



# Standard Practice for Preparation of Specimens and Reporting of Results for Permeance Testing of Pressure Sensitive Adhesive Sealed Joints in Insulation Vapor Retarders<sup>1</sup>

This standard is issued under the fixed designation C1809; 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 provides instruction for the preparation of test specimens of pressure sensitive adhesive (psa) sealed joints of the type employed in insulation vapor retarder systems, for subsequent testing per Test Methods E96/E96M to determine the water vapor permeance (“permeance”) of those joints. It does not cover preparation of other types of joints.

1.2 This practice also provides requirements for the content of reports issued in conjunction with Test Methods E96/E96M testing of these joints.

1.3 Joints are made with factory coated psa tapes or psa coated laminate jacket (vapor retarder cladding) materials.

1.3.1 The types of materials and joints to be tested are generally encountered in mechanical systems in commercial and industrial insulation applications, and in HVAC systems insulation.

1.3.2 Typical psa joints that are employed in vapor retarder systems for mechanical insulation include:

1.3.2.1 Overlap with double-sided tape.

1.3.2.2 Overlap with coated laminate jacket.

1.3.2.3 Butt with single-sided insulation tape.

1.3.2.4 Intersection of overlap and butt joint.

1.4 Test Methods E96/E96M is to be followed for specific testing instruction beyond the areas of guidance provided herein, that is, after the specimens are prepared in the desired test configuration.

1.5 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.

1.6 *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 appro-*

*priate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

C1775 Specification for Laminate Protective Jacket and Tape for Use over Thermal Insulation for Outdoor Applications

E96/E96M Test Methods for Water Vapor Transmission of Materials

C168 Terminology Relating to Thermal Insulation

## 3. Terminology

3.1 *Definitions:*

3.1.1 *laminate jacket*—see Specification C1775.

3.1.2 *water vapor permeance, water vapor barrier*—see Terminology C168.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *pressure sensitive adhesive, n*—an adhesive that requires some degree of pressure, and only pressure, to adequately bond to a substrate.

3.2.2 *SSL tape, n*—A pressure sensitive, double-sided “Self Sealing Lap” tape that is commonly used to seal the longitudinal overlap joint in pipe insulation jacketing.

## 4. Summary of Practice

4.1 Specimen preparation as directed herein addresses configuration and sealing of psa joints for subsequent permeance testing.

4.2 The permeance test itself is performed per Test Methods E96/E96M.

## 5. Significance and Use

5.1 PSA joints are a necessary and critical component of an insulation vapor retarder system and, in addition to knowing

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.40 on Insulation Systems.

Current edition approved March 1, 2016. Published April 2016. Originally approved in 2015. Last previous edition approved in 2015 as C1809 – 15. DOI: 10.1520/C1809-16.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

the permeance of the vapor retarder being used, assessing the permeance of the joints is necessary to indicate the expected performance of the system.

5.2 Test Methods E96/E96M does not include instructions specific to preparing multiple-piece assemblies such as psa joints. This practice provides those instructions.

5.3 There are a number of variables involved in making a psa joint, and those need to be considered in specimen preparation and data reporting. Such variables include:

- 5.3.1 Means of applying pressure to seal the joint,
- 5.3.2 Amount of pressure applied,
- 5.3.3 Dwell time prior to test,
- 5.3.4 Backing surface upon which joint is prepared,
- 5.3.5 Ambient conditions for specimen preparation,
- 5.3.6 Dimensions of materials,
- 5.3.7 Configuration of joint,
- 5.3.8 Dish size,
- 5.3.9 Test area of specimen, and
- 5.3.10 Area of joint.

5.4 It is not likely that field-installed joints will achieve as good a seal as those prepared in the laboratory. Field installations can involve extremes in ambient conditions, surface contamination, limited space, varying pipe radii, varying pressure applied, and variation in base insulation density and rigidity.

5.4.1 Results obtained through application of this practice and Test Methods E96/E96M are best used to compare mate-

rials and configurations. It is urged not to equate actual field performance with the results obtained in a laboratory setting.

## 6. Procedure

6.1 Use an aluminum test dish with nominal outside diameter of 6 in. (152 mm) and specimen template with nominal outside diameter of 5.75 in. (146 mm).

