

ITEM NO. 817

**HDPE Pipe Installation
Waterline by Pipe Bursting**

817.1 DESCRIPTION: This specification includes requirements to replace existing water mains by the pipe bursting method. The pipe bursting process involves the replacement of deteriorated water mains by installing a new waterline within the burst/enlarged excavation of the existing line created using a static, hydraulic, or pneumatic hammer bursting head device, suitably sized to break the existing main. Forward progress of the bursting head is aided by hydraulic equipment or other apparatus. The new replacement pipe is attached to the back of the bursting head and is pulled into the excavation during the bursting process. **Pipe bursting on AC water mains is not allowed.**

The Contractor shall provide equipment, planning, and job execution necessary to accomplish the work in an efficient manner and consistent with the objectives of these specifications, including preventing damage to existing infrastructure, maintaining pedestrian and vehicular access, and providing continual sewer service to customers.

817.2 REFERENCED STANDARDS:

1. San Antonio Water System (SAWS):
 - a. Specifications for Water and Sanitary Sewer Construction (2014)
 - b. SAWS Material Specifications
2. Texas Commission on Environmental Quality (TCEQ) Chapter 290 Rules and Regulations for Public Water Systems
3. American Society for Testing and Materials (ASTM) International:
 - a. D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
 - b. D2657, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings
 - c. D2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
 - d. D3350, Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
 - e. F714, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
 - f. ASTM D 1238: Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
 - g. ASTM D 1505: Standard Test Method for Density of Plastics by the Density-Gradient Technique
 - h. ASTM D 790: Standard Test Methods for Flexural Properties of

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- Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- i. ASTM D 638: Standard Test Method for Tensile Properties of Plastics
- j. ASTM D 1693: Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
- k. ASTM F2620: Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
- l. ASTM D 618: Standard Practice for Conditioning Plastics for Testing
- m. ASTM D 575: Standard Test Methods for Rubber Properties in Compression

817.3 SUBMITTALS All submittals shall be in accordance with most recent version of SAWS's General Conditions requirements. Submit the following 30 days prior to performing any work.

1. Pipe resin used to produce HDPE pipe for this Project must be sampled, tested, and approved for use to assure compliance with ASTM cell classification requirements.
2. Resin vendor's certification characterizing the HDPE material and stating compliance with all requirements must accompany all raw material resins used in the manufacture of the pipe.
3. The pipe Manufacturer's responsibility includes testing in accordance with ASTM D3350 for pipe and HDPE tubing.
4. Certifications:
 - a. Per General Conditions section 5.12.2 all Contractor submittals for all pipe and other products or materials furnished under this specification shall be marked as reviewed and approved by Contractor for compliance with Contract Documents and the referenced standards.
 - b. The Manufacturer shall provide ISO 9001 Certificate by a third party.
 - c. Submit written verification that the pipe Manufacturer has been manufacturing ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter pipe with similar design pressure and size as this Project for a minimum of ten (10) years.
 - d. Submit written verification that the pipe Manufacturer has been manufacturing ASTM D 2737 Standard Specification for Polyethylene (PE) Plastic Tubing with similar design pressure and size as this Project for a minimum of ten (10) years.
 - e. Submit written verification from the pipe Manufacturer demonstrating compliance with the production and delivery schedule of the pipe as indicated in the Contractor's preliminary CPM schedule.
 - f. Submit written verification from mechanical fitting Manufacturer that fitting is compatible with HDPE pipe and meets the requirements of this section.
5. Contractor shall submit Manufacturer's product data, installation recommendations, shop drawings, and certifications.
6. Shop Drawings:
 - a. Catalog Data Sheets for all materials confirming pipe, fittings, and other materials conform to requirements of this specification.

