



Designation: E746 – 23

Standard Practice for Determining Relative Image Quality Response of Industrial Radiographic Imaging Systems below 4 MeV¹

This standard is issued under the fixed designation E746; 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 standard covers a practice whereby industrial radiographic imaging systems or techniques may be comparatively assessed using the concept of relative image quality response (RIQR). Changes within a radiographic technique such as film/detector types, distances, or filtering/collimation can be comparatively assessed using this standard. The RIQR method presented within this practice is based upon the use of equivalent penetrometer sensitivity (EPS) described within Practice E1025 and subsection 5.4 of this practice. Fig. 1 illustrates a relative image quality indicator (RIQI) that has four different plaque thicknesses (0.38 mm, 0.25 mm, 0.20 mm, and 0.13 mm (0.015 in., 0.010 in., 0.008 in., and 0.005 in.)) sequentially positioned (from top to bottom) on an absorber plate of a specified material and thickness. The four plaques contain a total of 14 different arrays of penetrometer-type hole sizes designed to render varied conditions of threshold visibility when exposed to the appropriate radiation. Each “EPS” array consists of 30 identical holes; thus, providing the user with a quantity of threshold sensitivity levels suitable for relative image qualitative response comparisons. There are two standard materials (steel and plastic) specified herein for the RIQI and absorber. For special applications the user may design a non-standard RIQI-absorber configuration; however the RIQI configuration shall be controlled by a drawing similar to Fig. 1. Use of a non-standard RIQI-absorber configuration shall be described in the user’s written technique and approved by the CEO.

1.2 This practice is not intended to qualify the performance of a specific radiographic technique nor for assurance that a radiographic technique will detect specific discontinuities in a specimen undergoing radiographic examination.

1.3 This practice is not intended to be used to classify or derive performance classification categories for radiographic imaging systems. For example, performance classifications of

radiographic film systems may be found within Test Method E1815, and manufacturer characterization of computed radiography (CR) systems may be found in Practice E2446. However, the RIQI and absorber described in this practice are used by Practice E2446 for manufacturer characterization of computed radiography (CR) systems and by Practice E2445 to evaluate performance and to monitor long term stability of CR systems.

1.4 These tests are for applications below 4 MeV. When a gamma source or other high energy source is used, these tests may still be used to characterize the system, but may need a modification of the absorber thickness to adjust the available RIQR range as agreed between the user and cognizant engineering organization (CEO). For high-energy X-ray applications (4 MV to 25 MV), Test Method E1735 provides a similar RIQR standard practice.

1.5 The values stated in SI are to be regarded as the standard.

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 ASTM Standards:²

B152/B152M Specification for Copper Sheet, Strip, Plate, and Rolled Bar

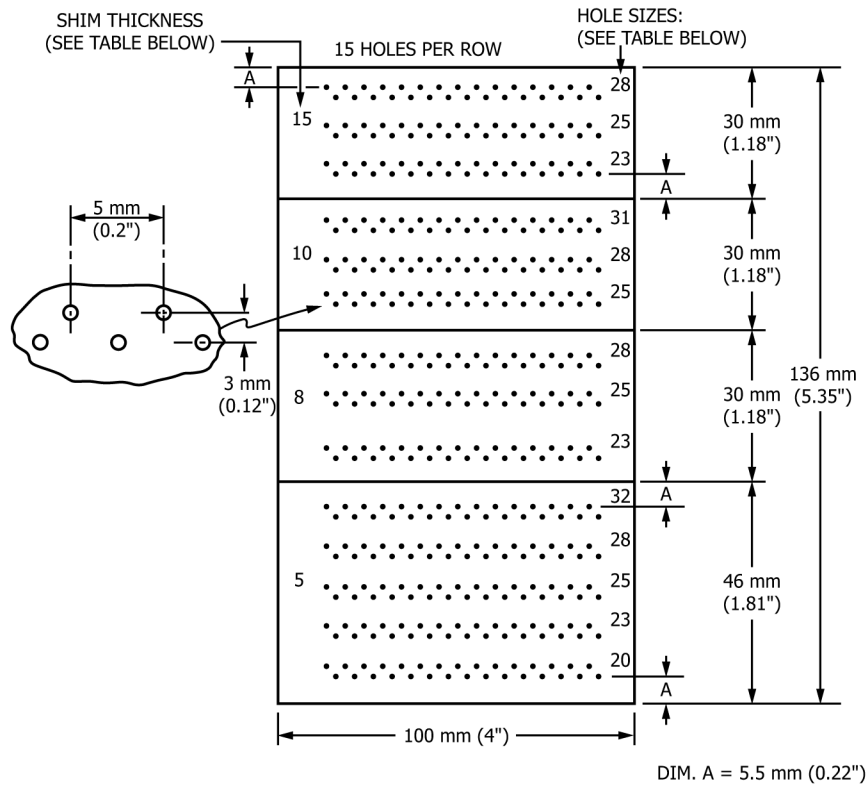
E999 Guide for Controlling the Quality of Industrial Radiographic Film Processing

