



Designation: **E1934 – 99a (Reapproved 2010) E1934 – 99a (Reapproved 2014)**

Standard Guide for Examining Electrical and Mechanical Equipment with Infrared Thermography¹

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1. Scope

1.1 This guide lists the responsibilities of the end user and the infrared thermographer when examining electrical and mechanical systems.

1.2 This guide outlines the specific content required to document qualitative and quantitative infrared examinations of electrical and mechanical equipment.²

1.3 *This guide may involve use of equipment and materials in the presence of heated, moving or all of these or electrically energized equipment.*

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
E1316 Terminology for Nondestructive Examinations

3. Terminology

3.1 Definitions:

3.1.1 *end user*—the person responsible for using the information provided by an infrared examination.

3.1.2 *exception*—an abnormally warm or cool connector, conductor or component.

3.1.3 *infrared examination*—the use of an infrared imaging system to provide thermal data about a structure, system, object or process.

3.1.4 *inventory list*—a list of the equipment by the infrared thermographer.

3.1.5 *qualified assistant*—a person provided and authorized by the end user to perform the tasks required by the infrared thermographer. He/she shall be knowledgeable of the operation and history of the equipment to be examined and of all safety practices and rules of the end user.

3.1.6 *qualitative infrared inspection*—an infrared examination that provides images of exceptions but not temperature data.

3.1.7 *quantitative infrared inspection*—an infrared examination that provides both images of exceptions and temperature data.

3.2 See also Terminology **E1316**.

4. Significance and Use

4.1 This guide can be used by an end user to specify infrared examinations of electrical and mechanical equipment and an infrared thermographer to perform them.

4.2 This guide lists the joint responsibilities of the end user and the infrared thermographer when using infrared thermography.

¹ This guide 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 This guide is adapted from the *Guideline for Infrared Inspection and Mechanical Systems* developed by Infraspection Institute, 425 Ellis Street, Burlington, NJ 08016.

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.

4.3 The purpose of an infrared examination is to identify and document exceptions in the end user's electrical or mechanical systems, or both.

4.3.1 In electrical equipment, warm exceptions are usually created by an increase in resistance caused by loose or deteriorated connections, short circuits, overloads, load imbalances or faulty, mismatched or improperly installed components. Cool exceptions are usually caused by failed components.

4.3.2 In mechanical equipment, warm exceptions are usually created by friction caused by improper lubrication, misalignment, worn components or mechanical loading anomalies. Cool exceptions are usually caused by failed components.

4.3.3 Exceptions in insulation systems are usually caused by missing or deteriorated materials, improper installation or insufficient amounts of material.

4.4 Providing opinions about the causes of exceptions, the integrity of the equipment or recommendations for corrective actions require knowledge and skills beyond those of infrared thermography.

4.5 Infrared examinations provide data about equipment at the time of examination only.

4.6 Infrared examinations are not remedial.

4.7 An infrared examination of electrical and mechanical equipment does not assure its proper operation. Other tests and proper maintenance are necessary to ensure their reliable performance.

5. Personnel Responsibilities

5.1 The infrared thermographer shall:

5.1.1 Have sufficient knowledge of the components, construction and theory of electrical or mechanical equipment, or both, to understand the observed patterns of radiation,

5.1.2 Be knowledgeable of, and comply with, the safety practices and rules of the end user, and

5.1.3 Use an infrared imaging system with imaging or radiometric capabilities, or both, sufficient to meet the examination requirements.

5.2 Unless he/she is a licensed electrician, professional engineer or has other equivalent qualifications, the infrared thermographer:

5.2.1 Shall not perform any tasks that are normally done by these personnel. Unless so qualified and authorized by the end user, the infrared thermographer,

5.2.2 Shall not remove or replace covers or open or close cabinets containing electrical or mechanical equipment,

5.2.3 Shall not measure electric loads of equipment, and

5.2.4 Shall not touch any equipment and shall maintain a safe distance from it.

5.3 The qualified assistant shall fulfill the responsibilities listed in 3.1.5, 6.1, 6.2, 6.4 through 6.4.3, 6.7.1, and 6.8.

5.4 The end user shall assume full responsibility for consequences resulting from actions taken, or not taken, as a result of data provided by an infrared examination.

6. Procedure

6.1 The end user shall provide, to accompany the infrared thermographer, a qualified assistant who is knowledgeable of the operation and history of the equipment to be examined.

6.2 With the assistance of the qualified assistant, the infrared thermographer shall develop an inventory list of the equipment to be examined in a logical, efficient and safe route through the facility.

6.3 The infrared thermographer shall perform a calibration test(s), before each quantitative infrared examination, to ensure that all temperature-measuring equipment is within the manufacturers' standard specifications for accuracy.

6.4 The qualified assistant shall prepare the equipment for examination by:

6.4.1 Obtaining authorization necessary to gain access to the equipment to be examined and notifying operations personnel of the examination activities,

6.4.2 Opening or removing, or both, all necessary cabinet and enclosure covers immediately before examination to provide the infrared thermographer with direct views of the equipment.

6.4.3 Ensuring that the equipment to be examined is under adequate load, creating satisfactory loads when necessary, and allowing sufficient time for recently energized equipment to produce stable thermal patterns.

6.5 When examining the equipment, the thermographer will comply with all safety rules, regulations and practices of the end user.

6.6 The infrared thermographer shall perform examinations when the environmental and physical conditions, such as solar gain, wind, surface and atmospheric moisture and heat transfer are favorable to gathering accurate data.

6.7 The infrared thermographer shall document any exceptions found by recording the data required in 7.2 through 7.2.9 or 7.3 through 7.3.6, or all of these.