by location, machined mating surfaces and shall be non-rocking.
2. Unless otherwise specified, castings shall be as manufactured by U.S. Foundry and Manufacturing Corp., Neenah Foundry, or approved equal.

B. Valve Boxes and Covers:

Valve boxes and covers shall be Department No. 52 or No. 53 in accordance with the Standard Details. Valve box covers shall be cast labeled with the letter "S". The foundry and country of origin shall be cast on the bottom of the covers.

C. Fill Cap Manhole:

Fill cap manhole shall be 12-inch, cast iron with rubber gasket, type OPW 104-A by Dover Corp., or approved equal.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 15995

PIPELINE TESTING AND DISINFECTION

PART 1 - GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall perform flushing and testing of all pipelines and appurtenant piping, complete, including conveyance of test water from City-designated source to point of use and all disposal thereof, all in accordance with the requirements of the Contract Documents.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards
 - ANSI/ AWWA B300 Hypochlorites
 - ANSI/ AWWA B301 Liquid Chlorine
 - ANSI/ AWWA C651 Disinfecting Water Mains

1.03 SUBMITTALS

- A. A testing schedule, including proposed plans for water conveyance, control, and disposal shall be submitted in writing for approval a minimum of seven (7) days before testing is to start.
- B. The Contractor shall submit disinfection test reports and hydrostatic test reports in accordance with Sections 01340 Shop Drawings and Section 01700 Project Closeout.

PART 2 - PRODUCTS

2.01 MATERIALS REQUIREMENTS

- A. All equipment, temporary valves or bulkheads, temporary vents or drains, pumps, piping, gauges or other water control equipment and materials required for testing of mains shall be furnished, installed and operated by the Contractor subject to the City's review. No materials shall be used which would be injurious to the construction or its future function.
- B. Pumps shall be of a non-pulsating type suitable for this application and gauge accuracy certification may be required at the Engineer of Record's discretion.
- C. All pressure and leakage testing shall be done in the presence of a representative of the City as a condition precedent to the approval and acceptance of the system.

- D. All water mains shall be flushed to remove all sand, debris, rock and other foreign matter. Dispose of the flushing water without causing a nuisance or property damage.

PART 3 - EXECUTION

3.01 GENERAL

- A. Notify the Engineer and City 48 hours in advance to obtain City's approval to commence testing and/or disinfection of any particular structure and/or pipeline. System isolation shall not be performed by the Contractor unless notification and approval has been obtained from the City.
- B. Unless otherwise provided herein, water for flushing and testing pipelines will be furnished by the City; however, the Contractor shall make all necessary provisions for conveying the water from the City-designated source to the points of use.
- C. All pressure and gravity pipelines shall be tested. All testing operations shall be performed in the presence of the City.

3.02 FLUSHING AND CLEANING

- A. At the conclusion of the installation work, the Contractor shall thoroughly clean all new liquid conveying pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, etc., which may have entered the pipe during the construction period. If after this cleaning any obstructions remain, they shall be corrected by the Contractor, at his own expense, to the satisfaction of the City. Liquid conveying pipelines shall be flushed at the rate of at least 2.5 feet per second for a duration suitable to the City or shall be flushed by other methods approved by the City.
- B. After the pipelines are cleaned and if the groundwater level is above the pipe, or following a heavy rain, the Engineer will examine the pipe for leaks. If defective pipes or joints are discovered at this time, they shall be repaired or replaced by the Contractor.

3.03 HYDROSTATIC TESTING OF PIPING (WATER AND FORCE MAINS)

- A. Following pipeline flushing, the Contractor shall hydrostatically test all pipelines either in sections or as a unit. The section of main being tested shall be limited to a maximum length of 2000 feet. No section of the pipeline shall be tested until all field-placed concrete or mortar has attained an age of 14 days. The test shall be made by closing valves when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water.

- B. The Contractor shall provide all reaction blocking and necessary plugs and caps required to test all piping installed as part of this Contract. The Contractor shall supply and install temporary air release valves for purposes of facilitating proper hydrostatic testing conditions. Location of the ARV's shall be as per the instructions given by the Engineer. The Contractor shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. Care shall be taken to see that all air vents are open during filling. The Contractor shall be responsible for removing temporary ARV's, reaction blocking and temporary plugs and caps upon the successful completion of the testing and shall be responsible for all associated site restorations resulting from his/her work.
- C. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the air valves at a reasonable velocity and all the air within the pipeline shall be properly purged. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb what water it will and to allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to the City shall be taken.
- D. The hydrostatic test shall consist of holding a test pressure of 150 psi on the pipeline for a period of 2 hours and in accordance with ANSI/AWWA Standard C605-05. All visible leaks shall be repaired in a manner acceptable to the City.

- E. The maximum allowable leakage shall be determined by the following formula:

$$L = \frac{S \cdot D \cdot \sqrt{P}}{148,000}$$

Where:

L = Allowable leakage for system in gallons per hour

D = Pipe diameter in inches

S = Length of lines in lineal feet

P = Average test pressure in psi

- F. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gallon / hour / inch of nominal valve size shall be allowed. Any questions pertaining to procedures used during the test shall be decided by the Engineer.
- G. The test is usually maintained for two hours, but it may be continued for one additional hour if it becomes apparent that the leakage is equal to or greater than the amount allowable. Water supplied to the main during the test to maintain the required pressure shall be measured by a 5/8-inch meter installed on the discharge side of the test pump, or by pumping from a calibrated container. A hose bib

connection will be provided by the Contractor to accept the test gauge supplied by the Owner.

- H. In the case of pipelines that fail to pass the prescribed leakage test, the Contractor shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines. No installation will be acceptable by the Owner until the leakage is less than the allowable for the system.
- I. The Contractor shall submit to the City a detailed description of the testing procedures to be utilized.

3.04 DISINFECTION (POTABLE WATER LINES ONLY)

- A. After the water mains have satisfied the leakage requirements, they shall be flushed through openings of the required size as detailed in ANSI/AWWA Standard C601 latest revision. The main shall then be disinfected in accordance with the provisions of the applicable sections of the above-named specifications. On main breaks, cut-ins, etc., a liberal application of calcium hypochlorite shall be made.
- B. Mains shall not be put into domestic service until the necessary bacteriological samples have been approved by the applicable regulatory agencies.
- C. Provide list of equipment required and a disinfection plan to execute the work of this Section.
- D. Inject the required amount of disinfectant to yield a minimum chlorine content of 50 ppm into piping system.
- E. Allow solution to remain in the pipes for twenty-four hours or longer, if required, to destroy all harmful bacteria.
- F. Operate all valves and other appurtenances during disinfection to assure the sterilizing mixture is dispersed into all parts of the system.
- G. After the solution has been retained for the required time, pipes shall be flushed and filled with municipal domestic water. Sterilizing water shall be disposed of in an approved manner. Sterilizing water shall not be allowed to flow into a waterway without reducing chlorine concentrations to a safe level. The Contractor shall be responsible for meeting all applicable requirements and acquiring all necessary permits for this work.
- H. Take one bacteriological sample and test from every segment of pipeline tested. Samples shall be taken and tested on each of two successive days and at the Contractor's expense. Contractor shall submit sample to a laboratory, approved by

Engineer, for testing. The disinfection process shall be repeated if laboratory test results reflect presence of harmful bacteria in the water. All testing and retesting including sampling and resampling as necessary will be at the Contractor's expense.

- I. The Contractor shall be responsible for coordination with Miami-Dade County Department of Health, who shall collect and test samples from main. The Contractor shall provide assistance to the Dept. of Health for the collection of samples or pay for a certified lab to take the samples and follow all sampling procedures. The samples shall be taken from each main or section of main to be placed in service where designated by the Dept. of Health. The samples must be approved by the Department of Health before the main is placed in service.
- J. The Contractor shall be responsible for any rechlorination and retesting that may be required until the Department of Health's approval is obtained. The Contractor shall be responsible for the disposal of all water flushed from the system and shall safeguard all adjoining properties from damage from flooding. The Contractor shall exercise due care in the protection of private property from water damage due to his operations. In addition, the Contractor shall assume complete liability for any damage which was directly or in-directly caused by his operations.

3.05 BACTERIOLOGICAL ANALYSES

- A. Provide analysis of treated water to meet standards and received acceptance from the Miami-Dade County Department of Health.
- B. Test samples in accordance with AWWA C601.
- C. Quality Assurance: Testing Laboratory: Certified for examination of drinking water in compliance with applicable legislation of the State of Florida.
- D. Regulatory Requirements: Conform to Chapter 17-22 of the Florida Administrative Code.
- E. Submittals
 - 1. Submit name of testing laboratory and evidence of qualification.
 - 2. Submit three copies of reports.
- F. Project Record Documents
 - 1. Submit reports under provisions of Sections entitled "Submittals", "Project Closeout", and "Project Record Documents and Survey".
 - 2. Bacteriological report; accurately record:

- a. Date issued, project name, and testing laboratory name, address, and telephone number.
- b. Time and date of water sample collection.
- c. Name of person collecting sample.
- d. Test locations.
- e. Initial and twenty-four- hour disinfectant residuals in ppm for each outlet tested.
- f. Coliform bacteria test results for each outlet tested.
- g. Certification that water conforms, or fails to conform to bacterial standards of State of Florida.
- h. Bacteriologist's signature.

3.06 TESTS FOR DRAIN AND GRAVITY SEWER LINES:

- A. Drain and gravity sewer lines shall be tested for infiltration and exfiltration.
- B. The allowable limits of infiltration or exfiltration (leakage) for the drain or sewer lines, or any portion thereof, shall not exceed the greater of the following:
 1. 100 gallons per inch of internal pipe diameter per mile of pipe per 24 hours with no allowance for laterals or manholes.
 2. As required by the Miami-Dade County DRER/FDEP permit.
 3. As per Chapter 33.94 of Recommended Standards for Wastewater Facilities (2004 Edition). Duration of test shall be a minimum of two hours.
- C. The system may be tested for infiltration or exfiltration in whole or in parts, as directed by the Engineer. Prior to testing for infiltration, the system shall be pumped out so that normal infiltration conditions exist at the time of testing. The amounts of infiltration or exfiltration shall be determined by pumping into or out of calibrated drums, or by other approved methods.
- D. The exfiltration test will be conducted by filling the portion of the system being tested with water to a level which will provide a minimum head of 2-feet in a lateral connected to the test portion, or in the event there are no laterals in the test portion, a minimum difference in elevation of 5-feet between the crown of the highest portion of the drain or sewer and the test level.

