



Standard Reference Radiographs for Examination of Aluminum Fusion Welds¹

This standard is issued under the fixed designation E 1648; 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 These reference radiographs illustrate various types and severity levels of discontinuities in aluminum fusion welds that may be revealed by radiographic examination. These reference radiographs do not specify the acceptable level of these discontinuities, rather they provide a visual reference for communicating the acceptable level.

NOTE 1—The reference radiographs consist of a set of eight plates (8½ by 11 in. (22 by 28 cm)), covering base material up to and including 0.75 in. (19 mm) in thickness.

1.2 These reference radiographs are based on two nominal weld thicknesses in wrought aluminum products and are applicable to the thickness ranges shown in Table 1. The welds were produced using base material plates of 6061 and 5083 alloys and 5356 and 4043 gas metal-arc (GMA) electrodes. These reference radiographs are intended for use in evaluating radiographs of welds in wrought aluminum products. They are not recommended for use with repair welds in cast materials; however, they are appropriate for use with assembly or fabrication welds. Reference radiographs for aluminum and magnesium castings are available in Reference Radiographs E 155 and E 505.

1.3 The adjunct contains illustrations of representative graded and ungraded discontinuities. Table 2 lists the discontinuity types and severities illustrated for each thickness of base material. Each of the graded discontinuity types has five severity levels, 1 through 5, in order of increasing severity. The ungraded discontinuities are included for informational purposes.

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

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

¹ These reference radiographs are under the jurisdiction of ASTM Committee E-7 on Nondestructive Testing and are the direct responsibility of Subcommittee E07.02 on Reference Radiological Images.

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TABLE 1 Applicable Thickness Ranges

| Illustration Thickness, in. (mm) | Base Material Thickness, in. (mm) |
|----------------------------------|---|
| 0.125 (3.2) | to and including 0.375 (9.5) |
| 0.50 (12.7) | over 0.375 (9.5) to and including 0.75 (19) |

E 94 Guide for Radiographic Testing²

E 155 Reference Radiographs for Inspection of Aluminum and Magnesium Castings²

E 505 Reference Radiographs for Inspection of Aluminum and Magnesium Die Castings²

E 1032 Test Method for Radiographic Examination of Weldments²

E 1316 Terminology for Nondestructive Examinations²

2.2 ASTM Adjuncts:

Reference Radiographs for Aluminum Fusion Welds:

Volume 1, Thicknesses Up to and Including 0.75 in. (19 mm)³

3. Terminology

3.1 *Definitions*—Definitions of terms relating to X ray and gamma radiology, as used in these reference radiographs, may be found in Terminology E 1316.

TABLE 2 Types of Discontinuities Illustrated for Each Thickness of Base Material

| Discontinuity Type | Base Material Thickness, in. (mm) and Grading | |
|--------------------------------------|---|--------------------|
| | 0.125 (3.2) | 0.50 (12.7) |
| Fine scattered porosity | Grades 1 through 5 | Grades 1 through 5 |
| Coarse scattered porosity | ... | Grades 1 through 5 |
| Aligned porosity | Grades 1 through 5 | Grades 1 through 5 |
| Clustered porosity | ... | Ungraded |
| Incomplete penetration | Ungraded | Ungraded |
| Tungsten inclusions | ... | Ungraded |
| Undercut | Ungraded | Ungraded |
| Cracks (longitudinal and transverse) | Ungraded | Ungraded |
| Crater crack | ... | Ungraded |

4. Significance and Use

4.1 Use of these reference radiographs requires agreement between the using parties as to the acceptable level of each discontinuity type. Illustrations are provided for welds in

² *Annual Book of ASTM Standards*, Vol 03.03.

³ Available from ASTM Headquarters. Order RRE1648.