ULTRASONIC EXAMINATION FOR WELLHEAD, CHRISTMAS TREE, MANIFOLD AND RELATED EQUIPMENT

Summary:
This document is both a specification and a bridging document for the purpose of referencing to Industry codes, and other FMC specifications and / or procedures for employing Ultrasonic Testing (UT) techniques to determine a material's internal volumetric integrity.

Reviewed By:
Ed Briggs
September 30, 2015
ASNT Level III, #1522
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1.0 SCOPE

This document is both a specification and a bridging document for the purpose of referencing to Industry codes, and other FMC specifications and / or procedures for employing UT techniques to determine a material's internal volumetric integrity.

The FMC Part Report (Data Base Information (DBI) may identify additional requirements or clarifications to support this specification. All requirements on the DBI are applicable.

For final certification purposes, the material shall be inspected after completion of welding, final machining and heat treatment. All processing is completed at the given part level unless otherwise instructed.

2.0 PROCEDURES, PERSONNEL, & DEFINITIONS

2.1 Procedures

Suppliers shall work to the latest revision of this procedure and be responsible for training personnel in the use of the procedure and maintaining records of the training. If the supplier prefers to use his own procedure that is fully compliant to the FMC specification, he shall submit this to FMC for written approval prior to use on a specific application basis.

The applicable technique sheets shall be submitted to and approved in writing by the appropriate FMC Subject Matter Expert (SME) personnel prior to use in production work.

The supplier primary Level III, qualified and certified in Ultrasonic Testing, shall qualify their UT technique, and document in accordance with ASME Section V, Articles 4 or 5 as applicable.

The qualification document(s) shall be submitted to FMC and customer for approval prior to the beginning of production inspection.

FMC or customer may request at any time that the method and techniques qualifying the procedure be demonstrated.

2.2 Personnel

NDE personnel responsible for NDE activities shall be nationally certified to Level III in the applicable NDE test method in accordance ASNT or ISO 9712 requirements.

Personnel performing inspections and interpreting results shall be certified to a minimum Level II by an independent certification body or authorized qualifying body
FMC is developing a major revision of our technician certification requirements that will be worked in collaboration with the approved NDE service suppliers on our Global Special Process Supplier List and aligned with customers’ requirements. Until a new agreement of requirements is achieved with Petrobras, the requirement noted below shall apply to all FMC Brazil purchase orders.

"All parts manufactured for FMC Brazil purchase orders shall be inspected by NDE personnel qualified to a primary nationally accredited entity (ASNT, ACCP, EN-ISO 9712, CGSB, or equivalent). Technicians qualified and certified in accordance with SNT-TC-1A are not acceptable for performing NDE methods of testing on parts manufactured for FMC Brazil.

Level I personnel may perform inspections under the direct supervision of Level II or Level III personnel.

Personnel performing API RP 2X inspections shall meet the requirements of paragraph 5.3 of API RP 2X.

2.3 Definitions

The following terms and definitions are in reference to Ultrasonic Testing as it applies to this specification:

- Ultrasonic Testing (UT) - Engineering the scanning of material with an ultrasonic (high frequency sound) beam, during which reflections from faults in the material can be detected: a powerful nondestructive test method.

- Volumetric – Of or pertains to measurement by volume. The volumetric ultrasonic scan includes scanning from all accessible surfaces, and in all directions.

- Technique - a technique is a specific way of utilizing a particular nondestructive examination (NDE) method.

- Nondestructive Examination (NDE) – the development and application of technical methods to examine materials and/or components in ways that do not impair future usefulness and serviceability in order to detect, locate, measure, interpret, and evaluate flaws.

- Procedure - An orderly sequence of actions describing how a specific technique shall be applied.

