



WL PLASTICS
An INEOS Business

WL110 Model Specification



Multi-application use

The ideal piping solution

WL110 Model Specification

NOTICE

This is a comprehensive model specification that can serve as a base document for many applications. It is expected that the user will select appropriate sections from the model spec for use as specifications for specific applications. Please select (cut and paste) the appropriate sections for the intended application. The user should employ due diligence to assure that any text sections selected from this model specification are applicable for the intended use, including reviewing referenced standards for applicability.

Section 15065: High density polyethylene (HDPE) pipe and fittings

Part 1. General

1.1 Description

A. Scope

This section specifies high density polyethylene (HDPE) pipe and fittings, including acceptable fusion technique and practice, and safe handling and storage.

B. Pipe description

Pipe and Fitting Suppliers shall furnish high density polyethylene (HDPE) pipe and fittings conforming to all applicable standards and procedures as referenced in this specification, and meeting all applicable testing and material properties as described by the applicable standards referenced in this specification or as required within this specification.

1.2 Quality assurance

A. References

1. This section contains references to the following documents. They are a part of this section to the extent referenced in this specification. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of a conflict between the requirements of this section and those of the referenced documents, the requirements of this specification shall prevail.
2. Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document in effect at the time of construction.

Reference	Title
AWWA C651	<i>Standard for Disinfecting Water Mains</i>
ANSI/AWWA C901	<i>Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm) for Water Service</i>
ANSI/AWWA C906	<i>Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 65 In. (1,600 mm), for Water Distribution and Transmission</i>
ASTM C923	<i>Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals</i>
AWWA M55	<i>Manual of Water Supply Practices, PE Pipe–Design and Installation</i>
ASTM D1603	<i>Standard Test Method for Carbon Black in Olefin Plastics</i>
ASTM D2321	<i>Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications</i>
ASTM D2774	<i>Standard Practice for Underground Installation of Thermoplastic Pressure Piping</i>
ASTM D3035	<i>Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PP) Based on Controlled Outside Diameter</i>
ASTM D3261	<i>Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing</i>
ASTM D3350	<i>Standard Specification for Polyethylene Plastics Pipe and Fittings Materials</i>
ASTM D4218	<i>Standard Test method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique</i>
ASTM F585	<i>Standard Practice for Insertion of Flexible Polyethylene Pipe Into Existing Sewers</i>
ASTM F714	<i>Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PP) Based on Outside Diameter</i>
ASTM F1055	<i>Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing</i>
ASTM F1290	<i>Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings</i>
ASTM F1417	<i>Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air</i>
ASTM F1962	<i>Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings</i>
ASTM F2164	<i>Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure</i>
ASTM F2206	<i>Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock</i>
ASTM F2620	<i>Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings</i>
ASTM F2786	<i>Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Gaseous Media Under Pressure (Pneumatic Leak Testing)</i>
NSF/ANSI 61	<i>Drinking Water System Components–Health Effects</i>
PPI TR-4	<i>PPI Listing of Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength Ratings for Thermoplastic Piping Materials for Pipe</i>
PPI TR-46	<i>Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of High Density Polyethylene Pipe</i>

B. Manufacturer requirements

1. High density polyethylene (HDPE) pipe and fittings shall be manufactured in accordance with the following standards
2. ASTM D3035 – ½ in through 24-in pipe
3. ASTM F714 – 3-in through 54-in pipe
4. AWWA C901 – 1/2 In. (130mm) through 3 In. (76 mm) pipe and tubing
5. AWWA C906 – 4 In. (100 mm) through 65 In (1,600 mm) pipe and fabricated fittings
6. ASTM D3261 – butt fusion fittings, saddles and flange adapters
7. ASTM F1055 – electrofusion couplings and saddles.
8. ASTM F2206 – fabricated fittings

