



SLOVENSKI STANDARD
oSIST prEN ISO 17660:2021
01-oktober-2021

Varjenje - Varjenje betonskega jekla (ISO/DIS 17660:2021)

Welding - Welding of reinforcing steel (ISO/DIS 17660:2021)

Schweißen - Schweißen von Betonstahl (ISO/DIS 17660:2021)

Soudage - Soudage des aciers d'armatures (ISO/DIS 17660:2021)

Ta slovenski standard je istoveten z: prEN ISO 17660

[oSIST prEN ISO 17660:2021](https://standards.iteh.ai/catalog/standards/sist/c25a75ec-d22d-4978-8760-794d2a7b2a0b/osist-pren-iso-17660-2021)

<https://standards.iteh.ai/catalog/standards/sist/c25a75ec-d22d-4978-8760-794d2a7b2a0b/osist-pren-iso-17660-2021>

ICS:

25.160.01	Varjenje, trdo in mehko spajkanje na splošno	Welding, brazing and soldering in general
-----------	--	---

oSIST prEN ISO 17660:2021

en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[oSIST prEN ISO 17660:2021](https://standards.iteh.ai/catalog/standards/sist/c25a75ec-d22d-4978-8760-794d2a7b2a0b/osist-pren-iso-17660-2021)

<https://standards.iteh.ai/catalog/standards/sist/c25a75ec-d22d-4978-8760-794d2a7b2a0b/osist-pren-iso-17660-2021>

DRAFT INTERNATIONAL STANDARD

ISO/DIS 17660

ISO/TC 44/SC 10

Secretariat: DIN

Voting begins on:
2021-08-23

Voting terminates on:
2021-11-15

Welding – Welding of reinforcing steel

ICS: 25.160.01

iTeh STANDARD PREVIEW (standards.iteh.ai)

[oSIST prEN ISO 17660:2021](https://standards.iteh.ai/catalog/standards/sist/c25a75ec-d22d-4978-8760-794d2a7b2a0b/osist-pren-iso-17660-2021)

<https://standards.iteh.ai/catalog/standards/sist/c25a75ec-d22d-4978-8760-794d2a7b2a0b/osist-pren-iso-17660-2021>

THIS DOCUMENT IS A DRAFT CIRCULATED FOR COMMENT AND APPROVAL. IT IS THEREFORE SUBJECT TO CHANGE AND MAY NOT BE REFERRED TO AS AN INTERNATIONAL STANDARD UNTIL PUBLISHED AS SUCH.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

This document is circulated as received from the committee secretariat.

ISO/CEN PARALLEL PROCESSING



Reference number
ISO/DIS 17660:2021(E)

© ISO 2021

iTeh STANDARD PREVIEW (standards.iteh.ai)

<https://standards.iteh.ai/catalog/standards/sist/c25a75ec-d22d-4978-8760-794d2a7b2a0b/osist-pren-iso-17660-2021>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Symbols and abbreviated terms	2
5 Welding processes	4
6 Preparations and specifications for welded joints	4
6.1 General.....	4
6.2 Butt joints.....	5
6.2.1 Butt joints welded by welding process 111, 114, 135, 136, 138 or 141.....	5
6.2.2 Butt joints welded by welding process 24, 25 or 42.....	6
6.2.3 Butt joints welded by welding process 47.....	6
6.3 Lap joints.....	6
6.4 Strap joints.....	7
6.5 Cross joints.....	8
6.5.1 General.....	8
6.5.2 Cross joints for welding process 111, 114, 135, 136, 138 or 141.....	8
6.5.3 Cross joints for welding process 21 or 23.....	9
6.6 Joints between reinforcing steel bars and other steel components.....	9
6.6.1 General.....	9
6.6.2 Types of joint.....	9
7 Materials	13
7.1 Parent materials.....	13
7.1.1 Reinforcing steels.....	13
7.1.2 Inspection documents.....	13
7.2 Welding consumables.....	14
8 Quality requirements	14
9 Welding personnel	14
9.1 Welding coordination.....	14
9.2 Welder and operator qualifications.....	14
9.2.1 Welders for load-bearing welded joints.....	14
9.2.2 Welding operators and resistance weld setters for load-bearing welded joints.....	16
9.2.3 Welders for non-load-bearing welded joints.....	16
9.3 Validity of qualification test certificate of welder and welding operator.....	16
10 Welding procedure specification (WPS)	16
11 Welding procedure qualification for load-bearing joints	16
11.1 General.....	16
11.2 Test specimens.....	16
11.3 Mechanical testing.....	16
11.4 Acceptance criteria.....	17
11.5 Range of qualification.....	17
11.5.1 Material.....	17
11.5.2 Diameter of reinforcing steel bar and material thickness.....	18
11.5.3 Other essential variables.....	19
11.6 Validity of welding procedure test.....	20
12 Production weld test	20
13 Execution and inspection of production welding of reinforcing steel	20
13.1 General.....	20
13.2 Welding of bent reinforcing steel bars.....	21

