



Standard Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions¹

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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 [C177](#), [C335](#), [C518](#), [C1033](#), [C1114](#) and [C1363](#) and Practices [C1043](#) and [C1044](#) 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 [C680](#).

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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 ([1](#)); (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:²

- [C168 Terminology Relating to Thermal Insulation](#)
- [C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus](#)
- [C335 Test Method for Steady-State Heat Transfer Properties of Pipe Insulation](#)
- [C518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus](#)
- [C680 Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs](#)
- [C1033 Test Method for Steady-State Heat Transfer Properties of Pipe Insulation Installed Vertically \(Withdrawn 2003\)³](#)
- [C1043 Practice for Guarded-Hot-Plate Design Using Circular Line-Heat Sources](#)
- [C1044 Practice for Using a Guarded-Hot-Plate Apparatus or Thin-Heater Apparatus in the Single-Sided Mode](#)
- [C1058 Practice for Selecting Temperatures for Evaluating and Reporting Thermal Properties of Thermal Insulation](#)
- [C1114 Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus](#)

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 Measurement.

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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.

³ The last approved version of this historical standard is referenced on www.astm.org.