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Designation: C 680 – 03

Standard 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[1]

This standard is issued under the fixed designation C 680; 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 algorithms and calculation methodologies for predicting the heat loss or gain and surface temperatures of certain thermal insulation systems that can attain one dimensional, steady- or quasi-steady-state heat transfer conditions in field operations.

1.2 This practice is based on the assumption that the thermal insulation systems can be well defined in rectangular, cylindrical or spherical coordinate systems and that the insulation systems are composed of homogeneous, uniformly dimensioned materials that reduce heat flow between two different temperature conditions.

1.3 Qualified personnel familiar with insulation-systems design and analysis should resolve the applicability of the methodologies to real systems. The range and quality of the physical and thermal property data of the materials comprising the thermal insulation system limit the calculation accuracy.

1.4 The computer program that can be generated from the algorithms and computational methodologies defined in this practice is described in Section 7 of this practice. The computer program is intended for flat slab, pipe and hollow sphere insulation systems. An executable version of a program based on this standard may be obtained from ASTM.

1.5 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

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 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 Insulation[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 585 Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)[2]

C 1055 Guide for Heated System Surface Conditions That Produce Contact Burn Injuries[2]

C 1057 Practice for Determination of Skin Contact Temperature from Heated Surfaces Using a Mathematical Model and Thermesthesiometer[2]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology C 168.

3.1.1 *thermal insulation system*—for this practice, a thermal insulation system is a system comprised of a single layer or layers of homogeneous, uniformly dimensioned material(s) intended for reduction of heat transfer between two different temperature conditions. Heat transfer in the system is steady-state. Heat flow for a flat system is normal to the flat surface, and heat flow for cylindrical and spherical systems is radial.

3.2 *Symbols*—The following symbols are used in the development of the equations for this practice. Other symbols will be introduced and defined in the detailed description of the development.

where:

h = surface conductance, Btu/(h·ft^2·°F) (W/(m^2·K)) h_i at inside surface; h_o at outside surface

[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.

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