Heat Insulation Materials Test Procedure –SAE J1324 DEC81

SAE Recommended Practice
Approved December 1981

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PREPRINT

HEAT INSULATION MATERIALS TEST PROCEDURE—SAE J1324 DEC81

SAE Recommended Practice

Report of the Nonmetallic Materials Committee, approved December 1981.

1. Scope—This SAE Recommended Practice provides test methods for determining the characteristics of heat insulation materials. Where applicable, methods of test developed by SAE and ASTM have been referenced.

2. Heat Insulation Terminology

2.1 Conduction—The transfer of heat from one part of a body to another part of the same body or between bodies in physical contact.

2.2 Convection—The transfer of heat by movement of the heated and/or cooled particles of a fluid medium.

2.3 Radiation—A process of emitting energy electromagnetically. (Thermal radiation differs from other forms of heat transfer in that its speed of propagation equals that of light and no intervening medium is required for its transmission.)

2.4 Emittance—The ability of a surface to emit radiant energy. It is expressed as the ratio of the radiant energy emitted per unit time, per unit area, by an opaque material to that by a blackbody at the same temperature.

2.5 Thermal Conductivity (k-Factor)—The rate of heat flow through a homogeneous material under steady-state conditions, through unit area, per unit temperature gradient in the direction perpendicular to an isothermal surface.

$$k = \frac{\text{Btu} \cdot \text{in}}{\text{h} \cdot \text{ft}^2 \cdot {}^\circ\text{F}} \qquad \lambda = \frac{\text{W}}{\text{m} \cdot \text{K}}$$

2.6 Thermal Conductance (C-Factor)—The rate of heat flow under steady-state conditions between two definite surfaces at uniform separation, divided by the difference of their average temperatures and by the area of one surface. The average temperature is one which adequately approximates that obtained by integrating the temperatures of the entire surface.

$$C = \frac{\text{Btu}}{\text{h} \cdot \text{ft}^2 \cdot {}^\circ\text{F}} \qquad C = \frac{\text{W}}{\text{m}^2 \cdot \text{K}}$$

2.7 Thermal Transmittance (U-Factor) (Overall Coefficient of Heat Transfer)—The rate of heat flow under steady-state conditions from surroundings on one side of a body, through a unit area of the body, to the surroundings on its opposite side, divided by the temperature difference between the two surroundings.

$$U = \frac{\text{Btu}}{\text{h} \cdot \text{ft}^2 \cdot {}^\circ\text{F}} \qquad U = \frac{\text{W}}{\text{m}^2 \cdot \text{K}}$$

2.8 Table of Abbreviations

Btu = British thermal units
ft = foot
h = hour
°F = degree Fahrenheit
in = inch
λ = metric symbol for thermal conductivity
W = watt
m = meter
K = degree kelvin
°C = degree Celsius (centigrade)

3. Conditioning—Test for material classification and for arbitration purposes shall be made on material conditioned to a constant weight in a controlled atmosphere of 21 ± 1°C (70 ± 2°F) and 50 ± 5% relative humidity. Quality control tests may be conducted on unconditioned specimens unless otherwise specified by the user.

4. Thickness—See SAE J1355, "Test Method for Measuring Thickness of Resilient Insulating Paddings."

5. Mass (Weight) per Unit Area—The mass (weight) per unit area determination shall be made according to the method described in SAE J315 SEP80, Section 6, and shall be reported as kg/m² (lb/ft²).

6. Density—The density shall be calculated, using the thickness and mass (weight) per unit area figures from paragraphs 4 and 5 and using the formula $d = \frac{M}{t}$ . . . . where d = density in kg/m³ (lb/ft³), M = mass (weight) per unit area in kg/m² (lb/ft²), and t = thickness in m (ft).

7. Thermal Conductivity (k-Factor)—For routine evaluation, quality control, and classification of materials, testing shall be conducted according to the method specified in ASTM C518. For arbitration purposes, the test method specified in ASTM C177, shall be used. Test results, in all cases, shall be reported in units of:

$$\frac{\text{W}}{\text{m} \cdot \text{K}} \qquad \frac{\text{Btu} \cdot \text{in}}{\text{h} \cdot \text{ft}^2 \cdot {}^\circ\text{F}}$$

The mean temperature, at which the k-Factor was determined, shall be reported. The temperature of the top and bottom platens contacting the surfaces of the test specimen shall also be reported.

8. Resistance to Heat Flow (R-Factor)—The R-Factor for a homogeneous material can be calculated from its k-factor and the thickness (t) of the material by the following formula: $R = \frac{t}{k}$

9. Heat Resistance—See SAE J1361 "Hot Plate Method for Evaluating Heat Resistance and Thermal Insulation Properties of Materials."

10. Resistance to Staining—See SAE J1326 "Test Method for Measuring Wet Color Transfer Characteristics."

11. Stiffness—Drapeability Test—See SAE J1325 "Test Method for Measuring the Relative Drapeability of Flexible Insulation Materials."

12. Compression-Recovery—See SAE J1352 "Compression and Recovery of Insulation Paddings."

13. Dimensional Stability—The linear expansion and contraction shall be determined by the test methods described in SAE J315b, Part 13.

13.1 % Expansion—Use Method A.

13.2 % Contraction—Use Method A, followed by Method C.

14. Odor—See SAE J1351, "Hot Odor Test for Insulation Materials."