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Standard Radiographic Examination for Soundness of Welds in Steel by Comparison to Graded ASTM E390 Reference Radiographs[1]

This standard is issued under the fixed designation E1955; 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 standard covers requirements for radiographic examination for soundness of welds in fabricated steel by comparison to selected severity levels of Reference Radiographs E390, 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 standard is not suitable for shipyard use.

NOTE 1—This standard was adopted to replace Mil-Std. 1264-B entitled "Radiographic Inspection For Soundness of Welds In Steel By Comparison To Graded ASTM E390 Reference Radiographs," dated 18 January, 1989. This standard is intended to be used for the same applications as the document which it replaced. Users should carefully review its requirements when considering the standard's use for new and/or different applications.

1.2 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.

1.3 *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:*[2]
E390 Reference Radiographs for Steel Fusion Welds
E1316 Terminology for Nondestructive Examinations

2.2 *Military Standards:*
NAS-410 Certification and Qualification of Nondestructive Test Personnel[3]

2.3 *ASNT Standards:*[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 D 1.1 Structural Welding Code Steel[5]

2.5 *American Petroleum Institute Standards:*
API STD-1104 Standard for Welding Pipelines and Related Facilities[6]

2.6 *Adjuncts:*
Reference Radiographs for Steel Fusion Welds: Volume II, Thickness Over ¼ to 3 in. (6.4 to 76 mm), incl[7]

3. Terminology

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

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 *examination lot*—an 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 examination at one time.

[1] This standard is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.02 on Reference Radiological Images.

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[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* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from Aerospace Industries Association of America, Inc. (AIA), 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209-3928, http://www.aia-aerospace.org.

[4] Available from American Society for Nondestructive Testing (ASNT), P.O. Box 28518, 1711 Arlingate Ln., Columbus, OH 43228-0518, http://www.asnt.org.

[5] Available from American Welding Society (AWS), 550 NW LeJeune Rd., Miami, FL 33126, http://www.aws.org.

[6] Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, http://www.api.org.

[7] Available from ASTM International Headquarters. Order Adjunct No. RRE039002.

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TABLE 1 Severity Level Requirements for Welds In Accordance With Reference Radiographs E390, Vol II Reference Radiographs[A,B]

Discontinuities	Illustration Thickness, in. (mm)	Grade I	Grade II	Grade III	Grade IV
Fine Scattered Porosity	⅜ (9.5)	None	1	2	3
	¾ (19)	None	2	2	3
	2 (51)	1	2	3	4
Coarse Scattered Porosity	⅜ (9.5)	None	1	2	3
	¾ (19)	None	2	2	3
	2 (51)	1	2	3	4
Clustered Porosity	⅜ (9.5)	None	1	2	3
	¾ (19)	None	2	2	3
	2 (51)	1	2	3	4
Linear Porosity or Globular Indications	⅜ (9.5)	None	1	2	3
	¾ (19)	None	2	2	3
	2 (51)	1	2	3	4
Slag Inclusions	⅜ (9.5)	None	1	2	3
	¾ (19)	None	2	2	3
	2 (51)	1	2	3	4
Tungsten Inclusions	⅜ (9.5)	None	1	2	3
	¾ (19)	None	2	2	3
	2 (51)	- - - -No Greater Than Ungraded Radiograph- - -			
Incomplete Penetration	⅜ (9.5)	None	1	2	3
	¾ (19)	None	2	3	4
	2 (51)	1	2	3	4
Lack of Fusion	⅜ (9.5)	None	1	2	3
	¾ (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 - - - - -

[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.

4. Significance and Use

4.1 This standard can be used to establish acceptance criteria for weld soundness based on the procedures and reference radiographs of ASTM E390. The grades specified in this standard, while applicable for general 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, 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 Examination*—Extent of radiographic examination of all welds shall be accomplished as required by the drawing, order, contract or other appropriate document. If extent is not provided, radiographic 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 ASTM E390.

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 standard are listed below:

Illustration Thickness, in. (mm)	Base Material Thickness Range, in. (mm)[8]
⅜ (9.5)	Over ¼ (6.4) to and including ½ (13)
¾ (19)	Over ½ (13) to and including 1½ (38)
2 (51)	Over 1½ (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 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 of noncompliance with this standard may be repaired. All repaired areas shall be re-examined to the requirements of this standard.

8. Keywords

8.1 discontinuities; fusion welds; reference radiographs; steel; 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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