



Designation: C1668 – 09

Standard Specification for Externally Applied Reflective Insulation Systems on Rigid Duct in Heating, Ventilation, and Air Conditioning (HVAC) Systems¹

This standard is issued under the fixed designation C1668; 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 specification covers the requirements and physical properties of reflective insulation systems applied externally to Rigid Heating, Ventilation, and Air Conditioning (HVAC) duct systems operating at or below 250°F (121.1 °C). These insulation systems consist of one or more low-emittance surfaces, such as metallic foil or metallic deposits, mounted on substrates to produce reflective air spaces. Reflective insulation systems derive their thermal performance from surfaces with an emittance of no greater than 0.1 facing enclosed air spaces.

1.2 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.

1.3 *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:*²
- C168 Terminology Relating to Thermal Insulation
 - C335 Test Method for Steady-State Heat Transfer Properties of Pipe Insulation
 - C390 Practice for Sampling and Acceptance of Thermal Insulation Lots
 - C411 Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation
 - C1045 Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions
 - C1258 Test Method for Elevated Temperature and Humidity Resistance of Vapor Retarders for Insulation

¹ This specification is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.21 on Reflective Insulation.

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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.

- C1338 Test Method for Determining Fungi Resistance of Insulation Materials and Facings
 - C1371 Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emis-someters
 - E84 Test Method for Surface Burning Characteristics of Building Materials
 - E96/E96M Test Methods for Water Vapor Transmission of Materials
 - E2231 Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics
- 2.2 *Other Test Method:*
TAPPI Standard T-512 sp-02 Creasing of Flexible Packag-ing Material Paper Specimens for Testing³

3. Terminology

3.1 Definitions:

3.1.1 Unless otherwise noted, the terms used in this specifi-cation conform to Terminology C168.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *HVAC ducts*—as pertaining to this standard, ducts having rigid rectangular or circular cross-section used to transfer air from the air handling equipment to the conditioned space and return.

3.2.2 *insulation spacers*—material used to form enclosed air spaces that are interior to the reflective insulation system.

3.2.3 *reflective insulation*—thermal insulation consisting of one or more low emittance surfaces, bounding one or more enclosed air space(s). **C168**

4. Classification

4.1 Products covered by this specification are classified according to the substrate material and have the physical properties as listed in Table 1.

4.1.1 *Type A*—Product with polyethylene foam substrate.

4.1.2 *Type B*—Product with polyethylene bubble pack sub-strate.

4.1.3 *Type C*—Product with fiberglass substrate.

³ Available from Technical Association of the Pulp and Paper Industry (TAPPI), 15 Technology Parkway South, Norcross, GA 30092, http://www.tappi.org.

TABLE 1 Classification Criteria

Property	Type A	Type B	Type C	Type D	Type E
Emittance	≤ 0.10	≤ 0.10	≤ 0.10	≤ 0.10	≤ 0.10
Max. Flame Spread Index	25	25	25	25	25
Max. Smoke Developed Index	50	50	50	50	50
Hot Surface Performance	Min. 250°F	Min. 250°F	Min. 250°F	Min. 250°F	Min. 250°F
Water Vapor Permeance (perms)	0.02	0.02	0.02	0.02	0.02

4.1.4 *Type D*—Product with polyester fiber substrate.

4.1.5 *Type E*—Product with kraft paper substrate.

5. Ordering Information

5.1 Specify the required thermal resistance.

5.2 Specify the number of layers of insulation, width, thickness of the insulation system and the configuration of the duct(s) to be insulated.

5.3 Special markings, if required, shall be specified.

5.4 Special performance requirements, if any.

6. Materials and Manufacture

6.1 Reflective insulation shall consist of low-emittance surface(s) with substrates and adhesives required to meet the specified thermal performance and physical properties. Air spaces shall be maintained by use of insulation spacers.

6.2 Multiple layer reflective insulation shall be designed to attain the intended separation of layers. The design separation shall be maintained by the use of proper size, location and method of securing the insulation spacers to the duct system.

