

**SECTION 02XXX****FIELD TESTING METHODS FOR HDPE PIPE AND FITTINGS****1.01 SCOPE OF WORK**

- A. The Contractor shall provide verification that butt fusion and electrofusion of HDPE pipe are performed in accordance with AWWA, ASTM, and other referenced documents and standards within this specification by submitting to various destructive testing methods covered within this specification.
- B. Types of field testing available
  - 1. Butt fusion testing includes preparing and conducting guided side bend back tests as a means to assess the ductility of a butt fusion joint by applying lateral (side) bending strain across a specimen taken from the full butt fusion cross-section. There are no test values provided by this test as the results are a non-numerical report.
  - 2. Electrofusion testing includes joint integrity tests, joint crush test, saddle type joint crush test and fusion evaluation test. These test are a means to assess if the exterior surface of the HDPE pipe at the location of the EF fitting have been properly prepared and if the EF fitting performs in accordance with this specification. There are no test values provided by this test as the results are a non-numerical report.

**1.02 REFERENCED STANDARDS**

- A. American Society for Testing and Materials (ASTM) latest edition:
  - 1. ASTM F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
  - 2. ASTM F3183 – Standard Practice for Guided Side Bend Evaluation of Polyethylene Pipe Butt Fusion Joint

**1.03 MATERIALS AND EQUIPMENT**

- A. HDPE Materials
  - 1. Polyethylene pipe and fittings 4-65 inch diameter shall be in accordance with AWWA C906-15, material designation code of PE4710, all applicable ASTM standards and be listed on the PPI TR-4 HSB Listing of Hydrostatic Design Basis Listed Materials.
  - 2. Polyethylene pipe ½ -3 inch diameter for main line piping shall be polyethylene pipe (not tubing) in accordance with AWWA C901, material designation code of PE4710 all applicable ASTM standards and be listed on the PPI TR-4 HSB Listing of Hydrostatic Design Basis Listed Materials.
  - 3. Butt fusion fittings shall be made of HDPE material with a minimum

material designation code of PE4710, all applicable ASTM standards and shall be listed in current versions of PPI TR-4. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified on the project documents. All fittings shall meet the requirements of AWWA C901, C906 and all applicable ASTM standards. Markings for molded fittings shall comply with the requirements of ASTM D3261. Fabricated fittings shall be marked in accordance with ASTM F2206. Socket fittings shall meet ASTM D2683. Fabricated fittings shall be manufactured using a DataLogger to record fusion time, pressure and temperature, and shall be marked with a unique joint identifier that corresponds to the joint report. A graphic representation of the time and pressure data for all fusion joints made producing fittings shall be maintained for a minimum of five years as part of quality control and will be available upon request of owner. Qualification of the fusion technician shall be demonstrated by evidence of fusion training within the past two years on the equipment to be utilized on this project in accordance with ASTM F2620.

4. Electrofusion fittings shall be made of HDPE material with a minimum material designation code of PE4710 and meet ASTM F1055. Electrofusion fittings shall have a pressure rating equal to the pipe unless otherwise specified on the project documents. All electrofusion fittings shall be suitable for use as pressure conduits and have nominal burst values of four times the working pressure rating of the fitting. Marking of electrofusion fittings shall comply with the requirements of ASTM F1055. All electrofusion fittings shall be properly stored in compliance with the manufacturers recommendation.

B. Guided side bend back test

1. The parts and components of the guided side bend back testing apparatus shall conform to ASTM F3183 – Standard Practice for Guided Side Bend Evaluation of Polyethylene Pipe Butt Fusion Joint.
2. Sawing or cutting of the HDPE required to cut the sample butt fusion into segments shall be in good and safe working condition free of oils, contaminants or other defects.
3. Machining equipment, such as a feed-through electric planer, to prepare the side bend test specimen into required test coupons shall be in good and safe working condition free of oils, contaminants or other defects.

C. Electrofusion testing

1. The parts and components of the electrofusion test components will conform to ASTM F1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
2. Equipment necessary to properly prepare the HDPE pipe for connecting and

fusing the electrofusion fitting, such as materials to properly clean the pipe, peelers, scrapers, clamps, heating mechanisms and electrofusion processors, shall be in good working order to safely prepare the electrofusion fitting.