END OF SECTION

SECTION 15997

POLYETHYLENE ENCASEMENT FOR CAST/DUCTILE IRON PIPE, FITTINGS, VALVES AND RISERS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. As required by the Engineer, all cast/ductile iron pipe, fittings, valves and risers shall be encased with polyethylene film in order to prevent contact between the pipe and the surrounding soil for the purpose of corrosion protection, following all requirements of this section. Polyethylene film shall be blue in color for water piping, purple in color for reuse piping and green in color for wastewater piping. Black polyethylene film shall only be used if approved by the City and Engineer.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01340 – Shop Drawings
- B. Section 15050 – Utility Piping, Fittings, Valves and Accessories

1.03 REFERENCED SPECIFICATIONS, CODES AND STANDARDS

- A. AWWA C105-10
- B. ANSI A21.5
- C. ASTM D149
- D. ASTM D882
- E. ASTM D1248
- F. ASTM D1709-B
- G. ASTM D1922
- H. ASTM D4976
- I. NT4112-05

1.04 SUBMITALLS

A. Submit following Section 01340.

1. Manufacturer's product data for polyethylene tubing
2. Manufacturer's product data for polyvinyl tape

PART 2 - PRODUCTS

2.01 MATERIALS

A. Polyethylene Tube:

1. Only virgin polyethylene material shall be approved. The material shall be 8 mil minimum, Group 2, Linear Low Density, flat tube polyethylene film meeting or exceeding the requirements of AWWA C105-10, ANSI A21.5-88, ASTM D4976 and NT4112-05, and having the following properties:

| | |
|-----------------------------|--------------------------------|
| Tensile Strength | 3600 psi, minimum - ASTM D882 |
| Elongation | 800%, minimum - ASTM D882 |
| Dielectric Strength | 800 V/mil, minimum - ASTM D149 |
| Impact Resistance | 600 g, minimum - ASTM D1709-B |
| Propagation Tear Resistance | 2550 gf, minimum - ASTM D1922 |

2. The film shall be marked showing trademark, year of manufacture, type of resin, specification conformance, applicable pipe sizes and the words "warning: corrosion protection-repair any damage."

3. Tube size will be as listed below:

| Nominal pipe diameter (in.) | Polyethylene flat tube width (in.) |
|------------------------------------|---|
| 4 | 16 |
| 5 | 20 |
| 8 | 24 |
| 12 | 30 |
| 16 | 37 |
| 20 | 45 |
| 24 | 54 |
| 30 | 67 |
| 36 | 81 |
| 42 | 95 |
| 48 | 108 |
| 54 | 121 |

B. Polyvinyl Tape:

1. The polyethylene encasement shall be secured to the cast/ductile iron using 6-inch, 10-mil "all weather" tape with polyvinyl film backing. On the tape shall be marked the UPC code and mil thickness designation. Pipe-wrap tape shall be moisture resistant, anti-corrosive, conform and adhere to both metal and plastic.

PART 3 - EXECUTION

3.01 POLYETHYLENE ENCASEMENT

- A. The polyethylene sleeve (polywrap) shall be installed in accordance with ANSI/AWWA C105/A21.5, "Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids". The polywrap shall be placed on the cast/ductile iron pipe so that no dirt or bedding material comes in contact with the pipe. All lumps of clay, mud, cinders, etc., on the pipe surface should be removed before the pipe is covered with polyethylene. If the polyethylene is damaged, it must be repaired before the trench is backfilled.

1. Small holes or tears can be repaired with a piece of tape placed over the hole. Large holes or tears should be repaired by taping another piece of polyethylene over the hole.
2. Overlaps, ends, and repairs can be held in place with tape or plastic tie straps until the trench is backfilled.

B. General installation recommendations:

1. When lifting polywrapped pipe with a backhoe, use a fabric-type "sling" or padded cable to protect the polyethylene.
2. When installing polywrap below the water table or in areas subject to tidal action, seal as thoroughly as possible both ends of each polyethylene tube with adhesive tape or plastic tie straps at the joint overlap. Also, place tape or plastic tie straps around the pipe at two (2) foot intervals.
3. Special care shall be taken to prevent damage to wrapping when placing backfill.
4. Quality of installation is more important than the actual sequence followed.

C. Per AWWA C105-05, there are 3 installation methods:

1. Method "A" - The polyethylene tube should be cut to lengths that provide a one foot overlap beyond each end of a pipe section. Slip the tubing over the pipe with the printed side up, and bunch it back to clear both ends. A shallow bell hole should be made to facilitate installation of the polyethylene. Lower pipe into position and make up the joint. Pull tubing over the joint from the preceding pipe length and tape it securely to the new pipe length. Overlap the polyethylene from the new pipe length back over the same joint and tape in place on the preceding pipe barrel. Pull the polyethylene along the length of the new pipe, folding excess tubing over the top of the pipe barrel and securing it every 3 to 4 feet. Keep the excess polyethylene for the overlap of the next joint bunched back from the joint in preparation for making the next joint. Repeat this process for each polyethylene taped into place.
2. Method "B" - Cut the polyethylene tube 1 ft. shorter than the length of pipe sections. Slip the tube around the pipe so as to allow 6 in. of bare pipe at each end. Before making a joint, slip a 3 ft. Length of polyethylene tube over the preceding pipe section. Overlap by at least 1 ft. and secure, after joint is made.
3. Method "C" - Wrap odd shaped fitting with sheet or split length of polyethylene tube by passing the sheet under the fitting and bringing it up around the body. Make seams by bringing it folding over twice, and tapping down. Tape the sheet securely in place at valve stems and other penetrations.
4. Pipe-shape fittings (bends, reducers, etc.) shall be treated according to Methods "A" and "B". Odd shaped fittings (valves, tees, etc.) shall be treated according to Method "C".

PART 4 – MEASUREMENT AND PAYMENT

- 4.01 Cost shall be included in the unit cost of furnishing and installing ductile iron pipe and fittings. Pipe wrap shall be installed and secured in accordance with all of the above requirements, and as approved by the Engineer for a complete installation.