6.2 Use a wax damming plate that produces an exposed specimen test surface diameter of 5.25 in. (133.5 mm).

6.3 Prepare specimens on a flat, smooth, hard and rigid surface, such as laboratory bench top, under standard conditions of 73°, ± 2°F (23°, ± 0.7°C) and 50 ± 5% RH.

### 6.4 Butt Joints:

6.4.1 Position the tape centered over two adjacent sheets of vapor retarder (see Fig. 1).

6.4.2 Separate the two sheets by a gap of 0.5 in. (12 mm) to duplicate a nominal field installation gap, centered in the dish.

6.4.3 Apply a 3 in. (76 mm) wide tape, centered over the gap.

### 6.5 Self-Sealing Overlap Joints:

6.5.1 Position the tape and vapor retarder sheets, or cladding sheets, so that there is a 1 in. (25 mm) overlap (see Fig. 2).

6.5.2 Center the exposed edge in the dish.

### 6.6 Overlap Seams with Single-Sided Tape Covering:

6.6.1 Overlap the vapor retarder by 1 in. (25 mm) with exposed lap edge centered in dish.

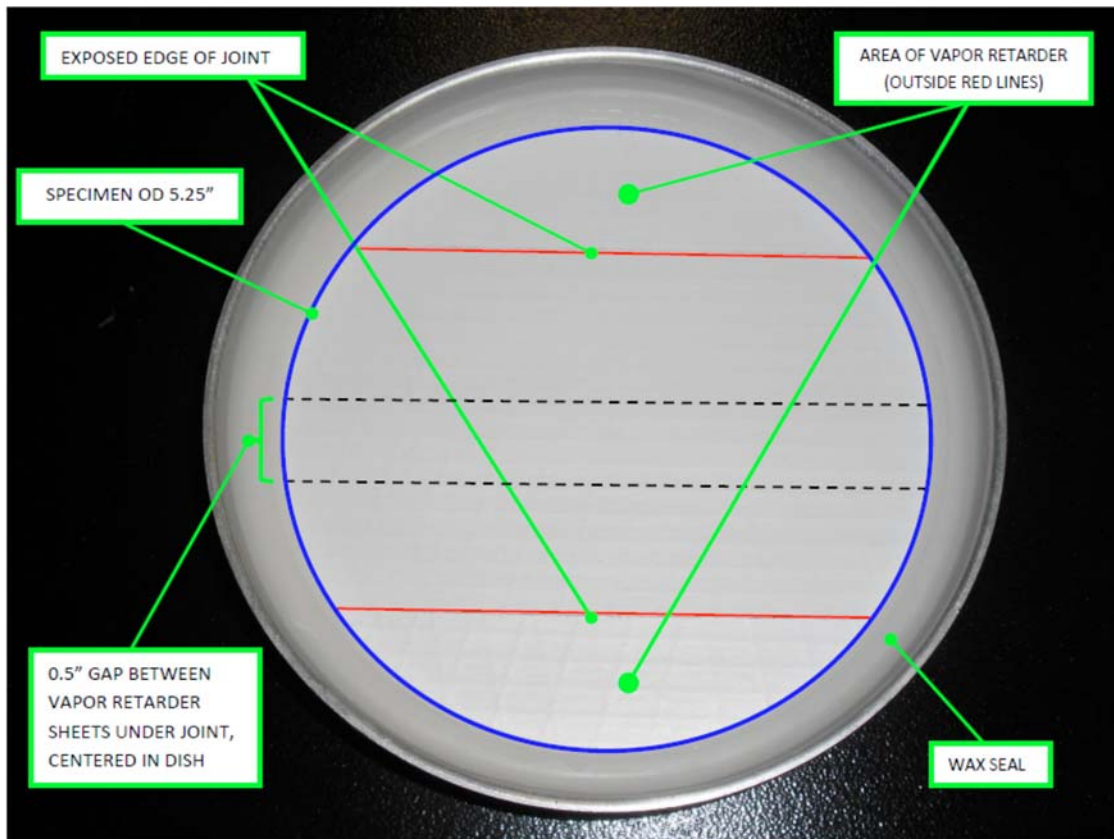


FIG. 1 Butt Joint Seam with a 3 in. Single-sided Tape Covering

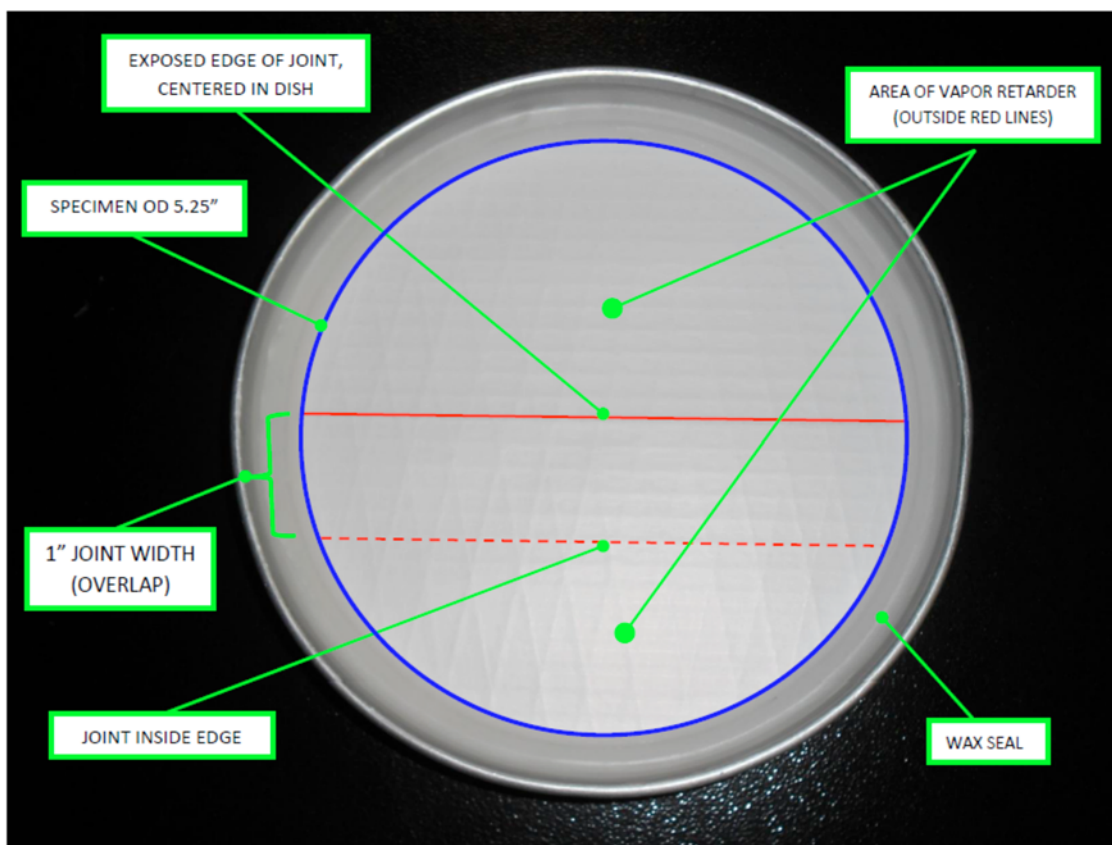


FIG. 2 1 in. Overlap Seam with Double-Sided Tape (SSL), or PSA Coated Cladding

6.6.2 Center a 3 in. (75 mm) single-sided tape over the exposed lap edge (see Fig. 3).

6.7 In all cases, make the vapor retarder sheet somewhat larger than the test specimen dimensions, then trim to correct size after making joint(s).

6.8 To seal the joint, use a 4 in. (102 mm) wide plastic tape applicator squeegee, available from insulation tape suppliers.

6.8.1 Apply a manual force of nominally 5 lbs. (2.3 kg) when rubbing the joint with the squeegee.

6.8.1.1 Practice exerting this force by applying the rubbing motion on a flat digital scale of 10-20 lb. (4.5-9.0 kg) capacity.

6.8.2 Rub down the joint using two passes in one direction only.

6.9 Do not apply additional force or passes to any parts of the joint.

6.10 If one surface of the vapor retarder or tape is hygroscopic (such as standard ASJ with exposed paper), test with non-hygroscopic side up. (In this case the joint is “upside down”, but this should not affect moisture ingress.)

## 7. Test Methods

7.1 Test Methods E96/E96M is to be used, employing a wax/resin seal.

7.2 Test the vapor retarder material by itself (without joints) to establish its permeance.

7.3 Test the specimens with joints.

NOTE 1—Per Test Methods E96/E96M, for a given configuration, three or four specimens, plus a dummy specimen, are tested.