C. Fusion technician requirements

1. Each Fusion Technician shall be separately qualified to make each type and size of fusion joint. Fusion joint types are butt fusion, saddle fusion and electrofusion. Qualification to make one type or size of fusion joint shall not qualify a Fusion Technician to make a different type or size of fusion joint.
2. Each Fusion Technician making butt fusion joints shall be qualified to make butt fusion joints in accordance with ASTM F2620. Qualification shall have occurred not more than 12 months before performing fusion joining on site in accordance with this specification. Qualification shall be a documented demonstration of proficiency by making joints in accordance with ASTM F2620 that are proved to be satisfactory by destructive testing in accordance with ASTM F2620.
3. Each Fusion Technician making saddle fusion joints shall be qualified to make saddle fusion joints in accordance with ASTM F2620. Qualification shall have occurred not more than 12 months before performing on-site fusion joining in accordance with this specification. Qualification shall be a documented demonstration of proficiency by making joints in accordance with ASTM F2620 that are proved to be satisfactory by destructive testing in accordance with ASTM F2620.
4. Each Fusion Technician making electrofusion fitting joints shall be qualified to make electrofusion fitting joints in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure. Qualification shall have occurred not more than 12 months before performing on-site fusion joining in accordance with this specification. Qualification shall be a documented demonstration of proficiency by making joints in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure that are proved to be satisfactory by destructive testing in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure.

D. Approved suppliers

1. Pipe and fitting suppliers shall be approved by the Project Engineer.
 - a. The following pipe manufacturers are approved:
 - WL Plastics
 - b. The following fitting manufacturers are approved:
 - [To be completed]

E. Warranty

1. Pipe and fitting suppliers shall provide a one-year warranty covering defects in product material and workmanship. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the supplier of warranty responsibility for the full warranty term.
2. Fusion providers shall provide a one-year warranty from the date of installation acceptance covering defects in fusion joining workmanship that shall provide for remaking defective butt fusion, saddle fusion or

electrofusion joints. A successful pressure test or pressure leak test prior to the expiration of the warranty period shall not relieve the installer of warranty responsibility for the full warranty term.

F. Submittals

1. The following information shall be submitted by pipe and fitting suppliers:
 - a. Name of the pipe manufacturer and a list of the piping and quantities to be provided by manufacturer.
 - b. Name(s) of fitting manufacturer(s) and lists of fittings and quantities to be provided by manufacturer.
 - c. Pipe and fitting product data indicating conformance with this specification, applicable standards, and warranty provisions, including written documentation regarding any intended variance from this specification and applicable standards.
 - d. At the time of shipment, the supplier shall provide certified documentation of pipe and fitting conformance with this specification and applicable pipe and fitting standards specified herein.
2. The following information shall be submitted by Fusion Providers.
 - a. Documentation that each Fusion Technician has met requirements for joining proficiency for each type of fusion joint performed by the Fusion Technician under this specification.
 - b. Documentation of conformance with this specification and applicable standards, including written documentation regarding any intended variance from this specification and applicable standards. This will include fusion joint warranty information and recommended project specific fusion. parameters, including criteria logged and recorded by data logger.
 - c. The following AS-RECORDED DATA is required from the Contractor and/or Fusion Provider:
 - 1) Fusion reports for each fusion joint performed on the project, including joints that were rejected. Submittals of the Fusion Technician's joint reports are required as requested by the Owner or Engineer. Specific requirements of the Fusion Technician's joint report shall include:
 - (a) Pipe or fitting size and DR or pressure class rating
 - (b) Fusion equipment size and identification
 - (c) Fusion Technician Identification
 - (d) Job Identification Number
 - (e) Fusion Number
 - (f) Fusion joining parameters
 - (g) Ambient Temperature

Part 2. Products

2.1 [Select this section for potable water service] Pipe and fittings for pressure potable water service

