



Designation: **C1785—16a C1785 – 17**

Standard Test Method for Concentration of Pinhole Detections in Moisture Barriers on Metal Jacketing¹

This standard is issued under the fixed designation C1785; 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 covers the determination of the concentration of pinhole detections in a moisture barrier film or coating that is applied to the interior surface of metal jacketing.

1.2 Since this method relies on the completion through the metal jacketing of an electrical circuit, this method is only applicable to jacketing that is electrically conductive and has a moisture barrier applied which is not electrically conductive.

1.3 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.

1.4 *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

[C168 Terminology Relating to Thermal Insulation](#)

[C1729 Specification for Aluminum Jacketing for Insulation](#)

[C1767 Specification for Stainless Steel Jacketing for Insulation](#)

[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)

[E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method](#)

3. Terminology

3.1 *Definitions*—Definitions in Terminology [C168](#) apply to terms used in this specification.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *continuous pinhole detection*—while the test is being conducted, a continuous sounding of the audible test equipment alarm over an area larger than the contact area of the cellulose sponge.

¹ This test method is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.33 on Insulation Finishes and Moisture.

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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.

3.2.1.1 *Discussion*—

In some cases, large portions of one or more of the test areas (see [8.2.1](#)) or even all of one or more test areas will yield a continuous pinhole detection. This concept of a continuous pinhole detection and the area yielding this performance is necessary to quantify the number of pinhole detections in a sample exhibiting this phenomenon (see [9.2](#) and [9.3](#))

3.2.2 *moisture barrier (moisture retarder)*—a layer of plastic film or other material applied to the inner side of metal jacketing to inhibit jacket corrosion by interfering with the formation of a galvanic cell between the dissimilar metals of the pipe and jacket or by preventing crevice or pitting corrosion.

3.2.3 *pinhole*—a hole completely through a moisture barrier typically too small to be seen by the eye.

3.2.4 *pinhole detection*—a single sounding of the audible test equipment alarm while the test is being conducted.

3.2.4.1 *Discussion*—

Because pinholes are very small and the dampened cellulose sponge contacts the moisture barrier in an area larger than a single pinhole (see 6.4), it is theoretically possible that multiple pinholes in close proximity to each other would register as a single detection. For this reason, this test method measures the concentration of pinhole detections rather than pinholes.

3.2.5 *holiday*—synonymous with pinhole.

4. Summary of Test Method

4.1 A voltage is applied across the nonconductive moisture barrier on metal jacketing using an electrode consisting of a cellulose sponge dampened with an electrically conductive liquid such as tap water. Holes in the moisture barrier lead to completion of an electrical circuit which triggers an audible alarm in the test equipment. The number of pinhole detections collectively in ten specified test areas is determined and reported.

5. Significance and Use

5.1 Corrosion on the interior surface of metal jacketing can be caused by the formation of a galvanic cell between the dissimilar metals of the pipe and jacket or by crevice or pitting corrosion.

5.2 The application of a moisture barrier to the interior surface of the metal jacketing inhibits this corrosion by interfering with the galvanic cell formation or by preventing water from contacting the interior metal surface.

5.3 Holes in the moisture barrier decrease its effectiveness in preventing corrosion. Large holes, scratches, or tears in the moisture barrier visible to the naked eye are easily discerned and are cause for rejection of the metal jacketing.

5.4 Small holes called pinholes or holidays that are not visible to the naked eye but are large enough to allow corrosion are a significant concern and should be avoided to the extent possible.

5.5 This test method is used to quantify the concentration of pinhole detections present in a moisture barrier for the purpose of quality control on metal jacketing with an applied moisture barrier.

5.6 Examples of standards which have specific requirements for the maximum allowable concentration of pinhole detections in the moisture barrier are Specifications **C1729** and **C1767**.

6. Apparatus

6.1 Test equipment shall be a pinhole or holiday detector with an output voltage of 65 to 75 volts DC that emits an audible signal when a connection between the two leads is detected.

NOTE 1—These instruments can be found by performing a web search for “wet sponge pinhole detector” or “wet sponge holiday detector”.

6.2 One lead of the pinhole detector shall have a spring tensioned metal clamp capable of being attached to the metal jacketing.

6.3 The other lead of the pinhole detector shall have a metal clamp capable of securing a cellulose sponge.

6.4 The cellulose sponge clamped to the pinhole detector lead shall have a size capable of touching the moisture barrier of $2 \pm \frac{1}{16}$ by $2 \pm \frac{1}{16}$ in. (50.8 ± 1.6 by 50.8 ± 1.6 mm).

6.5 Test equipment shall have its test voltage and operability validated on a regular basis.

7. Test Specimens

7.1 Specimens tested are metal jacketing rolls or metal jacketing sheets.

7.2 Any width that can be conveniently placed on a table can be tested but the typical width of metal jacketing is 3 ft (0.91 m) or, rarely, 4 ft (1.22 m).

