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

Essais non destructifs des assemblages soudés — Contrôle par ultrasons — Techniques, niveaux d'essai et évaluation

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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 fourth edition cancels and replaces the third edition (ISO 17640:2017), which has been technically revised. The main change compared to the previous edition is that Figure A.4 a) and b) has been corrected.

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

1 Scope

This document specifies techniques for the manual ultrasonic testing of fusion-welded joints in metallic materials of thickness ≥8 mm which exhibit low ultrasonic attenuation (especially that due to scatter) at object temperatures from 0 °C to 60 °C. It is primarily intended for use on full penetration welded joints where both the welded and parent material are ferritic.

Where material-dependent ultrasonic values are specified in this document, they are based on steels having an ultrasonic sound velocity of (5 920 ± 50) m/s for longitudinal waves and (3 255 ± 30) m/s for transverse waves.

This document specifies four testing levels, each corresponding to a different probability of detection of imperfections. Guidance on the selection of testing levels A, B, and C is given in Annex A.

This document specifies that the requirements of testing level D, which is intended for special applications, be in accordance with general requirements. Testing level D can only be used when defined by specification. This includes tests of metals other than ferritic steel, tests on partial penetration welds, tests with automated equipment, and tests at object temperatures outside the range 0 °C to 60 °C.

This document can be used for the assessment of discontinuities, for acceptance purposes, by either of the following techniques:

a) evaluation based primarily on length and echo amplitude of the discontinuity;

b) evaluation based on characterization and sizing of the discontinuity by probe movement techniques.

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

ISO 11666, *Non-destructive testing of welds — Ultrasonic testing— Acceptance levels*

ISO 16810, *Non-destructive testing — Ultrasonic testing — General principles*

ISO 16811, *Non-destructive testing — Ultrasonic testing — Sensitivity and range setting*

ISO 16826, *Non-destructive testing — Ultrasonic testing — Examination for discontinuities perpendicular to the surface*

ISO 17635, *Non-destructive testing of welds — General rules for metallic materials*

ISO 23279, *Non-destructive testing of welds — Ultrasonic testing — Characterization of discontinuities in welds*

EN 12668 (all parts), *Non-destructive testing — Characterization and verification of ultrasonic examination equipment*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5577 and ISO 17635 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/

4 Symbols

The symbols in Table 1 apply.

Table 1 — Symbols

Symbol	Definition	Unit
AL	acceptance level	—
D_{DSR}	diameter of the disk-shaped reflector (flat-bottomed hole)	mm
h	extension of the discontinuity in depth direction	mm
l	length of the discontinuity	mm
l_x	projected length of the discontinuity in the x-direction	mm
l_y	projected length of the discontinuity in the y-direction	mm
p	full skip distance	mm
t	thickness of parent material[a]	mm
x	position of the discontinuity in the longitudinal direction	mm
y	position of the discontinuity in the transverse direction	mm
z	position of the discontinuity in the depth direction	mm

[a] If the joined parts are not of equal thickness, t represents the smallest thickness.

Indications shall be considered to be originating from either longitudinal or transverse discontinuities, depending on the direction of their major dimension with respect to the weld axis, x, in accordance with Figure 1.

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