



Designation: E446 – 98 (Reapproved 2004)<sup>e1</sup>

## Standard Reference Radiographs for Steel Castings Up to 2 in. [51 mm] in Thickness<sup>1</sup>

This standard is issued under the fixed designation E446; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

<sup>e1</sup> NOTE—Editorial changes were made throughout the standard in January 2004.

### 1. Scope

1.1 These reference radiographs<sup>2</sup> illustrate various types and degrees of discontinuities occurring in steel castings that have section thicknesses up to 2 in. [51 mm] (Note 1).

NOTE 1—Reference radiographs previously used for this thickness range carried the designation E71, but included a now rarely used gamma source, that is, radium. The current document is also updated by inclusion of several recognized *shrinkage* or *C* categories and by elimination of the crack and hot tear categories except for one example of each of these discontinuity types. Reference radiographs for thicker sections may be found in E186 and E280.

1.2 These reference illustrations consist of three separate sets (Note 2) as follows: (1) medium voltage (nominal 250-kVp) X rays. (2) 1-MV X rays and Iridium-192 radiation, and (3) 2-MV to 4-MV X rays and cobalt-60 radiation. Each set is for comparison only with radiographs produced with equivalent radiation. It should be recognized that each energy level is not applicable to the entire thickness range covered by this document. Each set consists of 6 categories of graded discontinuities in increasing severity level and 4 categories of ungraded discontinuities furnished as examples only, as follows:

- 1.2.1 *Category A*—Gas porosity; severity levels 1 through 5.
- 1.2.2 *Category B*—Sand and slag inclusions; severity levels 1 through 5.
- 1.2.3 *Category C*—Shrinkage; 4 types:
  - 1.2.3.1 *CA*—Severity levels 1 through 5.
  - 1.2.3.2 *CB*—Severity levels 1 through 5.
  - 1.2.3.3 *CC*—Severity levels 1 through 5.
  - 1.2.3.4 *CD*—Severity levels 1 through 5.
- 1.2.4 *Category D*—Crack; 1 illustration.
- 1.2.5 *Category E*—Hot tear; 1 illustration.

1.2.6 *Category F*—Insert; 1 illustration.

1.2.7 *Category G*—Mottling; 1 illustration.

NOTE 2—The illustrations consist of the following:

*Volume I: Medium Voltage (Nominal 250 kVp) X-Ray Reference Radiographs*—Set of 34 illustrations (5 by 7 in.) in a 15 by 17-in. ring binder.

*Volume II: 1-MV X Rays and Iridium-192 Reference Radiographs*—Set of 34 illustrations (5 by 7 in.) in a 15 by 17-in. ring binder.

*Volume III: 2-MV to 4-MV X Rays and Cobalt-60 Reference Radiographs*—Set of 34 illustrations (5 by 7 in.) in a 15 by 17-in. ring binder.

NOTE 3—Although Category G—Mottling is listed for all three volumes, the appearance of mottling is dependent on the level of radiation energy. Mottling appears reasonably prominent in Volume I; however, because of the higher radiation energy levels mottling may not be apparent in Volume II nor Volume III.

1.3 The values stated in inch-pound units are to be regarded as the standard.

1.4 *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.*

### 2. Referenced Documents

2.1 *ASTM Standards*:<sup>3</sup>

E94 Guide for Radiographic Examination

E186 Reference Radiographs for Heavy-Walled (2 to 412-in. [51 to 114-mm]) Steel Castings

E242 Reference Radiographs for Appearances of Radiographic Images as Certain Parameters Are Changed

E280 Reference Radiographs for Heavy-Walled (412 to 12-in. [114 to 305-mm]) Steel Castings

E1316 Terminology for Nondestructive Examinations

2.2 *ASTM Adjuncts*:<sup>4</sup>

Reference Radiographs for Steel Castings Up to 2 in. [51 mm] in Thickness:

<sup>1</sup> These reference radiographs are under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and are the direct responsibility of Subcommittee E07.02 on Reference Radiographs.

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<sup>2</sup> For ASME Boiler and Pressure Vessel Code applications see related Reference Radiographs SE-446 in Section V of that Code.

<sup>3</sup> 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.

<sup>4</sup> Available from ASTM Headquarters.