



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

This standard is issued under the fixed designation F1473; 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 test method determines the resistance of polyethylene materials to slow crack growth under conditions specified within.

NOTE 1—This test method is known as PENT (Pennsylvania Notch Test) test.

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 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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:*³

[D1600 Terminology for Abbreviated Terms Relating to Plastics](#)

[D4703 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.

F412 Terminology Relating to Plastic Piping Systems

3. Terminology

3.1 Definitions are in accordance with Terminology [F412](#). Abbreviations are in accordance with Terminology [D1600](#), unless otherwise indicated.

3.2 Definitions:

3.2.1 *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 (Terminology [F412](#)).

3.3 Definitions of Terms Specific to This Standard:

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

4. Summary of Test Method

4.1 Specimens are prepared from compression molded plaques, precisely notched and then exposed to a constant tensile stress at elevated temperatures in air. Time on test is recorded for tests conducted against a minimum time before failure requirement or the time to complete failure is recorded.

NOTE 2—Minimum time before failure requirements are found in material or product specifications, codes, etc.

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 testing time or 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 test time or time to failure, all the conditions of the test shall 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

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