3. Any vise, clamp or other mechanism used to hold the test specimen during the test procedure should be in good working order to safely hold the test specimen during the test.

#### 1.04 EXECUTION OF GUIDED SIDE BEND BACK TEST

##### A. Preparation of side bend test specimens

1. Preparation of all butt fusions used to prepare side bend test specimens shall follow all applicable standards as referenced above.
2. Side bend test specimens are prepared from bend test coupon pairs that are cut from a sample butt fusion. These test coupons should be two approximately equal lengths of HDPE that are joined in the middle by butt fusion. The minimum length for one side of the test coupon should be 6 inches so the overall total length is a minimum of 12 inches. The minimum cut width of the bend test coupon shall be  $\frac{3}{4}$  inch width.
3. Side bend test coupon specimens can be taken from two or more equidistant sides of the circumference of the butt fused HDPE. More than two bend test coupons can be taken in order to test variation locations of the fusion heater plate if validation of even heating across the heater plate is necessary, as approved by the Owner or Engineer.
4. The internal and external bead of the side bend test specimens must remain intact during preparation of the test specimens. If either bead is removed during preparation, the test specimen shall be discarded.
5. Each side bend test specimen shall be marked, labeled, or tagged or otherwise identified so that information relating to the sample butt fusion joint such as date, time, operator, location relative to its position within the fusion machine, joining procedure, pipe material, pipe size, etc. are documented. The locations of the pipe specimen follow the positions of the clock relative to the butt fusion machine. For example, the location relative to the butt fusion machine shall be mean the upper most point of the butt fusion joint while in the butt fusion machine shall be considered 12:00 o'clock and the lowest shall be considered 6:00 o'clock.
6. A single side bend test specimen shall be machined from each side bend coupon. Equal amounts of material are removed from the  $\frac{3}{4}$  in width of the bend test coupon to achieve a uniform thickness of 0.25 in + or - 0.02 inches.
7. The final side bend test specimen surfaces shall be clean, smooth and parallel and show no signs of gouges, scratching, saw cuts or other surface markings. If the fusion beads have been damaged or removed, the side bend test specimen shall be discarded.
8. The final side bend test specimen shall be marked, labelled, tagged or

- otherwise identified in a manner consistent with the above marking process.
9. After preparation, the final side bend test specimen shall be stored at 70°F (plus or minus 5°F) for four hours or in water for a minimum of 1 hour. Test specimens tested in the field shall be protected from hot or cold surfaces prior to testing.

**B. Procedure**

1. The operator shall verify the temperature of the test specimen and testing environment as well as the thickness of the side bend test specimen.
2. Position the side bend test specimen with the width resting on the two rotatable supports in the side bend test apparatus with the butt fusion joint centered on the middle of the rotatable supports.
3. Start the actuator of the apparatus and bend the test strip to an angle of 90° or the side bend test specimen breaks. Record the bend angle achieved or broken side bend test specimen and the time to perform the test. Report these results to the Owner or Engineer.

**1.05 EXECUTION OF ELECTROFUSION TESTING**

**A. Preparation of electrofusion fittings for testing**

1. Preparation of all electrofusion fittings used to prepare electrofusion test specimens shall follow all applicable standards as referenced above.
2. Prepare the electrofusion fittings test specimen so that the minimum length of unreinforced pipe on either side of the fitting is equal to three times the diameter of the pipe but not less than 12 inches. Multiple fittings can be included on the same electrofusion fitting test specimen as long as they have the minimum 12 inches of separation.

**B. Procedure**

1. The operator shall verify the temperature of the test specimen and testing environment as well as the thickness of the side bend test specimen.
2. Pipe length extending outside of vise jaws may be cut back to 3 inches for ease of placing the test specimen in the vise jaws. The outer most wire of coils shall be placed within 1.25 inches of the vise jaws with the vise jaws closing on just the pipe portion of the test specimen.
3. Tighten the jaws of the vise until the inner walls of the pipe meet. Repeat the test on both sides of the test specimen.
4. Separation of the fitting from the pipe at the fusion interface constitutes a failure of the test.

**END OF SECTION**