7.4 Any test chamber conditions may be employed. The following are either commonly used, or may be appropriate for expected end use conditions or specification requirements:

7.4.1 Test Methods E96/E96M Procedure A, desiccant method at 73°F (23°C).

7.4.2 Test Methods E96/E96M Procedure B, water method at 73°F (23°C).

7.4.3 Test Methods E96/E96M Procedure E, desiccant method at 100°F (38°C).

## 8. Calculation of Result

8.1 Permeance of the psa joint is based on the area of the joint.

8.2 The permeance of the vapor retarder must be known.

8.3 Calculate the permeance attributable to the psa joint alone as follows:

$$P_j = [(A_s \cdot P_s) - (A_v \cdot P_v)] / A_j \quad (1)$$

$A_s$  = Area of full test specimen

$P_s$  = Permeance of full test specimen

$A_v$  = Area vapor retarder only (area not covered by joint)

$P_v$  = Permeance of vapor retarder (known)

$A_j$  = Area of psa joint (total area of specimen minus the area of two vapor retarder-only segments)

$P_j$  = Permeance of psa joint in test, at the tested width

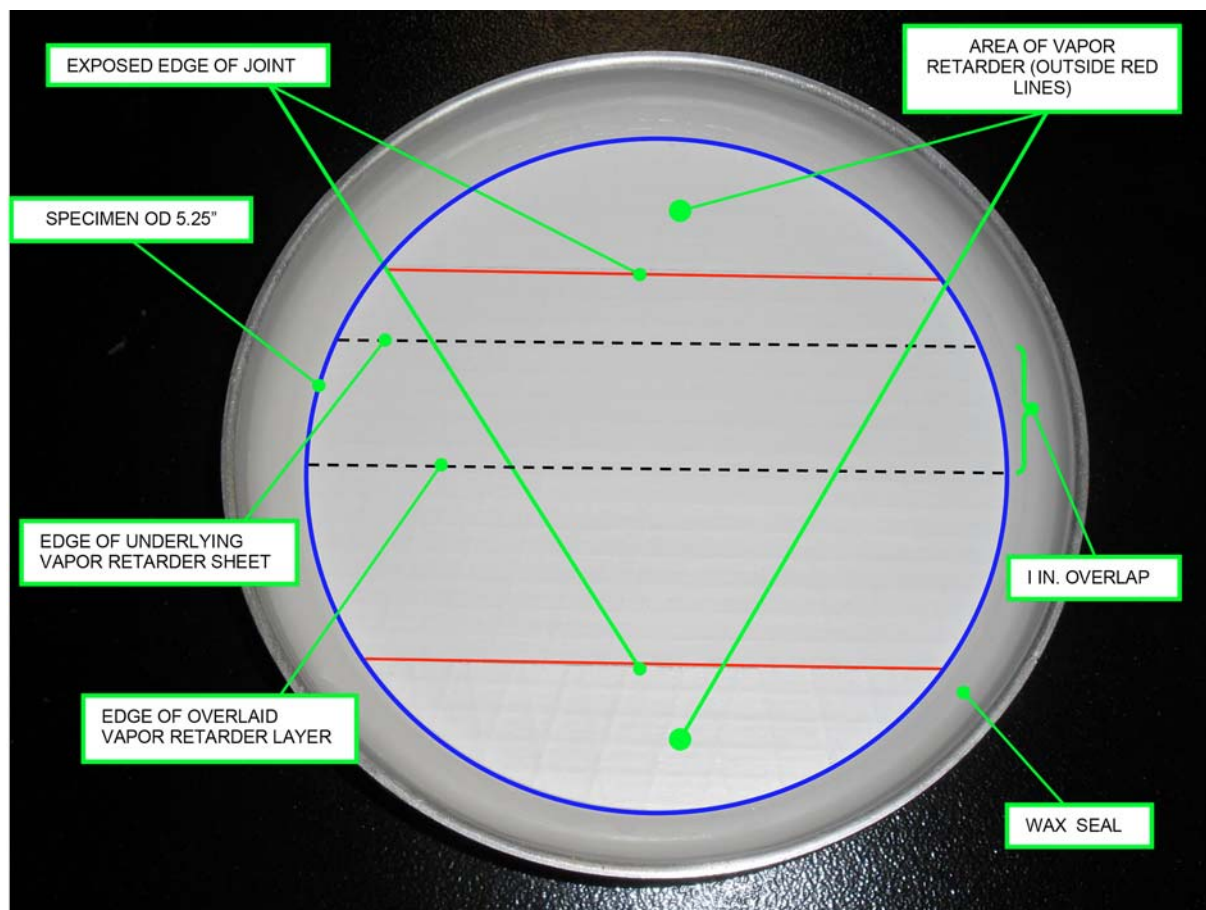


FIG. 3 Overlap Seam with 3 in. Single-Sided Tape Covering

#### 8.4 Known Values:

- 8.4.1 Area of full test specimen: 21.65 in.<sup>2</sup>.
- 8.4.2 Area of vapor retarder only, for butt joint: 6.80 in.<sup>2</sup>.
- 8.4.3 Area of joint, butt: 14.85 in.<sup>2</sup>.
- 8.4.4 Area of vapor retarder only, for self-sealing overlap joint: 16.53 in.<sup>2</sup>.
- 8.4.5 Area of joint, self-sealing overlap: 5.12 in.<sup>2</sup>.
- 8.4.6 Area of vapor retarder only, for overlap with single-sided tape covering: 6.80 in.<sup>2</sup>.
- 8.4.7 Area of joint, overlap with single-sided tape covering: 14.85 in.<sup>2</sup>.

NOTE 2—See Appendix X2 for further discussion of calculation.

## 9. Report

9.1 The following information, at a minimum, is to be included in the test report:

- 9.1.1 Vapor retarder identification,
- 9.1.2 Tape or laminate jacketing identification,
- 9.1.3 Test conditions,
- 9.1.4 Type of joint, and
- 9.1.5 Calculated permeance of psa joint, at stated tested width.

## 10. Keywords

10.1 butt joint; insulation tape; laminate jacketing; overlap joint; permeance; pressure sensitive; SSL; vapor retarder system



**ANNEX****(Mandatory Information)****A1. GEOMETRY AND DIMENSIONS OF TEST SPECIMENS**

A1.1 When testing a singular material per Test Methods **E96/E96M**, the size and shape of the exposed specimen surface is of no impact; only the area need be known.