A. PE4710 pipe and fitting material (compound)

1. PE4710 material (compound) shall conform to material requirements specified in [select pipe standard: ASTM D3035 or ASTM F714 or AWWA C901 or AWWA C906] [select fitting standard(s): AWWA C906 or ASTM D3261 or ASTM F1055 or ASTM F2206] as applicable for the pipe or fitting. PE4710 material shall meet the requirements of ASTM D3350 and shall meet or exceed a cell classification of 445574 per ASTM D3350.
2. PE4710 material compound shall have a hydrostatic design stress (HDS) rating for water at 73°F (23°C) of not less than 1000 psi that shall be listed in PPI TR-4 in the name of the pipe manufacturer.
3. PE4710 material compound shall have a hydrostatic design basis (HDB) rating at 140°F (60°C) of not less than 1000 psi that shall be listed in PPI TR-4 in the name of the pipe manufacturer.
4. PE4710 pipe and fitting material compound in PE4710 pipe and fittings shall contain color and ultraviolet (UV) stabilizer meeting the requirements of Code C or E per ASTM D3350. Code C material shall contain 2 to 3 percent carbon black to provide indefinite protection against UV degradation when material from the pipe is tested in accordance with ASTM D1603 or ASTM D4218. Code E material used for coextruded OD color stripes or a coextruded ID color layer shall contain sufficient UV stabilizer to protect the pipe against UV degradation for at least 24 months of unprotected outdoor exposure. Coextruded color PE compound material shall be PE4710 pipe material compound, 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 new material for the production of new pipe provided that the rework material is the same PE4710 material designation as the new material compound to which it is added. Finished products containing rework material shall meet the requirements this specification.
6. Qualification for potable water service. PE4710 compounds shall be tested and certified as suitable for use with potable water in accordance with requirements that are no less restrictive than the applicable requirements in NSF/ANSI 61.

B. PE4710 pipe and butt fusion fittings shall have plain ends for butt fusion.

C. PE4710 pipe

1. Nominal straight lengths of 3 inch and larger pipe shall be 40 ft. or 50 ft.
2. Nominal coil lengths of 4-inch and smaller pipe shall be 500 ft. Longer or shorter coils such as 800 ft for 4-inch pipe, 1000 ft for 3-inch pipe, or 2000 ft for 2 inch or smaller pipe shall be acceptable.
3. Pipe shall be black. Coextruded OD blue stripes shall be an acceptable option.
4. Pipe shall be permanently marked using heated indent printing including:
 - a. Nominal size and sizing system, e.g. IPS or DIPS
 - b. DR or SDR
 - c. Standard Designation, [select: ASTM D3035 or ASTM F714 or AWWA C901 or AWWA C906], material designation, and pressure rating or pressure class for water at 73°F.
 - 1) Marking the Standard Designation on the pipe shall serve as the manufacturer's certification that the pipe has been manufactured, sampled and tested and has been found to comply with the requirements of the standard.
 - 2) The ASTM D3035 or ASTM F714 pipe pressure rating for water at 73°F shall be "PE4710 PCXXX" where
XXX = pressure rating in psi
 - 3) The AWWA C901 or C906 pipe pressure class for water at 73°F shall be "PE4710 PCXXX" where
XXX = pressure class in psi.

- d. NSF-61 or NSFpw mark certifying suitability for potable water service
- e. Extrusion production-record code
- f. Manufacturer's Trademark or trade name, e.g. "WL Plastics"

D. PE4710 fittings

1. PE4710 butt fusion, saddle fusion, electrofusion and fabricated fittings shall be manufactured from PE4710 material (compound) in accordance with this specification.
2. PE4710 fittings shall comply with ASTM D3261 for molded butt fusion and saddle fusion fittings, flange adapters and MJ adapters, or shall comply with [select: ASTM F2206 or AWWA C906] for fabricated butt fusion fittings, or shall comply with ASTM F1055 for electrofusion fittings.
3. PE4710 fittings shall comply with the marking requirements of ASTM D3261 for molded butt and saddle fusion fittings, flange adapters and MJ adapters or shall comply with the marking requirements of [select: ASTM F2206 or AWWA C906] for fabricated butt fusion fittings, or shall comply with the marking requirements of ASTM F1055 for electrofusion fittings.
 - a. Marking shall include the NSF-61 or NSFpw mark verifying suitability for potable water service.
4. PE4710 fittings shall have pressure class ratings not less than the pressure class rating of the pipe to which they are joined.