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- b. Pipe Supplier Information. Submit company name, contact name, and contact number.
 - c. Details of all piping systems components confirming that the pipe and fittings conform to the specified requirements.
 - d. The Contractor shall submit shop drawings of pipe, fittings, gaskets, hardware, flanges, appurtenances, special details sufficient to demonstrate compliance with these Specifications.
 - e. Fabrication drawings showing:
 - 1) Wall thickness.
 - 2) Pipe length.
 - 3) Pipe joint (i.e. fused, mechanical)
7. Testing Plan: Submit at least 30 days prior to testing and at minimum, include the following:
- a. Testing dates.
 - b. Piping systems and section(s) to be tested.
 - c. Method of isolation. Method of isolation to be approved by SAWS' Inspector.
 - d. Method of conveying water from source to system being tested.
 - e. Hydrostatic leak testing.
 - 1) Submit a hydrostatic leak testing plan which includes equipment (pump, water meter, pressure regulating valve, pressure gauges, etc.), water handling procedures (supply and disposal), sequence and schedule by test section, and pressure test data. Must be per SAWS Specification Item No. 841 – Hydrostatic Testing Operations.
 - 2) Certifications of Calibration: Approved testing laboratory certificate if pressure gauge for hydrostatic test has been previously used. If pressure gauge is new, no certificate is required.
8. Testing Reports:
- a. Furnish affidavit certified that all pipe meet the provisions of the specification and has been tested and submit reports in accordance with the applicable ASTMs and AWWA C901 and AWWA C906.
 - b. Reports include the following.
 - 1) Hydrostatic proof test reports.
 - 2) Sustained pressure test reports.
 - 3) Burst strength test reports.
 - 4) Stress Regression Testing
 - c. Other reports may be requested by SAWS' Inspector.
9. Fusion Information: Submit the following prior to performing any work:
- a. Written fusion procedures, including procedures for cold weather work if needed.
 - b. Certification from pipe Manufacturer that Contractor is qualified to join, lay, and handle pipe.
 - c. Butt fusion shall be performed by personnel certified by McElroy (or Engineer approved equal) in large diameter pipeline fusion.

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- d. Fusion operators shall be qualified per PPI TN-42 and ASTM F3190.
 - e. The person performing the fusing of HDPE pipe and HDPE tubing shall have received training in the fusing of HDPE pipe and HDPE tubing in accordance with the recommendations of the pipe Manufacturer and the fusing equipment supplier.
 - f. Provide a statement from pipe Manufacturer that personnel responsible for fusing the pipe have been trained and qualified.
 - g. The Contractor shall maintain records of trained personnel and shall certify that training was received not more than 12 months before commencing construction.
 - h. The Contractor shall also submit details of welding/fusing procedures and equipment to be used.
 - i. Data Logger specification and sample report.
 - j. Fusion machine specification and maintenance log: At a minimum, reports shall include for each fusion machine fusion operator, time, date, heater temperature, pressure, and station number of joint.
 - k. Listing for all fusion operators to be used for the work must be approved by SAWS at least two weeks prior to the start of work.
 - l. Contractor to submit shop drawings and fusion information together as a complete package, in a timely manner for review prior to start of work.
10. Detail drawings indicating type, number, and other pertinent details of the slings and other methods proposed for pipe support and handling during manufacturing, transport, and installation.
 11. All pipe handling equipment and methods shall be acceptable to SAWS.
 12. Pipe Manufacturer's Written Quality Assurance/Quality Control Program.
 13. Field Service Representative Resume.

817.4 MATERIALS: High density polyethylene pipe (HDPE) related to pipe bursting or pipe crushing for a water main shall follow the SAWS Specification Item No. 815 - High Density Polyethylene (HDPE) Pipe Installation Direct Bury for Water

1. Pipe Marking: Each length of pipe shall be clearly marked with pipe manufacturer, pipe size, pipe class, production code, material designation and other relevant identifying information. Stripe along the length of pipe shall be blue in color to identify the pipe as potable water. Stripe shall be extruded in the pipe every 120° – painted on stripes are not acceptable.
 - a. Acceptable Manufacturer
 - b. Vendors must have approval through SAWS Standards Committee prior to product use and must meet all requirements set forth in this Specification.

817.5 QUALITY CONTROL AND ASSURANCE

1. Manufacturer's Qualifications

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- a. Manufacturer shall have a minimum of ten (10) years recent experience producing HDPE pressure pipe and fittings for at least the specified sizes and lengths and shall be able to submit documentation of at least five (5) installations in satisfactory operation for at least five (5) years.
- b. HDPE pipe and fittings manufacturers and distributors shall be listed as current members of the Plastics Pipe Institute (PPI).
 - (1) Fusion Contractor Qualification Requirements
- c. Fusion shall be performed by a work force that is experienced and certified in the performance of the related work.
- d. The fusion Contractor shall be certified by the pipe or fitting manufacturer to have been trained and approved in the fusion of the HDPE products and shall have a minimum of five (5) years total experience with the product.
- e. The Contractor shall submit such certification as required in Section 815.3.
 - (1) Onsite Observation:
- f. Pipe Supplier: The pipe and fitting supplier(s) shall provide the services of an experienced, competent, and authorized field service representative who is acceptable to the SAWS to be onsite for the initial installation of pipe and fittings.
 - (1) The field service representative shall have a minimum of five (5) years of experience and practical knowledge installing HDPE pipe with joints and fittings of the type to be furnished.
 - (2) The resume of the field service representative shall be submitted in accordance with the requirements of this section.
- g. Pipe Inspections: The Engineer and Inspector reserve the right to inspect pipes. Such inspection shall in no way relieve the manufacturer of the responsibilities to provide products that comply with the applicable standards and these Specifications. Approval of the products or tests is not implied by the Engineer's decision not to inspect the manufacturing, testing, or finished pipes
- h. For budgeting purposes, assume up to 16 hours on site will be required for the pre-installation and initial installation of pipe and fittings. Additional periodic site visits will be at the request and discretion of the
 - (1) SAWS for a minimum of one periodic site visit and a maximum of three periodic site visits.
 - (2) Assume each additional periodic site visit will require 8 hours on site. The field service representative duties shall include, but not be limited to, the following:
 - i. Observe the installation and fusion of the pipe and fittings.
 - ii. Report any concerns to the SAWS.
 - iii. Answer questions and provide assistance to SAWS and the Contractor.
 - (3) Submit copies of all field reports and test results.

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- i. Field tests
 - (1) Butt Fusion Joint Tests: Joint Tests shall be performed with McElroy's "Guided Side-Bend Tester" or Engineer approved equal test equipment meeting the requirements of ASTM F3183.
 - (2) Testing procedures shall be as recommended by the test apparatus manufacturer and ASTM F3183 and shall be performed for all fusion operators intended to be used on the project.
 - (3) Joint shall be prepared, fused, and tested in the presence of the SAWS Inspector and Engineer.
 - (4) Contractor shall perform Joint Tests whenever a fusion operator whose work has not yet been Joint Tested performs a fusion for the first time and randomly as requested by SAWS at the expense of the Contractor.
 - (5) Contractor should assume one (1) joint test for every 20 fusion joints.
 - (6) If fusion joint test fails, then additional joint tests in excess of one (1) test for every 20 fusion joints shall be at the expense of the Contractor.
 - (7) Electrofusion Joint Tests: Contractor's fusion operator shall demonstrate successful electrofusion coupling technique through a joint integrity test.
 - (8) Test shall be in accordance with ASTM F 1055 and shall be performed on a 16" or larger electrofusion coupling.
 - (9) Joint shall be prepared and fused in the presence of the SAWS' Inspector and Engineer.
 - (10) Contractor shall perform an additional Electrofusion Joint Test for any additional fusion operators whose work has not yet been joint tested.
 - (11) Hydrostatic Pressure and Leakage Tests: Hydrostatic testing shall be in accordance with this Specification Section 815.7 - Hydrostatic Testing and Disinfection.

817.6 CONSTRUCTION:

1. Location and number of insertion or launching pits will be chosen by the Contractor, and will typically be located near P.I.'s in the line, at logical breaks in the construction phasing, or at locations to comply with access or maintenance requirements. Location of pits shall be included in plan submitted to and approved by owner.
2. Pits shall be placed and located to minimize the total number of pulls and maximize the length of pipe replaced per pull, within the constraints of maintaining service and access and other requirements. Use excavations at point repair locations or alignment shifts for insertion pits where possible.

