



Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins¹

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^{ε1} NOTE—Replaced reference to withdrawn standard Practice D 1928 with current standard Practice D 4703 in November 2003.

1. Scope

1.1 This test method determines the resistance of polyethylene materials to slow crack growth under conditions specified within.

1.2 The test is generally performed at 80°C and at 2.4 MPa, but may also be done at temperatures below 80°C and with other stresses low enough to preclude ductile failure and thereby eventually induce brittle type of failure. Generally, polyethylenes will ultimately fail in a brittle manner by slow crack growth at 80°C if the stress is below 2.4 MPa.

1.3 The test method is for specimens cut from compression molded plaques.² See Appendix X1 for information relating to specimens from pipe.

1.4 *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:³

- D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing
- D 1600 Terminology for Abbreviated Terms Relating to Plastics
- D 3350 Specification for Polyethylene Plastics Pipe and Fittings Materials
- D 4703 Practice for Compression Molding Thermoplastic Materials into Test Specimens, Plaques, or Sheets

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 Lu, X., and Brown, N., “A Test for Slow Crack Growth Failure in Polyethylene Under a Constant Load,” *Journal of Polymer Testing*, Vol 11, pp. 309–319, 1992.

³ 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.

F 412 Terminology Relating to Plastic Piping Systems

3. Terminology

3.1 Definitions:

3.1.1 Definitions are in accordance with Terminology F 412. Abbreviations are in accordance with Terminology D 1600, unless otherwise indicated.

3.1.2 *brittle failure*—a pipe failure mode which exhibits no visible (to the naked eye) permanent material deformation (stretching, elongation, or necking down) in the area of the break (F 412).

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *slow crack growth*—the slow extension of the crack with time.

4. Summary of Test Method

4.1 Specimens are cut from compression molded plaques. It is precisely notched and then exposed to a constant tensile stress at elevated temperatures in air. The time for complete failure is recorded.

5. Significance and Use

5.1 This test method is useful to measure the slow crack growth resistance of molded plaques of polyethylene materials at accelerated conditions such as 80°C, 2.4-MPa stress, and with a sharp notch.

5.2 The time to failure depends on the following test parameters: temperature; stress; notch depth; and specimen geometry. Increasing temperature, stress, and notch depth decrease the time to failure. Thus, in reporting the time to failure, all the conditions of the test must be specified.

6. Apparatus

6.1 *Lever Loading Machine*, with a lever arm ratio of about 5:1. The tensile load may also be applied directly using dead weights or any other method for producing a constant load. The pull rods on the grips shall have universal action to prevent bending. The grips shall be serrated to prevent slippage. The load on the specimen shall be accurate to at least ±0.5 %.

