



# Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus<sup>1</sup>

This standard is issued under the fixed designation C1363; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method establishes the principles for the design of a hot box apparatus and the minimum requirements for the determination of the steady state thermal performance of building assemblies when exposed to controlled laboratory conditions. This method is also used to measure the thermal performance of a building material at standardized test conditions such as those required in material Specifications C739, C764, C1224 and Practice C1373.

1.2 This test method is used for large homogeneous or non-homogeneous specimens. This test method applies to building structures or composite assemblies of building materials for which it is possible to build a representative specimen that fits the test apparatus. The dimensions of specimen projections or recesses are controlled by the design of the hot box apparatus. Some hot boxes are limited to planar or nearly planar specimens. However, larger hot boxes have been used to characterize projecting skylights and attic sections. See 3.2 for a definition of the test specimen and other terms specific to this method.

NOTE 1—This test method replaces Test Methods C236, the Guarded Hot Box, and C976, the Calibrated Hot Box which have been withdrawn. Test apparatus designed and operated previously under Test Methods C236 and C976 will require slight modifications to the calibration and operational procedures to meet the requirements of Test Method C1363.<sup>2</sup>

1.3 A properly designed and operated hot box apparatus is directly analogous to the Test Method C177 guarded hot plate for testing large specimens exposed to air induced temperature differences. The operation of a hot box apparatus requires a significant number of fundamental measurements of temperatures, areas and power. The equipment performing these measurements requires calibration to ensure that the data are accurate. During initial setup and periodic verification testing, each measurement system and sensor is calibrated

against a standard traceable to a national standards laboratory. If the hot box apparatus has been designed, constructed and operated in the ideal manner, no further calibration or adjustment would be necessary. As such, the hot box is considered a primary method and the uncertainty of the result is analyzed by direct evaluation of the component measurement uncertainties of the instrumentation used in making the measurements.

1.3.1 In an ideal hotbox test of a homogenous material there is no temperature difference on either the warm or cold specimen faces to drive a flanking heat flow. In addition, there would be no temperature differences that would drive heat across the boundary of the metering chamber walls. However, experience has demonstrated that maintaining a perfect guard/metering chamber balance is not possible and small corrections are needed to accurately characterize all the heat flow paths from the metering chamber. To gain this final confidence in the test result, it is necessary to benchmark the overall result of the hot box apparatus by performing measurements on specimens having known heat transfer values and comparing those results to the expected values.

1.3.2 The benchmarking specimens are homogeneous panels whose thermal properties are uniform and predictable. These panels, or representative sections of the panels, have had their thermal performance measured on other devices that are directly traceable or have been favorably compared to a national standards laboratory. For example, a Test Method C177 Hot Plate, a Test Method C518 Heat Meter or another Test Method C1363 Hot Box will provide adequate specimens. Note that the use of Test Method C518 or similar apparatus creates additional uncertainty since those devices are calibrated using transfer standards or standard reference materials. By performing this benchmarking process, the hot box operator is able to develop the additional equations that predict the magnitude of the corrections to the net heat flow through the specimen that account for any hot box wall loss and flanking loss. This benchmarking provides substantial confidence that any extraneous heat flows can be eliminated or quantified with sufficient accuracy to be a minor factor of the overall uncertainty.

1.4 In order to ensure an acceptable level of result uncertainty, persons applying this test method must possess a knowledge of the requirements of thermal measurements and

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<sup>2</sup> Footnotes in the text are supplied to clarify the discussion only, and as such, are not mandatory.