E1025 Practice for Design, Manufacture, and Material

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 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.



Step Identification	Shim Thickness, mm (in.)	Hole Identification	Hole Size, mm (in.)
15	0.38 ± 0.012 (0.015 ± 0.0005)	32	0.81 ± 0.025 (0.032 ± 0.001)
10	0.25 ± 0.012 (0.010 ± 0.0005)	31	0.79 ± 0.025 (0.031 ± 0.001)
8	0.20 ± 0.012 (0.008 ± 0.0005)	28	0.71 ± 0.025 (0.028 ± 0.001)
5	0.13 ± 0.012 (0.005 ± 0.0005)	25	0.64 ± 0.025 (0.025 ± 0.001)
		23	0.58 ± 0.025 (0.023 ± 0.001)
		20	0.50 ± 0.025 (0.020 ± 0.001)

Hole Spacing (horizontal): $5 \text{ mm} \pm 0.1 \text{ mm}$ ($0.2 \text{ in.} \pm 0.004 \text{ in.}$) Nonaccumulative
Row Spacing: $3 \text{ mm} \pm 0.1 \text{ mm}$ ($0.12 \text{ in.} \pm 0.004 \text{ in.}$)
Spacing between hole sets: $5 \text{ mm} \pm 0.1 \text{ mm}$ ($0.2 \text{ in.} \pm 0.004 \text{ in.}$)
All other dimensions shall be in accordance with standard engineering practice.

FIG. 1 Relative Image Quality Indicator

Grouping Classification of Hole-Type Image Quality Indicators (IQI) Used for Radiography

- E1079 Practice for Calibration of Transmission Densitometers
- E1316 Terminology for Nondestructive Examinations
- E1735 Practice for Determining Relative Image Quality Response of Industrial Radiographic Imaging Systems from 4 to 25 MeV
- E1815 Test Method for Classification of Film Systems for Industrial Radiography
- E2002 Practice for Determining Image Unsharpness and Basic Spatial Resolution in Radiography and Radioscopy
- E2445 Practice for Performance Evaluation and Long-Term Stability of Computed Radiography Systems
- E2446 Practice for Manufacturing Characterization of Computed Radiography Systems

2.2 ISO Standards³:

- ISO 5-2 Photography Density Measurements-Part 2: Geometric Conditions for Transmission Density
- ISO 7004 Photography- Industrial Radiographic Film, Determination of ISO Speed, ISO average gradient, and ISO gradients G2 and G4 when exposed to X- and gamma-radiation

3. Terminology

3.1 *Definitions*—The definitions of terms relating to gamma and X-radiology in Terminology E1316 shall apply to terms used in this practice.

³ Available from International Organization for Standardization (ISO), 1, ch. De la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, <http://www.iso.org>.