A1.2 In order to obtain standard performance values for the joints in this test, it is necessary to establish standard geometry and dimensions for the specimens.

A1.3 Varying the overall size of the specimen, the width of the joint, or its location in the test dish (if round) will impact the result obtained.

A1.4 Given the above, these parameters have been standardized for the purposes of laboratory testing and reporting results for pressure sensitive joints.

**APPENDIXES****(Nonmandatory Information)****X1. DISCUSSION OF CALCULATION AND REPORTING OF PERMEANCE FOR THE TESTED JOINT**

X1.1 The permeance calculation uses the area of the joint—that area made up of the pressure sensitive adhesive and the material to which it is originally applied (coated).

X1.2 When using a circular test dish, the area of the joint is found by subtracting the area of the two segments that contain the vapor retarder only from the total specimen area.

X1.2.1 To calculate the area of the vapor retarder only in a circular test dish, (two segments) and of the joint, two values must be known: (1) radius of exposed specimen area, and (2) distance from joint edge to edge of specimen (for both segments), measured perpendicularly from the midpoint of the tape edge.

X1.2.2 These areas are easily determined by the specimen diameter and joint width dimensions specified in the procedure, using a calculator that provides segment area.

X1.3 There are two possible routes of entry of moisture vapor through the seal: (1) laterally through the adhesive layer and (2) through the tape substrate, or backing, which is a vapor retarding material, then into and through the adhesive layer. In some cases, such as a heavy aluminum foil tape, the backing itself is impermeable, so the only route of entry is through the adhesive layer.

X1.4 For practicality in expressing performance, the permeation of water vapor is attributed to the full area of the joint.

**X2. ADDITIONAL INFORMATION TO BE PROVIDED IN REPORTS OR PUBLISHED DATA**

X2.1 For reports, when specimens are prepared in advance by other than the testing lab, this should be noted and the preparer identified.

X2.2 Published data should include the following information to describe the test method employed:

X2.2.1 ASTM Test Methods **E96/E96M**,

X2.2.2 The specific Test Methods **E96/E96M** procedure (method and conditions), or other test conditions, employed, and

X2.2.3 The wording: “Specimens prepared per Practice C1809.”

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/*