



Standard Practice for Acoustic Pulse Reflectometry Examination of Tube Bundles¹

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1. Scope

1.1 This practice describes use of Acoustic Pulse Reflectometry (APR) technology for examination of the internal surface of typical tube bundles found in heat exchangers, boilers, tubular air heaters and reactors, during shutdown periods.

1.2 The purpose of APR examination is to detect, locate and identify flaws such as through-wall holes, ID wall loss due to pitting and/or erosion as well as full or partial tube blockages. APR may not be effective in detecting cracks with tight boundaries.

1.3 APR technology utilizes generation of sound waves through the air in the examined tube, then detecting reflections created by discontinuities and/or blockages. Analysis of the initial phase (positive or negative) and the shape of the reflected acoustic wave are used to identify the type of flaw causing the reflection.

1.4 When proper methods of signal and data analysis are developed, APR technology can be applied for sizing of flaw/blockage indications.

1.5 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standards.

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.*

¹ This test method is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.10 on Specialized NDT Methods.

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2. Referenced Documents

2.1 ASTM Standards:²

E543 Specification for Agencies Performing Nondestructive Testing

E1316 Terminology for Nondestructive Examinations

2.2 Other Documents:

SNT-TC-1A Recommended Practice for Nondestructive Testing Personnel Qualification and Certification³

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

NAS-410 Certification and Qualification of Nondestructive Test Personnel⁴

3. Terminology

3.1 *Definitions*—See Terminology E1316 for general terminology applicable to this practice.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *acoustic pulse reflectometry*—a technology for detecting, locating and analyzing sound reflections caused by discontinuities and abrupt changes on the internal surface of tubes and pipes as a response to an induced acoustic signal within the examined structure.

3.2.2 *reference signal*—a measured signal from a typical tube in the examined bundle without flaws or blockages. Reflections in the reference signal indicate structural features of the tube, probe or adaptor.

3.2.3 *signal-to-noise ratio (SNR)*—the ratio of the signal's Root Mean Square (RMS) to RMS of the noise signal.

3.2.4 *output gain*—the gain of the sound-source amplifier.

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 Society for Nondestructive Testing (ASNT), P.O. Box 28518, 1711 Arlingate Ln., Columbus, OH 43228-0518, <http://www.asnt.org>.

⁴ Available from Aerospace Industries Association of America, Inc. (AIA), 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209-3928, <http://www.aia-aerospace.org>.