



Standard Test Methods for Measuring and Compensating for Emissivity Using Infrared Imaging Radiometers¹

This standard is issued under the fixed designation E 1933; 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 These test methods cover procedures for measuring and compensating for emissivity when measuring the surface temperature of a specimen with an infrared imaging radiometer.²

1.2 The values stated in SI units are to be regarded as the standard.

1.3 *These test methods 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:*
E 1316 Terminology for Nondestructive Examinations³

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.

3.2 See also Terminology E 1316.

4. Summary of Test Method

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

4.2 A test method 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 test methods are provided for measuring and compensating for this error source.

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

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

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 thermometer.

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.

6.3 Both test methods require the specimen to be at a temperature that is at least 10°C warmer or cooler than the ambient temperature. Potential errors can be minimized by ensuring the stability of the temperature difference between the specimen and the ambient temperature during the test. Also, the emissivity measurement accuracy can be increased by increasing this temperature difference.

6.4 The emissivity of a specimen may be specific to the temperature of the specimen and the spectral waveband of the infrared imaging radiometer used to make the measurement. Therefore, the temperature of the specimen and the spectral waveband of the radiometer should be noted along with the measured emissivity value.

6.5 These test methods are valid only for specimens that are

¹ These test methods are under the jurisdiction of ASTM Committee E-7 on Nondestructive Testing and are the direct responsibility of Subcommittee E07.10 on Emerging NDT Methods.

Current edition approved Dec. 10, 1999. Published February 2000. Originally published as E 1933-97. Last previous edition E 1933-99.

² These test methods are adapted from the *Guideline for Measuring and Compensating for Reflected Temperature, Emittance and Transmittance* developed by Infraspection Institute, 1971 Shelburne Road, Shelburne, VT 05482, 1993.

³ *Annual Book of ASTM Standards*, Vol 03.03.