



Standard Practice for Determining Thermal Resistance of Building Envelope Components from the In-Situ Data¹

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1. Scope

1.1 This practice covers how to obtain and use data from in-situ measurement of temperatures and heat fluxes on building envelopes to compute thermal resistance. Thermal resistance is defined in Terminology C 168 in terms of steady-state conditions only. This practice provides an estimate of that value for the range of temperatures encountered during the measurement of temperatures and heat flux.

1.2 This practice presents two specific techniques, the summation technique and the sum of least squares technique, and permits the use of other techniques that have been properly validated. This practice provides a means for estimating the mean temperature of the building component for estimating the dependence of measured R -value on temperature for the summation technique. The sum of least squares technique produces a calculation of thermal resistance which is a function of mean temperature.

1.3 Each thermal resistance calculation applies to a subsection of the building envelope component that was instrumented. Each calculation applies to temperature conditions similar to those of the measurement. The calculation of thermal resistance from in-situ data represents in-service conditions. However, field measurements of temperature and heat flux may not achieve the accuracy obtainable in laboratory apparatuses.

1.4 This practice permits calculation of thermal resistance on portions of a building envelope that have been properly instrumented with temperature and heat flux sensing instruments. The size of sensors and construction of the building component determine how many sensors shall be used and where they should be placed. Because of the variety of possible construction types, sensor placement and subsequent data analysis require the demonstrated good judgement of the user.

1.5 Each calculation pertains only to a defined subsection of the building envelope. Combining results from different subsections to characterize overall thermal resistance is beyond the scope of this practice.

1.6 This practice sets criteria for the data-collection techniques necessary for the calculation of thermal properties (see

Note 1). Any valid technique may provide the data for this practice, but the results of this practice shall not be considered to be from an ASTM standard, unless the instrumentation technique itself is an ASTM standard.

NOTE 1—Currently only Practice C 1046 can provide the data for this practice. It also offers guidance on how to place sensors in a manner representative of more than just the instrumented portions of the building components.

1.7 This practice pertains to light-through medium-weight construction as defined by example in 5.8. The calculations apply to the range of indoor and outdoor temperatures observed.

1.8 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.9 *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:

C 168 Terminology Relating to Thermal Insulating Materials²

C 1046 Practice for In-Situ Measurement of Heat Flux and Temperature on Building Envelopes²

C 1060 Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings²

C 1130 Practice for Calibrating Thin Heat Flux Transducers²

C 1153 Practice for the Location of Wet Insulation in Roofing Systems Using Infrared Imaging²

3. Terminology

3.1 *Definitions*—For definitions of terms relating to thermal insulating materials, see Terminology C 168.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *building envelope component*—the portion of the building envelope, such as a wall, roof, floor, window, or door, that has consistent construction. — For example, an exterior stud wall would be a building envelope component, whereas a

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 *Annual Book of ASTM Standards*, Vol 04.06.