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Non-destructive testing of welds — Ultrasonic testing — Use of automated phased array technology

Essais non destructifs des assemblages soudés — Contrôle par ultrasons — Utilisation de la technique multi-éléments automatisés

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 5, *Testing and inspection of welds*.

Any feedback, question or request for official interpretation related to any aspect of this document should be directed to the Secretariat of ISO/TC 44/SC 5 via your national standards body. A complete listing of these bodies can be found at www.iso.org/members.html. Official interpretations, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

This second edition cancels and replaces the first edition (ISO 13588:2012), which has been technically revised. The main changes compared to the previous edition are as follows:

— Clauses 2 and 3 have been updated;

— a method of length and height measurement has been added;

— new Annex B has been added;

— the document has been editorially updated.

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Non-destructive testing of welds — Ultrasonic testing — Use of automated phased array technology

1 Scope

This document specifies the application of the phased array technology for the semi- or fully automated ultrasonic testing of fusion-welded joints in metallic materials of minimum thickness 6 mm. It applies to full penetration welded joints of simple geometry in plates, pipes, and vessels, where both the weld and the parent material are low-alloy and/or fine grained steel. For the testing of welds in other steel materials this document gives guidance. For coarse-grained or austenitic steels, ISO 22825 applies in addition to this document.

This document provides guidance on the specific capabilities and limitations of the phased array technology for the detection, location, sizing and characterization of discontinuities in fusion-welded joints. Phased array technology can be used as a stand-alone technology or in combination with other non-destructive testing (NDT) methods or techniques, for manufacturing inspection, pre-service and for in-service inspection.

This document specifies four testing levels, each corresponding to a different probability of detection of imperfections.

This document permits assessment of discontinuities for acceptance purposes based either on amplitude (equivalent reflector size) and length, or on height and length.

This document does not include acceptance levels for discontinuities.

This document is not applicable for automated testing of welds during the production of steel products covered by ISO 10893-8, ISO 10893-11 and ISO 3183.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5577, *Non-destructive testing — Ultrasonic testing — Vocabulary*

ISO 5817, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections*

ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel*

ISO 17640, *Non-destructive testing of welds — Ultrasonic testing — Techniques, testing levels, and assessment*

ISO 10863, *Non-destructive testing of welds — Ultrasonic testing — Use of time-of-flight diffraction technique (TOFD)*

ISO 18563-1, *Non-destructive testing — Characterization and verification of ultrasonic phased array equipment – Part 1: Instruments*

ISO 18563-2, *Non-destructive testing — Characterization and verification of ultrasonic phased array equipment — Part 2: Probes*

ISO 18563-3, *Non-destructive testing — Characterization and verification of ultrasonic phased array equipment — Part 3: Combined systems*

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ISO 19285, *Non-destructive testing of welds — Phased array ultrasonic testing (PAUT) — Acceptance levels*

ISO 22825, *Non-destructive testing of welds — Ultrasonic testing — Testing of welds in austenitic steels and nickel-based alloys*

EN 16018, *Non-destructive testing — Terminology — Terms used in ultrasonic testing with phased arrays*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5577, EN 16018 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
phased array image
one- or two-dimensional display, constructed from the collected information of phased array operation

3.2
indication
phased array indication
pattern or disturbance in the *phased array image* (3.1) which can need further evaluation

3.3
phased array setup
probe arrangement defined by probe characteristics (e.g. frequency, probe element size, beam angle, wave mode), *probe position* (3.4), and the number of probes

3.4
probe position
PP
distance between the front of the wedge and the weld centre line

3.5
scan increment
distance between successive data collection points in the direction of scanning (mechanically or electronically)

3.6
skewed scan
scan performed with a skewed angle

Note 1 to entry: The skewed angle can be achieved electronically or by means of probe orientation.

3.7
mode
phased array mode
combination of ultrasonic beams created by phased array technology, e.g. fixed angle, E-scan, S-scan

4 Testing levels

Quality requirements for welded joints are mainly associated with the material, welding process and service conditions. To comply with all of these requirements, this document specifies four testing levels (A, B, C and D).

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