SAE J1324 NOV84

Heat Insulation Materials Test Procedure

SAE Recommended Practice
Revised November 1984

an American National Standard

Ø HEAT INSULATION MATERIALS TEST PROCEDURE

1. **SCOPE**:

    This SAE Recommended Practice provides test methods for determining the characteristics of acoustical and thermal materials. Where applicalbe, methods of test developed by SAE and ASTM have been referenced.

2. **TERMINOLOGY**:

2.1 **Acoustical Terminology**:

2.1.1 **Sound Absorption**: Sound absorption is the change of sound energy into some other form, usually heat, in passing through a medium or on striking a surface.

2.1.2 **Transmission Loss**: Transmission loss is the reduction in the magnitude of some characteristic of a signal, between two stated points in a transmission system.

2.1.3 **Damping**: Damping is the dissipation of energy with time or distance.

   NOTE: Acoustical terminology adopted from ANSI 11-1960 (R 1971).

2.2 **Thermal Terminology**:

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

2.2.2 **Convection**: The transfer of heat by movement of the heated and/or cooled particles of a fluid medium.

2.2.3 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.)

2.2.4 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.

2.2.5 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.

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

2.2.6 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.

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

2.2.7 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.

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

2.2.8 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. TEST PROCEDURES:

3.1 Thickness: See SAE J1355, "Test Method for Measuring Thickness of Resilient Insulating Paddings."

3.2 Mass (Weight) per Unit Area: The mass (weight) per unit area determination shall be made according to the method described in SAE J315 Section 6, and shall be reported as kg/m^2 (lb/ft^2).

3.3 Density: The density shall be calculated, using the thickness and mass (weight) per unit area figures from paragraphs 3.1 and 3.2 and using the formula $d = \dfrac{M}{t}$ . . . . where d = density in kg/m^3 (lb/ft^3), M = mass (weight) per unit area in kg/m^2 (lb/ft^2), and t = thickness in m (ft).

3.4 Thermal Conductivity (k-Factor): For routine evaluation, quality control, and classification of materials, testing shall be conducted according to the method specified in ASTM C 518. For arbitration purposes, the test method specified in ASTM C 177, shall be used. Test results shall be reported in units of: λ or k.

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.

3.5 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: $R = \dfrac{t}{k}$

3.6 Heat Resistance: See SAE J1361, "Hot Plate Method for Evaluating Heat Resistance and Thermal Insulation Properties of Materials."

3.7 Resistance of Staining: See SAE J1326, "Test Method for Measuring Wet Color Transfer Characteristics."

3.8 Stiffness - Drapeability Test: See SAE J1325, "Test Method for Measuring the Relative Drapeability of Flexible Insulation Materials."

3.9 Compression-Recovery: See SAE J1352, "Compression and Recovery of Insulation Paddings."

3.10 Dimensional Stability: The linear expansion and contraction shall be determined by the test methods described in SAE J315, Part 13.

3.10.1 % Expansion - Use Method A.

3.10.2 % Contraction - Use Method A, followed by Method C.

3.11 Odor: See SAE J1351, "Hot Odor Test for Insulation Materials."

3.12 <u>Corrosion</u>:   See SAE J1389 MAY82, "Corrosion Test for Insulation Materials."

3.13 <u>Sound Absorption</u>:

3.13.1 <u>Normal Incidence</u>:   See ASTM C 384, "Test for Impedance and Absorption of Acoustical Materials by the Impedance Tube Method."

3.13.2 <u>Random Incidence</u>:   See ASTM C 423, "Test for Sound Absorption and Sound Absorption Coefficient by the Reverberation Room Method."

3.14 <u>Vibration Damping</u>:   See ASTM E 756, "Measuring Vibration-Damping Properties of Materials.

3.15 <u>Airborne Noise Reduction</u>:   See SAE J1400, "Laboratory Measurement of the Airborne Noise Reduction of Acoustical Materials."

4. <u>GENERAL COMMENTS</u>:

4.1 <u>Conditioning</u>:   Some materials require specific conditioning prior to testing when applicable, see ASTM C 870.