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3. The Contractor shall utilize pipe bursting equipment with adequate pulling force to complete pulls in a timely manner. The Contractor shall provide equipment on the pulling mechanism to verify the pulling force exerted on the pipe does not exceed the manufacturer's recommendation for allowable pulling force to prevent damage to the pipe. The pulling force may not exceed the following: 6 tons for 8.625 inch O.D.; 10 tons for 10.75 inch O.D.; 17 tons for 14 inch O.D.; 23 tons for 16 inch O.D.; 28 tons for 18 inch O.D. Allowable pulling force for all diameters shall be determined by the Contractor depending on the pipe size, wall thickness, manufacturer, field conditions, pull distance, bearing capacity of soils, adjacent infrastructure, related equipment and cable strength, and related considerations within the project limits.
4. Equipment shall be configured with adequate knives or other appropriate devices to minimize interruptions in the installation process due to obstruction removal and other problems. Pipe shall be secured to the pulling/pushing device in accordance with standard practice. The diameter of the pulling/pushing head shall be equal or slightly greater than the pipe OD.
5. Equipment used to perform the work will be located away from businesses or residents so as not to create a noise impact. Provide silencers or other approved devices to reduce machine noise, when it exceeds regulated limits.
6. The Contractor shall provide for the general safety of workers, pedestrians and traveling public throughout this project. Existing surface improvements and underground facilities and utilities shall also be protected. Damage caused by the Contractor shall be repaired at his own expense. Protection to be provided includes:
 - a. Provide barricades, warning lights and signs for excavations created by point repairs. Conform to requirements of TxDOT, City of San Antonio, and other entities specified in the contract documents.
 - b. Do not allow sand, debris, or runoff to enter the water distribution system. Verify location of all underground utilities and facilities potentially impacted by other project activities and take necessary precautions to provide protection from damage. Damage resulting from the Contractor shall be at his own cost and responsibility.
 - c. Protect the new pipe and components during all phases of work, including hauling, installation, entry into the launching pit, and prevention of scarring or gouging of the pipe or components.
7. Pipe shall be assembled and fused on the ground in sections equivalent to the length of the anticipated pull. During installation, all bending and loading of the pipe shall be in conformance with manufacturer's recommendations and shall not damage pipe.
8. Allow liner pipe to normalize to ambient temperatures as well as recover from imposed stretch before cutting to fit between tie-ins, fused fittings, and testing. Normalization usually takes at least 12 hours for polyethylene.
9. Solid wall pipe shall be produced with plain end construction for heat-joining (butt fusion) conforming to ASTM D2657.
 - a. Lay the pipe so that no high or low points other than those on the plans are

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introduced.

- b. To prevent high points or low points along the pipeline, the general slope of the pipeline shall not be changed between vertical angle points.
 - c. When pipe is to be connected to existing pipe, the terminus of the existing pipe shall be field located prior to fabricating new pipe.
 - d. The Contractor shall submit any required alignment adjustments to the SAWS' Inspector for acceptance.
 - e. The Contractor shall make any required field alignment adjustments to allow proper fit-up of pipe in conformance with tolerances specified.
 - f. Where necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the SAWS Inspector may change the alignment and/or the grades.
 - g. Whenever pipe laying is stopped, the open end of the line shall be closed with an inflatable pipe plug end board or other water tight seal to keep water and debris from entering the interior of the pipe.
10. Cutting Pipe:
- a. Cutting shall be in accordance with the pipe Manufacturer's recommendations.
 - b. Cuts shall be smooth, straight, and at right angle to the pipe axis.
 - c. After cutting, the end of the pipe shall be dressed to remove all roughness and sharp corners.
11. Jointing:
- a. All HDPE pipe shall be joined to itself by the heat fusion process per ASTM F2620 and ASTM F1290 which produces homogeneous, leak tight joints or by mechanical coupling.
 - b. Sections of HDPE pipe shall be joined above ground into continuous lengths by the thermal butt fusion method.
 - c. Socket fusion, extrusion welding, and hot gas welding will not be acceptable.
 - d. Contractor shall minimize use of mechanical couplings to join the plain ends of HDPE pipe and shall plan work stoppage to coincide with locations of mechanical fittings indicated in the plans where possible.
 - e. Use of other than butt fusion or electrofusion shall be in accordance with the Contractor's approved fusion plan or as approved by the Engineer.
 - f. If in ditch butt fusion or electrofusion cannot be utilized, mechanical couplings shall be from SAWS' APL and approved for use with HDPE by manufacturer, but must be approved by SAWS prior to installation.
 - g. Jointing of pipe and mechanical fittings shall be performed in accordance with the instructions and recommendations of the pipe and fitting Manufacturer.
 - h. Mechanical and flanged fittings shall be installed in accordance with the

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- fitting manufacturer's recommended procedures.
- i. Stainless steel stiffener inserts shall be utilized at all fittings.
12. Butt Fusion:
- a. The pipe shall be joined by the butt fusion procedure outlined in ASTM F 2620 or PPI TR-33.
 - b. All fusion joints shall be made in compliance with the pipe or fitting Manufacturer's recommendations.
 - c. Fusion joints shall be made by qualified fusion technicians per ASTM F3190.
 - (1) A record or certificate of training for the fusion operator must be provided that documents training to the fundamentals of ASTM F3190.
 - d. Considerations should be given to and provisions made for adverse weather conditions, such as cold air temperatures, precipitation, or wind, which is accepted by the SAWS' Engineer.
 - e. For 6" and larger pipe sizes, the pipe butt fusion machine shall be a self-contained hydraulic fusion machine capable of butt fusing HDPE pipe.
 - f. The carriage must be removable from the chassis for in-ditch use.
 - g. The machine must be compatible with an electronic data recording device.
 - h. Accessories will include all butt fusion inserts for the specified range of pipe sizes, a pyrometer kit for checking the surface temperature of the heater, extension cord (25' minimum), and hydraulic extension hoses (minimum of four).
 - i. The butt fusion machine will be by McElroy, or Engineer approved equivalent.
 - j. The butt-fused joint will be true alignment and will have uniform roll back beads resulting from the use of proper temperature and pressure.
 - k. The joint surfaces will be smooth.
 - l. The fused joint will be watertight and will have tensile strength equal to that of the pipe.
 - m. All joints will be subject to acceptance by the Inspector prior to installation.
 - n. All defective joints will be cut out and replaced at no cost to SAWS.
 - o. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than 10% of the wall thickness, will not be used and must be removed from the site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above.
 - p. Pipe having defects that in the opinion of the Inspector indicate the pipe may be damaged, faulty, substandard, improperly manufactured, or have other defects as listed herein, will be discarded and not used.
 - q. Defects warranting pipe rejection include the following: concentrated ridges, discoloration, excessive spot roughness, and pitting; insufficient or variable

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wall thickness; pipe damage from bending, crushing, stretching or other stress; pipe damage that impacts the pipe strength, the intended use, the internal diameter of the pipe, internal roughness characteristics; or any other defect of manufacturing or handling.

- r. All fusions shall be made with fusion equipment equipped with a Data Logger.
- s. Submit Data Logger reports to SAWS' Inspector for each previous day's pipe fusion.
- t. Fusion Data Recording:
 - (1) The device shall be capable of meeting the requirements of ASTM F 3124, "Standard Practice for Data Recording the Procedure used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings". The device, or combination of devices, shall record the following variables of each fused joint:
 - i. Heater surface temperature immediately before inserting the heater plate. Alternatively, the heater plate may be measured with a pyrometer and entered into the weld record.
 - i. Gauge pressure during the initial heat cycle.
 - ii. Gauge pressure and elapsed time during the heat-soak cycle.
 - iv. Heater removal (dwell) time.
 - v. Gauge pressure and elapsed time during the fusing/cool cycle.
 - vi. Drag pressure.
 - vii. Pipe diameter and wall thickness.
 - viii. Type of HDPE material (Specification and Classification) and Manufacturer.
 - ix. Fusion Machine Identification.
 - (2) The device shall record the operator, a unique operator ID number, the date and time of each weld.
 - (3) Records showing the device is up to date on all required calibration should be available for presentation when requested.
 - i. All fusion welds should be traceable to the report (via operator and weld ID) with permanent paint marker/pen only, next to fusion weld.
 - ii. When requested prior to commencement of work, a weld location map may be requested by the SAWS' Inspector or SAWS' representative.
 - i. All joining procedures shall be acceptable to SAWS' Engineer.
 - ii. Threaded or solvent cement joints and connections are not permitted.
 - iii. All equipment and procedures will be used in strict compliance with the manufacturer's recommendations.
 - iv. Fusing will be accomplished by personnel certified as fusion

