Designation: A 435/A 435M – 90 (Reapproved 2007)

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

This standard is issued under the fixed designation A 435/A 435M; 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 the procedure and acceptance standards for straight-beam, pulse-echo, ultrasonic examination of rolled fully killed carbon and alloy steel plates, ½ in. [12.5 mm] and over in thickness. It was developed to assure delivery of steel plates 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 plates are to be subjected to ultrasonic examination.

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 Documents:*[3]

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

## 3. Apparatus

3.1 The manufacturer shall furnish suitable ultrasonic equipment and qualified personnel necessary for performing the test. The equipment shall be of the pulse-echo straight beam type. The transducer is normally 1 to 1⅛ in. [25 to 30 mm] in diameter or 1 in. [25 mm] square; however, any transducer having a minimum active area of 0.7 in.$^2$ [450 mm$^2$] may be used. The test shall be performed by one of the following methods: direct contact, immersion, or liquid column coupling.

3.2 Other search units may be used for evaluating and pinpointing indications.

## 4. Test Conditions

4.1 Conduct the examination in an area free of operations that interfere with proper functioning of the equipment.

4.2 Clean and smooth the plate surface sufficiently to maintain a reference back reflection from the opposite side of the plate at least 50 % of the full scale during scanning.

4.3 The surface of plates inspected by this method may be expected to contain a residue of oil or rust or both. Any specified identification which is removed when grinding to achieve proper surface smoothness shall be restored.

## 5. Procedure

5.1 Ultrasonic examination shall be made on either major surface of the plate. Acceptance of defects in close proximity may require inspection from the second major surface. Plates ordered in the quenched and tempered condition shall be tested following heat treatment.

5.2 A nominal test frequency of 2¼ MHz is recommended. Thickness, grain size, or microstructure of the material and nature of the equipment or method may require a higher or lower test frequency. However, frequencies less than 1 MHz may be used only on agreement with the purchaser. A clear, easily interpreted trace pattern should be produced during the examination.

5.3 Conduct the examination with a test frequency and instrument adjustment that will produce a minimum 50 to a maximum 75 % of full scale reference back reflection from the opposite side of a sound area of the plate. While calibrating the instrument, sweep the crystal along the plate surface for a distance of at least 1*T* or 6 in. [150 mm], whichever is the greater, and note the position of the back reflection. A shift in location of the back reflection during calibration shall be cause for recalibration of the instrument.

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[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 1959. Last previous edition approved in 2001 as A 435/A 435M – 90 (2001)).

[2] For ASME Boiler and Pressure Vessel Code applications, see related Specifications SA-435/SA-435M 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.

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5.4 Scanning shall be continuous along perpendicular grid lines on nominal 9-in. [225-mm] centers, or at the manufacturer's option, shall be continuous along parallel paths, transverse to the major plate axis, on nominal 4-in. [100-mm] centers, or shall be continuous along parallel paths parallel to the major plate axis, on 3-in. [75-mm] or smaller centers. A suitable couplant such as water, soluble oil, or glycerin, shall be used.

5.5 Scanning lines shall be measured from the center or one corner of the plate. An additional path shall be scanned within 2 in. [50 mm] of all edges of the plate on the scanning surface.

5.6 Where grid scanning is performed and complete loss of back reflection accompanied by continuous indications is detected along a given grid line, the entire surface area of the squares adjacent to this indication shall be scanned continuously. Where parallel path scanning is performed and complete loss of back reflection accompanied by continuous indications is detected, the entire surface area of a 9 by 9-in. [225 by 225-mm] square centered on this indication shall be scanned continuously. The true boundaries where this condition exists shall be established in either method by the following technique: Move the transducer away from the center of the discontinuity until the heights of the back reflection and discontinuity indications are equal. Mark the plate at a point equivalent to the center of the transducer. Repeat the operation to establish the boundary.

## 6. Acceptance Standards

6.1 Any discontinuity indication causing a total loss of back reflection which cannot be contained within a circle, the diameter of which is 3 in. [75 mm] or one half of the plate thickness, whichever is greater, is unacceptable.

6.2 The manufacturer reserves the right to discuss rejectable ultrasonically tested plates with the purchaser with the object of possible repair of the ultrasonically indicated defect before rejection of the plate.

6.3 The purchaser's representative may witness the test.

## 7. Marking

7.1 Plates accepted in accordance with this specification shall be identified by stamping or stenciling UT 435 adjacent to marking required by the material specification.

## SUPPLEMENTARY REQUIREMENTS

The following shall apply only if specified in the order:

S1. Instead of the scanning procedure specified by 5.4 and 5.5, and as agreed upon between manufacturer and purchaser, 100 % of one major plate surface shall be scanned. Scanning shall be continuous along parallel paths, transverse or parallel to the major plate axis, with not less than 10 % overlap between each path.

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