- Procedure Qualification - When a written nondestructive examination procedure is qualified in accordance with the detailed requirements of this specification.
- Sensitivity - A measure of the level of response from a discontinuity by a nondestructive examination

- Automated Ultrasonic Examinations (AUT) - A technique of ultrasonic examination performed with equipment and search units that are mechanically mounted and guided, remotely operated, and motor-controlled (driven) without adjustments by the technician. The equipment used to perform the examinations is capable of recording the ultrasonic response data, including the scanning positions, by means of integral encoding devices such that imaging of the acquired data can be performed

- Discontinuity – Lack of continuity; irregularity; a break or gap in a material or component. A discontinuity is not necessarily a defect

- Scan Plan - A documented examination strategy that provides a standardized and repeatable methodology for weld examinations. The scan plan displays cross-sectional joint geometry, extent of coverage, clad or overlay (if present), Heat Affected Zone (HAZ) extent, search unit size(s) and frequency(ies), beam plots of all angles used, search unit(s) position in relation to the weld centerline [Probe Center Spacing (PCS) in the case of Time of Flight Diffraction (TOFD)], and if applicable, zonal coverage overlap

- Mechanized – To make mechanical; Automated; to introduce machinery into the system or process to replace manually rastering

- Phased Array Ultrasonic Testing (PAUT) – Phased Array Ultrasonic Testing is computer controlled excitation (amplitude and delay) of individual elements in a multi-element probe

- Written Practice – A procedure written to address the qualification and certification of NDE personnel

- Time Corrected Gain (TCG) – A control feature on ultrasonic instruments used to corrected the amplitudes of indications where they are all equal, no matter what the distance between them is

- Distance Amplitude Correction (DAC) – A line created or drawn manually or electronically on the ultrasonic instrument, in order to establish sensitivity levels from reflectors with distance between them.

### 3.0 REFERENCED DOCUMENTS

The latest revision of the following associated specifications shall be utilized, where applicable, as a part of the requirements of this specification.

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<thead>
<tr>
<th>FMC Procedure / Specification</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q02314</td>
<td>Ultrasonic Examination of Structural Steel Plate</td>
</tr>
<tr>
<td>Q02324</td>
<td>Ultrasonic Testing of Forgings, Hipped Parts, Bar Stock, and Mill Shapes</td>
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<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------</td>
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<tr>
<td>Q02325</td>
<td>Ultrasonic Testing of Pressure Containing Weldments</td>
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<td>Q02328</td>
<td>Automated Ultrasonic Examination of Closure Welds</td>
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<td>Q02329</td>
<td>Ultrasonic Testing for Butter Welds</td>
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<td>Q02330</td>
<td>FMC Phased Array Procedure for Ultrasonic Examination of Low Alloy Steel Butter Weld</td>
</tr>
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<td>Q02332</td>
<td>FMC Ultrasonic Examination Method Procedure for Alloy 625 Plug Welds</td>
</tr>
<tr>
<td>Q02333</td>
<td>Inspection of Weld Preparation Areas</td>
</tr>
<tr>
<td>Q02334</td>
<td>Ultrasonic Examination Methods for Detecting Discontinuities in CRA Build Up for 15K THD Shoulder</td>
</tr>
<tr>
<td>Q02200</td>
<td>Nondestructive Examination Personnel Qualification and Certification (Written Practice)</td>
</tr>
<tr>
<td>Q00100</td>
<td>Edition / Revision Levels of FMC Technologies Referenced Specifications</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry Specification</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNT-TC-1A</td>
<td>ASNT Recommended Practice for the Qualification and Certification for Nondestructive Testing Personnel</td>
</tr>
<tr>
<td>EN-473 / EN ISO 9712</td>
<td>Non-destructive Testing – Qualification and certification of NDT personnel</td>
</tr>
<tr>
<td>CGSB 48.9712</td>
<td>Nondestructive Testing Qualification and Certification of Personnel</td>
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<tr>
<td>ASTM E-213</td>
<td>Standard Practice for Ultrasonic Examination of Metal Pipe and Tubing</td>
</tr>
<tr>
<td>ASME B31.3</td>
<td>Process Piping</td>
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<td>ASME B31.8</td>
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<td>API 1104</td>
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<td>NORSOK M-601</td>
<td>Welding and Inspection of Piping</td>
</tr>
<tr>
<td>NORSOK M-630</td>
<td>Material Data Sheets for Piping</td>
</tr>
<tr>
<td>API 5L</td>
<td>Specification for Line Pipe</td>
</tr>
<tr>
<td>API 6A</td>
<td>Specification for Wellhead and Christmas Tree Equipment</td>
</tr>
<tr>
<td>API 17D</td>
<td>Specification for Subsea Wellhead and Christmas Tree Equipment</td>
</tr>
<tr>
<td>AWS D1.1</td>
<td>Structural Welding Code – Steel</td>
</tr>
<tr>
<td>NORSOK M-101</td>
<td>Structural Steel Fabrication</td>
</tr>
<tr>
<td>ASME V, Article 4</td>
<td>Ultrasonic Examination Methods for Welds</td>
</tr>
<tr>
<td>ASME V, Article 5</td>
<td>Ultrasonic Examination Methods for Materials</td>
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<tr>
<td>ASTM E1961</td>
<td>Standard Practice for Mechanized Ultrasonic Testing of Girth Welds Using Zonal Discrimination with Focused Search Units</td>
</tr>
</tbody>
</table>
4.0 ULTRASONIC EXAMINATION REQUIREMENTS FOR STRUCTURAL WELDS

