International Standard

ISO 17635

Non-destructive testing of welds — General rules for metallic materials

Essais non destructifs des assemblages soudés — Règles générales pour les matériaux métalliques

Fourth edition
2025-04

Reference number
ISO 17635:2025(en)

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Published in Switzerland

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Foreword

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This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 5, *Testing and inspection of welds*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding and allied processes*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 17635:2016), which has been technically revised.

The main changes are as follows:

— references updated;

— phased-array ultrasonic technique (UT-PA) for thin-walled steel components added;

— ultrasonic technique using total focusing technique (UT-TFM) added;

— Table 1 and Table 3 modified;

— Annex C reintroduced based on a version in ISO 17635:2010 and a flowchart added.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html. Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

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Non-destructive testing of welds — General rules for metallic materials

1 Scope

This document gives guidelines for the choice of non-destructive testing (NDT) methods for welds in metals and for the evaluation of the results for quality control purposes, based on quality requirements, material, weld thickness, welding process and extent of testing.

This document also specifies general rules and standards to be applied to the different types of testing, for the selection of the method, the techniques and the acceptance levels.

Acceptance levels cannot be a direct interpretation of the quality levels defined in ISO 5817 or ISO 10042. They are linked to the overall quality of the produced batch of welds.

The requirements specified in this document for acceptance levels for NDT conform with quality levels stated in ISO 5817 or ISO 10042 (moderate, intermediate, stringent) only on a general basis and not in detail for each indication.

Annex A gives correlations between quality levels, testing levels and acceptance levels for specific testing techniques.

Annex B gives an overview on specific testing techniques of standards linked to quality levels, acceptance levels and testing methods.

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 3452-1, *Non-destructive testing — Penetrant testing — Part 1: General principles*

ISO 4761:2021, *Non-destructive testing of welds — Phased array ultrasonic testing (UT-PA) for thin-walled steel components — Acceptance levels*

ISO 5817:2023, *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 10042:2018, *Welding — Arc-welded joints in aluminium and its alloys — Quality levels for imperfections*

ISO 10675-1:2021, *Non-destructive testing of welds — Acceptance levels for radiographic testing — Part 1: Steel, nickel, titanium and their alloys*

ISO 10675-2:2021, *Non-destructive testing of welds — Acceptance levels for radiographic testing — Part 2: Aluminium and its alloys*

ISO 10863:2020, *Non-destructive testing of welds — Ultrasonic testing — Use of time-of-flight diffraction technique (TOFD)*

ISO 11666:2018, *Non-destructive testing of welds — Ultrasonic testing — Acceptance levels*

ISO 13588:2019, *Non-destructive testing of welds — Ultrasonic testing — Use of automated phased array technology*

ISO 15626:2018, *Non-destructive testing of welds — Time-of-flight diffraction technique (TOFD) — Acceptance levels*

ISO 17636-1:2022, *Non-destructive testing of welds — Radiographic testing — Part 1: X- and gamma-ray techniques with film*

ISO 17636-2:2022, *Non-destructive testing of welds — Radiographic testing — Part 2: X- and gamma-ray techniques with digital detectors*

ISO 17637, *Non-destructive testing of welds — Visual testing of fusion-welded joints*

ISO 17638, *Non-destructive testing of welds — Magnetic particle testing*

ISO 17640:2018, *Non-destructive testing of welds — Ultrasonic testing — Techniques, testing levels, and assessment*

ISO 17643, *Non-destructive testing of welds — Eddy current testing of welds by complex-plane analysis*

ISO 19285:2017, *Non-destructive testing of welds — Phased array ultrasonic testing (PAUT) — Acceptance levels*

ISO 20601:2018, *Non-destructive testing of welds — Ultrasonic testing — Use of automated phased array technology for thin-walled steel components*

ISO 23277:2015, *Non-destructive testing of welds — Penetrant testing — Acceptance levels*

ISO 23278:2015, *Non-destructive testing of welds — Magnetic particle testing — Acceptance levels*

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

ISO 23864:2021, *Non-destructive testing of welds — Ultrasonic testing — Use of automated total focusing technique (TFM) and related technologies*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
testing level
testing class
degree of thoroughness and selection of parameter settings with which a testing method or testing technique is applied

Note 1 to entry: Different levels correspond to different sensitivities and/or probabilities of detection. The selection of testing levels is normally related to the quality requirements.

