Designation: C 1136 – 03

Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation[1]

This standard is issued under the fixed designation C 1136; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers vapor retarders for thermal insulation, specifically, flexible materials with permeance of 0.10 perm or lower and surface burning characteristics of 25 flame spread/50 smoke or lower. These materials are intended for use at surface temperatures of −20 to 150°F (−29 to 66°C). It does not cover mastics or barrier coatings applied in liquid form, nor materials intended for use as weather barriers.

1.2 This specification provides physical requirements for vapor retarders. Practice C 755 should provide assistance in solving problems related to moisture vapor transmission through thermal insulation materials.

1.3 The values stated in inch-pound units are to be regarded as standard. The SI units given in parentheses are for information only.

1.4 The following precautionary caveat pertains to the test methods portion only, Section 10, of this specification: *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:*

C 168 Terminology Relating to Thermal Insulation[2]

C 755 Practice for Selection of Vapor Retarders for Thermal Insulation[2]

C 1258 Test Method for Elevated Temperature and Humidity Resistance of Vapor Retarders for Insulation[2]

C 1263 Test Method for Thermal Integrity of Flexible Water Vapor Retarders[2]

C 1338 Test Method for Determining Fungi Resistance of Insulation Materials and Facings[2]

D 828 Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus[3]

D 882 Test Methods for Tensile Properties of Thin Plastic Sheeting[4]

D 1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature[5]

E 84 Test Method for Surface Burning Characteristics of Building Materials[6]

E 96 Test Methods for Water Vapor Transmission of Materials[2]

2.2 *TAPPI Standards:*

T461 Flame Resistance of Treated Paper and Paperboard

T803 Puncture Test of Containerboard

3. Terminology

3.1 *Definitions*—Definitions in Terminology C 168 apply to terms used in this specification.

4. Classification

4.1 Classification of vapor retarders is based on vapor retardance and strength properties, as listed in Table 1.

5. Materials and Manufacture

5.1 Vapor retarders may be constructed of any number of various films, foils, cloths, papers, and reinforcements, alone or in combination, to achieve required performance.

6. Physical Properties

6.1 Maximum permeance for a specific type vapor retarder shall be as shown in Table 1 when tested in accordance with 10.1.

6.2 All vapor retarders shall demonstrate a flame spread of 25 or less and smoke developed of 50 or less when testing the

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[2] *Annual Book of ASTM Standards*, Vol 04.06.

[3] *Annual Book of ASTM Standards*, Vol 15.09.

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

[5] *Annual Book of ASTM Standards*, Vol 08.03.

[6] *Annual Book of ASTM Standards*, Vol 04.07.

TABLE 1 Physical Property Requirements

Physical Properties	Type					
	I	II	III	IV	V	VI
Permeance, max, Perms ($Ng \cdot Pa^{-1}s^{-1}m^{-2}$)	0.02 (1.15)	0.02 (1.15)	0.10 (5.75)	0.10 (5.75)	0.20 (1.15)	0.03 (1.72)
Puncture Resistance, min, Beach units (metric units)	50 (58)	25 (29)	50 (58)	25 (29)	175 (87)	25 (29)
Machine Direction Tensile, min, lb/in. width (N/mm width, min)	45 (7.9)	30 (5.3)	45 (7.9)	30 (5.3)	40 (7.0)	20 (3.5)
Cross Direction Tensile, min, lb/in. width (N/mm width, min)	30 (5.3)	20 (3.5)	30 (5.3)	20 (3.5)	60 (10.6)	30 (5.3)
Dimensional Change, max %	0.50	0.50	0.50	0.50	4.5	2.6

finish side (the side opposite that contacting the insulation) in accordance with 10.2.

6.3 Minimum tensile strength for a specific type vapor retarder shall be as shown in Table 1 when tested in accordance with 10.3.

6.4 Maximum dimensional change for a specific type vapor retarder shall be as shown in Table 1, when tested in accordance with 10.4.

