

SECTION 02530
HIGH-DENSITY POLYETHYLENE PIPING and FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. High-Density Polyethylene (HDPE) piping and appurtenances for the use of installation of sanitary force main systems.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 01340 – Submittals
 - 4. Section 02300 – Earthwork
 - 5. Section 02510 – Ductile Iron Pipe
 - 6. Section 02610 – Valves

1.2 QUALITY ASSURANCE

- A. Manufacturer's Requirements
 - 1. All piping shall be made from compound conforming to a minimum cell classification of PE 445474C or PE 445574C per ASTM D3350.
- B. Fusion Technician Requirements
 - 1. Fusion Technicians shall be fully qualified by the pipe manufacturer to install, handle and fuse HDPE pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.
- C. Manufacturer and Installer Qualifications:
 - 1. Manufacturer shall have experience in manufacturing HDPE pipe of similar size and type to that specified herein. For a manufacturer to be determined acceptable for providing HDPE pipe, they must show evidence of manufacturing a minimum of 10,000 linear feet of HDPE piping and fittings and ten years' experience in the design and manufacturing of HDPE pipe and fittings of similar size, type and application (water/wastewater) as specified herein.
 - 2. Installer shall have experience in installing HDPE pipe and fittings and fusion of similar diameter and configuration as included herein. For installer to be determined acceptable for installing HDPE pipe and fittings, they must show evidence of installing a minimum of 5,000 linear feet of HDPE piping and fittings and ten years of experience for pipe and fittings of similar size, type and application (water/wastewater) as specified herein.
- D. Pipe and HDPE fittings shall be by the same manufacturer and not have been used in any previous application. HDPE fittings shall be used only where specifically indicated on the plans. Fittings not identified as HDPE shall be ductile iron in accordance with Specification Section 02510.

1.3 REFERENCE STANDARDS:

- A. ASTM International (ASTM):
 - 1. D3350, Standard Specification for Polyethylene Plastics Pipe and Fitting Materials
 - 2. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
 - 3. F1055, Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing
 - 4. F2206, Standard Specification for Fabrication Fittings of Butt-Fused Polyethylene (PE)
 - 5. F714, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
 - 6. D2837, The Hydrostatic Design Basis for Thermoplastic Pipe Materials
 - 7. F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure
 - 8. F2620, Standard Practice for Heat Fusion of Polyethylene Pipe and Fittings.
 - 9. D3216, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

10. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
- B. American Water Works Association (AWWA):
 1. AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In. (100 mm Through 1,650 mm), for Water Distribution and Transmission
 2. AWWA M55, PE Pipe – Design and Installation

1.4 SUBMITTALS

- A. Refer to Specification “Section 01340 – Submittals” for requirements for the mechanics and administration of the submittal process.
- B. Qualifications
 1. Manufacturer shall submit documented experience in manufacturing HDPE pipe and fittings similar in nature to the proposed work detailed in the Contract Documents.
 2. Contractor shall submit documented experience including project name, description, size and length of pipe, pipe materials, owner name and contact information and any other pertinent information for projects similar in nature to the proposed work detailed in the Contract Documents.
- C. Testing Plan:
 3. Testing Plan: Submit a minimum of one week prior to testing and include at least the information that follows.
 - a. Testing dates.
 - b. Piping systems and section(s) to be tested as indicated on a copy of the approved piping layout drawings.
 - c. Test type.
 - d. Method of isolation.
 - e. Calculation of maximum allowable leakage for piping section(s) to be tested.
 4. Certifications of Calibration: Testing equipment.
 5. Certified Test Report.
- D. Shop Drawings:
 1. Refer to Specification “Section 01340 – Submittals” for requirements for the mechanics and administration of the submittal process.
 2. Product technical data for pipe and appurtenances including:
 - a. Acknowledgement that products submitted meet the requirements of standards referenced.
 - 1) Acknowledgement shall be in the form of a letter or company-standard form containing all required data and signed by an officer of the manufacturing, fabricating or supplying company and at a minimum include:
 - a) Name and location of the Work.
 - b) Name and address of the Contractor.
 - c) Quantity and date or dates of shipment and/or delivery to which the certificate applies.
 - d) Name of the manufacturing or fabricating company.
 - b. Certificates:
 - 1) Certifications shall be in the form of a letter or company-standard form containing all required data and signed by an officer of the manufacturing, fabricating, or supplying company.
 - c. Test reports:
 - 1) All laboratory test reports, requested by the Owner, shall be provided at no additional cost and shall show the following information:
 - a) Date or dates of testing. Test data should be the most current available and be within 5 years of the Bid opening.
 - b) The specified requirements for which testing was performed.
 - c) Results of the test or tests.
 - d. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation for each type of pipe.
 3. Fabrication and/or layout drawings with information including:
 - a. Scale (minimum scale 1 IN equals 10 FT).
 - b. Dimensions of pipe lengths and fittings.
 - c. Invert or centerline elevations of pipe crossings.
 - d. Acknowledgement of bury depth requirements.
 - e. Details of transitions, tapping locations, thrust blocks, and related appurtenances.

