



# Standard Reference Radiographs for Gray Iron Castings Up to 4½ in. (114 mm) in Thickness <sup>1</sup>

This standard is issued under the fixed designation E802; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

## 1. Scope

1.1 These reference radiographs for gray iron castings consist of one set of illustrations of centerline shrinkage with severity levels 1 to 5 using three radiation source types as follows:

1.1.1 *Volume I: Medium Voltage (nominal 250 kVp) X-ray Reference Radiographs*—Set of 5 severity levels in a 15 by 17 in. folder.

1.1.2 *Volume II: Iridium-192 Reference Radiographs*—Set of 5 severity levels in a 15 by 17 in. folder.

1.1.3 *Volume III: Cobalt-60 Reference Radiographs*—Set of 5 severity levels in a 15 by 17 in. folder.

NOTE 1—The reference radiograph films are an adjunct to this document and must be purchased separately from ASTM International if needed.

1.2 From time to time, there may be minor changes to the process for manufacturing of the reference radiograph adjunct materials. These changes could include changes in the films or processing chemicals used, changes in the dies or printing for the cardboard mats, etc.; however, in all cases, these changes are reviewed by the Illustration Monitoring Subcommittee and all reference radiographs are reviewed against a fixed prototype image to ensure that there are no changes to the acceptance level represented by the reference radiographs. Therefore, the adjunct reference radiographs remain valid for use with this standard regardless of the date of production or the revision level of the text standard.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered 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.*

<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 Radiological Images.

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## 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

E94 Guide for Radiographic Examination

E186 Reference Radiographs for Heavy-Walled (2 to 4½-in. (50.8 to 114-mm)) Steel Castings

E446 Reference Radiographs for Steel Castings Up to 2 in. (50.8 mm) in Thickness

E1316 Terminology for Nondestructive Examinations

2.2 *ASTM Adjuncts*:

Reference Radiographs for Gray Iron Castings Up to 4½ in. (114 mm) in Thickness:

Volume I, Medium Voltage (Nominal 250 kVp) X-rays<sup>3</sup>

Volume II, Iridium-192<sup>4</sup>

Volume III, Cobalt-60<sup>5</sup>

## 3. Terminology

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

## 4. Significance and Use

4.1 These reference radiographs, along with the referenced applicable steel casting standards (Reference Radiographs E186 and E446), are supplied as a means of establishing categories and severity levels of common internal discontinuity types in gray iron castings subjected to radiographic examination. They may be used in accordance with contractual specifications as agreed upon between purchaser and supplier.

4.2 The use of this standard is not intended to be restricted to the specific energy level or to the absolute thickness limits that are contained in this standard title. The title is intended to be descriptive and not restrictive. This document may be used, where there is no other applicable document, for other energy levels or thicknesses, or both, for which it is found to be

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from ASTM International Headquarters. Order Reference Radiograph No. RRE080201.

<sup>4</sup> Available from ASTM International Headquarters. Order Reference Radiograph No. RRE080202.

<sup>5</sup> Available from ASTM International Headquarters. Order Reference Radiograph No. RRE080203.

applicable and for which agreement has been reached between purchaser and supplier.

## 5. Method of Preparation

5.1 The original radiographs used to prepare the accompanying reference radiographs were produced on high contrast, fine-grain film by the respective use of radiation energies stated in 1.1.1 – 1.1.3. The radiographs were made with a penetrameter sensitivity as determined by ASTM penetrameters (see Guide E94) of 2-2T. The reproductions have been prepared to an H&D density from 2.00 to 2.25 and they have retained substantially the contrast of the original radiographs.

5.2 *Film Deterioration*—Radiographic films are subject to wear and tear from handling and use. The extent to which the image deteriorates over time is a function of storage conditions, care in handling and amount of use. Reference radiograph films are no exception and may exhibit a loss in image quality over time. The radiographs should therefore be periodically examined for signs of wear and tear, including scratches, abrasions, stains, and so forth. Any reference radiographs which show signs of excessive wear and tear which could influence the interpretation and use of the radiographs should be replaced.

## 6. Determination of Radiographic Classification

6.1 For purposes of evaluation of castings, a determination must be made of the radiographic classification to be assigned to individual castings or specific areas of castings. The determination of the applicable radiographic-severity classification shall be based on an evaluation of the casting applications, design, and service requirements. In these evaluations, considerations shall be given to such factors as pressure, temperature, section thickness, applicable design safety factor, vibration, shock, resistance to corrosion, involvement of penetrating radiations or radiation products, and involvement of dangerous gases or liquids.

NOTE 2—The radiographic definition of the defects illustrated will vary according to the energy levels of the sources employed in the radiography.

## 7. Classification Specifications

7.1 The applicable radiographic severity level should be designated for each discontinuity type by the contracting agency in formal specifications or drawings and in the specific contract or order. For castings, the level should be indepen-

dently specified for each discontinuity type, since they have been shown to affect strength properties differently. For example, in the same casting severity level 2 might be specified for shrinkage Type 3 and severity level 4 for gas porosity Type 1. The specifications, drawings, contract, or order should also designate the sampling plan for the castings to be radiographed and the extent and quality level of the radiographic coverage.

## 8. Procedure for Evaluation

8.1 Compare radiographs of the casting submitted for evaluation with the reference radiographs applicable to the section thickness and the source used.

8.2 When a particular class or severity is called for and the radiograph being evaluated is equal to or better than the reference, indicate the casting as radiographically acceptable. If the radiograph shows a discontinuity of greater severity than the reference radiograph, the casting shall be rejected.

8.3 When two or more types of discontinuities are present in the same radiograph, the predominating ones, if unacceptable, shall govern without regard to the other types of discontinuities.

8.4 When two or more categories of discontinuities are present to an extent equal to the maximum permissible level, as shown in the pertinent standards for each category, then that part of the casting shall be judged unacceptable until satisfactorily repaired, if permissible.

8.5 In general, there is no limit with regard to the extent of acceptable discontinuities in a casting, provided that no 5 by 7-in. (127 by 178-mm) area throughout the casting contains discontinuities that exceed those indicated on the minimum acceptable reference radiographs.

8.6 Where the reference image consists of a collection of discontinuities, as in the case of porosity, for example, acceptability may be based on the aggregate size of the discontinuities present on both the reference radiograph and the object radiograph, the maximum defect size present, the spacing between discontinuities, or a combination of these or other criteria. These criteria must be determined based upon the particular application or part under consideration and must be specified by agreement between the purchaser and supplier.

## 9. Keywords

9.1 castings; discontinuities; gamma ray; gray iron; reference radiographs; X-ray

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