



Standard Practice for Guarded-Hot-Plate Design Using Circular Line-Heat Sources¹

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1. Scope

1.1 This practice covers the design of a circular line-heat-source guarded hot plate for use in accordance with Test Method C 177.

NOTE 1—Test Method C 177 describes the guarded-hot-plate apparatus and the application of such equipment for determining thermal transmission properties of flat-slab specimens. In principle, the test method includes apparatus designed with guarded hot plates having either distributed- or line-heat sources.

1.2 The guarded hot plate with circular line-heat sources is a design in which the meter and guard plates are circular plates having a relatively small number of heaters, each embedded along a circular path at a fixed radius. In operation, the heat from each line-heat source flows radially into the plate and is transmitted axially through the test specimens.

1.3 The meter and guard plates are fabricated from a continuous piece of thermally conductive material. The plates are made sufficiently thick that, for typical specimen thermal conductances, the radial and axial temperature variations in the guarded hot plate are quite small. By proper location of the line-heat source(s), the temperature at the edge of the meter plate can be made equal to the mean temperature of the meter plate, thus facilitating temperature measurements and thermal guarding.

1.4 The line-heat-source guarded hot plate has been used successfully over a mean temperature range from -10 to $+65^{\circ}\text{C}$, with circular metal plates and a single line-heat source in the meter plate. The chronological development of the design of circular line-heat-source guarded hot plates is given in Refs (1-8).²

1.5 This practice does not preclude (1) lower or higher temperatures; (2) plate geometries other than circular; (3) line-heat-source geometries other than circular; (4) the use of plates fabricated from ceramics, composites, or other materials; or (5) the use of multiple line-heat sources in both the meter and guard plates.

1.6 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 Materials³

C 177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus³

C 1044 Practice for Using the Guarded-Hot-Plate Apparatus in the One-Sided Mode to Measure Steady-State Heat Flux and Thermal Transmission Properties³

E 230 Specification for Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples⁴

2.2 ASTM Adjuncts:

Line-Heat-Source Guarded-Hot-Plate Apparatus⁵

3. Terminology

3.1 *Definitions*—For definitions of terms and symbols used in this practice, refer to Terminology C 168. For definitions of terms relating to the guarded-hot-plate apparatus refer to Test Method C 177.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *gap, n*—a separation between the meter plate and guard plate, usually filled with a gas or thermal insulation.

3.2.2 *guard plate, n*—the outer ring of the guarded hot plate that encompasses the meter plate and promotes one-dimensional heat flow normal to the meter plate.

3.2.3 *guarded hot plate, n*—an assembly, consisting of a meter plate and a co-planar, concentric guard plate, that provides the heat input to the specimens.

3.2.4 *line-heat-source, n*—a thin or fine electrical heating element that provides uniform heat generation per unit length.

3.2.5 *meter area, n*—the mathematical area through which the heat input to the meter plate flows normally under ideal guarding conditions into the meter section of the specimen.

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 The boldface numbers in parentheses refer to a list of references at the end of this practice.

³ Annual Book of ASTM Standards, Vol 04.06.

⁴ Annual Book of ASTM Standards, Vol 14.03.

⁵ Available from ASTM Headquarters. Order Adjunct: ADJC1043.