- f. Line slopes and vent locations.
- 4. Details of temporary restraints required for testing.
- E. Fusing
 - 1. Submit documents related to execution of fusion process, including but not limited to:
 - a. Certificates for all workers performing fusion, demonstrating they have been fully trained on equipment to be used for the fusion
 - b. List of equipment to be used during fusion process
 - c. Literature from the manufacturer/supplier of the fusion equipment that indicated required temperature and pressure to which the pipe shall be heated and pressed together and where such readings are indicated on the equipment.
- F. Field quality control documents:
 - 1. Test reports summarizing results of the following final field tests:
 - a. Backfill Compaction Test
 - b. Hydrostatic Pressure Test
 - c. Leakage Test
- G. Lay Schedule

1.5 DELIVERY, STORAGE AND HANDLING

- A. The Contractor shall use all means necessary to protect pipe materials, fittings, valves and products before, during, and after installation. Care shall be taken in loading, transporting, and unloading to prevent damage to the pipe, pipe linings and pipe coatings. The Contractor shall comply with AWWA M55 (HDPE), and, the referenced AWWA Standards for shipping, handling and storage procedures.
- B. Protect pipe and appurtenances during handling using methods recommended by the manufacturer and approved by the Engineer.
 - 1. Pipe shall be transported to the job site on padded bunks or oak timbers and secured with nylon tie down straps to adequately protect the pipe and coating.
 - 2. Use of bare cables, chains, hooks, metal bars or narrow skids in the contact with coated and/or lined pipe is not permitted.
 - 3. Handle only from the outside of the pipe and fittings. Lifting by inserting forks into the pipe or fittings is not permitted.
 - 4. No metal tools or heavy objects shall be permitted to come in contact unnecessarily with the finished coating.
- C. Prevent damage to pipe during transit.
 - 1. Pipe with noticeable abrasions, scars and blemishes shall be rejected. If repair of satisfactory quality cannot be achieved, replace damaged material in its entirety immediately.
 - 2. Any damage to linings or coatings discovered during the examination shall be repaired in accordance with the manufacturer's recommendations to the satisfaction of the Owner, before proceeding with the Work
 - 3. The Owner reserves the right to reject defective material shipped to and/or stored on site, and to examine the same to determine if damage has occurred prior to installation.
- D. Store materials in a manner to keep interior free from dirt and foreign matter and protect from the elements.
 - 1. The pipe shall not be stacked higher than the limits recommended by its manufacturer. The bottom tier shall be kept off the ground on timbers, or other method approved by the Owner. Stacking shall conform to manufacturer's recommendations and/or AWWA M55.
 - 2. Storing on stones or other hard material that can damage the pipe exterior is not permitted.
 - 3. Storing pipe on top of pipe is not permitted.
 - 4. Materials subject to corrosion shall be protected in accordance with the manufacturer's recommendations.
 - 5. Materials subject to UV degradation shall be protected in accordance with the manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers of Pressure Rated HDPE systems are acceptable:
1. HDPE Pipe and Fittings:
 - a. CPChem Performance Pipe
 - b. JM Eagle Manufacturing Pipe, Inc.
 - c. Or approved equal.
- B. Submit request for substitution in accordance with Specification “Section 00700, General Conditions.”