END OF SECTION

SECTION 15998

CATHODIC PROTECTION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Section includes requirements for a complete sacrificial cathodic protection system for pipelines.

1.02 QUALITY ASSURANCE

- A. Materials:
 - 1. Following applicable Standards for corrosion control.
 - 2. Supplied by manufacturer regularly engaged in production of corrosion control materials.
- B. Installer: Install test stations, insulating joints, anodes, and joint bonding under supervision of corrosion control technician or corrosion engineer experienced in corrosion control work.
- C. Corrosion Control Testing: NACE International Certified Corrosion Specialist, Senior Corrosion Technologist, or corrosion engineer with at least 5 years of experience in corrosion engineering to perform corrosion control testing.

1.03 SUBMITTALS

- A. Submit per Section 01300 – Shop Drawings.
 - 1. Catalog Data.
 - a. Materials to be used for joint bonding, joint insulating, anodes, and reference cells.
 - b. Thermite weld packages, including manufacturer's recommended cartridge and charge size for each application required.
 - 2. Catalog Data or Shop Drawings: Test stations.
- B. Quality Assurance/Control Submittals.
 - 1. Certificates:
 - a. Installer's qualifications.

- b. Corrosion control tester's qualifications, methods, and procedures for testing corrosion control system, including description of equipment and instruments to be used.

PART 2 - MATERIALS

2.01 MATERIALS

A. Wire

1. Bonding Wire: #2 or #4 AWG stranded copper wire rated at 600 volts with black high molecular weight polyethylene (HMWPE) insulation, length as shown on Standard Details.
2. Test Lead Wires: #6 through #12 AWG stranded copper wire rated at 600 volts with THW, THHN, THWN, or HMWPE insulation. Wire sizes and insulation colors following Standard Details.
3. Anode Header Wire: Stranded copper wire with black HMWPE insulation using #8 AWG for multiple galvanic anode installation and #4 AWG for impressed current anodes, unless otherwise noted on Drawings; length as required.

B. Exothermic (Thermite) Weld Materials

1. Thermite Weld Molds, Weld Powder, and Weld Metal Cartridges: Proper size and amounts for wire size, pipe size, and pipe material.
2. Approved Manufacturers.
3. Exothermic weld material:
 - a. ERICO Products Inc.
 - b. Continental Industries.
 - c. Or equal
4. Ductile Iron Pipe:
 - a. ERICO, Weld Metal Powder for Cast Iron 45 X F19.
 - b. Or equal.
5. Thermite weld caps:
 - a. Royston Handy Caps (caps pre-filled with mastic).
 - b. Thermite weld caps (empty caps to be field-filled with mastic).

c. Or equal

C. Terminations and Terminals

1. Wire Terminations for Bolted Connections: One piece bar lugs made of electrolytic grade copper bar stock and tin plated, assembled or fabricated before field delivery.
2. Approved Manufacturers.
3. Terminals for Terminating Test Lead Wires in Test Boxes: One piece, burr-free, crimp-type, non-insulated brazed seam terminals made of annealed electrolytic copper, sized to match various wire and stud sizes.

D. Protective Coating Materials

1. Exothermic Welds: Bituminous, coal tar, petroleum wax, or petrolatum-based mastic or tape and primer.
2. Approved Manufacturers:
 - a. Royston Laboratories.
 - b. Tapecoat Company.
 - c. Trenton Corporation.
 - d. Denso Incorporated.
 - e. Central Plastics Company.

E. Insulating Materials

1. Flange Insulating Kit.
2. Flange Insulating Gasket: Full flange diameter, Type E, made of laminated phenolic with neoprene on each side of gasket with minimum total thickness of 1/8 inch.
3. Dielectric strength: Not less than 500 volts per mil.
4. Compressive strength: Not less than 24,000 psi.
5. Water absorption: Maximum 2.5%.
6. Approved manufacturers/suppliers:
 - a. Advance Products & Systems, Inc.
 - b. Central Plastics Company.

- c. Pipeline Seal and Insulator, Inc. (PSI).
 - d. Or equal.
7. Insulating Flange Bolt Sleeves: High density polyethylene or spiral wrapped Mylar with dielectric strength not less than 1,200 volts per mil.
 8. Insulating Flange Bolt Washers: High strength phenolic with minimum thickness of 1/8 inch, dielectric strength not less than 500 volts per mil, and compressive strength not less than 25,000 psi.
 9. Steel Flange Bolt Washers for Placement over Insulating Washers: Minimum thickness of 1/8 inch and cadmium plated.
 10. One Piece Combination Sleeve and Washer:
 11. Only as noted on Drawings.
 12. When noted, 1 piece sleeve and washer of molded acetal or nylon resin having minimum thickness of 1/8 inch.
 - a. Dielectric strength not less than 500 volts per mil.
 - b. Compressive strength not less than 15,000 psi.
 13. Copper House Connections and Small Pipe Insulator.
 - a. Copper house connection insulator: Two brass parts and nylon dielectric bushing.
 - b. Insulator for other pipe 2 inch and smaller diameter: One piece threaded bushing made of nylon and sized to fit pipe.

F. Test Stations

1. Flush Mounted
 - a. Tube: Following Standard Details.
 - b. Cast iron or high impact plastic collar with ribs.
 - c. Cast iron or high impact plastic locking lid: Blue with permanent identification marking "WSSC Test Station" to withstand AASHTO H-20 traffic loads and ultra violet rays.
2. Above Ground
 - a. Weatherproof enclosure: Cast aluminum, galvanized steel, or high impact plastic, Lexan, Gyrlyn or equal.

