Designation: F2231 – 02 (Reapproved 2019)

Standard Test Method for Charpy Impact Test on Thin Specimens of Polyethylene Used in Pressurized Pipes[1]

This standard is issued under the fixed designation F2231; 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 describes the specimen preparation and the method of measuring the impact energy of polyethylene used in pressurized pipes.

1.2 The test specimens are taken from compression molded plaques of the resin from pellets or pipe.

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

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

1.5 *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]

D6110 Test Method for Determining the Charpy Impact Resistance of Notched Specimens of Plastics

F412 Terminology Relating to Plastic Piping Systems

2.2 *ISO Standard:*

ISO 13477 Small Scale Steady State S-4 Test[3]

3. Terminology

3.1 *General*—Definitions are in accordance with Terminology F412 unless otherwise indicated.

3.2 *Definitions of Terms Specific to this Standard:*

3.3 *ultimate critical temperature, (CT)*—for RCP in a pressurized pipe, the temperature above which RCP is not possible at any pressure based on ISO 13477.

4. Summary of Test Method

4.1 The Charpy specimen is 3 mm thick and taken from a compression-molded plaque of the resin. The specimen is notched precisely with a razor blade and tested between 19°C and 27°C.

5. Significance and Use

5.1 Brown and Lu[4,5] show the Charpy impact energy is related to the ultimate critical temperature of the rapid crack propagation [RCP] behavior as measured by the ISO 13477, S-4 test.[6]

5.2 The test method may be used to determine the impact energy of polyethylene used in the manufacture of pipe . This test method involves the preparation of a small compression molded specimen of PE resin that is then notched in a specified manner. The specimen is then broken in a pendulum impact machine. The impact energy is recorded in joules. The value obtained is referred to as the Charpy impact energy.

6. Apparatus

6.1 *Impact Tester,* with input energy of 1 to 3 J and impact velocity of about 3.0 µs. The energy loss shall be measured with a precision of ±0.004 J.

6.2 *Notching Machine,* shall be capable of notching with a razor blade with a precision of ±0.01 mm and pressing the razor blade into the specimen.

[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 American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[4] Brown, N. and Lu, X., "Dependence of Rapid Crack Propagation in PE Pipes on the Plane Stress Fracture Energy of the Resin," *Polymer Engineering and Science* Vol 41, 2001, p. 1140.

[5] Brown, N. and Lu, X., "A Simple Test to Prevent Rapid Crack Propagation," *Plastic Pipes XI*, Munich, 2001, p. 583.

[6] The critical temperature is also related to the dimensions of the pipe.