



SLOVENSKI STANDARD
oSIST prEN ISO 13919-1:2018
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Varjenje - Zvarni spoji z elektronskim in laserskim žarkom - Navodilo za stopnje sprejemljivosti napak - 1. del: Jeklo, nikelj, titan in njihove zlitine (ISO/DIS 13919-1:2018)

Welding - Electron and laser-beam welded joints - Guidance on quality levels for imperfections - Part 1: Steel, nickel, titanium and their alloys (ISO/DIS 13919-1:2018)

Schweißen - Elektronen- und Laserstrahl-Schweißverbindungen; Leitfaden für Bewertungsgruppen für Unregelmäßigkeiten - Teil 1: Stahl, Nickel, Titan und seine Legierungen (ISO/DIS 13919-1:2018)

Soudage - Assemblages soudés par faisceau d'électrons et par faisceau laser - Guide des niveaux de qualité des défauts - Partie 1: Acier (ISO/DIS 13919-1:2018)

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ICS:

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Welding — Electron and laser-beam welded joints — Guidance on quality levels for imperfections —

Part 1: Steel, nickel, titanium and their alloys

Soudage — Assemblages soudés par faisceau d'électrons et par faisceau laser — Guide des niveaux de qualité des défauts —

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ISO/DIS 13919-1:2018(E)

Foreword

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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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee [or Project Committee] ISO/TC [or ISO/PC] ###, [name of committee], Subcommittee SC ##, [name of subcommittee].

This second/third/... edition cancels and replaces the first/second/... edition (ISO #####:#####), which has been technically revised.

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

— xxx xxxxxxxx xxx xxxxx

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

Introduction

This International Standard is intended to be used as a reference in drafting application codes and/or other application standards. It contains a simplified selection of laser and electron beam welding imperfections based on the designations given in ISO 6520-1.

Some imperfections described in ISO 6520-1 have been used directly and some have been grouped together. The basic numerical referencing system from ISO 6520-1 has been used.

The purpose of this International Standard is to define the dimensions of typical imperfections which can be expected in normal fabrication. It can be used within a quality system for the production of welded joints. It provides three sets of dimensional values from which a selection can be made for a particular application. The quality level necessary in each case is defined by the application standard or the responsible designer in conjunction with the manufacturer, user and/or other parties concerned. The quality level is expected to be prescribed prior to the start of production, preferably at the enquiry or order stage. For special purposes, additional details can be prescribed.

The quality levels given in this International Standard provide basic reference data and are not specifically related to any particular application. They refer to the types of welded joint in fabrication and not to the complete product or component itself. It is possible, therefore, that different quality levels are applied to individual welded joints in the same product or component.

It would normally be expected that for a particular welded joint the dimensional limits for imperfections can all be covered by specifying one quality level. In some cases, it can be necessary to specify different quality levels for different imperfections in the same welded joint.

The choice of quality level for any application is expected to take account of design considerations, subsequent processing (e.g. surfacing), mode of stressing (e.g. static, dynamic), service conditions (e.g. temperature, environment) and consequences of failure. Economic factors are also important and are intended to include not only the cost of welding, but also of inspection, test and repair.

Although this International Standard includes types of imperfection relevant to the beam welding processes given in Clause 1, only those which are applicable to the process and application in question need to be considered.

Imperfections are quoted in terms of their actual dimensions, and their detection and evaluation may require the use of one or more methods of non-destructive testing. The detection and sizing of imperfections are dependent on the inspection methods and the extent of testing specified in the application standard or contract.

This International Standard does not address the methods used for the detection of imperfections. This International Standard is directly applicable to visual examination of welds and does not include details of recommended methods of detection or sizing by other non-destructive means. There are difficulties in using these limits to establish appropriate criteria applicable to non-destructive testing methods, such as ultrasonic, radiographic and penetrant testing, and they can need to be supplemented by requirements for inspection, examination and testing.

The values given for imperfections are for welds produced using normal welding practice. More stringent requirements as stated in quality level B can include additional manufacturing processes, e.g. grinding, dressing.

Welding — Electron and laser-beam welded joints - Guidance on quality levels for imperfections — Part 1: Part 1: Steel, nickel, titanium and their alloys

1 Scope

This document gives guidance on levels of imperfections in electron and laser beam welded joints in steel, nickel, titanium and their alloys. Three levels are given in such a way as to permit application for a wide range of welded fabrications. The levels refer to production quality and not to the fitness-for-purpose of the product manufactured.

