



Designation: E2375 – 22

Standard Practice for Ultrasonic Testing of Wrought Products¹

This standard is issued under the fixed designation E2375; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 *Purpose*—This practice establishes the minimum requirements for ultrasonic examination of wrought products.

NOTE 1—This practice was adopted to replace MIL-STD-2154, 30 Sept. 1982. This practice is intended to be used for the same applications as the document which it replaced. Users should carefully review its requirements when considering its use for new, or different applications, or both.

1.2 *Application*—This practice is applicable for examination of materials such as, wrought metals and wrought metal products having a thickness or cross section equal to 0.250 in. (6.35 mm) or greater.

1.2.1 *Wrought Aluminum Alloy Products*—Examination shall be in accordance with Practice B594. Angle beam scans of wrought aluminum alloy products shall be performed in accordance with this practice as agreed upon by the purchaser and supplier.

1.3 *Acceptance Class*—When examination is performed in accordance with this practice, engineering drawings, specifications, or other applicable documents shall indicate the acceptance criteria. Five ultrasonic acceptance classes are defined in Table 1. One or more of these classes may be used to establish the acceptance criteria or additional or alternate criteria may be specified.

1.4 *Order of Precedence*—Contractual requirements and authorized direction from the cognizant engineering organization may add to or modify the requirements of this practice. Otherwise, in the event of conflict between the text of this practice and the references cited herein, the text of this practice takes precedence. Nothing in this practice, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

1.5 *Measurement Values*—The values stated in inch-pounds are to be regarded as standard. The metric equivalents are in parentheses.

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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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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 The following documents form a part of this practice to the extent specified herein:

2.2 *ASTM Standards*:²

B107/B107M Specification for Magnesium-Alloy Extruded Bars, Rods, Profiles, Tubes, and Wire

B221 Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

B241/B241M Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube

B594 Practice for Ultrasonic Inspection of Aluminum-Alloy Wrought Products

E127 Practice for Fabrication and Control of Flat Bottomed Hole Ultrasonic Standard Reference Blocks

E164 Practice for Contact Ultrasonic Testing of Weldments

E213 Practice for Ultrasonic Testing of Metal Pipe and Tubing

E317 Practice for Evaluating Performance Characteristics of Ultrasonic Pulse-Echo Testing Instruments and Systems without the Use of Electronic Measurement Instruments

E543 Specification for Agencies Performing Nondestructive Testing

E1065 Practice for Evaluating Characteristics of Ultrasonic Search Units

E1316 Terminology for Nondestructive Examinations

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.

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

TABLE 1 Ultrasonic Classes

Class	Single Discontinuity Response ^{A,B}	Multiple ^C Discontinuities	Linear ^D Discontinuity Length and Response	Loss of Back Reflection Percent ^{E,F}	Noise ^{G,H}
AAA ^H	25 % of 3/64 in. FB	10 % of 3/64 in. (0.119 mm) FB	1/8 in. (3.176 mm) long or 10 % of 3/64 in. (0.119 mm) FB	50	alarm level
AA ^H	3/64 in. (1.19 mm) FB	3/64 in. ^I (0.794 mm) FB	1/2 in. (12.7 mm) long 3/64 in. response (0.794 mm) FB	50	alarm level
A	5/64 in. (1.98 mm) FB	3/64 in. (1.191 mm) FB	1 in. (25.4 mm) long 3/64 in. response (1.19 mm) FB	50	alarm level
B	9/64 in. (3.18 mm) FB	5/64 (1.98 mm) FB	1 in. (25.4 mm) long 5/64 in. response (1.98 mm) FB	50	alarm level
C	9/64 in. (3.18 mm)	Not Applicable	Not Applicable	50	alarm level

^A Any discontinuity with a response greater than the response from a flat-bottom hole or equivalent notch (see footnote^B) at the estimated discontinuity depth and the discontinuity size given is not acceptable.

^B See Fig. 2, Fig. 3, or Fig. 4 for dimensions of notches and holes when these are required for angle beam examination of tube walls and near-surface regions of cylindrical parts and other products.