2.2 HDPE PIPE

- A. Pipe:
1. HDPE pipe shall be PE4710 HDPE in accordance with ASTM F714 and AWWA C906-15 and shall have a nominal DIPS (Ductile Iron Pipe Size) outside diameter unless otherwise specified. The nominal size, pressure classification rating, and SDR of the pipe shall be as specified in the Contract Documents.
 2. A Pipe shall be homogeneous and uniform throughout; shall be free of injurious defects such as visible cracks, holes, foreign inclusions, voids, and blisters; and shall have uniform color and physical properties according to the provisions of AWWA C906-15.
 3. Commercial virgin PE Compounds shall meet ASTM D3350 physical property requirements and shall be classified per ASTM D3350 as shown in Table 1 of AWWA C906-15. The compound shall have HDB (Hydrostatic Design Basis) ratings at 73°F (23°C) and at 140°F (60°C) and HDS (Hydrostatic Design Stress) ratings at 73°F (23°C) determined in accordance with ASTM D2837 and PPI TR-3 (Policies and Procedures for Developing Recommended Hydrostatic Design Stress for Thermoplastic Pipe Materials).
 4. The PE Compound in the pipe shall contain color and ultraviolet (UV) stabilizer meeting the requirements of ASTM D3350 Codes C or E. Code C compounds shall contain 2 to 3 percent carbon black when material from the pipe is tested in accordance with Section 4.3.11 of AWWA C906-15. Code E compounds used for solid color pipe, color stripes, or color layer (shell) shall contain sufficient UV stabilizer to protect the pipe against UV degradation for at least 24 months of unprotected outdoor exposure. Color PE compounds used for stripes or color layers shall be of the same materials designation codes as the pipe material, varying only by color and UV stabilizer.
 5. Clean rework materials derived from pipe production by the same manufacturer are acceptable as part of a blend with virgin PE compound meeting section 4.2.1 of AWWA C906-15 for the production of new pipe, including sections 4.2.3.1, 4.2.3.2, 4.2.3.3 and 4.2.4.
 6. PE fittings or components shall be molded. Molded fittings shall meet the requirements of AWWA C906-15 and the requirements of ASTM D2683 for socket-type fittings, or ASTM D3261 for butt-type fittings.
 7. High Density Polyethylene pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.
 8. High Density Polyethylene pipe shall be manufactured in a standard 40' nominal length or custom lengths as specified and shall be black with a green identification stripe.
 9. Pipe shall be marked as follows:
 - a. Nominal pipe size
 - b. HDPE
 - c. Dimension Ratio, Standard Dimension Ratio, or Schedule
 - d. AWWA pressure class, or standard pressure rating for non-AWWA pipe, as applicable.
 - e. AWWA standard designation number, or pie type for non-AWWA pipe, as applicable.
 - f. Extrusion production-record code.
 - g. Trademark or trade name
 - h. Cell Classification and/or HDPE material code may also be included.
 10. HDPE pipe for this project shall be as indicated on the drawings, ductile iron pipe size (DIPS), DR 17.
- B. Utility Marking Tape:
1. Subsurface utility marking tape shall be of a durable, metalized, plastic film, bright green in color, imprinted with the legend “CAUTION: SEWER BELOW”.
 - a. The utility marking tape shall be manufactured by Griffolyn Company or approved equal.
- C. Tracer Wire:

1. Tracer Wire shall be attached to the pipe every 10 linear feet with plastic strapping. The wire shall terminate at every tracer wire termination box or air vent. Tracer wire shall not be terminated in valve boxes. The wire shall be sufficient length to be able to be coiled one foot at each end of tracer wire run and shall be continuous 10 gage solid copper wire with plastic coating. The tracer wire installation shall be considered complete when the owner can trace the entire length of the pipeline with tracing equipment. Any breaks in the wire shall be repaired by the contractor prior to project acceptance.