6.3 *Dimensions*—Insulation and properly sized insulation spacers shall be furnished in dimensions specifically agreed upon between the producer and the buyer.

7. Physical Properties

7.1 *Emittance*—Low-emittance surfaces used for this insulation shall have a surface emittance of 0.1 or less, as determined in accordance with 10.1.

7.2 *Water Vapor Permeance*—The water vapor permeance shall be determined in accordance with 10.2 and shall meet the requirements of Table 1.

7.3 *Surface Burning Characteristics*—Surface Burning Characteristics shall be determined in accordance with 10.3. The maximum flame spread index shall not exceed 25 and the maximum smoke developed index shall not exceed 50.

7.4 *Aging Resistance*—The laminates of the reflective insulation shall be tested for aging resistance in accordance with 10.4. Three specimens shall be tested. The test specimens shall be shielded from condensate that drips from the ceiling of the humidity chamber during the test.

7.4.1 After exposure the specimens shall be evaluated for visible corrosion and delamination. For purposes of corrosion evaluation, disregard the outer 0.25 in. (6 mm) perimeter. No tested specimen shall exhibit visible corrosion or unaided delamination of layers.

7.4.2 After exposure re-measure the emittance of the samples. No test specimen shall have greater than 0.02 deviation from the original emittance measurement.

7.5 *Adhesive Performance*—Adhesives when used shall show no sign of bleeding when tested in accordance with the

test procedure in 10.5. Disregard bleeding at cut edges. Bleeding or delamination, shall be cause for rejection.

7.6 *Pliability*—Specimens tested in accordance with the procedure in 10.6 shall not show cracking or delamination.

7.7 *Fungi Resistance*—Specimens shall not have growth greater than the comparative item (southern yellow pine) when tested in accordance with 10.7. Use interpretation of results in 7.2 of Test Method C1338.

7.8 *Thermal Resistance*—Determine the thermal resistance in accordance with procedures in 10.8. The surface-to-surface R-value of a test assembly shall not be less than 95 % of the label value when tested in accordance with 10.8.

7.9 *Hot-Surface Performance*—Determine the Hot-Surface performance in accordance with procedures in 10.9. The minimum temperature requirement is 250°F (121.1°C).

8. Workmanship, Finish and Appearance

8.1 The insulation system shall be manufactured, packaged and shipped in such a manner that, when received, it shall be suitable for installation.

9. Sampling

9.1 Sampling shall be performed in accordance with Practice C390.

10. Test Methods

10.1 *Emittance*—The emittance of the product shall be tested in accordance with Test Method C1371.

10.2 *Water Vapor Permeance*—The permeance of the insulation product shall be tested in accordance with Test Method E96/E96M (Desiccant Method).

10.3 *Surface Burning Characteristics*—The surface burning characteristics shall be determined in accordance with Test Method E84 and Practice E2231.

10.4 *Aging Resistance*—The aging resistance of the product shall be determined in accordance with Test Method C1258.

10.5 Adhesive Performance

10.5.1 Bleeding and Delamination:

10.5.2 *Scope*—This test method covers the determination of bleeding and delamination of the reflective insulation.

10.5.3 *Significance and Use*—It is necessary that reflective insulation not show adhesive bleeding or delamination since this could cause a loss of structural integrity, a change to the emittance or a change in water permeability, or both.

10.5.4 *Sampling*—A minimum of three specimens of the reflective insulation, with dimensions of approximately 3 by 6 in. (7.62 by 15.24 cm), shall be tested. The specimens shall be cut from separate locations on a roll or panel of the insulation.

10.5.5 *Procedure*—Suspend the specimens vertically in an oven and heat to a temperature of 356 ± 10°F (180 ± 5°C) for at least 5 hours. Determine, under 5× magnification, if the adhesive has bled or exuded through the surface, or if separation of the foil from substrate (delamination) has occurred.

10.5.6 *Precision and Bias*—No information is presented about either precision or bias of this test method for determining Bleeding and Delamination, since the test results are non-quantitative.

10.6 Pliability: