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An American National Standard

Standard Test Method for Laboratory Testing of Polyethylene (PE) Butt Fusion Joints using Tensile-Impact Method[1]

This standard is issued under the fixed designation F2634; 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 is a tensile impact test method that develops enough tensile impact energy at specific rates of strain to rupture standard tensile impact specimens of butt fused plastic pipe. It is used to determine the quality of PE butt fusion joints made in the field or in qualification testing. It can also be used to determine the optimum butt fusion joining parameters of PE materials.

1.2 This test method is applicable for testing pipe specimens with a diameter 2.37 in. (60.3mm) and larger with a wall thickness from 0.25 in. (6.3 mm) and larger.

NOTE 1—This test method is similar to ISO 13953.

1.3 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.

1.4 This test method may be used alone or together with other test methods, to evaluate the quality of the butt fused joints. When this test, conducted at laboratory temperatures per 9.2, is combined with the elevated temperature, sustained pressure test in Specification D3035, both the short term and long term strength of the PE butt fusion joint will be verified.

1.5 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D618 Practice for Conditioning Plastics for Testing

D638 Test Method for Tensile Properties of Plastics

D883 Terminology Relating to Plastics

D2513 Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings

D3035 ~~Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter~~ Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

2.2 *ISO Standard*[3]

ISO 13953 Polyethylene (PE) pipes and fittings - Determination of the tensile strength and failure mode of test pieces from a butt-fused joint

3. Terminology

3.1 Definitions of Terms Specific to this Standard.

3.1.1 *brittle rupture* —A brittle rupture in a butt fusion joint specimen consists of a clean or nearly clean part between the joining surfaces resulting in a smooth surface on both sides. (See Fig. 1.)

3.1.2 *ductile rupture* —A ductile rupture in a butt fusion joint specimen consists of either an elongation rupture of the machined

[1] This test method 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 International Organization for Standardization (ISO), 1 rue de Varembé, Case postale 56, CH-1211, Geneva 20, Switzerland, http://www.iso.ch.Available from

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

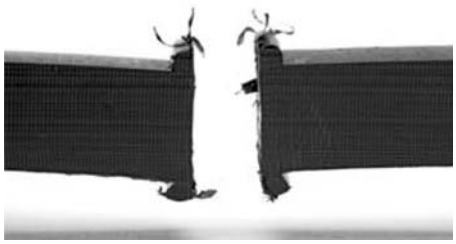

FIG. 1 Brittle Rupture

pipe outside the joint area (see Fig. 2) or adjacent to the butt fusion joint interface but resulting in considerable material tearing between the pipe end surfaces (see Fig. 3).

3.1.3 *maximum force*—the maximum force obtained during the test.

3.1.4 *rupture energy*—the energy required to rupture the coupon.

3.1.5 *yield point* —The point on the force/time curve where significant plastic deformation begins to occur. For the purposes of this standard, this is defined as occurring at zero slope point on the force/time curve.

3.1.6 *yield energy* —The energy imparted to the coupon by the yield point.

3.1.7 *average velocity*—The average velocity is the average crosshead speed for the duration (until coupon rupture) of the tensile test (inches/ sec.)

3.1.8 *instantaneous velocity*—The crosshead velocity at any discrete point during the test. This may be plotted to show the consistency of the velocity profile through the duration of the test.

3.1.9 *yield stress*—The stress value corresponding to the yield point.

3.1.9.1 *Discussion*—Additional definitions of terms applying to tensile test methods appear in Terminology D883

4. Significance and Use

4.1 This test method is designed to impart tensile impact energy to a butt fused plastic pipe specimen, record the energy to fail the specimen and plot the load over time curve of the tensile test. Energy recorded at yield and rupture and the rupture mode (brittle or ductile) are used as criteria in the evaluation of the butt fusion joint. The evaluation of the force/time curve not only makes it possible to compare different butt fusion parameters but also to evaluate the rupture mode of the specimen to determine joint integrity. Each coupon's test results will usually be compared to test results for coupons machined from the base pipe material, un-fused.

4.1.1 These data are also useful for qualitative characterization and for research and development. For many materials, there may be a specification that requires the use of this test method, but with some procedural modifications that take precedence when adhering to the specification. Therefore, it is advisable to refer to that material specification before using this test method.

4.2 Tensile properties may vary with specimen preparation and with speed and environment of testing. Consequently, where precise comparative results are desired, these factors must be carefully controlled.

4.2.1 It is realized that a material cannot be tested without also testing the method of preparation of that material. Hence, when comparative tests of materials per se are desired, the greatest care must be exercised to ensure that all specimens are prepared in exactly the same way, unless the test is to include the effects of specimen preparation. While care must be taken to secure the maximum degree of uniformity in details of preparation, treatment, and handling, the exact dimensions of the test specimens are entered into the Data Acquisition System (DAS) before initiating the test.

5. Apparatus

5.1 *Testing Machine*, A testing machine of the controlled rate-of-crosshead-movement type and comprising essentially the following:

5.1.1 *Fixed Member*, a fixed or essentially stationary member with tooling to pin a standard pipe specimen configuration.

5.1.2 *Movable Member*, a movable member with tooling to pin a standard pipe specimen configuration.

5.1.3 *Tooling for specimens*, Fixed clevis members attached to the testing machine for pinning the test specimen between the fixed member and the movable member of the testing machine. When the test specimen is inserted and pinned into the tooling,

FIG. 2 Ductile Rupture Outside Fusion Interface