Designation: A 577/A 577M – 90 (Reapproved 2007)

Standard Specification for Ultrasonic Angle-Beam Examination of Steel Plates[1]

This standard is issued under the fixed designation A 577/A 577M; 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[2] covers an ultrasonic angle-beam procedure and acceptance standards for the detection of internal discontinuities not laminar in nature and of surface imperfections in a steel plate. This specification is intended for use only as a supplement to specifications which provide straight-beam ultrasonic examination.

NOTE 1—An internal discontinuity that is laminar in nature is one whose principal plane is parallel to the principal plane of the plate.

1.2 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 which covers the qualification and certification of ultrasonic nondestructive examination candidates and which is acceptable to the purchaser.

1.3 The values stated in either inch-pound units 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 *ASNT Standards:*[3]

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

3. Ordering Information

3.1 The inquiry and order shall indicate any additions to the provisions of this specification as prescribed in 11.1.

4. Examination Conditions

4.1 The examination shall be conducted in an area free of operations that interfere with proper performance of the examination.

4.2 The surface of the plate shall be conditioned as necessary to provide a clear, easily interpreted trace pattern on the screen. Any specified identification which is removed to achieve proper surface smoothness shall be restored.

5. Apparatus

5.1 The amplitude linearity shall be checked by positioning the transducer over the depth resolution notch in the IIW or similar block so that the signal from the notch is approximately 30 % of the screen height, and the signal from one of the back surfaces is approximately 60 % of the screen height (two times the height of the signal from the notch). A curve is then plotted showing the deviations from the above established 2:1 ratio that occurs as the amplitude of the signal from the notch is raised in increments of one scale division until the back reflection signal reaches full scale, and then is lowered in increments of one scale division until the notch signal reaches one scale division. At each increment the ratio of the two signals is determined. The ratios are plotted on the graph at the position corresponding to the larger signal. Between the limits of 20 % and 80 % of the screen height the ratio shall be within 10 % of 2:1. Instrument settings used during inspection shall not cause variation outside the 10 % limits established above.

5.2 The search unit shall be a 45-deg (in steel) angle-beam type with active transducer length and width dimensions of a minimum of ½ in. [12.5 mm] and a maximum of 1 in. [25 mm]. Search units of other sizes and angles may be used for additional exploration and evaluation.

6. Examination Frequency

6.1 The ultrasonic frequency selected for the examination shall be the highest frequency that permits detection of the

[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 A01.11 on Steel Plates for Boilers and Pressure Vessels.

Current edition approved March 1, 2007. Published March 2007. Originally approved in 1967. Last previous edition approved in 2001 as A 577/A 577M – 90 (2001).

[2] For ASME Boiler and Pressure Vessel Code applications, see related Specification SA-577/SA-577M in Section II of that Code. Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, http://www.asme.org.

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

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States.

Provided by IHS
No reproduction or networking permitted without license from IHS
Not for Resale

required calibration notch, such that the amplitude of the indication yields a signal-to-noise ratio of at least 3:1.

7. Calibration Reflector

7.1 A calibration notch, the geometry of which has been agreed upon by the purchaser and the manufacturer, with a depth of 3 % of the plate thickness, shall be used to calibrate the ultrasonic examination. The notch shall be at least 1 in. [25 mm] long.

7.2 Insert the notch or notches on the surface of the plate so that they are perpendicular to the long axis at a distance of 2 in. [50 mm] or more from the short edge of the plate. Locate the notch not less than 2 in. [50 mm] from the long edges of the plate.

7.3 When the notch cannot be inserted in the plate to be tested, it may be placed in a calibration plate of ultrasonically similar material. The calibration plate will be considered ultrasonically similar if the height of the first back reflection through it is within 25 % of that through the plate to be tested at the same instrument calibration. The calibration plate thickness shall be within 1 in. [25 mm] of the thickness of plates to be tested, for plates of 2 in. [50 mm] thickness and greater and within 10 % of plates whose thickness is less than 2 in. [50 mm].

7.4 For plate thicknesses greater than 2 in. [50 mm], insert a second calibration notch as described in 7.2, on the opposite side of the plate.

8. Calibration Procedure

8.1 *Plate 2 in.* [50 mm] *and Under in Thickness:*

8.1.1 Place the search unit on the notched surface of the plate with the sound beam directed at the broad side of the notch and position to obtain maximum amplitude from the first vee-path indication which is clearly resolved from the initial pulse. Adjust the instrument gain so that this reflection amplitude is at least 50 but not more than 75 % of full screen height. Record the location and amplitude of this indication on the screen.

