



Designation: E 1955 – 9804

Standard Radiographic Examination for Soundness of Welds in Steel by Comparison to Graded ASTM E 390 Reference Radiographs¹

This standard is issued under the fixed designation E 1955; 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 radiograph standard covers requirements for radiographic examination for soundness of welds in fabricated steel by comparison to selected severity levels of Reference Radiographs E 390, Vol II. The base material varies from greater than 0.25 to 3 in. (6.4–76 mm) inclusive in thickness. Volume II is applicable. This radiograph standard is not suitable for shipyard use.

~~NOTE 1—When coordinated through the Department 1—This standard was adopted to replace Mil-Std. 1264-B entitled “Radiographic Inspection For Soundness of Defense (DOD) Welds In Steel By Comparison To Graded ASTM E 390 Reference Radiographs,” dated 18 January, 1989. This standard is intended to be used for the same applications as a the document which it replaced. Users should carefully review its requirements when considering the standard’s use for Mil-Std 1264-B, new and/or different applications.~~

1.2 The values stated in inch-pound units are to be regarded as the standard. The SI units given in parentheses brackets are for information only.

1.3 *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.*

¹ This radiograph standard is under the jurisdiction of ASTM Committee E-7 E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.02 on Reference Radiological Images.

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2. Referenced Documents

2.1 *ASTM Standards:*²

E 94 Guide for Radiographic Testing Examination
 E 390 Reference Radiographs for Steel Fusion Welds
 E 1742 Practice for Radiographic Examination
 E 1316 Terminology for Nondestructive Examinations

2.2 *Military Standards:*

~~MIL-STD-410 Nondestructive Testing Personnel Qualification~~
 NAS-410 Certification and Certification Qualification of Nondestructive Test Personnel³
~~MIL-STD-453 Inspection, Radiographic~~³

2.3 *ASNT Standards:*

~~SNT-TC-1A Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing~~⁴
 SNT-TC-1A Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing
 ANSI/ASNT-CP-189 Standard for Qualification and Certification of Nondestructive Testing Personnel

2.4 *American Welding Society Standards:*

~~AWS-B 3.0 Acceptance Criteria Porosity AWS Welding Procedure and Performance Qualification~~
 AWS D 1.1 Structural Welding Code Steel, 1981⁵ Code Steel⁵

2.5 *American Petroleum Institute Standards:*

API STD-1104 Standard for Welding Pipelines and Related Facilities⁶

2.6 *Adjuncts:*

Reference Radiographs for Steel Fusion Welds:
 Volume II, Thickness Over ¼ to 3 in. (6.4 to 76 mm), incl⁷

3. Terminology

3.1 *Definitions*— For definitions of terms used in this document, see Terminology E 1316.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *grades*—welds shall be designated Grades I, II, III, or IV as shown in Table 1. A Grade I weld would contain the least or smallest discontinuities, or both, and a Grade IV weld would contain the largest or most numerous discontinuities, or both.

3.2.2 *inspection examination lot*—an inspection examination lot shall consist of all welds of a specific design and size produced at one facility by the same personnel and production technique, and submitted for inspection examination at one time.

4. Significance and Use

4.1 This radiograph standard can be used to establish acceptance criteria for weld soundness based on the procedures and reference radiographs of Reference Radiographs ASTM E 390. The grades specified in this radiograph standard, while applicable for general inspection examination use for the materials and thicknesses indicated, may not be suitable for all applications.

5. General Practices

5.1 *Personnel Qualification*—Nondestructive testing (NDT) personnel shall be qualified in accordance with a nationally or internationally recognized NDT personnel qualification practice or standard such as ANSI/ASNT-CP-189, SNT-TC-1A, ~~MIL-STD-410~~, NAS-410, or a similar document. The practice or standard used and its applicable revision shall be specified in the contractual agreement between the using parties.

5.2 *Determination of Grades*—The customer shall establish the acceptance grade for each weld design and this grade shall be indicated on the applicable drawing, order, contract or other appropriate documents.

5.3 *Extent of Inspection Examination*—Extent of radiographic inspection examination of all welds shall be accomplished as required by the drawing, order, contract or other appropriate document. If extent is not provided, radiographic inspection examination shall be 100 % of weld joints.

6. Application of Reference Radiographs

6.1 *Acceptance Criteria*—Welds Graded I, II, III or IV shall contain discontinuities no more severe than those shown in the severity levels indicated in Table 1. The severity levels indicated refer to those illustrated in the reference radiographs of Reference Radiographs ASTM E 390.

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, Vol 03-03, volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from Superintendent of Documents, U.S. Government Printing Office, Aerospace Industries Association, 1050 Eye St., NW, Washington, DC 20402-20005.

⁴ Available from The American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036; Society for Nondestructive Testing (ASNT), P.O. Box 28518, 1711 Arlingate Ln., Columbus, OH 43228-0518.

⁵ Available from American Welding Society, 550 N.W. Lajuene Road, Miami, FL 33135.

⁶ Available from American Petroleum Institute, 1801 K Street N.W., Washington, DC 20226.

⁷ Available from ASTM Headquarters. Order PCN 17-503902-22.