2.3 FUSION JOINTS

- A. Unless otherwise specified, high density polyethylene pipe lengths shall be assembled in the field with butt-fused joints. The Contractor shall follow the pipe manufacturer's written guidelines for this procedure. All fusion joint shall be completed as described in this specification.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Items of material furnished under this Section shall be subject to inspection by the Owner's representation prior to installation.
 1. Carefully examine material for defects, and do not install material which is known to be defective.
 2. Replace all material found defective in manufacture or damaged in transit or handling at the Contractor's expense.
 3. Items found not to be in compliance with this Section shall be removed from the project site and replaced with items that have been approved for installation.
 4. Inspections and approvals do not relieve the Contractor from complying with the Contract Documents.
 5. The HRSD Representative reserves the right to reject all defective pipe, fittings, and appurtenances shipped to the job site or stored on the site. The HRSD Representative shall examine the pipe and determine if the pipe is damaged prior to the installation. Failure of the HRSD Representative to detect damaged pipe shall not relieve the Contractor from his total responsibility for the pipe if it leaks or breaks after installation. Classify defective pipe as follows:
 - a. Damage to exterior.
 - b. Damage to interior.
 - c. Pipe out of round.
 - d. Denting or gouges in plain end of pipe.
 - e. Any other item which would result in the potential failure of the pipe.
 - f. If the exterior or interior surface of any section of pipe which is nicked, cut or chipped greater than 0.5 inch in diameter (or 1 inch length) or greater in depth than 10% of the wall thickness shall be cut out and disposed.

3.2 CLEANING PIPE AND FITTINGS

- A. Clean and remove all foreign matter from each pipe, fitting before placing in the trench. Should foreign material or contaminants be observed in the pipe, cease work until foreign material or contaminated pipe is decontaminated or removed.
- B. Close open ends of pipe with a watertight plug at all times when pipe laying is not in progress

3.3 ALIGNMENT AND GRADE

- A. The temporary force main shall be laid above ground, except in those areas designated on the Drawings. The Contractor shall be responsible for locating underground utilities and obstructions within the areas of buried crossings and adjusting the bury depth of the force main to avoid said utilities and obstructions.

3.4 PIPE INSTALLATION

- A. General Requirements: Use proper and suitable tools and appliances for the proper and safe handling, lowering into trench and laying of pipes.
 1. Sections of pipe should be joined into continuous lengths on the jobsite above ground. The joining of the pipe shall be done in such a manner not to interfere with vehicular and/or pedestrian traffic within the public right-of-way.

2. The joining method shall be butt fusion performed in accordance with the pipe manufacturer's recommendations. The butt fusion process shall produce a weld strength equal to or greater than that of the pipe.
 3. Thoroughly clean the pipes and fittings before installation. Pipes and fittings shall be kept clean until the acceptance of the completed work.
 4. Take necessary precautions to prevent the floating of the pipe line by the accumulation of water in the trench, or the collapse of the pipe line from any cause. Should floating or collapse occur, restoration shall be at the Contactor's expense.
 5. Close all openings in the pipe line with watertight plugs when pipe laying is stopped at the close of the day's work for other reasons, such as rest breaks or meal breaks.
 6. Place enough backfill over the center sections of the pipe to prevent floatation.
- B. High Density Polyethylene Pipe Care
1. The HDPE pipe shall be handled with care to minimize the possibility of it being cut, kinked, gouged, or otherwise damaged. The use of cables or hooks will not be permitted.
 2. Sections of the HDPE pipe damaged, cut, or gouged shall be repaired by cutting out the section of damaged pipe and rejoining.
- C. Joining Method:
1. Fusing
 - a. The manufacturer will recommend the best joining method based on the project needs.
 - b. Pipe sections shall be joined on the job site above ground into continuous lengths by the thermal butt-fusion or electrofusion method, which shall be performed in strict accordance with the manufacturer's recommendations. The butt-fusion equipment used in the joining procedures shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400° F, optimum 425° F and maximum 450° F unless otherwise governed by manufacturer's recommendations; alignment, and 75 psi interfacial fusion pressure. Butt-fusion joining shall be 100% efficient and shall provide a joint weld strength equal to or greater than the tensile strength of the pipe. Socket-fusion, extrusion welding or hot gas welding of HDPE shall not be used for pressure pipe applications. Flanges, unions, grooved-couplers, transition fittings, and some mechanical couplers may be used to mechanically connect HDPE pipe without butt-fusion, if specified in the Contract Documents and approved by the manufacturer.
 - c. The fusion joint must be equal to or stronger than the strength of the pipe.
 - d. The face of opposing pieces of pipe to be fused shall be machined smooth in accordance with the equipment supplier's requirements.
 - e. Install in accordance with AWWA standards.
 - f. In inclement weather, the fusion operation should be enclosed or shielded to avoid precipitation or excessive wind. The joint area and its parts that are being fused must be completely dry. No liquid of any kind running through the pipe or its fittings is permissible.
 - g. No attempt by the Contractor shall be made to shorten cooling times of fusion by applying wet cloths, water, or the like. Pipe shall not be handled or installed in the trench until the joints are sufficiently cooled in accordance with manufacture's recommendations to prevent weakening the joint.
 - h. When removing pipe from the butt fusion machine and pulling into place, the Contractor must use lifting slings and pulling leads in good condition.
 2. Joining by Other Means
 - a. Polyethylene pipe and fittings may be joined to other materials by means of:
 - 1) Flanged connections (flange adapters and backup rings)
 - 2) Mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, and
 - 3) MJ adapter.
 - b. When transitioning between plain-end DIP and HDPE pipe, a DIPS Bell MJ adapter with kit for DIP pipe shall be supplied from ISCO Product Catalog or approved equal.
 - c. When joining by other means, the installation instructions of the joining device manufacturer shall be observed. All materials must be approved through a signed shop drawing submittal.