ISO/DIS 17660:2021(E)

13.3	Welds made by welding process 47	22
14	Mechanical testing of specimens	22
14.1	General.....	22
14.2	Tensile test.....	22
14.2.1	Test specimen.....	22
14.2.2	Test procedure.....	22
14.2.3	Evaluation of test results.....	22
14.2.4	Report of test results.....	23
14.3	Shear test.....	23
14.3.1	Test specimen.....	23
14.3.2	Test procedure.....	23
14.3.3	Evaluation of test results.....	24
14.3.4	Report of test results.....	24
14.4	Bend test.....	24
14.4.1	Test specimen.....	24
14.4.2	Test procedure.....	24
14.4.3	Evaluation of test results.....	24
Annex A	(informative) Welding procedure specification (WPS).....	25
Annex B	(informative) Test specimens.....	29
Annex C	(informative) Evaluation of testing of welded joints.....	34
Annex D	(informative) Example for production log.....	36
Annex E	(normative) Classification of shear strength of load-bearing cross joints.....	38
Annex F	(informative) Examples of diameter combinations for welding cross joints using welding processes 21 and 23.....	39
Bibliography	40

<https://standards.iteh.ai/catalog/standards/sist/c25a75ec-d22d-4978-8760-794d2a7b2a0b/osist-pren-iso-17660-2021>

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 [or Project Committee] ISO/TC [or ISO/PC] 44, *Welding and allied processes*, Subcommittee SC 10, *Quality management in the field of welding*.

This second edition cancels and replaces the first edition (ISO 17660-1:2006 and ISO 17660-2:2006), which has been technically revised.

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

- document editorially revised;
- part 1 and part 2 merged in one document;
- [Figure 3](#), [Figure 9](#), [Figure 10](#) and [Figure 11](#) technically revised;
- number of test pieces in [subclause 9.2](#) regarding *Welder and operator qualifications* changed.
- document editorially revised;

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[oSIST prEN ISO 17660:2021](https://standards.iteh.ai/catalog/standards/sist/c25a75ec-d22d-4978-8760-794d2a7b2a0b/osist-pren-iso-17660-2021)

<https://standards.iteh.ai/catalog/standards/sist/c25a75ec-d22d-4978-8760-794d2a7b2a0b/osist-pren-iso-17660-2021>

Welding – Welding of reinforcing steel

1 Scope

This document is applicable to the welding of weldable reinforcing steel and stainless reinforcing steel of load-bearing joints or non-load-bearing joints, in workshops or on site. It specifies requirements for materials, design and execution of welded joints, welding personnel, quality requirements, mechanical testing. All provisions except [subclause 9.2.3](#) apply to load-bearing joints. The requirements for non-load-bearing joints are specified or illustrated in the [subclause 6.1](#), [6.3](#), [6.5](#), [Clause 8](#), [subclause 9.2.3](#) and [13](#).

This document also covers welded joints between reinforcing steel bars and other steel components, such as connection devices and insertion anchors, including prefabricated assemblies.

This document is not applicable to factory production of welding fabric and lattice girders using multiple spot-welding machines or multiple projection welding machines.

The requirements of this document are only applicable to static loaded structures. For fatigue-loaded structures, depending on type of joint and welding process, it is recommended that an appropriate reduction be taken into account on the fatigue strength of the reinforcing steel.

iTeh STANDARD PREVIEW

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 3834-3, *Quality requirements for fusion welding of metallic materials — Part 3: Standard quality requirements*

ISO 3834-4, *Quality requirements for fusion welding of metallic materials — Part 4: Elementary quality requirements*

ISO 4063, *Welding and allied processes — Nomenclature of processes and reference numbers*

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

ISO 9606-1, *Qualification testing of welders — Fusion welding — Part 1: Steels*

ISO 14731, *Welding coordination — Tasks and responsibilities*

ISO 14732, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials*

ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding*

ISO 15609-2, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 2: Gas welding*

ISO 15609-5, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 5: Resistance welding*

ISO 15620, *Welding — Friction welding of metallic materials*

ISO/DIS 17660:2021(E)

ISO 15630-1, *Steel for the reinforcement and prestressing of concrete — Test methods — Part 1: Reinforcing bars, rods and wire*