**TABLE 1 Severity Level Requirements for Welds In Accordance
With Reference Radiographs E 390, Vol II Reference
Radiographs^{A,B}**

Discontinuities	Illustration Thickness, in.-([mm])	Grade	Grade	Grade	Grade
		I	II	III	IV
<u>Fine Scattered Porosity</u>	$\frac{3}{8}$ (9.5)	None	4	2	3
<u>Fine Scattered Porosity</u>	$\frac{3}{8}$ [9.5]	None	1	2	3
	$\frac{3}{4}$ (19)	None	2	2	3
	$\frac{3}{4}$ [19]	None	2	2	3
	2 (51)	4	2	3	4
	2 [51]	1	2	3	4
<u>Coarse Scattered Porosity</u>	$\frac{3}{8}$ (9.5)	None	4	2	3
<u>Coarse Scattered Porosity</u>	$\frac{3}{8}$ [9.5]	None	1	2	3
	$\frac{3}{4}$ (19)	None	2	2	3
	$\frac{3}{4}$ [19]	None	2	2	3
	2 (51)	4	2	3	4
	2 [51]	1	2	3	4
<u>Clustered Porosity</u>	$\frac{3}{8}$ (9.5)	None	4	2	3
<u>Clustered Porosity</u>	$\frac{3}{8}$ [9.5]	None	1	2	3
	$\frac{3}{4}$ (19)	None	2	2	3
	$\frac{3}{4}$ [19]	None	2	2	3
	2 (51)	4	2	3	4
	2 [51]	1	2	3	4
<u>Linear Porosity or Globular</u>	$\frac{3}{8}$ (9.5)	None	4	2	3
<u>Linear Porosity or Globular</u>	$\frac{3}{8}$ [9.5]	None	1	2	3
<u>Indications</u>	$\frac{3}{4}$ (19)	None	2	2	3
<u>Indications</u>	$\frac{3}{4}$ [19]	None	2	2	3
	2 (51)	4	2	3	4
	2 [51]	1	2	3	4
<u>Slag Inclusions</u>	$\frac{3}{8}$ (9.5)	None	4	2	3
<u>Slag Inclusions</u>	$\frac{3}{8}$ [9.5]	None	1	2	3
	$\frac{3}{4}$ (19)	None	2	2	3
	$\frac{3}{4}$ [19]	None	2	2	3
	2 (51)	4	2	3	4
	2 [51]	1	2	3	4
<u>Tungsten Inclusions</u>	$\frac{3}{8}$ (9.5)	None	4	2	3
<u>Tungsten Inclusions</u>	$\frac{3}{8}$ [9.5]	None	1	2	3
	$\frac{3}{4}$ (19)	None	2	2	3
	$\frac{3}{4}$ [19]	None	2	2	3
	2 (51)	--- No Greater Than Ungraded Radiograph ---			
	2 [51]	- - - No Greater Than Ungraded Radiograph - - -			
<u>Incomplete Penetration</u>	$\frac{3}{8}$ (9.5)	None	4	2	3
<u>Incomplete Penetration</u>	$\frac{3}{8}$ [9.5]	None	1	2	3
	$\frac{3}{4}$ (19)	None	2	3	4
	$\frac{3}{4}$ [19]	None	2	3	4
	2 (51)	4	2	3	4
	2 [51]	1	2	3	4
<u>Lack of Fusion</u>	$\frac{3}{8}$ (9.5)	None	4	2	3
<u>Lack of Fusion</u>	$\frac{3}{8}$ [9.5]	None	1	2	3
	$\frac{3}{4}$ (19)	None	2	2	3
	$\frac{3}{4}$ [19]	None	2	2	3
	2 (51)	4	2	3	4
	2 [51]	1	2	3	4

Ungraded Discontinuities (All applicable thickness ranges)
 All Crack Types - - - - -Not Allowed - - - - -
 Undercut - - - - -Not Allowed - - - - -
 Burn Through - - - - -Not Allowed - - - - -
 Icicles (Teardrops) - - - - -Not Allowed - - - - -
 Elongated (or Wormhole) Porosity - - - - -Not Allowed - - - - -

^A When two or more types of discontinuities are present, the extent of the predominant discontinuity must be less than the severity level allowed for that discontinuity type.

^B Discontinuities allowed by this table shall be cause for rejection when closer than twice their maximum dimension to an edge or extremity of a weldment in a highly stressed or critical area as specified on the drawing, order, contract or other appropriate documents.

6.2 *Applicable Thickness Ranges* —The applicable thickness ranges for the reference radiograph illustrations used to determine severity levels for welds in Table 1 of this ~~radiograph document~~ standard are listed below:

Illustration Thickness, in. (mm)
Illustration Thickness, in. [mm]
3/4 (9.5)
3/8 [9.5]
3/4 (19)
3/4 [19]
2 (51)
2 [51]

Base Material Thickness Range, in. (mm) ⁸
Base Material Thickness Range, in. [mm] ⁸
Over 1/4 (6.4) to and including 1/2 (13)
Over 1/4 [6.4] to and including 1/2 [13]
Over 1/2 (13) to and including 1 1/2 (38)
Over 1/2 [13] to and including 1 1/2 [38]
Over 1 1/2 (38) to and including 3 (76)
Over 1 1/2 [38] to and including 3 [76]

7. Supplementary Requirements

7.1 The customer may choose additional acceptance criteria from AWS D 1.1, Section ~~10.17~~; AWS B-3.0; 10.17 and API STD 1104, Section 6. These documents will only be applicable when they appear on the drawing, order, contract or other appropriate document.

7.2 Unless prohibited by the drawing, specification or other contract document, weld joints rejected because ~~on~~ of non-compliance ~~to~~ with this radiograph standard may be repaired. All repaired areas shall be re-examined to the requirements of this radiograph standard.

8. Keywords

8.1 discontinuities; fusion welds; reference radiographs; steel; ~~x~~ X-ray

⁸ In cases of joining two members of unequal thickness the standard applicable to the thinner member shall be used.

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