Designation: F 1589 – 95 (Reapproved 2001)

An American National Standard

Standard Test Method for Determination of the Critical Pressure for Rapid Crack Propagation in Plastic Pipe[1]

This standard is issued under the fixed designation F 1589; 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 minimum internal air pressure at which rapid crack propagation (RCP) can be sustained along a section of plastic pipe. This is termed the *critical pressure*.

1.2 This technique achieves steady state RCP in a small specimen by restraining the decompression which normally accompanies fracture, and therefore indicates a lower critical pressure than that measured on the same pipe using full-scale tests. This test method has been called "Small Scale Steady State" or S4.

1.3 This test method was developed for polyethylene pipe, and has been shown to correlate with the full-scale RCP test method. The user should determine if it is applicable to other plastic piping methods.

1.4 The values stated in inch-pound units are to be regarded as the 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:*

D 1600 Terminology for Abbreviated Terms Relating to Plastics[2]

D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings[3]

F 412 Terminology Relating to Plastic Piping Systems[3]

2.2 *ISO Standard:*

ISO 3126 Plastic pipes—Measurement of dimensions[4]

3. Terminology

3.1 Definitions—Definitions are in accordance with Terminology F 412, unless otherwise specified.

3.1.1 *axial pitch*—the center to center distance of the retaining rings that surround the outside diameter.

3.1.2 *baffle pitch*—center to center distance of baffles.

3.1.3 *chisel-ended striker*—the knife-edged projectile (striker) that is used to initiate crack.

3.1.4 *gage length*—nominally 7*D* less initiation section and sealing sections; at least 4.5*D*.

3.2 *Symbols:*Symbols—The following symbols are used in this test method for outside diameter controlled pressure pipe:

3.2.1 *a*—axial crack length into the gage length of the pipe test piece.

3.2.2 *D*—minimum outside diameter of pipe, which is the average outside diameter less the minus tolerance.

3.2.3 *p*—internal pressure within the gage length of the pipe test piece.

3.2.4 *PcS4*—critical pressure for rapid crack propagation, measured using the S4 method.

3.2.5 d_{min}—minimum inside diameter of pipe, calculated as follows:

$$d_{min} = D\left[1 - \frac{2.24}{SDR}\right]$$

3.3 Other abbreviations are in accordance with Terminology D 1600.

4. Significance and Use

4.1 A specified length of pipe, subject to constant internal air pressure, is penetrated near one end by a chisel-ended striker to result in a fast-running axial crack, under conditions where the crack initiation process itself disturbs the pipe as little as possible.

4.2 A series of tests at various measured pressures is used to identify the critical pressure, at which there is a sharp transition from abrupt arrest of this initial crack to continued steady propagation. The crack is said to propagate if the crack length *a* is greater than 4*D*. The critical pressure, P_{cS4}, is the maximum arrest pressure below the lowest propagation pressure. Rapid decompression due to propagation of the crack is retarded by internal baffles and by an external cage which restricts flaring of the pipe at the edges of the fracture. The RCP critical pressure becomes more significant for plastic pipe

[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] *Annual Book of ASTM Standards*, Vol 08.01.

[3] *Annual Book of ASTM Standards*, Vol 08.04.

[4] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.