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technicians by a manufacturer of polyethylene pipe and/or fusing equipment.

13. Electrofusion:

- a. Electrofusion joining shall be done in accordance with the manufacturers recommended procedure, ASTM F 1290, PPI TN 34, PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 12 Inch and Smaller Polyethylene (PE), and PPI Municipal Advisory Board (MAB) Generic Electrofusion Procedure for Field Joining of 14 Inch to 30 Inch Polyethylene (PE) Pipe (MAB-02).
- b. The process of electrofusion requires an electric source, commonly called an electrofusion processor, that has wire leads and a method to read electronically (by laser) or otherwise input the barcode of the fitting.
- c. The electrofusion processor must be capable of reading and storing the input parameters and the fusion results for later download to a record file.
- d. Qualification of the fusion technician shall be demonstrated by evidence of electrofusion training within the past year on the equipment to be utilized for this project and successful demonstration of jointing procedures through a destructive test as indicated in 815.5.
- e. Contractor shall perform electrofusion in strict conformance with MAB procedures.
- f. Contractor shall prepare ditch as required to allow adequate space for preparatory work and cleaning.
- g. Inspector may reject any electrofusion coupling installation which lacks witness marks for stab depth or lacks evidence of proper cleaning and scraping prior to fusing.

14. Fusion Operators:

- a. The Contractor of the fusion machine operator is responsible for the fusion joint quality of the fusion weld made by that individual.
- b. The Contractor is responsible for documenting all qualification and training records of that individual.
- c. All HDPE fusion equipment operators shall be qualified to the procedure used to perform pipe joining.
- d. Fusion equipment operators shall have current, formal training on all fusion equipment employed on the project.
- e. When the fusion machine operator is employed by the HDPE pipe and fusion machine supplier, the supplier shall maintain an ISO 9001 Certified Quality Management System.

15. Flange Installation:

- a. Flange connections shall be installed in accordance with the Manufacturer's recommended procedure.
- b. Flanges shall be centered and aligned to the mating component before assembling and tightening bolts.

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- c. In no case shall flange bolts be used to draw the connection into alignment.
 - d. Bolt threads shall be lubricated, and flat washers should be used under the nuts.
 - e. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer.
 - f. At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer.
 - g. Connections shall be retightened a second time after at least 4 hours in accordance with Manufacturer's recommendations.
 - h. The final tightening torque shall be as recommended by the gasket Manufacturer.
16. Connections with Existing Piping:
- a. Connections between new work and existing piping shall be made using connections as shown on Drawing Series DD-812.
 - b. To minimize effects from temperature shrinkage, connections to existing piping shall only be made after pipeline is backfilled and pipeline has reached ambient temperature of the existing ground (trench).
 - c. Connection to existing piping shall only be made after concrete anchor reaction blocks have been in place at least seven (7) days.
 - d. Contractors shall coordinate connection so that SAWS Inspector is in attendance during connection installation and testing. Each connection with an existing pipe shall be made at a time and under conditions that will least interfere with service to customers, and as authorized by SAWS.
 - e. Facilities shall be provided for proper dewatering and for disposal of all water removed from the dewatered lines and excavations without damage to adjacent property.
 - f. Special care shall be taken to prevent contamination of potable water lines when dewatering, cutting into, and making connections with existing pipe.
 - g. Trench water, mud, and other contaminating substances shall be kept out of the lines.
 - h. The interior of all pipe, fittings, and valves installed in connections to existing piping shall be thoroughly cleaned and then swabbed in accordance with the requirements of AWWA C651.
 - i. Connections to existing piping shall be fully restrained in accordance with Manufacturer's recommendations.
 - j. Sunlight Protection:
 - (1) Pipe shall be protected from extended exposure to sunlight, shall be kept as cool as possible during installation.
 - (2) Pipe shall be covered with backfill immediately after installation.
 - (3) Allow pipe to cool prior to making any connections to flanges, existing pipeline systems, or structures.