- b. Test box enclosure with locking waterproof cover: Fasten on pipe using non- rusting materials: stainless steel, galvanized steel, or cadmium plated steel fasteners.
- c. Terminal block: Phenolic resin, plastic, micarta, Lexan, or Bakelite high dielectric material, with 7 terminals unless otherwise shown on Drawings.
- d. Terminals: Nickel plated brass 1/4 inch threaded studs, nuts, and washers.
- e. Shunt: 0.01 ohm with minimum of 6 ampere capacity in test stations with galvanic anodes following Drawings.

G. Reference Electrodes

- 1. Zinc Reference Cell: Zinc bar in prepackaged backfill with test lead wire.
- 2. Contents: High purity zinc, 99.99 percent pure, meeting requirements of ASTM B418, Type II.
- 3. Size: Approximately 1.4 inches by 1.4 inches by 9 inches and weigh approximately 5 pounds.
- 4. Prepackaged Backfill:
 - a. 75 percent ground hydrated gypsum.
 - b. 20 percent powdered bentonite.
 - c. 5 percent anhydrous sodium sulfate.
 - d. In water permeable fabric sack with zinc bar centered in sack, weighing not less than 20 pounds.
- 5. Lead Wire: No. 12 AWG, 600 volts stranded copper wire with THW, THWN, or THHN green insulation, at least 25 feet long and silver soldered or exothermically welded to core of zinc bar.
- 6. Copper to Copper Sulfate Cell: In plastic tube in prepackaged backfill with test leadwire, with accuracy of ± 5 millivolts and minimum design life of 15 years.
- 7. Contents: High purity copper element, 99.99 percent pure, inside a tube containing a super saturated solution of copper sulfate.
- 8. Prepackaged Backfill:
 - a. 75 percent ground hydrated gypsum.
 - b. 20 percent powdered bentonite.
 - c. 5 percent anhydrous sodium sulfate.

- d. In water permeable fabric sack with zinc bar centered in sack, weighing less than 20 pounds.
9. Lead wire: No.12 AWG, 600 volts stranded copper wire with THW, THWN, or THHN red insulation, at least 25 feet long and crimped and soldered or brazed to copper element.

H. Anodes

- 1. Magnesium bar in prepackaged backfill with test lead wire, in weights following Drawings.
- 2. Chemical Composition of Magesium Anodes: Percent by weight.

| <u>Standard</u> | <u>High Potential</u> | |
|-----------------|-----------------------|--------------------------------|
| Aluminum | 5.0-7.0 | 0.010 Max. |
| Zinc | 2.0-4.0 | 0.05 Max. |
| Manganese | 0.150 Min. | 0.50-1.30 |
| Copper | 0.100 Max. | 0.020 Max. |
| Silicon | 0.300 Max. | 0.05 Max. |
| Iron | 0.003 Max. | 0.030 Max. |
| Nickel | 0.003 Max. | 0.001 Max. |
| Others | 0.300 Max. | 0.050 each or 0.300 Max Total. |
| Magnesium | Balance | Balance |

- 3. Prepackaged Backfill:
 - a. 75 percent ground hydrated gypsum.
 - b. 20 percent powdered bentonite.
 - c. 5 percent anhydrous sodium sulfate.
 - d. In water permeable fabric sack with anode centered in sack.
- 4. Lead wire: No. 12 AWG 600 volts solid copper wire with THW, THWN, or THHN white insulation, at least 15 feet long, and factory connected to core with silver brazing alloy with minimum silver content of 15 percent.

- I. Detectable Warning Tape: Yellow Mylat encased aluminum foil, minimum of 6 inches wide, with imprinted words "CATHODIC PROTECTION."

CALCULATED RESISTANCE TABLE

| Diameter in Inches | DUCTILE IRON PIPE | |
|-----------------------|-------------------|---------------------------|
| | Class | Resistance per Foot (OHM) |
| 4 | 51 | 0.0000762 |
| 4 | 52 | 0.0000688 |
| 4 | 53 | 0.0000628 |
| 4 | 54 | 0.0000578 |
| 4 | 55 | 0.0000536 |
| 4 | 56 | 0.0000500 |
| 6 | 51 | 0.0000486 |
| 6 | 52 | 0.0000441 |
| 6 | 53 | 0.0000404 |
| 6 | 54 | 0.0000373 |
| 6 | 55 | 0.0000346 |
| 6 | 56 | 0.0000323 |
| 8 | 50 | 0.0000380 |
| 8 | 51 | 0.0000343 |
| 8 | 52 | 0.0000313 |
| 8 | 53 | 0.0000288 |
| 8 | 54 | 0.0000266 |
| 8 | 55 | 0.0000248 |
| 8 | 56 | 0.0000233 |
| 10 | 50 | 0.0000287 |
| 10 | 51 | 0.0000261 |
| 10 | 52 | 0.0000239 |
| 10 | 53 | 0.0000221 |
| 10 | 54 | 0.0000205 |
| 10 | 55 | 0.0000192 |
| 10 | 56 | 0.0000180 |
| 12 | 50 | 0.0000225 |
| 12 | 51 | 0.0000206 |
| 12 | 52 | 0.0000190 |
| 12 | 53 | 0.0000176 |
| 12 | 54 | 0.0000164 |
| 12 | 55 | 0.0000154 |
| 12 | 56 | 0.0000145 |
| 14 | 50 | 0.0000182 |
| 14 | 51 | 0.0000167 |
| 14 | 52 | 0.0000155 |

