



Designation: E 1955 – 98

# Standard Radiographic Examination for Soundness of Welds In Steel by Comparison to Graded ASTM E 390 Reference Radiographs<sup>1</sup>

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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This radiograph 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 is not suitable for shipyard use.

NOTE 1—When coordinated through the Department of Defense (DOD), this radiograph is intended as a direct replacement for Mil-Std 1264-B.

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

## 2. Referenced Documents

### 2.1 ASTM Standards:

- E 94 Guide for Radiographic Testing<sup>2</sup>
- E 390 Reference Radiographs for Steel Fusion Welds<sup>2</sup>
- E 1742 Practice for Radiographic Examination<sup>2</sup>
- E 1316 Terminology for Nondestructive Examinations<sup>2</sup>

### 2.2 Military Standards:

- MIL-STD-410 Nondestructive Testing Personnel Qualification and Certification<sup>3</sup>
- MIL-STD-453 Inspection, Radiographic<sup>3</sup>

### 2.3 ASNT Standards:

- SNT-TC-1A Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing<sup>4</sup>
- ANSI/ASNT-CP-189 Standard for Qualification and Certi-

fication of Nondestructive Testing Personnel<sup>4</sup>

### 2.4 American Welding Society Standards:

- AWS B 3.0 Acceptance Criteria-Porosity-AWS-Welding Procedure and Performance Qualification<sup>5</sup>
- AWS D 1.1 Structural Welding Code-Steel, 1981<sup>5</sup>

### 2.5 American Petroleum Institute Standards:

- API STD-1104 Standard for Welding Pipelines and Related Facilities<sup>6</sup>

### 2.6 Adjuncts:

Reference Radiographs for Steel Fusion Welds:

Volume II, Thickness Over 1/4 to 3 in. (6.4 to 76 mm), incl<sup>7</sup>

## 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 lot*—an inspection 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 at one time.

## 4. Significance and Use

4.1 This radiograph can be used to establish acceptance criteria for weld soundness based on the procedures and reference radiographs of Reference Radiographs E 390. The grades specified in this radiograph, while applicable for general inspection 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 recognized NDT personnel qualification practice or standard

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

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 03.03.

<sup>3</sup> Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

<sup>4</sup> Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

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

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

<sup>7</sup> 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<sup>A,B</sup>**

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

<sup>A</sup> 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.

<sup>B</sup> 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.

such as ANSI/ASNT-CP-189, SNT-TC-1A, MIL STD-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.

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*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.*

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*—Extent of radiographic inspection of all welds shall be accomplished as required by the drawing, order, contract or other appropriate document. If extent is not provided, radiographic inspection 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 E 390.

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 are listed below:

Illustration Thickness, in. (mm)	Base Material Thickness Range, in (mm) <sup>8</sup>
3/8 (9.5)	Over 1/4 (6.4) to and including 1/2 (13)
3/4 (19)	Over 1/2 (13) to and including 1 1/2 (38)
2 (51)	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; 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 non-compliance to this radiograph may be repaired. All repaired areas shall be re-examined to the requirements of this radiograph.

## 8. Keywords

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

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