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Standard Guide for Radiographic Examination Using Industrial Radiographic Film¹

This standard is issued under the fixed designation E94/E94M; 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 This guide² covers satisfactory X-ray and gamma-ray radiographic examination as applied to industrial radiographic film recording. It includes statements about preferred practice without discussing the technical background which justifies the preference. A bibliography of several textbooks and standard documents of other societies is included for additional information on the subject.

1.2 This guide covers types of materials to be examined; radiographic examination techniques and production methods; radiographic film selection, processing, viewing, and storage; maintenance of inspection records; and a list of available reference radiograph documents.

NOTE 1—Further information is contained in Guide E999, Practice E1025, Practice E1030/E1030M, and Practice E1032.

1.3 The use of digital radiography has expanded and follows many of the same general principles of film based radiography but with many important differences. The user is referred to standards for digital radiography [E2597, E2698, E2736, and E2737 for digital detector array (DDA) radiography and E2007, E2033, E2445/E2445M, and E2446 for computed radiography(CR)] if considering the use of digital radiography.

1.4 *Interpretation and Acceptance Standards*—Interpretation and acceptance standards are not covered by this guide, beyond listing the available reference radiograph documents for castings and welds. Designation of accept - reject standards is recognized to be within the cognizance of product specifications and generally a matter of contractual agreement between producer and purchaser.

¹ This guide is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.01 on Radiology (X and Gamma) Method.

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² For ASME Boiler and Pressure Vessel Code applications, see related Guide SE-94 in Section V of that Code.

1.5 *Safety Practices*—Problems of personnel protection against X-rays and gamma-rays are not covered by this guide. For information on this important aspect of radiography, reference should be made to the current document of the National Committee on Radiation Protection and Measurement, Federal Register, U.S. Energy Research and Development Administration, National Bureau of Standards, and to state and local regulations, if such exist. For specific radiation safety information, refer to NIST Handbook ANSI 43.3, 21 CFR 1020.40, and 29 CFR 1910.1096 or state regulations for agreement states.

1.6 *Units*—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 should be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.7 If an NDT agency is used, the agency should be qualified in accordance with Specification E543.

1.8 *Personnel Qualification*—If specified in the contractual agreement, personnel performing examinations to this guide should be qualified in accordance with a nationally or internationally recognized NDT personnel qualification practice or standard and certified by the employer or certifying agency, as applicable.

1.9 *This standard does not purport to address all of the safety problems, 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.* (See 1.5.)

1.10 *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.*

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

2. Referenced Documents

2.1 ASTM Standards:³

- E543** Specification for Agencies Performing Nondestructive Testing
- E746** Practice for Determining Relative Image Quality Response of Industrial Radiographic Imaging Systems
- E747** Practice for Design, Manufacture and Material Grouping Classification of Wire Image Quality Indicators (IQI) Used for Radiology
- E801** Practice for Controlling Quality of Radiographic Examination of Electronic Devices
- E999** Guide for Controlling the Quality of Industrial Radiographic Film Processing
- E1000** Guide for Radioscopy
- E1025** Practice for Design, Manufacture, and Material Grouping Classification of Hole-Type Image Quality Indicators (IQI) Used for Radiography
- E1030/E1030M** Practice for Radiographic Examination of Metallic Castings
- E1032** Practice for Radiographic Examination of Weldments Using Industrial X-Ray Film
- E1079** Practice for Calibration of Transmission Densitometers
- E1165** Test Method for Measurement of Focal Spots of Industrial X-Ray Tubes by Pinhole Imaging
- E1254** Guide for Storage of Radiographs and Unexposed Industrial Radiographic Films
- E1316** Terminology for Nondestructive Examinations
- E1390** Specification for Illuminators Used for Viewing Industrial Radiographs
- E1453** Guide for Storage of Magnetic Tape Media that Contains Analog or Digital Radioscopic Data
- E1475** Guide for Data Fields for Computerized Transfer of Digital Radiological Examination Data
- E1735** Practice for Determining Relative Image Quality Response of Industrial Radiographic Imaging Systems from 4 to 25 MeV
- E1742/E1742M** Practice for Radiographic Examination
- E1815** Test Method for Classification of Film Systems for Industrial Radiography
- E1817** Practice for Controlling Quality of Radiological Examination by Using Representative Quality Indicators (RQIs)
- E1936** Reference Radiograph for Evaluating the Performance of Radiographic Digitization Systems
- E2007** Guide for Computed Radiography
- E2033** Practice for Radiographic Examination Using Computed Radiography (Photostimulable Luminescence Method)
- E2339** Practice for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE)
- E2445/E2445M** Practice for Performance Evaluation and Long-Term Stability of Computed Radiography Systems

- E2446** Practice for Manufacturing Characterization of Computed Radiography Systems
- E2597** Practice for Manufacturing Characterization of Digital Detector Arrays
- E2698** Practice for Radiographic Examination Using Digital Detector Arrays
- E2736** Guide for Digital Detector Array Radiography
- E2737** Practice for Digital Detector Array Performance Evaluation and Long-Term Stability
- E2903** Test Method for Measurement of the Effective Focal Spot Size of Mini and Micro Focus X-ray Tubes
- E3169** Guide for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE)

2.2 ANSI Standard:⁴

- ANSI/I3A/PIMA IT 2.26** Determination of Safelight Conditions

2.3 Federal Standards:⁵

- Title 21**, Code of Federal Regulations (CFR) 1020.40, Safety Requirements of Cabinet X-Ray Systems
- Title 29**, Code of Federal Regulations (CFR) 1910.96, Ionizing Radiation (X-Rays, RF, etc.)

2.4 ISO Standards:⁶

- ISO 14096-2** Non-destructive Testing — Qualification of Radiographic Film Digitization Systems — Part 2: Minimum Requirements
- ISO 18901** Imaging Materials — Processed Silver-Gelatin-type Black-and-white Films — Specifications for Stability
- ISO 18902** Imaging Materials — Processed Imaging Materials — Albums, Framing and Storage Materials
- ISO 18917** Photography—Determination of Residual Thio-sulphate and Other Related Chemicals in Processed Photographic Materials—Methods Using Iodine-amylose, Methylene Blue and Silver Sulfide

2.5 Other Document:⁷

- NBS Handbook ANSI N43.3** General Radiation Safety Installations Using NonMedical X-Ray and Sealed Gamma-Ray Sources up to 10 MeV

3. Terminology

- 3.1 Definitions**—For definitions of terms used in this guide, refer to Terminology **E1316**.

4. Significance and Use

- 4.1** Within the present state of the radiographic art, this guide is generally applicable to available materials, processes, and techniques where industrial radiographic films are used as the recording media.

- 4.2 Limitations**—This guide does not take into consideration the benefits and limitations of nonfilm radiography such as

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

⁵ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

⁶ Available from International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <https://www.iso.org>.

⁷ Available from National Technical Information Service (NTIS), U.S. Department of Commerce, 5301 Shawnee Rd, Alexandria, VA 22312.

³ 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.