| CALCULATED RESISTANCE TABLE (Cont'd.) | | |
|---------------------------------------|-------------------|---------------------------|
| Diameter in Inches | DUCTILE IRON PIPE | |
| | Class | Resistance per Foot (OHM) |
| 14 | 53 | 0.0000144 |
| 14 | 54 | 0.0000135 |
| 14 | 55 | 0.0000127 |
| 14 | 56 | 0.0000119 |
| 16 | 50 | 0.0000155 |
| 16 | 51 | 0.0000143 |
| 16 | 52 | 0.0000132 |
| 16 | 53 | 0.0000123 |
| 16 | 54 | 0.0000115 |
| 16 | 55 | 0.0000109 |
| 16 | 56 | 0.0000103 |
| 20 | 50 | 0.0000118 |
| 20 | 51 | 0.0000109 |
| 20 | 52 | 0.0000101 |
| 20 | 53 | 0.0000095 |
| 20 | 54 | 0.0000089 |
| 20 | 55 | 0.0000084 |
| 20 | 56 | 0.0000079 |
| 24 | 50 | 0.0000093 |
| 24 | 51 | 0.0000087 |
| 24 | 52 | 0.0000081 |
| 24 | 53 | 0.0000076 |
| 24 | 54 | 0.0000071 |
| 24 | 55 | 0.0000067 |
| 24 | 56 | 0.0000064 |
| 30 | 50 | 0.0000073 |
| 30 | 51 | 0.0000066 |
| 30 | 52 | 0.0000061 |
| 30 | 53 | 0.0000056 |
| 30 | 54 | 0.0000052 |
| 30 | 55 | 0.0000049 |
| 30 | 56 | 0.0000046 |
| 36 | 50 | 0.0000055 |
| 36 | 51 | 0.0000050 |
| 36 | 52 | 0.0000045 |
| 36 | 53 | 0.0000041 |
| 36 | 54 | 0.0000038 |
| 36 | 55 | 0.0000035 |

| | | |
|----|----|-----------|
| 36 | 56 | 0.0000033 |
| 42 | 50 | 0.0000043 |
| 42 | 51 | 0.0000039 |
| 42 | 52 | 0.0000035 |
| 42 | 53 | 0.0000032 |
| 42 | 54 | 0.0000029 |
| 42 | 55 | 0.0000027 |
| 42 | 56 | 0.0000025 |
| 48 | 50 | 0.0000035 |
| 48 | 51 | 0.0000031 |
| 48 | 52 | 0.0000028 |
| 48 | 53 | 0.0000025 |
| 48 | 54 | 0.0000023 |
| 48 | 55 | 0.0000021 |
| 48 | 56 | 0.0000019 |
| 54 | 50 | 0.0000028 |
| 54 | 51 | 0.0000025 |
| 54 | 52 | 0.0000022 |
| 54 | 53 | 0.0000020 |
| 54 | 54 | 0.0000018 |
| 54 | 55 | 0.0000017 |
| 54 | 56 | 0.0000015 |

Joint Bond Wire Resistances

| | |
|------------|-----------------------|
| #2AWG Wire | 0.000162 OHM Per Foot |
| #4AWG Wire | 0.000259 OHM Per Foot |

PART 3 - EXECUTION

3.01 THERMITE WELDING OF WIRES

- A. Thermite weld test lead and joint bond wires to ductile iron and steel pipe joints and fittings, except where limited use of lugs is permitted following Standard Details.
 - 1. This weld process may be specified for use on other metallic structures.
- B. Select and use thermite welding equipment following equipment manufacturer's instructions and Standard Details.
 - 1. Use equipment and molds to accommodate wire size, metallic structure's shape, wire position of attachment (vertical or horizontal) and other criteria specified.

2. Before a mold is used, remove and clean slag, dirt, and other foreign matter from mold.
3. Use cartridge and charge size based on manufacturer's recommendations for specific application.
4. Different charges are required for steel and ductile iron. polyethylene.

C. Surface Preparation:

1. Surface with Little or No Coating:
 - a. Cleaned to bare metal by grinding or filing area approximately 3 inches square to produce bright metal surface.
 - b. Removed of coating, dirt, mill scale, oxide, grease, moisture, and other foreign matter from weld areas.
2. Surfaces with High Performance or Thick Coating: Cut 4 inch square window through coating and clean 3 inch square of surface to bright metal, avoiding damage to surrounding coating.

D. Preparation for Welding

1. Before welding, remove wire insulation as required to fit mold, avoiding damage to exposed copper wire.
2. If wire is cut or nicked over half way through its diameter, cut off and strip new end.
3. If manufacturer requires use of copper sleeve, crimp it securely to wire and remove excess wire protruding from end of sleeve.

E. Test Connection

1. After charge is set, remove mold and slag from weld area with welder's hammer.
2. Strike top and sides of weld with hammer to test secureness of connection.
3. If weld does not hold, remove scrap weld material, clean, and begin weld process again.
4. After welding and before coating cleaned weld area, Engineer may test joint bond wires for electrical continuity.

F. Weld Caps

1. When weld passes test for soundness and electrical continuity, repair coating in weld area with petrolatum or petroleum wax mastic and weld cap placed over weld following Standard Details.
2. Apply mastic to fill weld cap or pre-filled weld cap and cover exposed metal of structure and wire to minimum thickness of 1/4 inch.
3. Repair damage to coating around weld area following coating manufacturer's recommendations.
4. If weld cap will not fit due to physical space limitations, coat bare metal and wire in weld area with minimum 1/4 inch thickness of petrolatum or petroleum wax mastic.

