



Designation: E1030/E1030M – 21

Standard Practice for Radiographic Examination of Metallic Castings¹

This standard is issued under the fixed designation E1030/E1030M; 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 practice² provides a uniform procedure for radiographic examination of metallic castings using radiographic film as the recording medium.

1.2 This standard addresses the achievement of, or protocols for achieving, common or practical levels of radiographic coverage for castings, to detect primarily volumetric discontinuities to sensitivity levels measured by nominated image quality indicators. All departures, including alternate means or methods to increase coverage, or address challenges of detecting non-volumetric planar-type discontinuities, shall be agreed upon between the purchaser and supplier and shall consider **Appendix X1** and **Appendix X2**.

1.3 The radiographic techniques stated herein provide adequate assurance for defect detectability; however, it is recognized that, for special applications, specific techniques using more or less stringent requirements may be required than those specified. In these cases, the use of alternate radiographic techniques shall be as agreed upon between purchaser and supplier (also see Section 5).

1.4 *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 are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.5 *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.*

1.6 *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 ASTM Standards:³

- E94 Guide for Radiographic Examination Using Industrial Radiographic Film
- E155 Reference Radiographs for Inspection of Aluminum and Magnesium Castings
- E186 Reference Radiographs for Heavy-Walled (2 to 4½ in. (50.8 to 114 mm)) Steel Castings
- E192 Reference Radiographs of Investment Steel Castings for Aerospace Applications
- E272 Reference Radiographs for High-Strength Copper-Base and Nickel-Copper Alloy Castings
- E280 Reference Radiographs for Heavy-Walled (4½ to 12 in. (114 to 305 mm)) Steel Castings
- E310 Reference Radiographs for Tin Bronze Castings
- E446 Reference Radiographs for Steel Castings Up to 2 in. (50.8 mm) in Thickness
- E505 Reference Radiographs for Inspection of Aluminum and Magnesium Die Castings
- E543 Specification for Agencies Performing Nondestructive Testing
- E689 Reference Radiographs for Ductile Iron Castings
- E747 Practice for Design, Manufacture and Material Grouping Classification of Wire Image Quality Indicators (IQI) Used for Radiology
- E802 Reference Radiographs for Gray Iron Castings Up to 4½ in. (114 mm) in Thickness
- E999 Guide for Controlling the Quality of Industrial Radiographic Film Processing
- E1025 Practice for Design, Manufacture, and Material Grouping Classification of Hole-Type Image Quality Indicators (IQI) Used for Radiography
- E1079 Practice for Calibration of Transmission Densitometers
- E1254 Guide for Storage of Radiographs and Unexposed

¹ This practice 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 Test Method SE-1030 in Section II of that Code.

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.

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



Industrial Radiographic Films

E1316 Terminology for Nondestructive Examinations

E1320 Reference Radiographs for Titanium Castings

E1742/E1742M Practice for Radiographic Examination

E1815 Test Method for Classification of Film Systems for Industrial Radiography

2.2 *ASNT/ANSI Standards*:⁴

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

CP-189 Qualification and Certification of Nondestructive Testing Personnel⁴

2.3 *AIA Standard*:⁵

NAS 410 National Aerospace Standard Certification and Qualification of Nondestructive Test Personnel

2.4 *ISO Standards*:⁶

ISO 5579 Non-Destructive Testing—Radiographic Testing of Metallic Materials Using Film and X- or Gamma-rays—Basic Rules

ISO 9712 Non-Destructive Testing—Qualification and Certification of NDT Personnel

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, see Terminology **E1316**.

4. Significance and Use

4.1 The requirements expressed in this practice are intended to control the quality of the radiographic images, to produce satisfactory and consistent results, and are not intended for controlling the acceptability or quality of materials or products.

5. Basis of Application

5.1 The following items shall be agreed upon by the purchaser and supplier:

5.1.1 *Nondestructive Testing Agency Evaluation*—If specified in the contractual agreement, nondestructive testing (NDT) agencies shall be qualified and evaluated in accordance with Practice **E543**. The applicable version of Practice **E543** shall be specified in the contractual agreement.

5.1.2 *Personnel Qualification*—Personnel performing examinations to this standard shall be qualified in accordance with a nationally or internationally recognized NDT personnel qualification practice or standard such as ANSI/ASNT CP-189, SNT-TC-1A, NAS 410, ISO 9712, or a similar document and certified by the employer or certifying agency, as applicable. The practice or standard used and its applicable revision shall be identified in the contractual agreement between the using parties.

5.1.3 *Apparatus*—General requirements (see **6.1** through **6.9**) shall be specified.

5.1.4 *Requirements*—General requirements (see **8.1**, **8.2**, **8.5**, and **8.7.4**) shall be specified.

5.1.5 *Procedure Requirements* (see **9.1**, **9.1.1**, **9.3**, **9.7.4**, and **9.7.7**) shall be specified.

5.1.6 *Records*—Record retention (see **12.1**) shall be specified.

6. Apparatus

6.1 *Radiation Sources*:

6.1.1 *X Radiation Sources*—Selection of appropriate X-ray voltage and current levels is dependent upon variables regarding the specimen being examined (material type and thickness) and economically permissible exposure time. The suitability of these X-ray parameters shall be demonstrated by attainment of required penetrameter (IQI) sensitivity and compliance with all other requirements stipulated herein. Guide **E94** contains provisions concerning exposure calculations and charts for the use of X-ray sources.

6.1.2 *Gamma Radiation Sources*—Isotope sources, when used, shall be capable of demonstrating the required radiographic sensitivity.

6.2 *Film Holders and Cassettes*—Film holders and cassettes shall be light-tight and shall be handled properly to reduce the likelihood that they may be damaged. They may be flexible vinyl, plastic, or any durable material; or, they may be made from metallic materials. In the event that light leaks into the film holder and produces images on the film extending into the area of interest, the film shall be rejected. If the film holder exhibits light leaks, it shall be repaired before reuse or discarded. Film holders and cassettes should be routinely examined to minimize the likelihood of light leaks.

6.3 *Intensifying Screens*:

6.3.1 *Lead-Foil Screens*:

6.3.1.1 Intensifying screens of the lead-foil type are generally used for all production radiography. Lead-foil screens shall be of the same approximate area dimensions as the film being used and they shall be in direct contact with the film during exposure.

6.3.1.2 Recommended screen thicknesses are listed in **Table 1** for the applicable voltage range being used.

6.3.1.3 Sheet lead, with or without backing, used for screens should be visually examined for dust, dirt, oxidation, cracking or creasing, foreign material or other condition that could render undesirable nonrelevant images on the film.

6.3.2 *Fluorescent, Fluorometallic, or Other Metallic Screens*:

6.3.2.1 Fluorescent, fluorometallic, or other metallic screens may be used. However, they must be capable of demonstrating the required penetrameter (IQI) sensitivity. Fluorescent or fluorometallic screens may cause limitations in image quality (see Guide **E94**, Appendix X1.)

6.3.2.2 *Screen Care*—All screens should be handled carefully to avoid dents, scratches, grease, or dirt on active surfaces. Screens that render false indications on radiographs shall be discarded or reworked to eliminate the artifact.

6.3.3 *Other Screens*—International Standard ISO 5579 contains similar provisions for intensifying screens as this practice. International users of these type screens who prefer the use of

⁴ Available from the American Society for Nondestructive Testing, (ASNT), 1711 Arlingate Plaza, P.O. Box 28518, Columbus, OH 43228.

⁵ Available from Aerospace Industries Association of America, Inc. (AIA), 1000 Wilson Blvd Suite 1700, Arlington, VA 22209-3928.

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