



Designation: C 1136 – 03a

# Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation<sup>1</sup>

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 ( $\epsilon$ ) 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  $150^{\circ}\text{F}$  ( $-29$  to  $66^{\circ}\text{C}$ ). 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:<sup>2</sup>

- C 168 Terminology Relating to Thermal Insulation
- C 755 Practice for Selection of Vapor Retarders for Thermal Insulation
- C 1258 Test Method for Elevated Temperature and Humidity Resistance of Vapor Retarders for Insulation

<sup>1</sup> This specification 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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<sup>2</sup> 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.

- C 1263 Test Method for Thermal Integrity of Flexible Water Vapor Retarders
  - C 1338 Test Method for Determining Fungi Resistance of Insulation Materials and Facings
  - D 828 Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus
  - D 882 Test Method for Tensile Properties of Thin Plastic Sheeting
  - D 1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
  - E 84 Test Method for Surface Burning Characteristics of Building Materials
  - E 96 Test Methods for Water Vapor Transmission of Materials
- 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 finish side (the side opposite that contacting the insulation) in accordance with 10.2.

**TABLE 1 Physical Property Requirements**

Physical Properties	Type I	Type II	Type III	Type IV	Type V	Type VI
Permeance, max Perms (ng·Pa <sup>-1</sup> ·s <sup>-1</sup> ·m <sup>-2</sup> )	0.02 (1.15)	0.02 (1.15)	0.10 (5.75)	0.10 (5.75)	0.02 (1.15)	0.03 (1.72)
Puncture Resistance, min Beach units (Joules) <sup>A</sup>	50 (1.50)	25 (0.75)	50 (1.50)	25 (0.75)	175 (5.23)	25 (0.75)
Tensile, Machine Direction lb/in. width, min (N/mm width, min)	45 (7.9)	30 (5.3)	45 (7.9)	30 (5.3)	40 (7.0)	20 (3.5)
Tensile, Cross Direction lb/in. width, min (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 percent	0.50	0.50	0.50	0.50	4.5	2.6

<sup>A</sup> Previously used metric units were cm/kg. The conversion from Beach units was 1.15 cm/kg/Beach unit.

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 sustain 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  $\pm \frac{1}{8}$  in. ( $\pm 3$  mm) on width and +5, -0 % on length.

7.3 Tolerance for sheeted materials shall be  $\pm \frac{1}{8}$  in. ( $\pm 3$  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 Methods 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 criterion 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  $150 \pm 4^\circ\text{F}$  ( $66 \pm 2^\circ\text{C}$ ) 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.