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17. The polyethylene pipe will be assembled and joined at the site using the thermal butt-fusion method to provide a leak proof and structurally sound joint. Threaded or solvent- cement joints and connections are not permitted. All equipment and procedures will be used in strict compliance with the manufacturer's recommendations. Fusing will be accomplished by personnel certified as fusion technicians by a manufacturer of polyethylene pipe and/or fusing equipment.
18. The butt-fused joint will be true alignment and will have uniform roll back beads resulting from the use of proper temperature and pressure. The joint surfaces will be smooth. The fused joint will be watertight and will have tensile strength equal to that of the pipe. All joints will be subject to acceptance by the Inspector prior to insertion. All defective joints will be cut out and replaced at no cost to SAWS. Any section of the pipe with a gash, blister, abrasion, nick, scar, or other deleterious fault greater in depth than 10% of the wall thickness, will not be used and must be removed from the site. However, a defective area of the pipe may be cut out and the joint fused in accordance with the procedures stated above.
19. Pipe having defects that in the opinion of the Inspector indicate the pipe may be damaged, faulty, substandard, improperly manufactured, or have other defects as listed herein, will be discarded and not used. Defects warranting pipe rejection include the following: concentrated ridges, discoloration, excessive spot roughness, and pitting; insufficient or variable wall thickness; pipe damage from bending, crushing, stretching or other stress; pipe damage that impacts the pipe strength, the intended use, the internal diameter of the pipe, internal roughness characteristics; or any other defect of manufacturing or handling.
20. Clamps and Gaskets: Clamps shall be stainless steel, including bolts and lugs as manufactured by JCM Industries Type 108, or other approved equal. Furnish full circle, universal clamp couplings with a minimum 3/16-inch-thick neoprene, grid-type gasket. Select clamps to fit outside diameter of pipe. Use minimum clamp length of 30 inches for replacement pipes O.D. of 10.75 inches (10inch nominal) or greater and 18 inches for replacement pipe O.D. less than 10.75 inches.
21. Terminal sections of pipe that are joined within the insertion pit will be connected with a full circle pipe repair clamp. The butt gap between pipe ends will not exceed ½ inch.
22. Water services shall be relayed or reconnected to the new pipe through small excavations from the surface. Water service installation shall be in accordance with the SAWS Standard Specification for Construction Item 824 or as noted in SAWS Specification Item 815. All excavations required for reconnecting or relaying services, entry pits, exit pits, and point repairs are to be kept to a minimum and all damage to surface and underground features, facilities, utilities and improvements are to be repaired. Area disturbed by construction shall be clean and restored per SAWS specification Item No. 804. Seal between new pipe and existing service shall be water tight.

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817.7 HYDROSTATIC TESTING AND DISINFECTION:

1. Hydrostatic Testing:
 - a. Prior to pressure test of newly installed main, insure all fittings within test section have been installed correctly and restrained against movement.
 - b. All concrete anchor blocks shall have been installed a minimum of seven (7) days prior to pressurizing the line.
 - c. Pressure test the installed main per ASTM F2164 as outlined herein.
 - d. The hydrostatic leak test procedure consists of filling, an initial expansion phase, a test phase, and depressurizing.
 - e. There are two alternatives for the test phase.
 - f. Filling – Flush the main in accordance with SAWS' Specification Item 841 Hydrostatic Testing Operations.
 - g. No valve in SAWS's water distribution system shall be operated by the Contractor without prior permission of the Inspector.
 - h. The Contractor shall notify the SAWS' Inspector when a valve is to be operated and shall only operate the valve in the presence of the SAWS' Inspector.
 - i. Initial Expansion Phase – Gradually pressurize the test section to test pressure and maintain test pressure for three (3) hours.
 - j. During initial expansion phase, polyethylene pipe will expand slightly.
 - k. Additional water will be required to maintain pressure. It is not necessary to monitor amount of water added during the initial expansion phase.
 - l. If test pressure cannot be attained, or if it takes an unreasonably long time to reach test pressure, discontinue test and verify there are no faults with test equipment or pipeline before proceeding.
 - m. Hydrostatic Test - Test pressures shall be in accordance with Specification Item No. 841 - Hydrostatic Testing Operations.
 - n. At the discretion of SAWS, the test method used may be either a Monitored Make-up Water Test or a Non-Monitored Make-up Water Test.
 - (1) Monitored Make-up Water Test: This alternative is applicable when the test pressure is 150% of the system design pressure.
 - (2) Immediately following the initial expansion phase, monitor the amount of make-up water required to maintain test pressure for one (1), two (2), or three (3) hours.
 - (3) If the amount of make-up water needed to maintain test pressure does not exceed the amount in Table 815-1, no leakage is indicated.
 - (4) Non-monitored Make-up Water Test
 - (5) Immediately following the initial expansion phase, reduce test pressure by 10 PSI and stop adding additional water.
 - (6) If the test pressure remains steady (within 5% of the target value) for one (1) hour, no leakage is indicated.

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- o. Total time allotted for test shall not exceed 8 hours.
- p. If successful test cannot be completed in this period, then the test section must be depressurized and allowed to relax for a minimum of 8 hours before retest.
- q. Re-test after repair.
- r. Retest per the requirements of this specification.
- s. Manifest shall be filled out with all pressure test results.

TABLE 815-1 MAKEUP WATER ALLOWANCE TABLE			
Make-Up Water Allowance for Test Phase, Monitored Make-Up Water (U.S. Gallons/100 feet of Pipe)			
Nominal Pipe Size (in)	1-Hour Test	2-Hour Test	3-Hour Test
6	0.3	0.6	0.9
8	0.5	1.0	1.5
12	1.1	2.3	3.4
16	1.7	3.3	5.0
20	2.8	5.5	8.0
24	4.5	8.9	13.3
30	6.3	12.7	19.2

2. Disinfection

- a. Disinfection shall be performed by SAWS in accordance with the requirements of SAWS’ Standard Construction Specifications Item No. 847 - Disinfection, except as modified herein.
- b. Contractor shall provide connections for disinfection as required in the Drawings and Specification Item No. 847 - Disinfection.
- c. The disinfection chemical solution shall not exceed 12% active chlorine.
- d. The duration of the test should not exceed 24 hours.

817.8 MEASUREMENT: All pipe will be measured from insertion point to receiving point in conjunction with the Contractor’s approved pipe bursting plan. Measurement will be continuous through any fittings in the main.

817.9 PAYMENT: Payment for items included in this specification shall be in accordance with the pay items listed below. Work included in these items shall include and the price provided by the Contractor will be considered as full compensation for furnishing and placing of all materials, labor, tools, and equipment; cleaning, preparation, repairs, inspection; and phasing, protecting, work execution and any other work necessary to complete the project.

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- a. Installed Pipe: The inserted pipe will be paid for per linear foot of pipe installed using pipe bursting crushing method for the pipe diameter, type, quantity, and depth specified and will include all pipe installation materials, all submittals, launching pits, receiving pits, post testing, shoring, bedding, backfill, and all necessary, corresponding, and related work specified herein.
- b. Services: Locating and reconstruction of services and all connections of services will be paid for per each connection made, including fittings and pipe. Payment for services shall follow the SAWS Specification Item 824 and Item 815 for HDPE.

- End of Specification -