



Standard Practice for Crack Detection Using Vibroacoustic Thermography¹

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1. Scope

1.1 Purpose—This practice covers procedures required to conduct an examination of components using vibroacoustic thermography.

1.2 Application—The vibroacoustic thermography process has been used for component inspections in the aircraft, power generation, automotive, and other industries for testing new and serviced components, both coated and uncoated. Current applications are mostly targeting metallic components, but composite and ceramic component applications are under development.

1.3 Background—Vibroacoustic thermography is a new technique within the area of active thermography. The technique was first published by Henneke, et al. in 1979 (1)² and has been expanded on and popularized by Favro, et al. (2). During the test a defect thermal response resulting from a short burst of ultrasonic energy typically in the range of 15 kHz to 40 kHz is detected by an infrared camera. The ultrasound coupled into the component being tested can activate a thermal response in defects with contact areas that can move against each other, that is, cracks and delamination. There are different energizing and coupling techniques that are commonly used depending on the needs and capabilities. These variations and the down selection process are not included in the procedure and should be developed/optimized by experimentation for each new component application.

NOTE 1—Vibroacoustic thermography is typically sensitive to tight planar defects (3). Volumetric defects such as porosity, inclusions, open ruptures or cracks in wide-open areas, will not typically result in an indication. Therefore, an augmenting method should be conducted to detect volumetric defects.

NOTE 2—Vibroacoustic thermography is a surface examination but has demonstrated detection sensitivity for subsurface defects including back wall defects for thin components (4), (5). Care should be taken when developing vibroacoustic thermography for the detection of subsurface defects.

¹ This test method 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 The boldface numbers in parentheses refer to a list of references at the end of this standard.

1.4 Warning—Vibroacoustic thermography requires the energization of the test article with vibrational energy. During energization, the complete component may be excited with vibroacoustic (vibration) energy for as long as several seconds. The development of this test for a new application requires special measurements, precautions and attention to component response. The component design engineer and the NDE engineering specialist, knowledgeable of this technique should be satisfied that the test will not cause damage or reduction of service life.

1.5 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:

E168 [Practices for General Techniques of Infrared Quantitative Analysis](#) (Withdrawn 2015)³

E1213 [Practice for Minimum Resolvable Temperature Difference for Thermal Imaging Systems](#)

E1252 [Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis](#)

E1311 [Practice for Minimum Detectable Temperature Difference for Thermal Imaging Systems](#)

E1316 [Terminology for Nondestructive Examinations](#)

E1933 [Practice for Measuring and Compensating for Emissivity Using Infrared Imaging Radiometers](#)

E2585 [Practice for Thermal Diffusivity by the Flash Method](#)

2.2 ASNT Standards:⁴

[SNT-TC-1A Recommended Practice, Personnel Qualification and Certification in Nondestructive Testing](#)
[ANSI/ASNT CP-189-2001 Standard for Qualification and Certification of Nondestructive Testing Personnel](#)

2.3 ATA Standards:⁵

[ATA-105 Guidelines for Training and Qualifying Personnel in Nondestructive Testing](#)

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from American Society for Nondestructive Testing (ASNT), P.O. Box 28518, 1711 Arlingate Ln., Columbus, OH 43228-0518, <http://www.asnt.org>.

⁵ Available from Air Transport Association, 1301 Pennsylvania Avenue, Suite 1100, Washington, DC 20004-1707.