Designation: C 1045 – 01

Standard Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions[1]

This standard is issued under the fixed designation C 1045; 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 practice provides the user with a uniform procedure for calculating the thermal transmission properties of a material or system from data generated by steady state, one dimensional test methods used to determine heat flux and surface temperatures. This practice is intended to eliminate the need for similar calculation sections in Test Methods C 177, C 335, C 518, C 976, C 1033, C 1114 and C 1363 by permitting use of these standard calculation forms by reference.

1.2 The thermal transmission properties described include: thermal conductance, thermal resistance, apparent thermal conductivity, apparent thermal resistivity, surface conductance, surface resistance, and overall thermal resistance or transmittance.

1.3 This practice provides the method for developing the apparent thermal conductivity as a function of temperature relationship for a specimen from data generated by standard test methods at small or large temperature differences. This relationship can be used to characterize material for comparison to material specifications and for use in calculation programs such as Practice C 680.

1.4 The SI unit values used in this practice are considered standard.

1.5 This practice includes a discussion of the definitions and underlying assumptions for the calculation of thermal transmission properties. Tests to detect deviations from these assumptions are described. This practice also considers the complicating effects of uncertainties due to the measurement processes and material variability. See Section 7.

1.6 This practice is not intended to cover all possible aspects of thermal properties data base development. For new materials, the user should investigate the variations in thermal properties seen in similar materials. The information contained in Section 7, the Appendix and the technical papers listed in the References section of this practice may be helpful in determining whether the material under study has thermal properties that can be described by equations using this practice. Some examples where this method has limited application include: (*1*) the onset of convection in insulation as described in Reference **(21)**; (*2*) a phase change of one of the insulation system components such as a blowing gas in foam; and (*3*) the influence of heat flow direction and temperature difference changes for reflective insulations.

2. Referenced Documents

2.1 *ASTM Standards:*

C 168 Terminology Relating to Thermal Insulating Materials[2]

C 177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus[2]

C 335 Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulations[2]

C 518 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus[2]

C 680 Practice for Determination of Heat Gain or Loss and the Surface Temperature of Insulated Pipe and Equipment Surfaces by the Use of a Computer Program[2]

C 976 Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box[2]

C 1033 Test Method for Steady-State Heat Transfer Properties of Pipe Insulation Installed Vertically[2]

C 1058 Practice for Selecting Temperatures for Evaluating and Reporting Properties of Thermal Insulation[2]

C 1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus[2]

C 1199 Test Method for Measuring the Steady-State Thermal Transmittance of Fenestration Systems Using Hot Box Methods[2]

C 1363 Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus[2]

E 122 Practice for Choice of Sample Size to Estimate the Average Quality of a Lot or Process[3]

3. Terminology

3.1 *Definitions*— The definitions and terminology of this practice are intended to be consistent with Terminology C 168. However, because exact definitions are critical to the use of this

[1] This practice is under the jurisdiction of ASTM Committee C16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.30 on Thermal Measurements.

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

[3] *Annual Book of ASTM Standards*, Vol 14.02.

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