2.2 [Select this section for pressure or non-pressure non-potable piping service] Pipe and fittings for [select: forced main or reclaimed water or irrigation water or wastewater] service

A. PE4710 pipe and fitting material (compound)

1. PE4710 material (compound) shall conform to material requirements specified in [select pipe standard: ASTM D3035 or ASTM F714 or AWWA C901 or AWWA C906] [select fitting standard: AWWA C906 or ASTM D3261 or ASTM F2206 or ASTM F1055] as applicable for the pipe or fitting. PE4710 material (compound) shall meet the requirements of ASTM D3350 and shall meet or exceed a cell classification of 445574 per ASTM D3350.
2. PE4710 material (compound) shall have a hydrostatic design stress (HDS) rating for water at 73°F (23°C) of not less than 1000 psi that shall be listed in PPI TR-4 in the name of the pipe manufacturer.
3. PE4710 material (compound) shall have a hydrostatic design basis (HDB) rating at 140°F (60°C) of not less than 1000 psi that shall be listed in PPI TR-4 in the name of the pipe manufacturer. (This clause may be omitted for non-pressure service.)
4. PE4710 pipe and fitting material (compound) in PE4710 pipe and fittings shall contain color and ultraviolet (UV) stabilizer meeting the requirements of Code C or E per ASTM D3350. Code C material shall contain 2 to 3 percent carbon black to provide indefinite protection against UV degradation when material from the pipe is tested in accordance with ASTM D1603 or ASTM D4218. Code E material used for coextruded OD color stripes or a coextruded ID color layer shall contain sufficient UV stabilizer to protect the pipe against UV degradation for at least 24 months of unprotected outdoor exposure. Coextruded color PE compound material shall be PE4710 pipe material compound, 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 new material for the production of new pipe provided that the rework material is the same PE4710 material designation as the new material (compound) to which it is added. Finished products containing rework material shall meet the requirements this specification.

B. PE4710 pipe and butt fusion fittings shall have plain ends for butt fusion.

C. PE4710 pipe

1. Nominal straight lengths of 3 inch and larger pipe shall be 40 ft. or 50 ft.
2. Nominal coil lengths of 4-inch and smaller pipe shall be 500 ft. Longer or shorter coils such as 800 ft for 4-inch pipe, 1000 ft for 3-inch pipe, or 2000 ft for 2 inch or smaller pipe shall be acceptable. Pipe shall be

black. Coextruded lavender or purple stripes or a coextruded lavender or purple layer shall be an acceptable option.

3. Pipe shall be permanently marked using heated indent printing in accordance with [select pipe standard: ASTM D3035 or ASTM F714 or AWWA C901 or AWWA C906] as applicable for the pipe size including:
 - a. Nominal size and sizing system, e.g. IPS or DIOD
 - b. DR or SDR
 - c. Standard Designation, [select: ASTM D3035 or ASTM F714 or AWWA C901 or AWWA C906], material designation, and pressure rating or pressure class for water at 73°F.
 - 1) Marking the Standard Designation on the pipe shall serve as the manufacturer's certification that the pipe has been manufactured, sampled and tested and has been found to comply with the requirements of the standard.
 - 2) The ASTM D3035 or ASTM F714 pipe pressure rating for water at 73°F shall be "PE4710 PRXXX" where
XXX = pressure rating in psi
 - 3) The AWWA C901 or C906 pipe pressure class for water at 73°F shall be "PE4710 PCXXX" where
XXX = pressure class in psi.
 - d. Extrusion production-record code
 - e. Manufacturer's Trademark or trade name

D. PE4710 fittings

1. PE4710 butt fusion, saddle fusion, electrofusion and fabricated fittings shall be manufactured from PE4710 material (compound) in accordance with this specification.
2. PE4710 fittings shall comply with ASTM D3261 for molded butt fusion and saddle fusion fittings, flange adapters and MJ adapters, or shall comply with [select: ASTM F2206 or AWWA C906] for fabricated butt fusion fittings, or shall comply with ASTM F1055 for electrofusion fittings.
3. PE4710 fittings shall comply with the marking requirements of ASTM D3261 for molded butt and saddle fusion fittings, flange adapters and MJ adapters or shall comply with the marking requirements of [select: ASTM F2206 or AWWA C906] for fabricated butt fusion fittings, or shall comply with the marking requirements of ASTM F1055 for electrofusion fittings.
4. PE4710 fittings shall have pressure class ratings not less than the pressure class rating of the pipe to which they are joined. (This clause may be omitted for non-pressure service.)

