



Standard Guide for Acousto-Ultrasonic Assessment of Composites, Laminates, and Bonded Joints¹

This standard is issued under the fixed designation E 1495; 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 guide explains the rationale and basic technology for the acousto-ultrasonic (AU) method. Guidelines are given for nondestructive evaluation (NDE) of flaws and physical characteristics that influence the mechanical properties and relative strength of composite structures (for example, filament-wound pressure vessels), adhesive bonds (for example, joints between metal plates), and interlaminar and fiber/matrix bonds in man-made composites and natural composites (for example, wood products).

1.2 This guide covers technical details and rules that must be observed to ensure reliable and reproducible quantitative AU assessments of laminates, composites, and bonded structures. The underlying principles, prototype apparatus, instrumentation, standardization, examination methods, and data analysis for such assessments are covered. Limitations of the AU method and guidelines for taking advantage of its capabilities are cited.

1.3 The objective of AU is to assess subtle flaws and associated strength variations in composite structures and bonded joints. Discontinuities such as large voids, disbonds, or extended lack of contact at interfaces can be assessed by other NDE methods such as conventional ultrasonics.

1.4 Additional information may be found in the publications cited in the list of references at the end of this guide. The referenced works provide background on research, applications, and various aspects of signal acquisition, processing, and interpretation.

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

1.6 *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 543 Practice for Agencies Performing Nondestructive Testing²

E 1316 Terminology for Nondestructive Examinations²

2.2 ASNT Standard³:

ANSI/ASNT-CP-189 Standard for Qualification and Certification of Nondestructive Testing Personnel
Recommended Practice SNT-TC-1A Personnel Qualifications and Certification in Nondestructive Testing

2.3 AIA Document:

NAS-410 Certification and Qualification of Nondestructive Testing Personnel⁴

3. Terminology

3.1 Definitions:

3.1.1 *acousto-ultrasonics (AU)*—a nondestructive examination method that uses induced stress waves to detect and assess the diffuse defect states, damage conditions, and variations of mechanical properties of an examination structure. The AU method combines aspects of acoustic emission (AE) signal analysis with ultrasonic materials characterization methods (Terminology E 1316).

3.1.2 Additional related definitions may be found in Terminology E 1316.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *stress wave factor (SWF)*—a generic measure of the relative energy loss (attenuation) or propagation efficiency of stress waves generated by the AU method. There are many ways to define and calculate the SWF. Several of these are described in Section 11 of this guide.

4. Summary of Guide

4.1 *General*—Two probes are attached to a sample in a send-receive configuration. One (a pulsed sending probe) is optimized for wave generation, while the other (a receiving

¹ This guide is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.04 on Acoustic Emission Method.

Current edition approved July 10, 2002. Published September 2002. Originally published as E 1495 – 92. Last previous edition E 1495 – 97.

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 Aerospace Industries Association of America, Inc., 1250 Eye St., NW, Washington, DC 20005.