



# Standard Practice for Immersed Ultrasonic Examination by the Reflection Method Using Pulsed Longitudinal Waves<sup>1</sup>

This standard is issued under the fixed designation E 214; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

## 1. Scope

1.1 This practice<sup>2</sup> describes in general terms an ultrasonic test procedure for detecting discontinuities in material using testing instruments which have been designed to transmit and receive pulsed longitudinal ultrasonic waves introduced into the material to be inspected through a liquid coupling agent.

NOTE 1—Practice E 1001 is a complementary document that extends Practice E 214 by describing more detailed procedures.

1.2 *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 127 Practice for Fabricating and Checking Aluminum Alloy Ultrasonic Standard Reference Blocks<sup>3</sup>

E 428 Practice for Fabrication and Control of Steel Reference Blocks Used in Ultrasonic Inspection<sup>3</sup>

E 1001 Practice for Detection and Evaluation of Discontinuities by the Immersed Pulse-Echo Ultrasonic Method Using Longitudinal Waves<sup>3</sup>

## 3. Application

3.1 This procedure applies to any material that can conduct sound waves of an appropriate frequency, and can be immersed in a liquid coupling agent for inspection, or can be subject to inspection by the use of a column or stream of the couplant through an appropriate container attached to the part or transducer.

## 4. Apparatus

4.1 *Electronic Apparatus*—The electronic apparatus shall be capable of producing, receiving, and displaying high-

frequency electrical pulses at the required frequency and energy levels, and employ A-Scan; time base versus magnitude (Note 2). The instrument used should provide stable amplification of received pulses at the required test sensitivity levels. An appropriate line-voltage regulating transformer shall be used, if required, to ensure maximum stability.

NOTE 2—Other presentations, such as B-Scan and C-Scan, are available but are not covered in this practice.

4.2 *Immersion Search Units*—Immersible transducers for transforming electrical impulses into sound vibrations and vice versa, at the appropriate frequencies and energy levels shall be used. The transducers shall be capable of transmitting and receiving ultrasound to and from the immersed test specimen.

4.3 *Couplant*—The couplant, a liquid such as water, oil, glycerin, etc., capable of conducting ultrasonic vibrations from the transducer to the material being tested shall be used. Rust inhibitors, softeners, and wetting agents may be added to the couplant. The couplant liquid with all additives should not be detrimental to the surface condition of the test specimen or the container, and should wet the surface of the material to provide an intimate contact. Couplant may be heated to a comfortable working temperature and must be free of air bubbles.<sup>3</sup> 1996

4.4 *Manipulator*—The holder for the search tube and search unit that provides angular manipulation of the transducer for optimum response from the internal discontinuities. The maximum tolerance or play allowable in the manipulator and in the traversing unit should be adequate to permit ultrasonic testing at the sensitivity specified.

4.5 *Accessory Equipment*—Coaxial cables and search tubes used in conjunction with the electronic apparatus capable of conducting the electrical pulses while immersed in a liquid, and collimators for shaping the sound beam shall be used.

4.6 *Reference Blocks*—In order to correct for the many variables involved in ultrasonic testing, it is necessary to use references to establish instrument settings, assist reproducibility of techniques, and evaluate discontinuities. The fabrication of reference blocks should be governed by the requirements described in Practices E 127 or E 428.

## 5. Calibration of Apparatus

5.1 Prior to inspection, it is recommended that the ultrasonic system be standardized by means of ASTM reference blocks as

<sup>1</sup> 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 Testing Procedures.

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<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications see related Practice SE-214 in the Code.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 03.03.