Designation: A 898/A 898M – 07

Standard Specification for Straight Beam Ultrasonic Examination of Rolled Steel Structural Shapes[1]

This standard is issued under the fixed designation A 898/A 898M; 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 specification covers the procedure and acceptance standards for straight beam, pulse echo, ultrasonic examination of rolled structural shapes having a minimum section thickness of ½ in. [12.5 mm]. It was developed to ensure delivery of steel structural shapes free of gross internal discontinuities such as pipe, ruptures, or laminations and is to be used whenever the inquiry, contract, order, or specification states that the shapes are to be ultrasonically examined. Two levels of acceptance standards are included. Level II is intended for normal applications where freedom from gross internal discontinuities is desired, particularly in connection regions. Level I is intended for critical applications such as welded chord members used in tension loading, where internal discontinuities could be detrimental. Level II is normally applicable unless otherwise specified in contract documents or the purchase order. Supplementary requirements for alternative scanning coverages are provided.

1.2 The values stated in either inch-pound or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 6/A 6M Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

E 317 Practice for Evaluating Performance Characteristics of Ultrasonic Pulse-Echo Testing Instruments and Systems without the Use of Electronic Measurement Instruments

2.2 *ASNT Standard:*[3]

SNT-TC-1A Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing[3]

3. Ordering Information

3.1 The inquiry and order should indicate the following:

3.1.1 Acceptance level requirements will be Level II unless otherwise specified.

3.1.2 Any additions to the provisions of this specification as outlined in 8.3.

3.1.3 Supplementary requirements, if any.

4. Apparatus

4.1 The manufacturer shall furnish suitable ultrasonic equipment and qualified personnel necessary for performing the examination. The equipment shall be straight beam, pulse-echo and span a nominal test frequency range of 1 to 5 MHz. The search unit shall be within the range of ½ in. [12.5 mm] to 1⅛ in. [30 mm] in diameter or ½ [12.5 mm] to 1 in. [25 mm] square (including the pitch-catch type probe). The test shall be performed by one of the following methods: contact, immersion, or liquid column coupling.

4.2 Other search units may be used for evaluating and pin-pointing indications.

5. Personnel Qualification

5.1 Individuals performing examinations in accordance with this specification shall be qualified and certified in accordance with the requirements of the latest edition of ASNT SNT-TC-1A or an equivalent accepted standard. An equivalent standard is one that covers the qualification and certification of ultrasonic nondestructive examination candidates, and that is acceptable to the purchaser.

6. Test Conditions

6.1 Conduct the examination in an area free of operations that interfere with proper functioning of equipment and testing personnel.

[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.02 on Structural Steel for Bridges, Buildings, Rolling Stock and Ships.

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

***A Summary of Changes section appears at the end of this standard.**

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6.2 The section surfaces shall be sufficiently clean and smooth to maintain a back reflection from the opposite side of the flanges, legs, and webs approximately comparable to the height observed at the scanning gain level obtained in 8.2.

6.3 The surfaces of the shapes inspected by this method may be expected to contain a residue of oil or rust or both. Any specified identification that is removed when grinding as a result of surface preparation or examination shall be restored.

7. Calibration

7.1 Standards having ¼ in. [6 mm] diameter flat bottomed holes are used for calibration. The metal distance between the hole bottom and sound entry surface in relation to section thickness is given in Table 1.

7.2 Standards shall be obtained from a rolled structural shape or plate having surface conditions and acoustic properties similar to that of the product being inspected.

8. Test Method

8.1 Ultrasonic examination shall be made on the major surface of each flange and one major web surface. Evaluation of indications may require inspection from an opposite surface.

8.2 The reference level sensitivity shall be established by adjusting the maximum response obtained from the flat-bottomed hole between 50 and 80 % of full screen scale. When scanning, the gain level shall be increased to at least twice the reference level sensitivity as measured on the cathode ray tube (CRT) (typically 6 dB). All indications shall be evaluated at the reference level sensitivity.

8.2.1 When scanning the flanges or legs above the web, the calibrated range control (sweep) of the instrument should be set so there is adequate display range for indications that may lie between fillets, at a depth greater than the flange or leg thickness.

8.3 A nominal frequency between 1 and 5 MHz is recommended for examination. Thickness, grain size, or microstructure of the material and nature of the equipment or method may require a different test frequency. However, frequencies less than 1 MHz may be used only by agreement with the purchaser. A clear, easily interpreted trace pattern should be produced during the examination.

8.4 *Scanning Coverage*:

8.4.1 Scanning coverage of the web and flange is illustrated in Fig. 1. A 6-in. wide [150 mm] lateral strip with a 10 % overlap between each scan path shall be scanned at each end, and a zig-zag scan shall be utilized over the length of the remaining flanges and web areas.