3.02 BOLTED WIRE CONNECTIONS

- A. Bolted wire connections for bonding purposes are permitted to bolts on valve body: Follow Standard Details and specified herein.
- B. Connect wire to bolt on valve body that is closest to pipe centerline.
 1. After valve bolt is removed, clean valve surface under bolt head to bright metal.
- C. Use prefabricated bar lug on bonding wire end that will connect to valve bolt.
 1. Size bar lughole to fit valve bolt, and make bolted connection following Standard Details.
 2. After bolted wire connection is completed, test joint bond wires for electrical continuity.
 3. After bond wire passes electrical continuity test, coat bar lug, exposed copper wire and valve metal cleaned to make connection with minimum 1/4 inch of petrolatum or petroleum wax mastic.

3.03 JOINT BONDING OF PIPE

- A. Bond pipe joints and fittings to form electrically continuous pipeline following Drawings and Standard Details.

- B. Wire.
 - 1. Size wire used for joint bonding according to pipe diameter and following Standard Details.
 - 2. Cut bond wire to shortest length practicable, including some slack, for given span.
 - a. Locate bond wire welds on pipe and fittings following Standard Details.
 - b. Horizontal welds are preferable, but where there is insufficient space on fitting, vertical welds will be permitted.
 - c. Where multiple parallel bond wires are involved, space wires neatly and without wires crossing each other.
 - 3. Do not splice bond wires.
 - a. Entirely replace bond wires broken during construction.
 - b. Reweld loose weld connections.
 - 4. If insulation of bond wire is damaged between welds, repair insulation:
 - a. Thoroughly clean damaged area and 6 inches either side of it.
 - b. Wrap minimum of 1 overlapping layer of rubberized electrical tape around damaged area and extend at least 2 inches each side.
 - c. Wrap 2 overlapping layers of plastic electrical tape around rubberized tape and extend at least 1 inch beyond rubberized tape at each end.

3.04 INSULATED JOINTS

- A. Install insulated joints of type and at location following Drawings and Standard Details.
- B. After insulated joint is completed, test and verify that joint is completely insulated.
 - 1. Coat entire joint including bolt ends and nuts with coating material specified herein.
 - 2. Fully coat minimum of 12 inches on each side of flange.
 - 3. Clean surface of flange and components and prepare surface following manufacturer's recommendations.
 - 4. Apply uniform coat of primer to flange and all components.
 - 5. Apply filler mastic to all irregular surfaces of flange to provide smooth profile for tape application.

6. Apply innerwrap to flange and all components in spiral fashion; minimum overlap 55 percent.
 7. Apply outerwrap to flange and all components in spiral fashion; minimum overlap 1 inch with sufficient tension to provide continuous adhesion of tape.
 8. Install test facilities at insulated flanges following Drawings.
- C. For copper house connections and other small pipe, install connection insulator following Drawings.
1. Locate insulator at copper pipe tie-in following Standard Details

1.01 INSTALLATION OF TEST STATIONS

A. Location of Test Stations

1. Follow Drawings and Standard Details.
 - a. Unless otherwise directed by Engineer, locate surface of concrete pad at finish grade.
2. Identify test station with number following Drawings or Engineer furnished number.
 - a. Paint number legibly inside test box lid or cover and on terminal block.
 - b. Use permanent and weatherproof paint for metal or plastic surfaces.
3. Immediately after installation in areas to be improved, protect and identify test station locations with 3 stakes extending at least 4 feet above existing grade, equally spaced around test station and wrapped with orange fluorescent flagging material within 6 inches from top of stakes.
4. Situate pipe for pipe mounted test stations directly over pipeline.
 - a. If this is not possible, locate at Engineer's direction.

B. Test Lead Wires

1. Install test lead wires without splices as shown on Standard Details and attach to pipe using exothermic welding method.

2. Terminate test lead wires inside test box using proper sized crimp type connectors on wire ends.
 - a. Connect each wire to terminal maintaining at least 18 inches slack in each wire at test station.
 - b. Neatly coil slack wire in test station below terminal board.
3. Locate wires on top and along pipe and at right angles to pipeline when wires depart for offset test stations.
 - a. Protect wires from damage during backfilling operations with adequate slack and support.
4. Place continuous yellow detectable warning tape directly over test lead wires, 12 inches to 18 inches below finished surface.
5. Test each lead wire for continuity after backfill is completed.
 - a. If test for continuity fails, repair or replace at Engineer's direction.
 - b. After continuity is verified, connect each lead wire to terminal block in test station.

C. Reference Cells:

1. Install reference cell following Standard Details or Drawings.
2. Protect cloth sack with prepackaged backfill surrounding reference cell from tearing or damage.
3. If damage occurs, provide new prepackaged reference cell.
4. Test wire from reference cell for proper function.
 - a. If reference cell is not functioning properly, repair or replace.
 - b. After test cell is functioning properly, connect lead wire from reference cell to terminal block at test station.
 - c. Do not attach other test lead wire to terminal that is used for reference cell.

D. IR Drop Lead Wires:

1. Locate IR drop test stations following Drawings. Use wire size, type, and length following Standard Details.

2. Locate long lead wires below springline of pipe and taped to pipe for protection, following drawings.
- E. Foreign Pipeline:
1. Provide test stations at foreign pipelines following Drawings and Standard Details.
 2. Notify City of foreign pipeline at least 2 weeks before test station construction. Unless otherwise indicated only foreign pipeline City or approved representative will be permitted to weld wires to foreign pipeline.

