



Designation: E1311 – 14 (Reapproved 2022)

Standard Practice for Minimum Detectable Temperature Difference for Thermal Imaging Systems¹

This standard is issued under the fixed designation E1311; 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 the determination of the minimum detectable temperature difference (MDTD) capability of a compound observer-thermal imaging system as a function of the angle subtended by the target.

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 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

E1316 Terminology for Nondestructive Examinations

3. Terminology

3.1 *Definitions:*

3.1.1 *differential blackbody*—an apparatus for establishing two parallel isothermal planar zones of different temperatures, and with effective emissivities of 1.0.

3.1.2 *field of view (FOV)*—the shape and angular dimensions of the cone or the pyramid that define the object space imaged by the system; for example, rectangular, 4-deg wide by 3-deg high.

¹ 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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² 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.

3.1.2.1 *Discussion*—The size of the field of view is customarily expressed in units of degrees.

3.1.3 See also Terminology E1316.

4. Summary of Practice

4.1 A standard circular target is used in conjunction with a differential blackbody that can establish one blackbody isothermal temperature for the target and another blackbody isothermal temperature for the background by which the target is framed. The target, at an undisclosed orientation, is imaged onto the monochrome video monitor of a thermal imaging system whence the image may be viewed by an observer. The temperature difference between the target and the background, initially zero, is increased incrementally until the observer, in a limited duration, can just distinguish the target. This critical temperature difference is the MDTD.

NOTE 1—Observers must have good eyesight and be familiar with viewing thermal imagery.

4.2 The temperature distributions of each target and its background are measured remotely at the critical temperature difference that defines the MDTD.

4.3 The background temperature and the angular subtense for each target are specified together with the measured value of MDTD. The (fixed) field of view included by the background is also specified.

4.4 The probability of detection is specified together with the reported value of MDTD.

5. Significance and Use

5.1 This practice gives a measure of a thermal imaging system's effectiveness for detecting a small spot within a large background. Thus, it relates to the detection of small material defects such as voids, pits, cracks, inclusions, and occlusions.

5.2 MDTD values provide estimates of detection capability that may be used to compare one system with another. (Lower MDTD values indicate better detection capability.)

5.3 Due to the partially subjective nature of the procedure, repeatability and reproducibility are apt to be poor and MDTD differences less than 0.2 °C are considered to be insignificant.

NOTE 2—Values obtained under idealized laboratory conditions may or