7.3 For rolls, a length of 30 ft (9.1 m) is required.

7.4 For sheets, test as many sheets at a time as will fit on the approximately 30 ft (9.1 m) long testing surface.

8. Procedure

8.1 *Sample Preparation:*

8.1.1 Place specimen(s) on a reasonably flat, level, and clean surface with the moisture barrier facing up.

8.1.2 If necessary, secure the jacketing to the test surface so that it is reasonably flat and does not curl up during testing. This can be done with weights or with clamps. Assure that the securement method does not scratch or damage the moisture barrier.

8.1.3 The moisture barrier must not come in contact with dirt or grit, for example, by walking on the surface, as this is likely to cause damage to the moisture barrier.

8.2 Test Area Selection:

8.2.1 For roll jacketing, select about 4.8 to 5.2 ft² (0.45 to 0.48 m²) in each of ten successive 3 lineal ft (0.91 m) long sections of the test specimen. This yields 10 approximately evenly spaced and evenly sized test areas.

8.2.2 For sheet jacketing, select one or more 4.8 to 5.2 ft² (0.45 to 0.48 m²) sections per sheet. Test enough sheets to yield 10 approximately evenly spaced and evenly sized test areas.

NOTE 2—For both roll and sheet jacketing, a series of ten rectangular test areas of size 2 by 2.5 ft (610 by 762 mm) is recommended.

8.3 Normal Testing Procedure:

8.3.1 Wet a test area with an electrolyte such as tap water without allowing a wet connection to form between the wetted areas and any bare metal edge of the jacketing. Do not flood the moisture barrier surface with electrolyte.

8.3.2 Water tends to run freely on the surface of painted and plastic film moisture barriers so special care must be taken to prevent contact of the electrolyte with the bare metal edges when testing these types.

8.3.3 Allow 5 min after wetting for the water to permeate the moisture barrier.

8.3.4 Test for pinhole detections between five and ten minutes after initial wetting.

8.3.5 Attach one lead of the pinhole tester to bare metal on the jacketing piece being tested.

8.3.6 Wet the cellulose sponge attached to the other lead and move this sponge over the test area such that all portions of the test area are tested once. The presence of one or more pinholes in the area covered by the sponge allows the completion of an electrical circuit which will be signaled by the test equipment as an audible alarm.

8.3.7 During the test, note the number of discrete soundings of the audible alarm in the test area.

8.3.8 If one or more portions of the test area yield a continuous pinhole detection (see 3.2.1), mark these areas.

8.3.8.1 Determine the size of the marked continuous pinhole detection areas in inches squared (millimeters squared) and note this value.

8.3.9 Repeat steps 8.3.1 through 8.3.8 for each of the remaining nine test areas.

8.4 Alternative Testing Procedure:

NOTE 3—This alternative testing procedure is more time-consuming during sample preparation but is useful on those specimens where there are many irregularly shaped relatively small areas of continuous pinhole detection. See X1.2.4 for further information.

8.4.1 Outline a rectangular 4.8 to 5.2 ft² (0.45 to 0.48 m²) test area with a permanent marker. An area of size 2 by 2.5 ft (610 by 762 mm) is recommended.

8.4.2 Using a permanent marker, draw a series of lines 2 in. (51 mm) apart roughly parallel to both sides of the rectangular test area identified and marked per 8.4.1. This will yield 180 marked boxes of size 4 in.² (2581 mm²). The left drawing in Fig. 1 shows an example of a test area marked in the manner described in 8.4.1 and 8.4.2. Note that the size of each marked box is about the same as the size of the sponge specified in 6.4.

8.4.3 Wet the test area with an electrolyte such as tap water without allowing a wet connection to form between the wetted areas and any bare metal edge of the jacketing. Do not flood the moisture barrier surface with electrolyte.

8.4.4 Water tends to run freely on the surface of painted and plastic film moisture barriers so special care must be taken to prevent contact of the electrolyte with the bare metal edges when testing these types.

8.4.5 Allow 5 min after wetting for the water to permeate the moisture barrier.

8.4.6 Test for pinhole detections between five and ten minutes after initial wetting.

8.4.7 Attach one lead of the pinhole tester to bare metal on the jacketing piece being tested.

8.4.8 Wet the cellulose sponge attached to the other lead and touch this sponge with light pressure to each of the 180 squares marked in the test area (see 8.4.2). The presence of one or more pinholes in the area covered by the sponge allows the completion of an electrical circuit which will be signaled by the test equipment as an audible alarm.

8.4.9 During the testing of the 180 squares in the test area, count the number of discrete soundings of the audible alarm in the test area and note this number. This technique differs from that in 8.3.6 because each of the 180 marked squares in the test area is tested individually rather than moving the sponge over the entire test area.

NOTE 4—If the number of squares exhibiting a pinhole detection is large, it is easier to mark each square in which a pinhole detection occurs and then later count the number of marked squares. A grease pencil is recommended for this since a permanent marker will not work because the surface of the moisture barrier is wet.

8.4.10 Repeat steps 8.4.1 – 8.4.9 for each of the remaining nine test areas.

9. Calculations

9.1 Sum the number of discrete pinhole detections in each of the ten test areas to yield a total number of pinhole detections collectively in all ten test areas. Call this sum P1.