



Standard Practice for Ultrasonic Surface Testing Using Electromagnetic Acoustic Transducer (EMAT) Techniques¹

This standard is issued under the fixed designation E1962; 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 guidelines for utilizing EMAT techniques for detecting material discontinuities that are primarily open to the surface (for example, cracks, seams, laps, cold shuts, laminations, through leaks, lack of fusion). This technique can also be sensitive to flaws and discontinuities that are not surface-breaking, provided their proximity to the surface is less than or equal to the Rayleigh wave length.

1.2 This practice covers procedures for the non-contact coupling of surface waves into a material via electromagnetic fields.

1.3 The procedures of this practice are applicable to any material in which acoustic waves can be introduced electromagnetically. This includes any material that is either electrically conductive or ferromagnetic, or both.

1.4 This practice is intended to provide examination capabilities for in-process, final, and maintenance applications.

1.5 This practice does not provide standards for the evaluation of derived indications. Interpretation, classification, and ultimate evaluation of indications, albeit necessary, are beyond the scope of this practice. Separate specifications or agreement will be necessary to define the type, size, location, and direction of indications considered acceptable or non-acceptable.

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

1.7 *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.*

¹ This practice is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.06 on Ultrasonic Method.

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2. Referenced Documents

2.1 ASTM Standards:²

E543 Specification for Agencies Performing Nondestructive Testing

E587 Practice for Ultrasonic Angle-Beam Contact Testing

E1316 Terminology for Nondestructive Examinations

E1774 Guide for Electromagnetic Acoustic Transducers (EMATs)

E1816 Practice for Ultrasonic Testing Using Electromagnetic Acoustic Transducer (EMAT) Techniques

2.2 ANSI/ASNT Standards:

Recommended Practice SNT-TC-1A Personnel Qualification and Certification in Nondestructive Testing³

ANSI/ASNT CP-189 Standard for Qualification and Certification of Nondestructive Testing Personnel³

2.3 Military Standard:

MIL-STD-410 Nondestructive Testing Personnel Qualification and Certification⁴

3. Terminology

3.1 Definitions:

3.1.1 Additional related terminology is defined in Terminology E1316.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *electromagnetic acoustic transducer (EMAT)*—an electromagnetic device for converting electrical energy into acoustical energy in the presence of a magnetic field.

3.2.2 *Lorentz forces*—applied to electric currents when placed in a magnetic field. Lorentz forces are perpendicular to both the direction of the magnetic field and the current direction.

3.2.3 *magnetostrictive forces*—forces arising from magnetic domain wall movements within a magnetic material during

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 Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

*A Summary of Changes section appears at the end of this standard