Designation: F1734 – 24

An American National Standard

Standard Practice for Qualification of a Combination of Squeeze Tool, Pipe, and Squeeze-Off Procedures to Avoid Long-Term Damage in Polyethylene (PE) Gas Pipe[1]

This standard is issued under the fixed designation F1734; 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 practice covers qualifying a combination of a squeeze tool, a polyethylene gas pipe, and a squeeze-off procedure to avoid long-term damage in polyethylene gas pipe. Qualifying is conducted by examining the inside and outside surfaces of pipe specimens at and near the squeeze to determine the existence of features indicative of long-term damage. If indicative features are absent, sustained pressure testing in accordance with Test Method D1598 is conducted to confirm the viability of the squeeze-off process.

NOTE 1—This practice may be useful for evaluating the effects of squeeze-off of other piping materials. If applied to other piping materials, research testing to confirm the applicability of this practice to other materials should be conducted.

NOTE 2—Qualification of historic pipe should follow the historic version of F1734 closest to the pipe manufactured data.

1.2 This practice is appropriate for any combination of squeeze tool, PE gas pipe, and squeeze-off procedure.

1.3 This practice is for use by squeeze-tool manufacturers and gas utilities to qualify squeeze tools made in accordance with Test Method F1563; and squeeze-off procedures based on with Guide F1041 with pipe manufactured in accordance with Specification D2513.

1.4 Governing codes and project specifications should be consulted. Nothing in this practice should be construed as recommending practices or systems at variance with governing codes and project specifications.

1.5 Where applicable in this practice, "pipe" shall mean "pipe and tubing."

1.6 *Units*—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.

1.7 *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.*

1.8 *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]

D1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure

D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

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

F1041 Guide for Squeeze-Off of Polyolefin Gas Pressure Pipe and Tubing

F1563 Specification for Tools to Squeeze-off Polyethylene (PE) Gas Pipe or Tubing

2.2 *ISO Standards*[3]

ISO 4437 Plastics piping systems for the supply of gaseous fuels

3. Terminology

3.1 *Definitions:*

3.1.1 *squeeze-off, n*—a technique used to temporarily control the flow in a polyethylene pipe by flattening the pipe with a mechanical or hydraulic device.

[1] This practice is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.60 on Gas.

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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), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, https://www.iso.org.

3.1.1.1 *Discussion*—Depending on pipe size and wall thickness, stopping flow completely may not be possible. In some cases, attempting to stop flow may over-compress the pipe walls, permanently damage the pipe and lead to premature failure at the squeeze. Some seepage through the squeeze should be expected especially with larger sizes.

3.1.2 *squeeze process, n*—the combination of the squeeze tool, the pipe being squeezed, and the squeeze-off procedure being used.

3.1.3 *wall compression (WC), n*—the percentage extent to which the pipe walls are compressed when the pipe is squeezed. (See Fig. 1.) It is defined as:

$$WC, \% = \left(1 - \frac{L}{2t}\right) \times 100 \quad (1)$$

where:

L = distance between the squeeze tool bars as shown in Fig. 1, and

t = uncompressed pipe wall thickness, expressed in the same units as L.

3.1.3.1 *Discussion*—When the distance between the squeeze tool bars is greater than twice the wall thickness, the pipe walls are not compressed, which yields a negative value for the wall compression percentage. The value becomes positive when the L value is less than the $2t$ value. Typical squeeze tool stops are set for 30 % or less wall compression based on Specification D2513 maximum wall thickness for pipe size and DR combination. This is a distance between the squeeze bars equal to 70 % of twice the maximum wall thickness for pipe size and DR combination when the squeeze tool is closed to the stops. Maximum wall thickness is the minimum wall thickness plus the wall thickness tolerance of 12 %.

4. Significance and Use

4.1 This practice relies on a screening process using visual inspection followed by 80 °C sustained pressure testing to qualify a squeeze-off process.

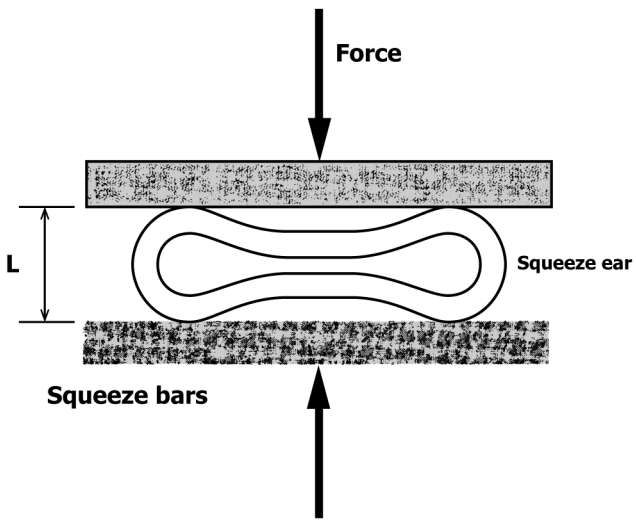

FIG. 1 Definition of Wall Compression

4.2 Squeeze-off is widely used to temporarily control the flow of gas in PE pipe. Squeeze tools vary in squeeze bar shape and size, operating method, and available stop gaps depending on the tool manufacturer and the size of the pipe the tool will be used on. Multiple squeeze tools are required for a range of pipe size and DR combinations. Squeeze-off procedures can vary depending on the tool design, pipe material, pipe size and DR, pipe operating conditions, and pipe environmental conditions.

4.3 Experience indicates that damage leading to gas pipe failure is possible with some combinations of polyethylene material, pipe temperature, tool design, wall compression percentage, and procedure. This practice is useful for determining the suitability of a tool for squeeze-off and for determining acceptable limits for squeeze-off such as acceptable minimum and maximum pipe temperature for squeeze and acceptable line pressure for squeeze. Tests conducted at different pipe temperatures with various sizes of tools and pipes can be used to verify a range of temperatures, tool sizes, and pipe sizes for which the squeeze-off procedure is applicable.

4.4 The area of wrinkling at the ears on the inside diameter (ID) of the pipe and the area on the outside of the pipe opposite the ears are examined. Evidence of any one or a combination of void formation, cracks or extensive localized stress whitening, or failure during sustained pressure testing disqualifies the squeeze-off process.

4.5 Typical unacceptable features implying long-term damage are shown in Appendix X1 photographs.

4.6 Studies of polyethylene pipe extruded in the late 1980s (PE2306 and PE3408) show that damage typically does not develop when the wall compression percentage is 30 % or less, when closure rates are 2 in./minute or less and release rates are 0.5 in./minute or less, and when squeeze bars have radii 4 times or greater than the pipe maximum wall thickness.

4.7 This practice provides a method to qualify a combination of squeeze tool, pipe size and material, and squeeze-off procedure to ensure that long-term damage does not occur. This practice is useful for all polyethylene gas pipe, for all pipe diameters, for new or revised squeeze tool designs, and for new or revised squeeze-off procedures.

5. Apparatus and Materials

5.1 *Squeeze-off Tools,* meeting Specification F1563 that are to be covered by the squeeze-off process.

5.2 *Pipe Cutters and Saws,* capable of cutting the PE pipe.

5.3 *Jeweler's Loupe or (Stereo) Optical Microscope,* providing 10× or higher magnification.

5.4 *Vernier Caliper or Ball-End Micrometer,* with an accuracy of at least 0.001 in.

5.5 *Stopwatch,* that can indicate time to at least the nearest second.

5.6 Sustained pressure testing apparatus in accordance with Test Method D1598.

5.7 Flow testing apparatus similar to that shown in Fig. 2 or Fig. 3.