2.3 Fusion joints

- A. Unless otherwise specified, PE4710 pipe and fittings shall be assembled in the field with butt fusion, saddle fusion or electrofusion joints. ASTM F2620 and the pipe manufacturer's recommended procedure (WL Plastics WL101) shall be observed for butt fusion and saddle fusion joints. ASTM F1290 and the electrofusion fitting manufacturer's recommended joining procedure shall be observed for electrofusion joints.
- B. Field butt fusion, saddle fusion and electrofusion joints shall be made by Fusion Technicians that are qualified in accordance with this specification to make the specific fusion joint type.
- C. Field fusion joints shall be recorded and documented in accordance with this specification.

2.4 Connections and fittings for pressure applications

- A. Connections shall be defined in conjunction with the linking of project piping, as well as the tie-ins to other piping systems.
- B. **Mechanical fittings**
 1. Acceptable mechanical fittings for use with PE4710 pipe and fittings shall be mechanical fittings that are qualified by the mechanical fitting manufacturer for use with HDPE pipe and fittings.

2. Mechanical fittings for use with HDPE pipe shall provide restraint against longitudinal separation that is inherent to the design of the joint. Mechanical joints that do not provide restraint against pull-out or push-off are prohibited.
3. Mechanical connections to non-HDPE devices and appurtenances shall be by bolted flange adapter or MJ adapter. Flange adapter and MJ adapter connections shall be assembled, installed and tightened in accordance with flange adapter or MJ adapter manufacturer's instructions. Flange bolt tightening shall be in accordance with PPI TN-38.

C. Gasketed, push-on fittings

1. Gasketed push-on fittings shall be fitted with external mechanical restraints that span across the joint and are assembled in accordance with restraint manufacturer's instructions.
 - a. Thrust blocking does not provide acceptable restraint and is prohibited.
 - b. Where plain-end PE4710 pipe is assembled with push-on fittings, the PE4710 pipe end shall be fitted with electrofusion restraints so that external mechanical restraint may be secured to the PE4710 pipe.
2. Where PE4710 pipe is connected to gasketed mechanical joint fittings or appurtenances, the connection shall be made by butt fusing a PE4710 MJ Adapter to the PE4710 pipe and connecting the PE4710 MJ Adapter to the mechanical joint fitting or appurtenance.

D. Sleeve-type couplings

Sleeve-type mechanical couplings shall be manufactured for use with HDPE pipe, and shall be restrained as indicated on the drawings and in these specifications. Unrestrained sleeve-type couplings are prohibited.

E. Expansion and flexible couplings

Expansion-type mechanical couplings are prohibited.

F. Connection hardware

Bolts and nuts for buried service shall be made of non-corrosive, high-strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21.11, regardless of any other protective coating.

2.5 Connections for non-pressure sewer or wastewater applications

- A.** The following connections are to be used in conjunction with tie-ins to other non-pressure sewer piping and structures, and shall be as indicated on the drawings.

1. Sleeve-type couplings

Sleeve-type mechanical couplings shall be manufactured for use with solid-wall non-pressure HDPE pipe, and may be restrained or unrestrained as indicated on the drawings and in these specifications.

2. Connection hardware

Bolts and nuts for buried service shall be made of non-corrosive high strength, low-alloy steel having the characteristics specified in ANSI/AWWA C111/A21, regardless of any other protective coating.

3. Connection to non-pressure manholes and structures

- a. Non-pressure PE4710 pipe and fittings shall be connected to manholes and other structures to provide a leak-free, properly graded flow into or out of the manhole or structure.
- b. Connections to existing manholes and structures shall be as specified and shown on the drawings.
 - 1) For a cored or drilled opening provide a flexible, watertight connection that meets and/or exceeds ASTM C923.
 - 2) For a knock out opening, provide a watertight connection (waterstop or other method) meeting the material requirements of ASTM C923 that is securely attached to the pipe with stainless steel bands or other means.
 - 3) Grout opening in manhole wall with non-shrink grout. Pour concrete collar around pipe and outside manhole opening.

