



Standard Test Method for Determining Image Quality in Direct Thermal Neutron Radiographic Examination¹

This standard is issued under the fixed designation E545; 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 test method covers the use of an Image Quality Indicator (IQI) system to determine the relative² quality of radiographic images produced by direct, thermal neutron radiographic examination. The requirements expressed in this test method are not intended to control the quality level of materials and components.

1.2 *This standard does not purport to address 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.*

1.3 The values stated in SI units are regarded to be standard.

2. Referenced Documents

2.1 ASTM Standards:³

E543 Specification for Agencies Performing Nondestructive Testing

E748 Practices for Thermal Neutron Radiography of Materials

E803 Test Method for Determining the *L/D* Ratio of Neutron Radiography Beams

E1316 Terminology for Nondestructive Examinations

E2003 Practice for Fabrication of the Neutron Radiographic Beam Purity Indicators

E2023 Practice for Fabrication of Neutron Radiographic Sensitivity Indicators

¹ This test method is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.05 on Radiology (Neutron) Method.

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² The numerical values obtained in the calculations described herein may vary between different film processing systems, film types, and within one processing system if processing variables changes.

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.

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, see Terminology **E1316**, Section H.

4. Summary of Test Method

4.1 The judgment of the quality of a neutron radiograph is based upon the evaluation of images obtained from indicators that are exposed along with the test object. In cases of limited film size or extended object size, the indicators may be exposed on another film immediately prior to or following exposure of the test object under exactly the same conditions (refer to Process Control Radiographs, Section 10). The IQI values must be determined from films with an optical density between 2.0 to 3.0. Two types of IQIs are used.

4.1.1 *Beam Purity Indicator (BPI)*—The BPI is a device used for quantitative determination of radiographic quality. It is a polytetrafluoroethylene block containing two boron nitride disks, two lead disks, and two cadmium wires. A key feature of the BPI is the ability to make a visual analysis of its image for subjective information, such as image unsharpness and film and processing quality. Densitometric measurements of the image of the device permit quantitative determination of the effective value for the thermal neutron content, gamma content, pair production content, and scattered neutron content. The BPI shall be constructed in accordance with Practice **E2003**. Optionally, any BPI fabricated prior to publication of Practice **E2003** which conforms to Test Method E545 - 81 through 91 may be used.

4.1.2 *Sensitivity Indicator (SI)*—The SI is one of several devices used for qualitative determination of the sensitivity of detail visible on a neutron radiograph. The SI is a step-wedge device containing gaps and holes of known dimensions. Visual inspection of the image of this device provides subjective information regarding total radiographic sensitivity with respect to the step-block material. The SI shall be in accordance with Practice **E2023**. Optionally, any SI fabricated prior to publication of Practice **E2023** which conforms to Test Method E545-81 through 91 may be used.

4.2 Neutron radiography practices are discussed in Practices **E748**.

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