8.4.2 When an indication of concern (reference level) is detected along a given scan line in Fig. 1, the flange or web shall be continuously scanned (100 %) with not less than 10 % overlap between each scan path for 9 in. [230 mm] adjacent to the scan line in both directions.

8.4.3 All indications shall be evaluated on the flat-bottomed hole reference level criteria, and not by loss of back reflection.

8.5 A suitable couplant such as water, water soluble oil, oil, or glycerin, shall be used when the contact method is utilized.

TABLE 1 Relationship of Distance and Thickness

Section Thickness, T, (in.)	Metal Distance, in. [mm]
½ to 1	½ in. [12.5 mm]
Over 1 to 1 ½	½ to ¾ T
Over 1 ½ to 2	1 in. [25 mm]
Over 2	½ to ¾ T

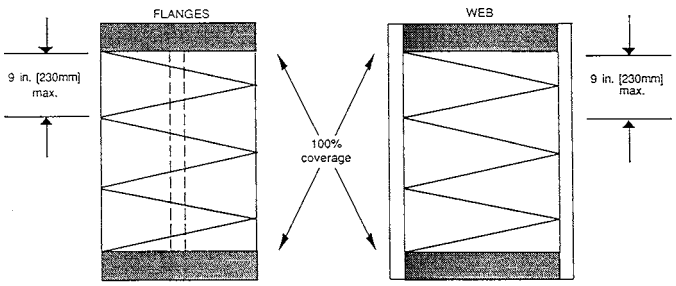


FIG. 1 Scanning Pattern and Coverage

9. Acceptance Standards

9.1 Any discontinuity indication that equals or exceeds the reference level response from the flat-bottomed hole shall be evaluated. A reference level indication that exceeds any of the following criteria is cause for material rejection.

9.2 *Level I*:

9.2.1 *Flanges or Legs*—Any reference level indication that is continuous for a distance of 3 in. [75 mm] or greater in any direction is cause for rejection. Any reference level indication less than 3 in. [75 mm] long must be separated from another reference level indication by one-half the flange or leg thickness or 2 in. [50 mm], whichever is greater, or the two indications must be contained within a 3-in. [75 mm] diameter circle for acceptance.

NOTE 1—A loss of back reflection over the web will be experienced during the flange scan and is not a cause for rejection.

9.2.2 *Web*—Any reference level indication that is continuous for a distance of 4 in. [100 mm] or greater in any direction is cause for rejection. Any reference level indication less than 4 in. [100 mm] long must be separated from another reference level indication by one-half the web thickness or 2 in. [50 mm], whichever is greater, or the two indications must be contained within a 4-in. [100 mm] diameter circle for acceptance.

9.3 *Acceptance Standards–Level II, Flanges, Legs, and Web*—Any reference level indication shall be rejectable if it is continuous for a distance of more than 15 in. [375 mm] in any direction or its area exceeds 7 in.^{2}[4375 mm^2].

NOTE 2—A loss of back reflection over the web will be experienced during the flange scan and is not a cause for rejection.

10. Rejection and Rehearing

10.1 The manufacturer reserves the right to discuss rejectable ultrasonically tested structural shapes with the purchaser with the object of possible repair of the ultrasonically indicated imperfection in lieu of rejection of the shape.

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11. Product Marking

11.1 Structural shapes accepted in accordance with this specification shall be marked UT-A-898-1 for Level I or UT-A-898-2 for Level II, adjacent to marking required by the material specification.

12. Keywords

12.1 acceptance standards; internal discontinuities; procedure; pulse echo; rolled; shapes; steel; straight beam; structural steel; ultrasonic examination

SUPPLEMENTARY REQUIREMENTS

These supplementary requirements shall apply only when individually specified by the purchaser. When details of these requirements are not covered herein, they are subject to agreement between the manufacturer and purchaser.

S1. Scanning Designated Additional Areas

S1.1 In addition to the scanning specified in 8.4, scanning of additional areas or different scanning patterns may be specified by agreement between the manufacturer and purchaser.

S1.2 Acceptance Level II shall apply unless otherwise agreed to between the manufacturer and purchaser.

S2. Scanning 100 %

S2.1 Scanning shall be continuous over 100 % with a 10 % overlap between each scan path of both flange or leg surfaces and one major web surface.

S2.2 The acceptance criteria for Level I shall apply.

S3. Restrictive Acceptance and Scanning Criteria

S3.1 More stringent acceptance and scanning criteria may apply upon agreement between the purchaser and manufacturer.

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (8898/A898M – 91 (2001) that may impact the use of this standard. (Approved March 1, 2007).

(1) The diameter of the flat-bottomed hole used in the calibration standard is reduced from ½ in. [12.5 mm] to ¼ in. [6 mm].

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