The ultrasonic examination of structural welds shall be in accordance with AWS D1.1, NORSOK M-101 or API RP2X, whichever is most prevalent in the region of manufacture unless otherwise specified on the DBI.

Volumetric NDE is required for primary structural welds. These should be full penetration welds by design. Secondary structural welds do not require volumetric NDE. The FMC Part Report (DBI) or drawing shall indicate which welds are secondary. If undefined the weld shall be considered primary.

The Ultrasonic Examination requirements for structural welds when working in accordance with AWS D1.1:

- The acceptance criteria for the Ultrasonic Examination of Structural Welds (Non Tubular) shall be based on the Static Acceptance Criteria of AWS D1.1. (Appendix A)
- Pad eyes:

  Pad eyes and lifting eyes shall be based on AWS D1.1 cyclic acceptance criteria.

The Ultrasonic Examination requirements for structural welds when working in accordance with NORSOK M-101:

- The acceptance criteria for the welds shall be in accordance with Norsok M101 per the inspection category noted on the drawing. (Appendix B), if the category is not listed on the drawing acceptance category A shall apply.

The Ultrasonic Examination requirements for structural welds when working in accordance with API RP2X:

- Tubular T, Y, K structural welds shall be evaluated to Level C criteria
- Non-Tubular pad eye, lifting eye and other non-tubular primary welds shall be evaluated to Level A criteria with the additional requirement that imperfections which produce a response ≥ 50% of the reference level that are interpreted to be cracks, lack of fusion, or incomplete penetration shall be unacceptable regardless of length.

FMC subcontracts volumetric NDE for structural welds and does not have an FMC procedure to perform this work. Suppliers are required to submit procedures to FMC for approval prior to use.

Conductor and Wellhead SDS pile extensions are to be treated as pressure containing welds, not structural.
5.0 ULTRASONIC TESTING OF PIPING AND TUBULAR PRODUCT

The supplier shall perform ultrasonic examination of piping and tubular components in accordance with API 5L and the material specification on the part report. The acceptance criteria shall be in accordance with the applicable pipe specification.

UT procedures shall be written in accordance with Section 2.0 of this document, and acceptance criteria established to comply with the applicable industry specification(s).

There is no FMC procedure for tubular products as this inspection should be performed at the pipe/tubular manufacturer.

6.0 ULTRASONIC TESTING OF FORGINGS, HIPPED PARTS, BAR STOCK, AND MILL SHAPES

The supplier shall perform ultrasonic examination of forgings, hipped parts, bar stock, and mill shapes in accordance with API 6A PSL 3 and this specification unless otherwise specified on the DBI or its attached material specification.

The FMC procedure for UT examination of forgings, hipped parts, bar stock, and mill shapes is Q02324.

Acceptance Criteria:
Refer to Section 11.1 thru 11.3 and section 12 of FMC Specification / Procedure Q02324 for the acceptance criteria for Forgings, Hipped Parts, Bar Stock, and Mill Shapes, as applicable.