8.1.2 Move the search unit away from the notch until the second vee-path indication is obtained. Position the search unit for maximum amplitude and record the indication amplitude. Draw a line between the peaks from the two successive notch indications on the screen. This line is the distance amplitude curve (DAC) for this material and shall be a 100 % reference line for reporting indication amplitudes.

8.2 *Plate Over 2 to 6 in.* [50 to 150 mm] *Inclusive in Thickness:*

8.2.1 Place the search unit on the test surface aimed at the broad side of the notch on the opposite surface of the plate. Position the search unit to obtain a maximum one-half vee-path indication amplitude. Adjust the instrument gain so that this amplitude is at least 50 % but not more than 80 % of full screen height. Record the location and amplitude on the screen. Without adjusting the instrument settings, repeat this procedure for the 1½ vee-path indication.

8.2.2 Without adjusting the instrument settings, reposition the search unit to obtain a maximum full vee-path indication from the notch on the test surface. Record the location and amplitude on the screen.

8.2.3 Draw a line on the screen connecting the points established in 8.2.1 and 8.2.2. This curve shall be a DAC for reporting indication amplitudes.

8.3 *Plate over 6 in.* [150 mm] *in Thickness:*

8.3.1 Place the search unit on the test surface aimed at the broad side of the notch on the opposite surface of the plate. Position the search unit to obtain a maximum one-half vee-path indication amplitude. Adjust the instrument gain so that this amplitude is at least 50 % but not more than 80 % of full screen height. Record the location and amplitude on the screen.

8.3.2 Without adjusting the instrument settings, reposition the search unit to obtain a maximum full vee-path indication from the notch on the test surface. Record the location and amplitude on the screen.

8.3.3 Draw a line on the screen connecting the points established in 8.3.1 and 8.3.2. This line shall be a DAC for reporting indication amplitudes.

9. Examination Procedure

9.1 Scan one major surface of the plate on grid lines perpendicular and parallel to the major rolling direction. Grid lines shall be on 9-in. [225-mm] centers. Use a suitable couplant such as water, oil, or glycerin. Scan by placing the search unit near one edge with the ultrasonic beam directed toward the same edge and move the search unit along the grid line in a direction perpendicular to the edge to a location two plate thicknesses beyond the plate center. Repeat this scanning procedure on all grid lines from each of the four edges.

9.2 Measure grid lines from the center or one corner of the plate.

9.3 Position the search unit to obtain a maximum indication amplitude from each observed discontinuity.

9.4 For each discontinuity indication that equals or exceeds the DAC, record the location and length, and the amplitude to the nearest 25 %. No indication with an amplitude less than the DAC shall be recorded.

9.5 At each recorded discontinuity location, conduct a 100 % examination of the mass under a 9-in. [225-mm] square which has the recorded discontinuity position at its center. Conduct the examination in directions perpendicular and parallel to the major rolling direction.

10. Acceptance Standard

10.1 Any discontinuity indication that equals or exceeds the DAC shall be considered unacceptable unless additional exploration by the longitudinal method indicates it is laminar in nature.

11. Report

11.1 Unless otherwise agreed upon between the purchaser and manufacturer, the manufacturer shall report the following data:

11.1.1 Plate identity including pin-pointed recordable indication locations, lengths, and amplitudes.

11.1.2 Examination parameters, including: couplant; search unit type, angle, frequency, and size; instrument make, model, and serial number; and calibration plate description.

11.1.3 Date of examination and name of operator.

Provided by IHS
No reproduction or networking permitted without license from IHS
Not for Resale

12. Inspection

12.1 The purchaser's representative shall have access, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works that concern the ultrasonic examination of the material ordered. The manufacturer shall afford the representative all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification. All examinations and verifications shall be so conducted as not to interfere unnecessarily with the manufacturer's operations.

13. Rehearing

13.1 The manufacturer reserves the right to discuss unacceptable ultrasonically examined plate with the purchaser with the object of possible repair of the ultrasonically indicated discontinuity before rejection of the plate.

14. Marking

14.1 Plates accepted in accordance with this specification shall be identified by metal stamping or stencilling "UT A 577" in one corner of the plate, at a location within 6 in. [150 mm] of the heat number.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

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 International 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, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).

Provided by IHS
No reproduction or networking permitted without license from IHS
Not for Resale