Note 2 to entry: The term testing level includes testing class and is used as a synonym.

[SOURCE: ISO/TR 25901-1:2016, 2.2.4.5, modified — "non-destructive" was deleted from the definition.]

3.2
testing organization
internal or external organization carrying out the testing

[SOURCE: ISO/TR 25901-1:2016, 2.2.1.7, modified — "destructive testing or non-destructive" was deleted from the definition.]

3.3
indication
<non-destructive testing> representation or signal from a discontinuity in the format allowed by the non-destructive testing method used

[SOURCE: ISO/TR 25901-1:2016, 2.2.4.2, modified — "in the format allowed by the non-destructive testing method used" was added to the definition.]

3.4
internal discontinuity
<non-destructive testing of welds> discontinuity that is not open to a surface or not directly accessible

3.5
quality level
description of the quality of a weld on the basis of type, size and amount of specified imperfections

[SOURCE: ISO/TR 25901-1:2016, 2.5.17, modified — "selected" is replaced by "specified".]

3.6
testing lot
<non-destructive testing of welds> group of welds which is expected to show a uniform quality

Note 1 to entry: Group members can be a part of a weld, a full weld or several welds.

Note 2 to entry: The uniform quality can be due to welding procedure applied, material, type of joint, welder, environmental conditions during execution, time period or other items affecting the quality.

4 Abbreviated terms

For the purposes of this document, the abbreviated terms given in Table 1 apply.

Table 1 — Abbreviated terms

Term	Abbreviation
Eddy current testing	ET
Magnetic testing	MT
Penetrant testing	PT
Radiographic testing	RT
Radiographic testing using films	RT-F
Digital radiographic testing	RT-D
Digital radiographic testing using Computed Radiography	RT-D using CR
Digital radiographic testing using digital detector arrays	RT-D using DDA
Radioscopy	RT-S
Ultrasonic testing	UT
Ultrasonic testing using pulse-echo technique	UT-PE
Ultrasonic testing using time-of-flight diffraction technique	UT-TOFD
Ultrasonic testing using phased-array technique	UT-PA
Ultrasonic testing using total focusing technique	UT-TFM
Visual testing	VT

5 Limitations

5.1 Stage of manufacture

This document has been prepared for the testing of completed welds (see 10.3).

Testing of parent materials prior to welding or between welding sequences is not covered by this document.

It is, however, recommended that such testing be performed in accordance with the selected testing standard(s) and standard(s) providing acceptance levels.

5.2 Extent of testing

The extent of testing shall be given in an application standard or defined in a specification.

5.3 Materials

This document includes requirements for testing of fusion welds in the following materials, their alloys and their combinations:

a) steel;

b) aluminium;

c) nickel;

d) titanium.

The use of this document for other metallic materials, e.g. copper, shall be specified.

6 Personnel qualification

Personnel performing NDT and the evaluation of the results for final acceptance of welds shall be qualified in accordance with ISO 9712 or equivalent at an appropriate qualification level in the relevant industrial sector.

7 Testing organization

The testing organization shall be organized independently of the production and its activities shall be controlled by a quality management system.

8 Documentation

8.1 Documentation prior to testing

8.1.1 General

a) Prior to testing, all necessary preliminary information required by the applicable testing standard(s) shall be provided.

b) The criteria for acceptable indications shall be selected from a standard providing acceptance levels or defined in an individual specification.

8.1.2 Written procedure

All testing shall be performed in accordance with a written procedure as required by applicable individual testing standard(s) or as specified.

8.1.3 Testing plan

It can be necessary to carry out additional testing including more than one NDT method or multiple testing techniques of one testing method.