7.0 ULTRASONIC TESTING OF PRESSURE CONTAINING WELDS

The supplier shall perform ultrasonic examination of pressure containing welds in accordance with ASME Section V Article 4 and this specification unless otherwise specified on the DBI.

The FMC procedure for conventional UT examination of pressure containing welds is Q02325.

Definitions:

- Recordable Indications - Indications exceeding 50% of the reference amplitude line or the Distance Amplitude Correction (DAC) curve for welds and heat affected zones.
• Single Indications - Indications Where the minimum distance between different indications is greater than 1/2" (12.7mm) apart in any direction.

• Multiple Indications - Two or more recordable indications within 1/2" (12.7mm) of each other in any direction.

Evaluation of indications will be carried out with the gain (attenuation) setting at the calibration reference level.

Record amplitudes of indications in increments of 1%, location to the nearest 0.1" (2.54 mm), and dimensions, if mapped, by the 6 db drop method.

Items with rejectable indications that will be removed in machining operations may be acceptable only if subsequent examination proves that all the rejectable indications have been completely removed.

Acceptance Criteria:
Refer to Section 10.0 of FMC Specification Q02325 for the Acceptance Criteria of Pressure Containing Welds.

8.0 ULTRASONIC EXAMINATION OF WELD METAL CORROSION RESISTANT ALLOY OVERLAY

The FMC procedure for UT examination of weld metal corrosion resistant alloy overlay clad for bond is Q02311.

Acceptance Criteria:
Refer to Section 4.0 of the FMC Specification / Procedure Q02311.

9.0 AUTOMATED ULTRASONIC TESTING (AUT) REQUIREMENTS FOR CLOSURE WELDS

When required by instruction of the Part Report (DBI), the supplier shall perform Automated Ultrasonic Testing (AUT), either conventional or phased array, of full penetration, pressure containing closure welds. Where access limits or restricts AUT, an alternate UT technique that has been demonstrated and approved in writing by FMC and the customer may be used. The acceptance criteria in Section 10.0 of specification Q02325 applies.

When more than one technique is used in the inspection of closure welds on the assembly, the UT inspection report shall include a weld map or schematic indicating where each technique was used in the inspection.

The FMC specification for UT examination for volumetric AUT of closure welds is Q02328. Supplier procedures shall meet the requirements of Q02328.
10.0 ULTRASONIC PROCEDURE FOR BUTTER WELD

The FMC procedure for conventional UT examination of alloy steel butter welds and nickel alloy butter welds is Q02329.

The Acceptance Criteria:

Refer to Section 11.2 of FMC Specification / Procedure Q02329 for the Acceptance Criteria of convention UT examination of butter weld fusion.

When conventional UT examination is used, also conduct Radiological Testing (RT) per Q01906.

11.0 PHASED ARRAY PROCEDURE FOR ULTRASONIC EXAMINATION OF BUTTER WELD

The FMC procedure for phased array UT examination of alloy steel butter welds and nickel alloy butter welds is Q02330.

Acceptance Criteria:

Refer to Section 12.0 of FMC Specification / Procedure Q02330 for the Acceptance Criteria of phased array UT examination of butter weld fusion.

12.0 ULTRASONIC EXAMINATION METHODS FOR DETECTING DISCONTINUITIES IN PRESSURE PIPING DUPLEX AND SUPERDUPLEX BUTT WELDS

The FMC procedure for UT examination of pressure piping duplex and superduplex butt welds is Q02331.

Acceptance Criteria:

Reference Section 12.0 of FMC Specification / Procedure Q02331 for the Acceptance Criteria of Pressure Piping Duplex and Superduplex Butt Welds

13.0 ULTRASONIC PROCEDURE FOR INCONEL PLUG WELD INSPECTION PROCEDURE

The FMC procedure for UT examination of alloy 625 plug welds is Q02332.

