
Neporušitveno preskušanje zvarnih spojev - Stopnje sprejemljivosti pri radiografskem preskušanju - 1. del: Jeklo, nikelj, titan in njihove zlitine (ISO/DIS 10675-1:2021)

Non-destructive testing of welds - Acceptance levels for radiographic testing - Part 1: Steel, nickel, titanium and their alloys (ISO/DIS 10675-1:2021)

Zerstörungsfreie Prüfung von Schweißverbindungen - Zulässigkeitsgrenzen für die Durchstrahlungsprüfung - Teil 1: Stahl, Nickel, Titan und deren Legierungen (ISO/DIS 10675-1:2021)

Essais non destructifs des assemblages soudés - Niveaux d'acceptation pour évaluation par radiographie - Partie 1: Acier, nickel, titane et leurs alliages (ISO/DIS 10675-1:2021)

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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).

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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*.

This third edition cancels and replaces the second edition (ISO 10675-1:2016), which has been technically revised.

The main changes compared to the previous edition are as follows:

- The document has been technically and editorial revised;
- [Clause 4](#) Radiographic technique has been technically revised;
- [Clause 5](#) General has been added;
- The acceptance levels in [clause 6](#) have been extended;
- [Table 1](#) - Radiographic testing was split into [Table 1](#) - Radiographic testing for RT-F and [Table 2](#) - Radiographic testing for RT-S and RT-D;
- In [Table 3](#) Acceptance levels for internal indications in butt welds No 3: acceptance levels for maximum permissible pore sizes were added;
- In [Annex B](#) the capture of Figure B.1 was revised;
- in [Annex C Figures C.1, C.2](#) and the text were revised to be conform to ISO 5817:2014.

A list of all parts of the ISO 10675 series can be found on the ISO website.

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>.

Non-destructive testing of welds — Acceptance levels for radiographic testing —

Part 1: Steel, nickel, titanium and their alloys

1 Scope

This document specifies acceptance levels for indications from imperfections in butt welds of steel, nickel, titanium and their alloys detected by radiographic testing. If agreed, the acceptance levels can be applied to other types of welds (such as fillet welds etc.) or materials.

The acceptance levels can be related to welding standards, application standards, specifications or codes. This document assumes that the radiographic testing has been carried out in accordance with ISO 17636-1 for RT-F (F = film) or ISO 17636-2 for RT-S (S = radioscopy) and RT-D (D = digital detectors).

When assessing whether a weld meets the requirements specified for a weld quality level, the sizes of imperfections permitted by standards are compared with the dimensions of indications revealed by a radiograph made of the weld.

2 Normative references (standards.iteh.ai)

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

ISO 6520-1, *Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding*

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

ISO 17636-2, *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 2553, *Welding and allied processes — Symbolic representation on drawings — Welded joints*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5817 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/>

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4 Radiographic technique

Depending on the weld quality level, radiographic technique A or B in accordance with ISO 17636-1 shall be used for RT-F as shown in [Table 1](#) and radiographic technique A or B in accordance with ISO 17636-2 shall be used for RT-S or RT-D as shown in [Table 2](#).

Table 1 — Radiographic testing for RT-F

Quality levels in accordance with ISO 5817	Testing techniques and classes in accordance with ISO 17636-1 for RT-F ^a	Acceptance levels in accordance with this document
B	B	1
C	B ^b	2
D	A	3

^a RT-F = Radiographic testing with film

^b However, the minimum number of exposure for circumferential weld testing may correspond to the requirements of class A of ISO 17636-1.

Table 2 — Radiographic testing for RT-S and RT-D

Quality levels in accordance with ISO 5817	Testing techniques and classes in accordance with ISO 17636-2 for RT-S ^a and RT-D ^b	Acceptance levels in accordance with this document
B	B	1
C	B ^c	2
D	A	3

^a RT-S = Radioscopic testing

^b RT-D = Radiographic testing with digital detectors

^c However, the minimum number of exposure for circumferential weld testing may correspond to the requirements of class A of ISO 17636-2.

5 General

Welded joints should be visually tested in accordance with ISO 17637 and evaluated before radiographic testing.