- c. Connections to a new manhole or structure shall be as specified and shown on the drawings.
 - 1) A flexible, watertight gasket per ASTM C 923 shall be cast integrally with riser section(s) for all precast manhole and structures.
 - 2) Drop connections shall be required where shown on drawings.
 - 3) Grout internal joint space with non-shrink grout.

Part 3. Execution

3.1 Delivery and off-loading

- A. All piping shall be bundled or packaged for transportation by commercial carrier to the site.
- B. Before off-loading, pipe shall be inspected for damage. Any pipe damaged in shipment shall be assessed and either accepted or rejected as directed by the Owner or Engineer, and the pipe supplier shall be notified of rejected pipe within 7 days of delivery at the site. Rejected pipe shall be quarantined for disposition. Each pipe shipment shall be checked for quantity and proper pipe size, color and type.
- C. Pipe shall be off-loaded and handled in accordance with the pipe manufacturer's instructions and AWWA M55.

3.2 Handling and storage

- A. Pipe lengths should be placed and stored on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer. The interior of the pipe, as well as all end surfaces, should be kept free from dirt and foreign matter.
- B. Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal. Care shall be exercised when handling the pipe to not cut, gouge, scratch or otherwise abrade the piping in any way. Use of hooks, chains, wire rope or any other handling device which creates the opportunity to damage the surface of the pipe is strictly prohibited.
- C. Covering or shading of PE4710 pipe and fittings against exposure to ultraviolet light from sunlight is not required. Black HDPE pipe and fittings will provide continuous service in an outdoor exposure environment without degradation. (Ref: https://plasticpipe.org/pdf/tr-18_weatherability_thermo_pipe_systems.pdf)

3.3 Fusion process

A. General

- 1. Butt and saddle fusion of PE4710 pipe and fittings shall be in accordance with ASTM F2620 and the manufacturer's recommended joining procedure.
- 2. Electrofusion of PE4710 pipe and fittings shall be performed in accordance with ASTM F1290 and the electrofusion fitting manufacturer's recommended procedure.
- 3. PE4710 pipe and fittings shall be fused by qualified fusion technicians, as documented by the fusion provider. Training records for qualified fusion technicians shall be available to Owner or Engineer upon request.
- 4. As each fusion joint is constructed, pressure, time and temperature parameters shall be recorded and logged by an electronic monitoring device (data logger) affixed to the fusion machine. Joint data shall be submitted as part of the As-Recorded information, in accordance with this specification.
- 5. Butt fusion pipe machines shall incorporate the following properties, including the following elements:
 - a. **Heat plate** – Heat plates and the non-stick coatings on heating surfaces shall be in good condition without heating surface gouges or scratches. The non-stick coating shall be intact, clean and free of any contamination. Heater controls and temperature indicators shall function properly, and electrical cords and connections shall be in good condition. The heat plate shall maintain a uniform and consistent temperature on all areas of the heating surfaces on both sides of the heat plate.

- b. **Carriage** – Carriage shall travel smoothly with no binding at less than 50 psi for hydraulic fusion machines. Clamps shall be in good condition with proper inserts for the pipe size being fused.
- c. **General machine** – Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.
- d. **Data logger** – The current version of the pipe supplier's recommended and compatible software shall be used. Protective case shall be utilized for the hand held wireless portion of the unit. Data logger operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.
- e. Other equipment specifically required for fusion processes shall include the following:
- f. Pipe rollers shall be used to support pipe to either side of the butt fusion machine and provide for vertical and lateral pipe alignment straight through the butt fusion machine.
- g. A protective enclosure that provides for full machine motion of the clamps, heat plate, fusion assembly and carriage shall be provided for fusion in inclement and/or windy weather. Pipe ends shall be covered or blocked where open pipe ends could allow prevailing winds to blow through the pipe.
- h. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times.