6.5 All type vapor retarders shall not substain growth of fungi when tested in accordance with 10.5.

6.6 All type vapor retarders shall not crack or delaminate at temperatures from −20 to 150°F (−29 to 66°C) when tested in accordance with 10.6.

6.7 Minimum puncture resistance for a specific type vapor retarder shall be as shown in Table 1 when tested in accordance with 10.7.

6.8 Vapor retarders containing paper or paper products shall not demonstrate an increase in char length of more than 20 % when tested in accordance with 10.8.

6.9 All type vapor retarders shall not corrode or delaminate, nor demonstrate, after exposure, a permeance greater than the maximum allowable for the type being tested, when tested in accordance with 10.9.

7. Dimensions, Mass, and Permissible Variations

7.1 Dimensions for roll or sheeted materials shall be as specified by the purchaser.

7.2 Tolerance for roll materials shall be ±⅛ in. (±3 mm) on width and +5, −0 % on length.

7.3 Tolerance for sheeted materials shall be ±⅛ in. (±3 mm) on length and width.

8. Workmanship, Finish, and Appearance

8.1 There shall be no defects in materials or workmanship that will affect the required performance of the vapor retarder.

8.2 There shall be no defects that adversely affect the appearance of the vapor retarder.

8.3 There shall be no defects that would affect ability of user to process material.

9. Significance and Use

9.1 Entrapment of water in thermal insulation caused by condensation of water vapor that has penetrated into the insulation is detrimental to the thermal resistance of the insulation. For this reason, in certain installations where temperature and moisture conditions have the potential to create a vapor driving force toward the insulation, a deterrent to the passage of such vapor into the installed insulation should be provided. This is the primary function of the vapor retarder.

9.2 In addition to the function stated in 9.1, a vapor retarder may provide physical protection and added strength to the insulation system.

9.3 This specification is used to specify material by physical property requirements that address the above prerequisites. The designer of an insulation system, after determining the degree of protection needed for the insulation, can use this specification to specify the appropriate type of vapor retarder when one is required.

10. Test Methods

10.1 *Water Vapor Permeance*—Test water vapor permeance in accordance with Test Method E 96, Procedure A.

10.2 *Surface Burning Characteristics*—Test in accordance with Test Method E 84.

10.3 *Tensile Strength*:

10.3.1 Test the tensile strength of plastic sheet vapor retarders in accordance with Test Method D 882, with results reported in pounds per inch width of specimen (Newtons per millimetre width).

10.3.2 Test the tensile strength of all other vapor retarders in accordance with Test Method D 828, with results reported in pounds per inch of specimen width (Newtons per millimetre width).

10.3.3 Tested specimens shall be 2 in. (51 mm) wide with 1 in. (25 mm) between jaws.

10.3.4 Since the criterium for jaw breaks of Test Method D 828 (a break within 1 in. of jaw) cannot be used with the above specimen configuration, employ visual inspection and appropriate care to ensure that the clamping action is not initiating breakage.

10.4 *Dimensional Stability*:

10.4.1 Test dimensional stability in accordance with Test Method D 1204.

10.4.2 Expose the specimens to a temperature of 150 ± 4°F (66 ± 2°C) for 24 h.

10.5 *Fungi Resistance*:

10.5.1 Test fungi resistance in accordance with Test Method C 1338.

10.5.2 For all tests, inoculate three specimens of the subject sample. Growth on any of the three specimens constitutes failure of the sample.

10.5.3 Test both sides of laminated products that use dissimilar materials, with the exception of a metallic foil side, which need not be tested.

10.5.4 Test either side of single layer products such as polymeric films.

10.6 *Thermal Integrity of Flexible Water Vapor Retarders*—Test in accordance with Test Method C 1263.

10.7 *Puncture Resistance of Vapor Retarders*—Test in accordance with TAPPI Test T803, Puncture Test of Containerboard.

10.7.1 Since only one side of the vapor retarder material will be exposed in service, only that side need be evaluated for puncture resistance.

10.8 *Permanence of Flame Retardancy*—Test in accordance with TAPPI Test 461, Flame Resistance of Treated Paper and Paperboard.