1.02 ANODE INSTALLATION

- A. Locate anodes as shown on Drawings and Standard Details.
1. Do not lift anode by lead wire.
 2. Protect cloth sack with prepackaged backfill surrounding anode from tearing or damage.
 3. If damage occurs, provide new prepackaged anode.
 4. After anode is in place, backfill around it with rock-free material and compact following Restoration Schedule on Drawings.
 5. After backfill is completed to at least 1 foot above anode, pour at least 15 gallons of water over anode, unless groundwater covers it.
- B. Connect anode lead wire to terminal block at test station, or when shown on Drawings, directly to pipe by exothermic weld.

1.03 PLACING SYSTEM IN SERVICE

- A. Accomplish final connections and place Cathodic Protection System in service specified under Corrosion Control Testing.

1.04 CORROSION CONTROL TESTING

- A. Record methods and instruments used to perform required tests including all readings, measurements, and calculated resistances.

B. Minimum Equipment To Perform Corrosion Control Testing:

1. DC ammeter with full scale ranges of 1, 10, and 100 amperes, accurate to within 1 percent of full scale. A millivolt meter with 1 percent of full scale accuracy and shunts may also be used.
2. Voltmeter with minimum input resistance of 10 megohms, with DC low range of 200 millivolts full scale to DC high range of 100 volts full scale and accurate to within 1 percent of full scale.
3. Alternative to 1. and 2. above may be high impedance multi combination voltmeter- ammeter used with 100 ampere shunt, Miller B3A, or equal.
4. DC power supply with steady capacity of 50 amperes minimum, produced from portable cathodic protection rectifier, 6 or 12 volt automotive type wet cell batteries, or equal.
5. Test leads and clamps suitable for carrying test current, rated up to 75 amperes with lead wire length.
6. Adjustable resistors with sizes and capacities to handle desired outputs.
7. Safety switch rated for test current.
8. One pair of electrical probes for voltmeter.
9. Saturated copper-copper sulfate reference half cell.

C. Continuity testing.

1. Submit records of joint bond resistance testing including:
 - a. Instruments and equipment used, with sketch of test connections.
 - b. Test amperages, voltages, and voltage changes during testing.
 - c. Joint resistance, measured and calculated.
 - d. Location of each test station, giving pipe station and street address.
2. Calculate theoretical joint and bond resistances.
 - a. Measure distance between test stations.
 - b. Using Calculated Resistance Table included herein at end of Section, multiply measured distance by Resistance Per Foot (OHM) from table to obtain theoretical (or calculated) resistance.

- c. Measured resistance shall not exceed 10 percent of calculated resistance.
- D. Test each insulating joint after assembly and prior to backfilling for insulation, using methods generally accepted in corrosion control engineering. Repair or replace defective or ineffective insulating joint.
 1. Submit records of insulated joint testing including:
 - a. Test method and instruments used, with sketch of test connections.
 - b. Location of insulated joint, giving pipe station and/or street address.
 - c. Instrument readings of current, voltage, and calculated resistance.
- E. After Backfill is Completed and Test Stations are in Place:
 1. Test and verify continuity and electrical isolation of pipeline.
 2. Measure pipe-to-soil potentials in close interval over-the-line survey, continuously at electrode spacing not to exceed 5 feet. Relate contact points of reference electrodes to pipeline stations and known pipeline appurtenances.
 3. Make sketch of each test station terminal board and test lead wire hookups.
 4. Make plan view sketch of each test station location with physical features and GPS coordinates as follows: Horizontal Control--MD State Plane Coordinates NAD83/91 to 0.01 foot accuracy, Vertical Control--NGVD29 to 0.01 foot accuracy.
- F. For Pipeline with Cathodic Protection System, perform following:
 1. Before anode connection:
 - a. Close interval pipe-to-soil potential survey.
 - b. Pipe-to-soil potential at each test station.
 - c. Reference cell-to-pipe potential at each test station.
 - d. IR drop calculations (K factor).
 - e. IR drop measurements - current flow and direction.
 - f. Anode potential.
 2. At time of anode connection:
 - a. Connect anodes to an appropriate test lead wire and shunt in each test station.

- b. Pipe-to-soil potential at each test station.
 - c. Reference-to-pipe potential at each test station.
 - d. IR drop measurements - current flow and direction.
 - e. Anode current output.
- 3. Three to 4 weeks following anode connection (i.e., cathodic protection system activation):
 - a. Close interval pipe-to-soil potential survey.
 - b. Pipe-to-soil potential at each test station.
 - c. Reference cell-to-pipe potential at each test station.
 - d. IR drop measurements - current flow and direction.
 - e. Anode current output.
- G. For Pipeline without Cathodic Protection System, perform following:
 - 1. Close interval pipe-to-soil potential survey.
 - 2. Pipe-to-soil potential at each test station.
 - 3. Reference cell-to-pipe potential at each test station.
 - 4. IR drop calculations (K factor).
 - 5. IR drop measurements - current flow and direction.
- H. At stations where foreign structures are interconnected, check for stray current.
 - 1. If stray current is revealed, identify source, if possible, and inform Engineer of findings.

PART 4 – MEASUREMENT AND PAYMENT

- A. Measurement: By each complete in place.
- B. Payment: At unit price for each as listed in Bid Schedule.
- C. Payment includes provisions to provide test stations, including but not limited to, joint bonding, insulating joints, lead wires, anodes and other necessary components to complete corrosion control system.

END OF SECTION