



Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings¹

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1. Scope

1.1 This practice is a guide to the proper use of infrared imaging systems for conducting qualitative thermal inspections of building walls, ceilings, roofs, and floors, framed in wood or metal, that may contain insulation in the spaces between framing members. This procedure allows the detection of cavities where insulation may be inadequate or missing and allows identification of areas with apparently adequate insulation.

1.2 This practice offers reliable means for detecting suspected missing insulation. It also offers the possibility of detecting partial-thickness insulation, improperly installed insulation, or insulation damaged in service. Proof of missing insulation or a malfunctioning envelope requires independent validation. Validation techniques, such as visual inspection or *in-situ* R-value measurement, are beyond the scope of this practice.

1.3 This practice is limited to frame construction even though thermography can be used on all building types.^{2,3}

1.4 Instrumentation and calibration required under a variety of environmental conditions are described. Instrumentation requirements and measurement procedures are considered for inspections from both inside and outside the structure. Each vantage point offers visual access to areas hidden from the other side.

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

1.6 *This standard does not purport to address all of the safety problems 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.* In particular, caution should be taken in the handling of any cryogenic liquids or pressurized gases required for use in this practice. Specific precautionary statements are given in Notes 1 and 3.

2. Referenced Documents

2.1 ASTM Standards:

C 168 Terminology Relating to Thermal Insulating Materials⁴

E 1213 Test Method for Minimum Resolvable Temperature Difference for Thermal Imaging Systems⁵

3. Terminology

3.1 *Definitions*—Definitions pertaining to insulation are defined in Terminology C 168.

3.2 *Descriptions of Terms Specific to This Standard:*

3.2.1 *anomalous thermal image*—an observed thermal pattern of a structure that is not in accordance with the expected thermal pattern.

3.2.2 *envelope*—the construction, taken as a whole or in part, that separates the indoors of a building from the outdoors.

3.2.3 *field-of-view (FOV)*—the total angular dimensions, expressed in degrees or radians, within which objects can be imaged, displayed, and recorded by a stationary imaging device.

3.2.4 *framing spacing*—distance between the centerlines of joists, studs, or rafters.

3.2.5 *infrared imaging system*—an instrument that converts the spatial variations in infrared radiance from a surface into a two-dimensional image of that surface, in which variations in radiance are displayed as a range of colors or tones.

3.2.6 *infrared thermography*—the process of generating thermal images that represent temperature and emittance variations over the surfaces of objects.

3.2.7 *instantaneous field of view (IFOV)*—the smallest angle, in milliradians, that can be instantaneously resolved by a particular infrared imaging system.

3.2.8 *masonry veneer*—frame construction with a non-load bearing exterior masonry surface.

3.2.9 *minimum resolvable temperature difference (MRTD)*—a measure of the ability of the operators of an infrared imaging system to discern temperature differences with that system. The MRTD is the minimum temperature difference between a four-slot test pattern of defined shape and size and its blackbody background at which an average observer can discriminate the pattern with that infrared imaging system at a defined distance.

3.2.10 *thermal pattern*—a representation of colors or tones that indicate surface temperature and emittance variation.

3.2.11 *thermogram*—a recorded image that maps the

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² ISO/TC 163/SC 1/WG N31E Thermal Insulation—Qualitative Detection of Thermal Irregularities in Building Envelopes—Infrared Method, available from American National Standards Institute, 1430 Broadway, New York, NY 10018.

³ Guidelines for Specifying and Performing Infrared Inspections, Infraspection Institute, Shelburne, VT, 1988.

⁴ Annual Book of ASTM Standards, Vol 04.06.

⁵ Annual Book of ASTM Standards, Vol 03.03.