3.5 CONNECTIONS WITH EXISTING PIPING

- A. Connections or interconnection to the existing force main shall be made at locations shown on the Drawings in accordance with details shown on the Drawings and Specifications. Prior to making connections into existing piping systems, the contractor shall:
 - 1. Field verify location, size, pipe material, and piping system of the existing pipe.
 - 2. Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or others as shown in the construction documents.
 - 3. Have installed all temporary pumps and/or pipes in accordance with established connection plans.
- B. Unless otherwise approved, new piping system shall be completely assembled and successfully tested prior to making connections into existing pipe systems.
- C. Provide suitable equipment to dewater, drain, and dispose of liquid removed from existing pipe during connection.
- D. The Owner and Contractor shall have a coordination meeting with the Owner's personnel at least 10 days prior to the planned force main shutdown and provide a written Work Plan. The Owner shall review the Work Plan and either approve it or meet with the Contractor within 3 business days after receipt of the schedule to satisfactorily modify it.
- E. The Contractor shall follow the procedures herein for any joints of the new force main and fittings that have not been previously hydrostatically pressure tested:
 - 1. The Owner reestablishes services in the line.
 - 2. One half hour will elapse, after air venting is complete by the Owner.
 - 3. Joints will be visually inspected for signs of leakage by Owner or Owner's Representative.
 - 4. Any leakage noted shall be corrected to the satisfaction of the Owner.
 - 5. After satisfactory visual testing of exposed joints by the Owner and any corrective action, the Contractor shall wrap the pipe and/or fitting as required and immediately proceed to backfill the pipe and restore to grade conditions or for reestablishment of traffic if in a roadway. Soil backfill compaction tests may be specified by the Owner for work within roadway travel lanes.
 - 6. If specified, utility warning tape shall be installed above the connection in accordance with the Contract Documents.
 - 7. Any joints not inspected by the Owner will not be approved and shall be excavated for inspection.
- F. Careful attention shall be given to the depth of new pipelines at points where tie-ins to existing mains are to be made. The existing main shall be uncovered in the presence of the Owner and the new pipeline set to proper elevation to provide for a perpendicular and level tie-in.

3.6 FIELD QUALITY CONTROL

- A. Installation
 - 1. The manufacturer's representative shall be made available a minimum of 2 working days (time on site) during the project when requested by the Owner, including the first 2 Days of pipeline installation.
 - 2. The cost for the services of the manufacturer's representative, including expenses, shall be considered incidental to the project and will not be paid separately.
- B. Testing of Pipe:
 - 1. General Procedures for Hydrostatic Pressure Testing:
 - a. The Contractor shall furnish all pumps, fittings, and gauges as necessary to fill the line with water, expel air from the system, and pressurize the pipeline for the tests.
 - b. The Contractor will be responsible for providing proper safety measures during pressure testing operations.
 - c. Testing shall be in accordance with ASTM F2164 and per the Manufacturer's requirements as approved by the HRSO Representative.
 - d. The Contractor shall test the line prior to contacting the Owner for the formal pressure test.
 - e. There shall be no leakage in heat-fusion joined HDPE pipe. In addition, heat-fusion joined HDPE pipe pressure testing shall be in accordance with ASTM F2164 and shall also comply with the following:
 - 1) Before testing, heat fusion joints are to be completely cooled.
 - 2) All parts of the test section shall be restrained against movement. Temporarily remove, restrain, or isolate expansion joints and expansion compensators before starting.
 - 3) Observe all safety precautions identified in ASTM F2164.

- f. Retesting - If retesting is necessary, depressurize the test section per ASTM F2164 and correct any faults/leaks. Allow the test section to “relax” for at least 8 hours before repressurizing and repeat the Initial expansion and test phases as indicated above.

C. Testing Procedure

1. All HDPE mains shall be field-tested. Contractor shall supply all labor, equipment, material, gages, pumps, meters and incidentals required for testing. Each main shall be pressure tested upon completion of the pipe laying and backfilling operations, including placement of any required temporary roadway surfacing. The Contractor shall provide all temporary restraint at terminal locations prior to filling and testing the line. Testing against valves shall not be permitted.
2. The Contractor shall submit his plan for testing to the HRSD Representative for review prior to starting the test and shall notify the Engineer a minimum of 48 hours prior to test.
3. All force mains shall be tested at 100 PSI unless otherwise noted.
4. The total test time including initial pressurization, initial expansion, and the time at the test pressure, must not exceed eight (8) hours. If the pressure test is not completed due to leakage, equipment failure, etc., the test section shall be depressurized, and allowed to relax for at least eight (8) hours before bringing the test section up to pressure again.
5. Pressure testing procedure shall be per Manufacturer’s recommendations or as follows:
 - a. Fill lines slowly with water. Maintain flow velocity less than 2 feet per second.
 - b. Expel air completely from the line during filling and again before applying test pressure. Air shall be expelled by means of taps at point of highest elevation.
 - c. Apply initial test pressure and allow to stand without makeup pressure for three hours, to allow for diametric expansion or pipe stretching to stabilize.
 - d. After this equilibrium period, apply the specified test pressure and turn the pump off. The final test pressure shall be held for three hours.
 - e. Upon completion of the test, the pressure shall be bled off from a location other than the point where the pressure is monitored. The pressure drop shall be witnessed by the HRSD Representative at the point where the pressure is being monitored.
6. Allowable amount of makeup water for expansion during the pressure test shall conform to ASTM F2164. If there are no visual leaks or significant pressure drops during the final test period, the installed pipe passes the test.
7. If a pressure drop greater than the manufacturer’s recommended loss is observed, the Contractor shall, at his/her own expense, locate and repair the cause of leakage and retest the line.
8. All visible leaks are to be repaired regardless of the amount of leakage.
9. Visual Leak Test
 - a. Joints at tie-ins that cannot be hydrostatically tested shall be visually inspected for leaks in the presence of the HRSD Representative in accordance with this specification.
 - b. The contractor shall not wrap or backfill any joints of the new force main that have not been previously tested until the force main has been placed back in service, operating pressure restored, and the pipe work inspected by the HRSD Representative
 - c. Any joints not inspected by the HRSD Representative will not be approved and shall be excavated for inspection. All joints and connections not pressure tested shall be visually inspected for leaks by the HRSD Representative in accordance with the following procedure:
 - 1) HRSD re-establishes service in the line and vents air.
 - 2) One half hour will elapse after air venting is complete.
 - 3) Joints will be visually inspected for signs of leakage. No leakage shall be permitted.
 - 4) Any leakage noted shall be corrected to the satisfaction of HRSD Representative.

END OF SECTION