



Standard Practice for Determination of Skin Contact Temperature from Heated Surfaces Using a Mathematical Model and Thermesthesiometer¹

This standard is issued under the fixed designation C 1057; 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 covers a procedure for evaluating the skin contact temperature for heated surfaces. Two complimentary procedures are presented. The first is a purely mathematical approximation that can be used during design or for worst case evaluation. The second method describes the thermesthesiometer, an instrument that analogues the human sensory mechanism and can be used only on operating systems.

NOTE 1—Both procedures listed herein are intended for use with Guide C 1055. When used in conjunction with that guide, these procedures can determine the burn hazard potential for a heated surface.

1.2 A bibliography of human burn evaluation studies and surface hazard measurement is provided in the References at the end of Guide C 1055. Thermesthesiometer and mathematical modeling references are provided in the References at the end of this practice (1-5).²

1.3 This practice addresses the skin contact temperature determination for passive heated surfaces only. The analysis procedures contained herein are not applicable to chemical, electrical, or other similar hazards that provide a heat generation source at the location of contact.

1.4 *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:³

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.

Current edition approved Oct. 1, 2003. Published October 2003. Originally approved in 1986. Last previous edition approved in 1998 as C 1057-92 (Reapproved 1998)^{ε1}.

² The boldface numbers in parentheses refer to the list of references at the end of this practice.

³ 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.

C 680 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
C 1055 Guide for Heated System Surface Conditions That Produce Contact Burn Injuries

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *acceptable contact time*—the limit of time of contact for the heated surface and the exposed skin. Practice has suggested limits of 5 s for industrial processes and up to 60 s for consumer items.

3.1.2 burns:

3.1.2.1 *first degree burn*—the reaction to an exposure where the intensity and duration is insufficient to cause complete necrosis of the epidermal layer. The normal response to this level of exposure is dilation of the superficial blood vessels (reddening of the skin).

3.1.2.2 *second degree burn*—the reaction to an exposure where the intensity and duration is sufficient to cause complete necrosis of the epidermis but no significant damage to the dermis. The normal response to this exposure is blistering of the epidermis.

3.1.2.3 *third degree burns*—the reaction to an exposure where significant dermal necrosis occurs. Significant dermal necrosis has been defined in the literature as a 75 % destruction of the dermis thickness. The normal response to this exposure is open sores that leave permanent scar tissue upon healing.

3.1.3 skin:

3.1.3.1 *epidermis*—the outermost layer of skin cells. This layer contains no vascular or nerve cells and acts to protect the outer skin layers. The thickness of this layer averages 0.08 mm.

3.1.3.2 *dermis*—the second layer of skin tissue. This layer contains blood vessels and nerve endings. The thickness of this layer is about 2 mm.

3.1.3.3 *necrosis*—localized death of living cells. This is a clinical term that defines when damage to the skin layer has occurred.

3.1.4 *skin contact temperature*—the temperature of the skin at a depth of 0.08 mm reached after contact with a heated surface for a specified time.