Designation: F2928 – 18 (Reapproved 2023)

Standard Practice for Specimens and Testing Conditions for Testing Polyethylene (PE) Pipe Butt Fusions Using Tensile and Hydrostatic Test Methods[1]

This standard is issued under the fixed designation F2928; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This practice provides standardized sample butt fusion preparation, conditioning, and testing conditions for tension testing of specimens prepared from sample butt fusion joints or hydrostatic tests of sample butt fusion joints in accordance with:

1.1.1 Test Method D638, tension testing;

1.1.1.1 The preparation or use of tensile specimens other than Test Method D638 Type I through Type V is beyond the scope of this practice.

1.1.2 Test Method D1598, constant (sustained) hydraulic pressure testing;

1.1.3 Test Method D1599, short-term hydraulic pressure testing.

1.1.4 It is not within the scope of this practice to include plastic materials other than polyethylene or other tests for butt fusions. The exclusion of other plastic materials and other tests does not imply that other plastic materials are suitable or unsuitable for butt fusion, or that the tests cited herein are adequate or inadequate for qualitative characterization and for research and development of butt fusion joints, or that other tests do not have lesser, equal, or greater utility for such purpose.

1.1.5 The evaluation of test results and the determination of test result evaluation criteria are not within the scope of this practice. This practice is limited to standardized butt fusion test specimens and testing conditions for the comparison of test data from multiple parties.

1.1.6 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.1.7 In this standard, text in parentheses, notes in the body of the standard and appendices are informational and non-mandatory. For tables in the body of the standard, table notes are mandatory.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D618 Practice for Conditioning Plastics for Testing

D638 Test Method for Tensile Properties of Plastics

D1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure

D1599 Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings

D1600 Terminology for Abbreviated Terms Relating to Plastics

F412 Terminology Relating to Plastic Piping Systems

F2620 Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

2.2 *PPI Standards:*[3]

PPI2 TR-3 Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe

[1] This practice is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.40 on Test Methods.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from Plastics Pipe Institute (PPI), 105 Decker Court, Suite 825, Irving, TX 75062, http://www.plasticpipe.org.

***A Summary of Changes section appears at the end of this standard**

PPI TR-33 Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe

3. Terminology

3.1 Definitions shall be in accordance with Terminology F412, Test Method D638, Test Method D1598, and Test Method D1599 as applicable. Abbreviations and initialisms shall be in accordance with Terminology F412 and D1600.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *failure, hydraulic, n*—any continuous loss of pressure with or without the transmission of test fluid through the body of the specimen under test.

3.2.2 *ductile failure, hydraulic, n*—the continuous loss of pressure through a break in the pipe specimen under test where localized expansion (deformation, elongation, necking down, or ballooning) of the pipe wall at the break is apparent.

3.2.3 *non-ductile failure, hydraulic, n*—the continuous loss of pressure through a break in the pipe specimen under test where localized expansion (deformation, elongation, necking down, or ballooning) of the pipe wall at the break is not apparent.

3.2.4 *pressure depletion, hydraulic, n*—a temporary loss of test sample source pressurization due to equipment or control failure, power loss, etc.

4. Summary of Practice

4.1 This practice specifies procedures for preparing sample butt fusions, preparing test specimens from sample butt fusions, sample and specimen conditioning, and requirements for testing sample butt fusions or specimens from sample butt fusions in accordance with Test Method D638, Test Method D1598, and Test Method D1599.

4.2 Alternate testing conditions for research, development or other purposes are allowed.

5. Significance and Use

5.1 This practice provides requirements for standardized preparation of sample butt fusions, preparation of specimens from sample butt fusions, and conditioning for testing in accordance with Test Method D638, Test Method D1598, or Test Method D1599. This practice is intended to improve the ability to reliably compare test results from multiple parties.

6. Sample Butt Fusions

6.1 *Sample Preparation*—Each sample butt fusion shall be at least two lengths of PE pipe that are joined together in accordance with a butt fusion joining procedure that has been selected by the parties involved. All pipe lengths in the sample butt fusion shall be the same length plus or minus five percent. The minimum pipe length shall be as specified in 7.1 or 8.1.2 or 9.1.2.

6.1.1 *Multiple Joint Sample Butt Fusions*—For Test Method D1598 or D1599, sample butt fusions containing multiple butt fusion joints shall be acceptable. The pipe length between butt fusion joints shall be the same length plus or minus five percent and shall not be less than the minimum pipe length specified in 8.1.2 or 9.1.2. The overall length of multiple joint sample butt fusions shall not exceed testing equipment capabilities.

6.2 Sample butt fusions shall be conditioned to the test temperature in accordance with Table 1.

NOTE 1—Butt fusion procedures such as Practice F2620 require cooling the fusion joint to ambient temperature before pulling, installation or rough handling. Conditioning in this practice is intended to stabilize test samples to test temperature. Additional conditioning time may be necessary when testing at temperatures significantly above or below 73 °F (23 °C), or when samples have been temporarily stored at temperatures significantly above or below test temperature.

6.3 Each sample butt fusion shall be marked, labeled, tagged or otherwise identified so that information relating to the sample butt fusion joint such as date, time, operator, location, joining procedure, pipe material, etc., and testing results will be cross-referenced and documented.

6.3.1 Each Test Method D638 tension test specimen shall be marked, labeled, tagged or otherwise identified so that information relating to the tension test specimen such as date, time, operator, location, joining procedure, pipe material, etc., and testing results will be cross-referenced and documented.

7. Tension Testing

7.1 *Tension Test Specimen Preparation*—Prepare sample butt fusions in accordance with Section 6 and 7.1.1. Prepare tension test specimens from the sample butt fusions in accordance with 7.1.3 – 7.1.5 .

7.1.1 The minimum pipe length on each side of the butt fusion shall be at least 6 in. (152 mm) so that the sample butt fusion is at least 12 in. (305 mm) in overall length.

7.1.2 For pipe smaller than 1 in. (25 mm) outside diameter, each sample butt fusion shall be cut longitudinally in half. For pipe 1 in. (25 mm) outside diameter and larger, each sample butt fusion shall be cut longitudinally into quadrants.

7.1.3 Depending on pipe wall thickness and the Test Method D638 specimen type, tension test specimens are prepared from all or parts of the pipe wall. Where wall thickness exceeds the thickness of the chosen Test Method D638 specimen type, pipe wall is machined away to achieve the thickness specified for the Test Method D638 specimen type.

TABLE 1 Minimum Sample Butt Fusion Conditioning Time

	Minimum Conditioning Time in Medium at Test Temperature	
Pipe Wall Thickness[A]	Circulating water per Practice D618, Procedure D	Circulating air per Practice D618, Procedure A
≤1 in. (≤25 mm)	1 h	4 h
>1 in. (250 mm) to ≤2.5 in. (64 mm)	2 h	8 h
>2.5 in. (64 mm) to ≤4 in. (102 mm)	3 h	12 h
>4 in. (102 mm)	4 h	16 h

[A] For butt fusions between unequal wall thickness pipes, use the greater wall thickness of the two pipes.