B. Joint recording

Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine that shall register and/or record the parameters required by the manufacturer and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

3.4 Installation

- A. The PE4710 pipe and fittings shall be installed such that PE4710 pipe curvature is not less than the minimum bending radius recommended by the pipe manufacturer.
- B. Direct burial installation of PE4710 pressure pipe shall be in accordance with ASTM D2774 and the pipe manufacturer's recommendations.
- C. Direct burial installation of PE4710 non-pressure pipe shall be in accordance with ASTM D2321 and the pipe manufacturer's recommendations.
- D. Installation of PE4710 pipe by horizontal directional drilling shall be in accordance with ASTM F1962 or PPI TR-46 and the pipe manufacturer's recommendations.
- E. Installation of PE4710 pipe by sliplining or insertion within a casing or host pipe shall be in accordance with ASTM F585 and the pipe manufacturer's recommendations.
- F. **Tracer Wire** – All PE4710 piping shall be installed with a continuous, insulated TW, THW, THWN, or HMWPE insulated copper, 10 gauge or thicker wire for pipeline location purposes by means of an electronic line tracer.
 - 1. The wires shall be installed along the entire length of the pipe.
 - 2. Sections of wire shall be spliced together using approved splice caps and waterproof seals. Twisting the wires together is not acceptable.

3.5 Making connections to non-PE4710 piping systems

- A. Approximate locations for non-PE4710 piping systems are shown on the drawings or detailed in the specifications. Prior to making connections into existing piping systems, the Contractor shall:
 - 1. Verify the actual field location, size, piping material and service of non-PE4710 piping systems.
 - 2. Obtain all required non-PE4710 piping manufacturer(s) approved fittings (i.e. saddles, sleeve type couplings, flanges, tees, etc., as shown).
 - 3. Have installed all temporary pumps and/or pipes in accordance with established connection plans.

4. Have on hand pipe stoppers, blind flanges or other devices to seal a valve or appurtenance that fails to seal properly. When applied to pressure rated valves or appurtenances, all such devices shall be pressure rated equal to or greater than the pressure rating of the valve or appurtenance to which they are attached.
- B.** Where PE4710 pipe connects in-line to unrestrained gasketed push-on piping, the end of the PE4710 pipe shall be anchored in-line within 10 ft of the connection to restrict longitudinal movement of the PE4710 pipe.
1. The PE4710 pipe shall be fitted with a PE4710 wall anchor or electrofusion flex restraints.
 2. The PE4710 wall anchor or electrofusion flex restraints shall be encased in reinforced concrete that is sufficient to withstand Poisson effect longitudinal loads in accordance with AWWA M55 In-Line Anchoring.
- C.** Unless otherwise approved by the Engineer, new piping systems shall be completely assembled and successfully tested prior to making connections to non-PE4710 piping systems.

3.6 Pipe system connections

Pipe connections shall be installed per applicable standards and regulations, as well as per the connection manufacturer's recommendations and as indicated on the drawings. Pipe connections to structures shall be installed per applicable standards and regulations, as well as per the connection manufacturer's recommendations.

3.7 Tracer wire testing

- A.** Upon completion of installation by direct burial, sliplining, directional boring or pipe bursting, the Contractor shall demonstrate that the tracer wire is continuous and unbroken through the entire run of the pipe.
1. Demonstration shall include full signal conductivity (including splices) when energizing for the entire run in the presence of the Owner or Engineer.
 2. If the wire is broken, the Contractor shall repair or replace it. Pipeline installation will not be accepted until the tracer wire passes a continuity test.

3.8 Tapping for potable and non-potable water applications

- A.** Tapping shall be performed using standard saddle fusion fittings, electrofusion saddle fittings, or mechanical tapping saddles or sleeves designed for use on HDPE piping. Tapping by threading directly into the PE4710 pipe wall is prohibited.
- B.** Branching connections requiring a larger diameter shall be made with saddle fusion branch saddle fittings or mechanical branch connection fittings as specified and indicated on the drawings.
- C.** Equipment used for tapping shall be made specifically for tapping HDPE pipe:
1. Tapping bits shall be slotted "shell" style cutters, specifically made for HDPE pipe. 'Hole saws' made for cutting wood, steel, ductile iron, or other materials are strictly prohibited.
 2. Manually operated or power operated drilling machines may be used.
- D.** Taps may be performed while the pipeline is filled with water and under pressure ('wet' tap), or when the pipeline is not filled with water and not under pressure ('dry' tap).