This document applies to electron and laser beam welding of:

- steel, nickel, titanium and their alloys;
- all types of welds welded with or without additional filler wire;
- materials equal to or above 0,5 mm thickness for electron and laser beam welding.

When significant deviations from the joint geometries and dimensions stated in this standard are present in the welded product, it is necessary to evaluate to what extent the provisions of this Standard can apply.

Metallurgical aspects, e.g. grain size, hardness are not covered by this standard.

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 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 12932, *Welding — Laser-arc hybrid welding of steels, nickel and nickel alloys — Quality levels for imperfections*

ISO 17639, *Destructive tests on welds in metallic materials — Macroscopic and microscopic examination of welds*

3 Terms and definitions

No terms and definitions are listed in this document.

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

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Symbols (and abbreviated terms)

For the purposes of this document, the following symbols apply.

- ΔL distance between two imperfections (pore, cavity)
- b width of weld
- b_1 required width of weld
- d maximum size of an imperfection (pore, cavity)
- f projected areas of pores or cavities
- h size of the imperfection (height, width)
- h_1 deviation from the weld penetration
- l length of imperfection (measured in maximum size direction)
- L weld length under consideration (weld length examined)
- L_c length of combined porosity (affected weld length)
- s weld penetration
- s_1 weld penetration in T-joint
- t workpiece thickness
- β angle of angular misalignment

5 Assessment of imperfections (adapted to ISO 5817 and ISO 12932)

Limits to imperfections are given in Table 1. These limits apply to the finished weld and may also be applied to an intermediate stage of fabrication.

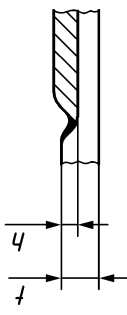
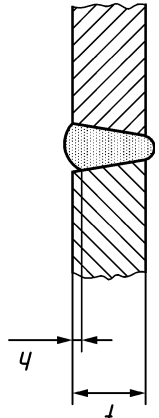
If a method other than macro examination is used for the detection of imperfections, only those imperfections which can be detected with a maximum magnification of tenfold shall be considered. Cracks (see Table 1, No 1.1, No 1.2, No 2.1 and No. 2.2) and micro lack of fusion (see Table 1, No 1.5 and No 2.7) are excluded.

A welded joint should normally be assessed separately for each individual type of imperfection.

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

For joints made of base materials having different thicknesses, the evaluation of the defects shall be based on the thickness of the thinnest base material. For stake welds made in parallel joints and lap joints, the evaluation of the defects shall be based on the sum of the thickness of the base materials for full penetration welds, and on the designed fusion penetration for partial penetration welds.

Table 1 — Imperfections

No.	ISO 6520-1 reference	Imperfection designation	Remarks	t mm	Limits for imperfections for quality levels		
					D	C	B
1 Surface imperfections							
1.1	100	Crack	All types of cracks except crater cracks (magnification less than 50x)	≥ 0,5	Not permitted	Not permitted	Not permitted
1.2	104	Crater crack	Magnification less than 50x	≥ 0,5	Permitted	Not permitted	Not permitted
1.3	2017 516	Surface pore Root porosity	Maximum dimension of a single pore for Spongy formation at the root of a weld due to bubbling of the weld metal at the moment of solidification (e.g. lack of gas backing)	≥ 0,5	$d \leq 0,3 s$, but max. 3 mm	Not permitted	Not permitted
1.4	2025	End crater pipe		$\geq 0,5$ ≤ 3	$h \leq 0,4 t$	$h \leq 0,3 t$	$h \leq 0,2 t$
1.5	401	Lack of fusion (incomplete fusion)	All types of lack of fusions (magnification less than 50x)	≥ 0,5	$h \leq 0,25 s$ or 1 mm, whichever is smaller	Not permitted	Not permitted
1.6	4021	Incomplete root penetration	—	≥ 0,5	Short imperfections: 0,05 L	Not permitted	Not permitted
1.7	5011 5012	Continuous undercut Intermittent undercut	Smooth transition is required. This is not regarded as a systematic imperfection. 	≥ 0,5	$h \leq 0,15 t$, but max. 1 mm	$h \leq 0,1 t$, but max. 0,5 mm	$h \leq 0,05 t$, but max. 0,5 mm