^C Multiple discontinuities with indications greater than the response from a reference flat-bottom hole or equivalent notch at the estimated discontinuity depth of the size given (diameter) are not acceptable if the centers of any two of these discontinuities are less than one inch apart (not applicable to Class C).

^D Any discontinuity longer than the length given with indications exceeding the response given (flat-bottom hole or notch response) is not acceptable. Not applicable to Class C.

^E Loss of back reflection by more than 50 %, when accompanied by an increase in noise level of double the normal background noise signal, compared to non-defective material in the same or a similar part, is not acceptable.

^F For longitudinal examination of material over 6 in. (152.4 mm) thick in the short transverse direction, any loss of back reflection equal to or greater than 12 dB over an area 2 by 2 in. (50.8 by 50.8 mm) is rejectable. (Noise level is not relevant to this back reflection evaluation).

^G Noise which exceeds the alarm level setting (see 7.4.10.7), is not acceptable, except for titanium. For titanium alloys, the alarm level may be set just above the noise level, but shall not exceed 70 % of the reference standard response.

^H When examining titanium, Class AA and Class AAA, no rejection shall be made on the basis of "noise" level, if within the limits specified in footnote^G.

^I Evaluation may be done by setting up on a 3/64 in. (1.19 mm) hole and adding 7 dB of gain. (Also see Note 5 under Table 5.)

2.3 ASNT Standards:³

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

2.4 SAE Standards:⁴

AMS 4928 Titanium Alloy, Bars, Wire, Forgings, and Rings 6Al-4V Annealed
AMS 6409 Steel, Bars, Forgings, and Tubing, 0.80 Cr, 1.8 Ni, 0.25 Mo, (0.38 - 0.45 C), (SAE 4340) Special Aircraft Steel Cleanliness, Normalized and Tempered
AMS 6415 Steel, Bars, Forgings, and Tubing, 0.80 Cr, 1.8 Ni, 0.25 Mo (0.38 - 0.43 C) (SAE 4340)
AMS 6484 Steel, Bars, Forgings, and Tubing, 0.80 Cr, 1.8 Ni, 0.25 Mo (0.38 - 0.43 C) (SAE 4340) Normalized and Tempered

2.5 AIA Standard:⁵

NAS 410 Certification and Qualification of Nondestructive Test Personnel

2.6 Federal Specifications:⁵

QQ-A-225/6 Aluminum Alloy Bar, Rod, and Wire, Rolled, Drawn, or Cold Finished, 2024
QQ-A-225/9 Aluminum Alloy Bar, Rod, Wire, and Special Shapes, Rolled, Drawn, or Cold Finished, 7075

2.7 Military Standards:⁶

NOTE 2—For DoD contracts, unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS (Department of Defense Index of Specifications Standards) cited in the solicitation.

3. Terminology

3.1 *Definitions*—Definitions relating to ultrasonic examination, which appear in Terminology E1316, shall apply to the terms used in this standard.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *display, n*—the display on which ultrasonic data are presented, including, but is not limited to, cathode ray tubes, liquid crystals, electro-luminescent phosphors, or plasmas.

3.2.2 *full scale deflection (FSD), n*—the maximum displayable signal amplitude on the display device, or any signal reaching or exceeding the 100 % amplitude scale graduation.

3.2.3 *horizontal limit, n*—the maximum readable length of horizontal position that is determined either by electrical or a physical limit in the A-scan presentation of an ultrasonic examination instrument.

3.2.4 *primary reference response, n*—the maximized signal amplitude obtained from the applicable reference reflector that produces the lowest amplitude signal.

³ Available from The American Society for Nondestructive Testing (ASNT), P.O. Box 28518, 1711 Arlingate Ln., Columbus, OH 43228-0518.

⁴ Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001.

⁵ Available from Aerospace Industries Association (AIA), 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209, <http://www.aia-aerospace.org>.

⁶ Copies of specifications, standards, drawings and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.