3.9 Testing

- A.** testing shall comply with all local building codes, statutes, standards, local jurisdiction, and laws.
- B.** Segments of the pipe may be tested separately in accordance with standard testing procedure, as approved by the Owner and Engineer.
- C. *Hydrostatic leakage testing for pressure piping***
1. hydrostatic leakage testing shall comply with ASTM F2164. Joint leakage and any defective materials and/or workmanship shall be repaired or replaced by the Contractor at no additional cost to the Owner.
 2. Pneumatic (compressed air) leakage testing of PE4710 pressure piping is prohibited.

D. Leakage testing for non-pressure piping

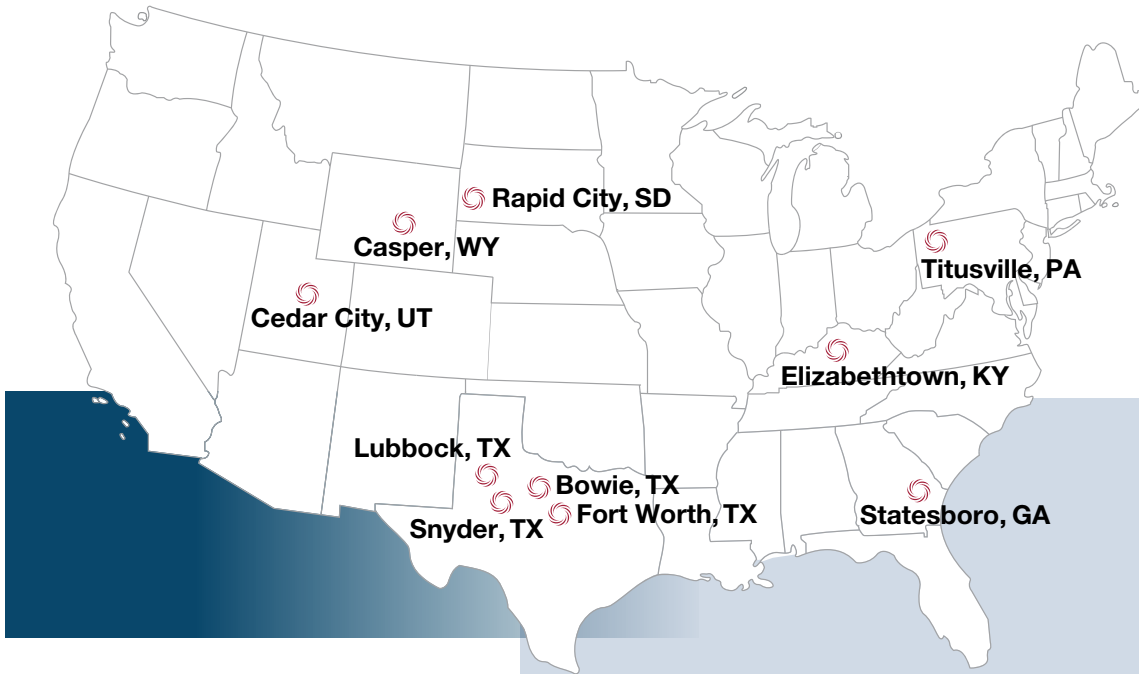
1. Non-pressure piping such as sewers shall be tested for excessive leakage in accordance with ASTM F1417.
2. Joint leakage and any defective materials and/or workmanship shall be repaired or replaced by the Contractor at no additional cost to the Owner.

E. Disinfection of the pipeline for potable water piping

After installation, the pipeline, having passed all required testing, shall be disinfected prior to being put into service per AWWA C651 unless otherwise directed by the Owner or Engineer.



WL PLASTICS
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Manufacturing locations

Bowie, TX
Casper, WY
Cedar City, UT
Elizabethtown, KY
Lubbock, TX (HDPE)
Lubbock, TX (MDPE)
Rapid City, SD
Snyder, TX
Statesboro, GA
Titusville, PA (HDPE/MDPE)

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