10.9 *Elevated Temperature and Humidity Resistance of Vapor Retarders for Insulation*—Test in accordance with Test Method C 1258.

11. Sampling, Inspection, and Rejection of Defective Material

11.1 A lot of material shall be considered to be the largest quantity of a specific vapor retarder received by the purchaser under one order, or, it so designated by the manufacturer, that quantity of products identified as the particular lot.

11.2 A unit of material shall be considered to be the smallest packaged quantity of vapor retarder within a lot, that is, one roll in a lot of rolls or one bundle of sheets in a lot of sheeted material.

11.3 Inspection shall consist of any tests for specification conformance the user deems necessary. Due to the impracticality of performing some tests on an inspection basis, the user may request certification to specific test requirements.

11.4 Incoming lots shall be sampled at a minimum rate of 5 % of units received for inspection.

11.5 If any nonconformance to specification is detected within the 5 % sample, increase sampling to 10 % of the lot.

11.6 If 50 % or more of the 10 % sampled units is determined to be defective, the lot shall be considered unacceptable.

11.7 It shall be left to the discretion of the user whether to continue sampling for acceptable material. In any case, units found defective shall be considered unacceptable and rejected.

12. Certification

12.1 When specified in the purchaser order or contract, the purchaser shall be furnished certification that samples representing each lot have been either tested or inspected as directed in this specification and the requirements have been met. When specified in the purchaser order or contract, a report of the results shall be furnished.

12.2 *Qualification Requirements*—The following requirements are generally designated for initial product qualification:

12.2.1 Permeance,
12.2.2 Surface burning characteristics,
12.2.3 Tensile strength,
12.2.4 Dimensional stability,
12.2.5 Fungi resistance,
12.2.6 Thermal integrity,
12.2.7 Puncture resistance,
12.2.8 Flame retardance permanence, and
12.2.9 Elevated temperature and humidity resistance.

12.3 *Inspection Requirements*—The following requirements are generally designated for acceptance sampling of lots of qualified products:

12.3.1 Dimensions, and
12.3.2 Workmanship and appearance.

13. Product Marking

13.1 The packaged vapor retarder material shall bear identification including the following information:

13.1.1 Manufacturer,
13.1.2 Product designation,
13.1.3 Roll or sheet dimensions, and
13.1.4 Lot number.

13.2 If required by the user, the packaged material shall bear a marking of conformance to this specification, such as: ASTM C-1136, Type ___.

13.3 If required by the user, material which has been classified as to surface burning characteristics in accordance with Test Method E 84 by an independent testing laboratory agreed upon by both parties, shall bear the authorized label or marking of that institution.

14. Packaging

14.1 Unless otherwise specified, the material shall be supplied in the manufacturers standard commercial package.

15. Keywords

15.1 flexible; low permeance; thermal insulation; vapor retarders

APPENDIX

(Nonmandatory Information)

X1. PERMEANCE UNDER OTHER THAN STANDARD TEST CONDITIONS

X1.1 Transmission of water vapor through a vapor retarder is induced by a vapor pressure differential between sides of the vapor retarder, caused by different conditions of relative humidity from side to side.

X1.2 The resistance of materials to the passage of water may change under varying vapor driving conditions, such as higher or lower temperatures, higher or lower relative humidity differentials, or like differentials at different ranges (that is, 50/0 % as opposed to 75/25 %).

X1.3 For purposes of this specification, a standard test condition is used, that of 73°F (23°C) with 50 % relative humidity on one side and 0 % relative humidity on the other.

X1.4 It is conceivable that a material that meets a requirement for permeance under the test conditions of the specification may not be adequate under actual conditions of use.

X1.5 Since varying test conditions or conditions of use may affect performance (in this or any physical testing), a user may deem it necessary to evaluate a vapor retarder for permeance under conditions more closely approximating actual service conditions.

X1.6 Considerations of such aspects as performance under conditions other than standard test conditions must be agreed upon between user and supplier and do not constitute a part of this specification.