The acceptance levels of this document are basically valid for evaluation of imperfections which cannot be detected and evaluated by visual testing (see [Table 3](#)). Surface imperfections (see [Table 4](#); such as undercut and excessive penetration, surface damage, weld spatter, etc.) which, due to object geometry, cannot be evaluated by visual testing, but where the interpreter suspects that the ISO 5817 quality levels are not fulfilled, shall be subject to more specific testing for quantification.

When quantification of undercut and/or excessive penetration by radiographic testing is required, specific procedures using test exposures may be applied in order to establish a basis for approximate quantification in accordance with the requirements of ISO 5817. This shall be specified in the adopted specification/procedure.

6 Acceptance levels

The acceptance levels for indications are shown in [Table 3](#) and [Table 4](#). The types of imperfections are selected from ISO 5817 and defined in ISO 6520-1.

The symbols used in [Table 2](#) and [Table 3](#) are the following:

- l length of indication, in millimetres (see also [Fig. C3](#) and [Fig. C4](#) for linear Porosity);
- s nominal butt weld thickness, in millimetres (see also ISO 2553);
- t base material thickness, in millimetres;
- L any 100 mm testing length;
- w_p width of the weld, in millimetres;
- h width of indication, the width or height of surface imperfection, in millimetres;
- d diameter of pore, in millimetres;
- d_A diameter of pore envelope area;
- b width of excess penetration of weld, in millimetres;
- A sum of projected areas of indications related to each $L \times w_p$, in % (see [Annex B](#));
- Σl summary length of imperfections within L , in millimetres (indications shall not be divided into different ranges L).

Any two adjacent imperfections separated by a distance smaller than the major dimension of the smaller imperfection shall be considered as a single imperfection.

Indications shall not be divided into different ranges L .

Table 3 — Acceptance levels for internal indications in butt welds

No.	Type of internal imperfections in accordance with ISO 6520-1	oSIST prEN ISO 10675-1:2021		
		Acceptance level 3 ^a	Acceptance level 2 ^a	Acceptance level 1
1	Cracks (100)	Not permitted	Not permitted	Not permitted
2a	Porosity and gas pores (2012, 2011) Single layer	$A \leq 2,5 \%$ $d \leq 0,4s$, max. 5 mm $L = 100$ mm	$A \leq 1,5 \%$ $d \leq 0,3s$, max. 4 mm $L = 100$ mm	$A \leq 1 \%$ $d \leq 0,2s$, max. 3 mm $L = 100$ mm
2b	Porosity and gas pores (2012, 2011) Multilayer	$A \leq 5 \%$ $d \leq 0,4s$, max. 5 mm $L = 100$ mm	$A \leq 3 \%$ $d \leq 0,3s$, max. 4 mm $L = 100$ mm	$A \leq 2 \%$ $d \leq 0,2s$, max. 3 mm $L = 100$ mm
3 ^b	Clustered (localized) porosity (2013)	$d_A \leq w_p$, max. 25 mm $d \leq 0,4s$, max. 5 mm	$d_A \leq w_p$, max. 20 mm $d \leq 0,3s$, max. 4 mm	$d_A \leq w_p/2$, max. 15 mm $d \leq 0,2s$, max. 3 mm
4	Linear porosity (2014)	$l \leq s$, max. 75 mm $d \leq 0,4s$, max. 4 mm $L = 100$ mm	$l \leq s$, max. 50 mm $d \leq 0,3s$, max. 3 mm $L = 100$ mm	$l \leq s$, max. 25 mm $d \leq 0,2s$, max. 2 mm $L = 100$ mm
5 ^d	Elongated cavities (2015) and wormholes (2016)	$h < 0,4s$, max. 4 mm $\Sigma l \leq s$, max. 75 mm $L = 100$ mm	$h < 0,3s$, max. 3 mm $\Sigma l \leq s$, max. 50 mm $L = 100$ mm	$h < 0,2s$, max. 2 mm $\Sigma l \leq s$, max. 25 mm $L = 100$ mm

^a Acceptance levels 3 and 2 may be specified with suffix X, which denotes that all indications over 25 mm are unacceptable.

