



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

This standard is issued under the fixed designation E 1816; 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 procedures for the use of electromagnetic acoustic transducers (EMATs) for specific ultrasonic examination applications. Recommendations are given for specific applications for using EMAT techniques to detect flaws through both surface and volumetric inspections as well as to measure thickness.

1.2 These procedures recommend technical details and guidelines for the reliable and reproducible ultrasonic detection of flaws and thickness measurements using electromagnetic acoustic transducers for both the pulsing and receiving of ultrasonic waves. The EMAT techniques described herein can be used as a basis for assessing the serviceability of various components nondestructively, as well as for process control in manufacturing.

1.3 These procedures cover noncontact techniques for coupling ultrasonic energy into materials through the use of electromagnetic fields. Surface, Lamb, longitudinal, and shear wave modes are discussed.

1.4 These procedures are intended to describe specific EMAT applications. These procedures are intended for applications in which the user has determined that the use of EMAT techniques can offer substantial benefits over conventional piezoelectric search units. It is not intended that EMAT techniques should be used in applications in which conventional techniques and applications offer superior benefits (refer to Guide E 1774).

1.5 These procedures are applicable to any material in which acoustic waves can be introduced electromagnetically. This includes any material that is either electrically conductive or ferromagnetic.

1.6 The procedures outlined in this practice address proven EMAT techniques for specific applications; they do not purport to address the only variation or all variations of EMAT techniques to address the given applications. Latitude in application techniques is offered where options are considered appropriate.

1.7 The values stated in inch-pound units are to be regarded

as the standard. The values given in parentheses are for information only.

1.8 *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:

E 114 Practice for Ultrasonic Pulse-Echo Straight-Beam Examination by the Contact Method²

E 494 Practice for Measuring Ultrasonic Velocity in Materials²

E 587 Practice for Ultrasonic Angle-Beam Examination by the Contact Method²

E 797 Practice for Measuring Thickness by Manual Ultrasonic Pulse-Echo Contact Method²

E 1316 Terminology for Nondestructive Examinations²

E 1774 Guide to Electromagnetic Acoustic Transducers (EMATs)²

2.2 ASNT Standards:³

SNT-TC-1A Recommended Practice for Personnel Qualifications and Certification in Nondestructive Testing

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

2.3 Military Standard:

MIL-STD-410 Nondestructive Testing Personnel Qualification and Certification⁴

3. Terminology

3.1 *Definitions*—Related terminology is defined in Terminology E 1316.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *bulk wave*—an ultrasonic wave, either longitudinal or shear mode, used in nondestructive testing to interrogate the volume of a material.

3.2.2 *electromagnetic acoustic transducer (EMAT)*—an electromagnetic device for converting electrical energy into

¹ This practice is under the jurisdiction of ASTM Committee E-7 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.06 on Ultrasonic Method.

Current edition approved May 10, 1996. Published July 1996.

² *Annual Book of ASTM Standards*, Vol 03.03.

³ Available from American Society for Nondestructive Testing, 1711 Arlinggate Plaza, P.O. Box 28518, Columbus, OH 43228-0518.

⁴ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.