Acceptance Criteria:

Refer to Section 10.0 of FMC Specification / Procedure Q02332 for the Acceptance Criteria of Alloy 625 Plug Welds.
14.0 ULTRASONIC TESTING OF ROLLED CARBON AND ALLOY STEEL PLATE

The supplier shall perform ultrasonic examination of rolled carbon and alloy steel plate in accordance with API 19D, ASTM A578, and this specification unless otherwise specified on the DBI or its attached material specification.

The FMC procedure for UT straight beam examination of rolled carbon and alloy steel plate is Q02314.

Acceptance Criteria:
Refer to Section 8.0 of FMC Specification / Procedure Q02314 for the Acceptance Criteria of Rolled Carbon and Alloy Steel Plate.

15.0 INSPECTION OF WELD PREPARATION AREAS

The FMC procedure for UT examination of pipe bevel weld preparations is Q02333.

Acceptance Criteria:
Refer to Section 4.5 of FMC Specification / Procedure Q02333 for the Acceptance Criteria of pipe bevel weld preparations.

16.0 ULTRASONIC EXAMINATION METHODS FOR DETECTING DISCONTINUITIES IN CRA BUILD UP FOR 15K THD SHOULDER

The FMC procedure for UT examination of CRA build up for 15K THD Shoulder is Q02334.

Acceptance Criteria:
Refer to Section 4.0 of FMC Specification / Procedure Q02334 for the Acceptance Criteria for ultrasonic inspection of weld preparation areas.

17.0 REPORTING

An Ultrasonic examination report is required and will contain the following minimum information:

- Ultrasonic Test Report Number
• Part Number and revision Level

• Part Description

• Traceability Code and / or weld identification

• Date of examination

• Scope of examination, including referenced scan plan. (If a similar scan plan is found in one of the applicable FMC documents, mention the figure or scan plan in the report. If not, make a sketch of the component showing the details of the technique(s) and the scan plan employed for different areas and geometries of the component)

• FMC UT specification number(s) and revision level(s)

• Inspection procedure number and revision level

• Examination parameters: transducer type, frequency, and size. Sensitivity setting, type of instrument, couplant, and any other information necessary to duplicate the examination.

• Type of Instrument used, manufacturer, model, serial number, and calibration date

• Reference or calibration blocks used for examination

• Quantity Examined

• Results of examination: rejectable, and recordable indications, location, depth, and size

• Technician Name and Certification Type (ASNT, SNT-TC-1A, EN-473, etc.) and Level

• If examination is performed by third party, the report shall be presented to FMC on third party letter head

• For purposes of reporting the locations of rejectable and recordable indications, a sketch will be prepared showing the physical outline of the raw material part or physical cross section of the weld including dimensions of all areas, if any, not inspected due to geometric limitations or geometric configuration with the axial, radial and circumferential distribution of the indications when applicable.

• The traceability code or weld identification on the UT report shall match that provided by the material and / or weld supplier.

• Customer witness name and date (if applicable).
# APPENDIX A - AWS D1.1 ACCEPTANCE CRITERIA - Ultrasonic Examination of Structural Welds (Non Tubular - Static Load)

<table>
<thead>
<tr>
<th>Discontinuity Severity Class</th>
<th>Weld Thickness in [mm]</th>
<th>Search Unit Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5/16 to 3/4</td>
<td>70°</td>
</tr>
<tr>
<td></td>
<td>3/4 through 1 1/2</td>
<td>70°</td>
</tr>
<tr>
<td></td>
<td>[8-20] [20-38]</td>
<td>60°</td>
</tr>
<tr>
<td></td>
<td>&gt; 1 1/2 through 2 1/2</td>
<td>45°</td>
</tr>
<tr>
<td></td>
<td>[38-65]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 2 1/2 through 4</td>
<td>70°</td>
</tr>
<tr>
<td></td>
<td>[65-100]</td>
<td>60°</td>
</tr>
<tr>
<td></td>
<td>&gt; 4 through 8</td>
<td>70°</td>
</tr>
<tr>
<td></td>
<td>[100-200]</td>
<td>60°</td>
</tr>
</tbody>
</table>