^b See [Figure C.1](#) and [Figure C.2](#) (normative).

^c See [Figure C.3](#) and [Figure C.4](#) (normative).

^d See [Figure C.5](#) and [Figure C.6](#) (normative).

^e If the length of the weld is below 100 mm, then the maximum length of indications shall not exceed 25% of that weld.

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Table 3 (continued)

No.	Type of internal imperfections in accordance with ISO 6520-1	Acceptance level 3 ^a	Acceptance level 2 ^a	Acceptance level 1
6 ^e	Shrinkage cavity (202) (other than crater pipes)	$h < 0,4s$, max. 4 mm $l \leq 25$ mm	Not permitted	Not permitted
7	Crater pipe (2024)	$h \leq 0,2t$, max. 2 mm $l \leq 0,2t$, max. 2 mm	Not permitted	Not permitted
8 ^d	Slag inclusions (301), flux inclusions (302) and oxide inclusions (303)	$h < 0,4s$, max. 4 mm $\Sigma l \leq s$, max. 75 mm $L = 100$ mm	$h < 0,3s$, max. 3 mm $\Sigma l \leq s$, max. 50 mm $L = 100$ mm	$h < 0,2s$, max. 2 mm $\Sigma l \leq s$, max. 25 mm $L = 100$ mm
9	Metallic inclusions (304) (other than copper)	$l \leq 0,4s$, max. 4 mm	$l \leq 0,3s$, max. 3 mm	$l \leq 0,2s$, max. 2 mm
10	Copper inclusions (3042)	Not permitted	Not permitted	Not permitted
11 ^e	Lack of fusion (401)	Permitted, but only intermittently and not breaking the surface $\Sigma l \leq 25$ mm, $L = 100$ mm	Not permitted	Not permitted
12 ^e	Lack of penetration (402)	$\Sigma l \leq 25$ mm, $L = 100$ mm	Not permitted	Not permitted

^a Acceptance levels 3 and 2 may be specified with suffix X, which denotes that all indications over 25 mm are unacceptable.

^b See Figure C.1 and Figure C.2 (normative).

^c See Figure C.3 and Figure C.4 (normative).

^d See Figure C.5 and Figure C.6 (normative).

^e If the length of the weld is below 100 mm, then the maximum length of indications shall not exceed 25% of that weld.

^e If the length of the weld is below 100 mm, then the maximum length of indications shall not exceed 25 % of that weld.

Table 4 — Surface imperfections

No.	Type of surface imperfections in accordance with ISO 6520-1	Acceptance level 3 ^a	Acceptance level 2 ^a	Acceptance level 1
13	Crater cracks (104)	Not permitted	Not permitted	Not permitted
14a	Undercut, continues and intermittent (5011,5012) $t > 3$ mm	Smooth transition is required $h \leq 0,2t$, max. 1 mm	Smooth transition is required $h \leq 0,1t$, max. 0,5 mm	Smooth transition is required $h \leq 0,05t$, max. 0,5 mm
14b ^b	Undercut, continues and intermittent (5011,5012) $0,5$ mm $\leq t \leq 3$ mm	Smooth transition is required $l \leq 25$ mm, $h \leq 0,2t$	Smooth transition is required $l \leq 25$ mm, $h \leq 0,1t$	Smooth transition is required Not permitted
15a ^b	Shrinkage groove (root undercut 5013) $t > 3$ mm	Smooth transition is required $l \leq 25$ mm, $h \leq 0,2t$, max. 2 mm	Smooth transition is required $l \leq 25$ mm, $h \leq 0,1t$, max. 1 mm	Smooth transition is required $l \leq 25$ mm, $h \leq 0,05t$, max. 0,5 mm

NOTE The acceptance levels are those defined for visual testing. These defects are normally evaluated by visual testing.

^a Acceptance levels 3 and 2 may be specified with suffix X, which denotes that all indications over 25 mm are unacceptable.

^b If the length of the weld is below 100 mm, then the maximum length of indications shall not exceed 25% of that weld.