



# Standard Practice for Measuring and Compensating for Emissivity Using Infrared Imaging Radiometers<sup>1</sup>

This standard is issued under the fixed designation E1933; 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 practice covers procedures for measuring and compensating for emissivity when measuring the surface temperature of a specimen with an infrared imaging radiometer.<sup>2</sup>

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *These procedures may involve use of equipment and materials in the presence of heated or electrically-energized equipment, or both.*

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:*<sup>3</sup>  
**E1316 Terminology for Nondestructive Examinations**

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *reflected temperature*—the temperature of the energy incident upon and reflected from the measurement surface of the specimen.

3.1.2 *surface-modifying material*—any tape, spray, paint or the like that is used to change the emissivity of the specimen surface.

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.10 on Specialized NDT Methods.

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<sup>2</sup> These procedures are adapted from the *Guideline for Measuring and Compensating for Reflected Temperature, Emittance and Transmittance* developed by the Infrasonics Institute, 425 Ellis Street, Burlington, NJ 08016.

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.2 See also Terminology **E1316**.

## 4. Summary of Practice

4.1 Two procedures are given for measuring the emissivity of a specimen surface, the contact thermometer method and the non-contact thermometer method.

4.2 A procedure is also given for compensating for the error produced by emissivity using the computer built into an infrared imaging radiometer.

## 5. Significance and Use

5.1 The emissivity of a specimen can cause surface temperature measurement errors. Two procedures are provided for measuring and compensating for this error source.

5.2 These procedures can be used in the field or laboratory, using commonly available materials.

5.3 These procedures can be used with any infrared radiometers that have the required computer capabilities.

5.4 The values of emissivity are defined only in terms of the procedure for the purpose of process control and nondestructive evaluation of materials.

## 6. Interferences

6.1 *Contact Thermometer Method*—Contact thermometers can act as heat sinks and change the temperature of the specimen.

6.2 *Noncontact Thermometer Method:*

6.2.1 The use of surface-modifying materials can change the heat transfer properties and temperature of the specimen. Any such errors can be minimized by applying surface-modifying materials to the smallest area that satisfies the measurement accuracy requirements of the radiometer and infrared thermographer.

6.2.2 Before the surface-modifying material is applied to an area of the specimen adjacent to the area where the emissivity is to be measured (as directed in 8.2.4), errors can be minimized by viewing the imager display to ensure that both areas have the same temperature.

6.2.3 When removing a surface-modifying material, as directed in 8.2.7, errors can be minimized by ensuring that the surface is returned to its original condition.

\*A Summary of Changes section appears at the end of this standard