### General Notes:
- Class B and C discontinuities shall be separated by at least 2L, L being the length of the longer discontinuity, except that when two or more such discontinuities are not separated by at least 2L, but the combined length of discontinuities and their separation distance is equal to or less than the maximum allowable length under the provisions of Class B or C, the discontinuity shall be considered a single acceptable discontinuity.
- Class B and C discontinuities shall not begin at a distance less than 2L from weld ends carrying primary tensile stress, L being the discontinuity length.
- Discontinuities detected at "scanning level" in the root face area of CFT double groove weld joints shall be evaluated using an indicating rating 4 dB more sensitive than described in 6.25.5.5 when such welds are designated as "tension welds" on the drawing (subject to 4 dB from the indication rating category). This shall not apply if the weld joint is backgrooved to sound metal to remove the root face and MT used to verify that the root face has been removed.
- BW or BWs: discontinuities detected at "scanning level" which exceed 2 in. [50 mm] in length shall be inspected as being piping porosity and shall further be evaluated with radiography.
- For indications that remain on the display as the search unit is moved, refer to 6.13.1.

### Note:
1. Weld thickness shall be defined as the nominal thickness of the thinner of the two parts being joined.

## Scanning Levels

<table>
<thead>
<tr>
<th>Sound path in [mm]</th>
<th>Above Zero Reference, dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>through 2 1/2 [65 mm]</td>
<td>14</td>
</tr>
<tr>
<td>&gt; 2 1/2 through 5 [65-125 mm]</td>
<td>10</td>
</tr>
<tr>
<td>&gt; 5 through 10 [125-250 mm]</td>
<td>29</td>
</tr>
<tr>
<td>&gt; 10 through 15 [250-380 mm]</td>
<td>39</td>
</tr>
</tbody>
</table>

Note:
2. This column refers to sound path distance, NOT material thickness.
19.0 APPENDIX B - NORSOK M101 ACCEPTANCE CRITERIA (The acceptance criteria shall be in accordance with Norsok M101 category A)

<table>
<thead>
<tr>
<th>Description</th>
<th>Inspection category A + B</th>
<th>Inspection category C, D, E</th>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>If the type of defect can not be ascertained with certainty the defect shall be repaired when the length exceeds 10 mm and the echo height exceeds the reference curve.</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Cracks</td>
<td>Unambiguous cracks are unacceptable regardless of size or amplitude.</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Lack of fusion or incomplete penetration</td>
<td>Internal defects:</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>I: The echo height exceeds the reference curve:</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Max. length l, Max. 25 mm</td>
<td>Max. length 2t, Max. 50 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II: The echo height is between 50 and 100% of the reference curve:</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Max. length 2t, Max. 50 mm</td>
<td>Max. length 4t, Max. 100 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surface defects are not acceptable except:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>For root defects in single sided welds, the max. length for which the echo height exceeds the reference curve shall be:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max. length l, Max. 25 mm</td>
<td>Max. length 2t, Max. 50 mm</td>
<td></td>
</tr>
<tr>
<td>Slag inclusions</td>
<td>When echo height exceeds the reference curve:</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Max. length 2t, Max. 50 mm</td>
<td>Max. length 4t, Max. 100 mm</td>
<td></td>
</tr>
<tr>
<td>Porosity</td>
<td>Repair is required if porosity may mask for other defects.</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

**NOTE 1** Type of defect shall be decided by:
I: Supplementary non-destructive testing.
II: The ultrasonic operator's assessment of the defect, using his knowledge of the welding process, signal geometry, defect position etc.

**NOTE 2** If elongated defects are situated on line and the distance between them is less than the length of the longest indication, the defects shall be evaluated as one continuous defect.

**NOTE 3** Defect length is defined as the distance between points where the echo reach or pass 50% DAC (for defects larger than the beam).
For defects smaller than the beam, the maximum amplitude technique may be used.

**NOTE 4** With UT performed from only one side of the weld with only one surface accessible, the acceptable echo heights are reduced from 100% to 50% and from 50% to 20%, respectively.

**NOTE 5** With "internal defects" it means defects which are located more than 6 mm from the nearest surface. A defect is classified as a "surface defect" if any part of the defect is located less than 6 mm or t/4, whichever is smaller, from the nearest surface.