ISO 15630-2, *Steel for the reinforcement and prestressing of concrete — Test methods — Part 2: Welded fabric and lattice girders*

ISO 16020, *Steel for the reinforcement and prestressing of concrete — Vocabulary*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in 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 <https://www.electropedia.org/>

3.1**Load-bearing welded joints**

welded joint used for transmission of specified loads between reinforcing steel bars or between reinforcing steel bars and other steel products

3.2**Non-load-bearing welded joints**

welded joint whose strength is not taken into account in the design of the reinforced concrete structure

Note 1 to entry: The purpose of a non-load-bearing welded joint is usually only to keep the reinforcing components in their correct places during fabrication, transport and concreting. The weld is often called tack weld.

3.3**Shear factor**

S_f
relation between the shear force of a cross joint and the nominal yield strength R_e , multiplied by the nominal cross section area A_s , of the loaded bar

3.4**manufacturer**

enterprise carrying out the welding works within workshops or on site

4 Symbols and abbreviated terms

a	throat thickness
A_{gt}	percentage total elongation at maximum force
A_n	nominal cross-sectional area of the bar
A_s	nominal cross-sectional area of the bar to be anchored
b	excess of the bar
d, d_1, d_2	nominal diameter of the welded bar
d_{max}	maximum nominal diameter of the welded bar
d_{min}	minimum nominal diameter of the welded bar

e	distance between the bars
F	force to be anchored by transverse bar
F_{\max}	maximum tensile force
F_s	shear force
l	length of the weld (cross joint)
l_o	overall lap length
L_{\min}	minimum length of the test specimen
r	radius of bent reinforcing steel bar
R_e	specified characteristic yield strength of the reinforcing steel
R_m	nominal tensile strength of the reinforcing steel
S_f	shear factor
s	throat thickness for butt weld
t	thickness of the web of a section or of a plate to be welded
t_{\min}	minimum thickness of the web of a section or of a plate to be welded
w	weld width
x	root gap
y	depth of root face
z, z_1, z_2	leg length
α	included angle
BW	butt weld
CEV	carbon equivalent value
FW	fillet weld
SF	shear factor class
WPQR	welding procedure qualification record
WPS	welding procedure specification

ISO/DIS 17660:2021(E)

5 Welding processes

The following welding processes in accordance with ISO 4063 may be used (see [Table 1](#)):

Table 1 — List of welding processes and reference numbers in accordance with ISO 4063

Welding process	English term	American term
111	Manual metal-arc welding (Metal-arc welding with covered electrode)	Shielded metal-arc welding
114	Self-shielded tubular cored arc welding	
131	MIG welding with solid wire electrode	Gas metal-arc welding using inert gas and solid wire electrode
135	MAG welding with solid-wire electrode	Gas metal-arc welding using active gas with solid-wire electrode
136	MAG welding with flux-cored electrode	Gas metal-arc welding using active gas and flux-cored electrode
138	MAG welding with metal-cored electrode	Gas metal-arc welding using active gas and metal-cored electrode
141	TIG welding with solid filler material (wire/rod)	Gas tungsten-arc welding using inert gas and solid filler material (wire/rod)
21	Resistance spot welding	Spot welding
23	Projection welding	
24	Flash welding	
25	Resistance butt welding	Upset welding
42	Friction welding	
47	Oxyfuel gas pressure welding	Pressure gas welding

The principles of this document may be applied to other welding processes.

6 Preparations and specifications for welded joints

6.1 General

For load-bearing welded joints, minimum joint strength depending on the type of welded joint with stipulated welding process is given in [Table 2](#). The shear strength for cross joints shall be specified in the design (see also [Annex E](#)).

For non-load-bearing welded joints, lap joint or cross joint is applicable and minimum joint strength is not required generally. Peculiar strength for the joint or measures to avoid influence in the load-bearing capacity or ductility of the bars shall be specified in the design.

Table 2 — Minimum strength of load-bearing welded joints

Type of welded joint	Recommended welding process	Minimum joint strength
butt joint	111, 114	
	135, 136, 138, 141, 24, 25	
	42, 47	
^a d_{\min} / d_{\max} should be $\geq 0,2$.		

Table 2 (continued)

Type of welded joint	Recommended welding process	Minimum joint strength
lap joint / strap joint	111, 114 135, 136, 138, 141	axial load with full load-bearing capacity of the bar
joint to other steel component	111, 114 135, 136, 138, 141 42	
cross joint ^a	111, 114 135, 136, 138, 141, 21, 23	shear with the product of shear factor and nominal yield capacity of the bar

^a d_{\min} / d_{\max} should be $\geq 0,2$.

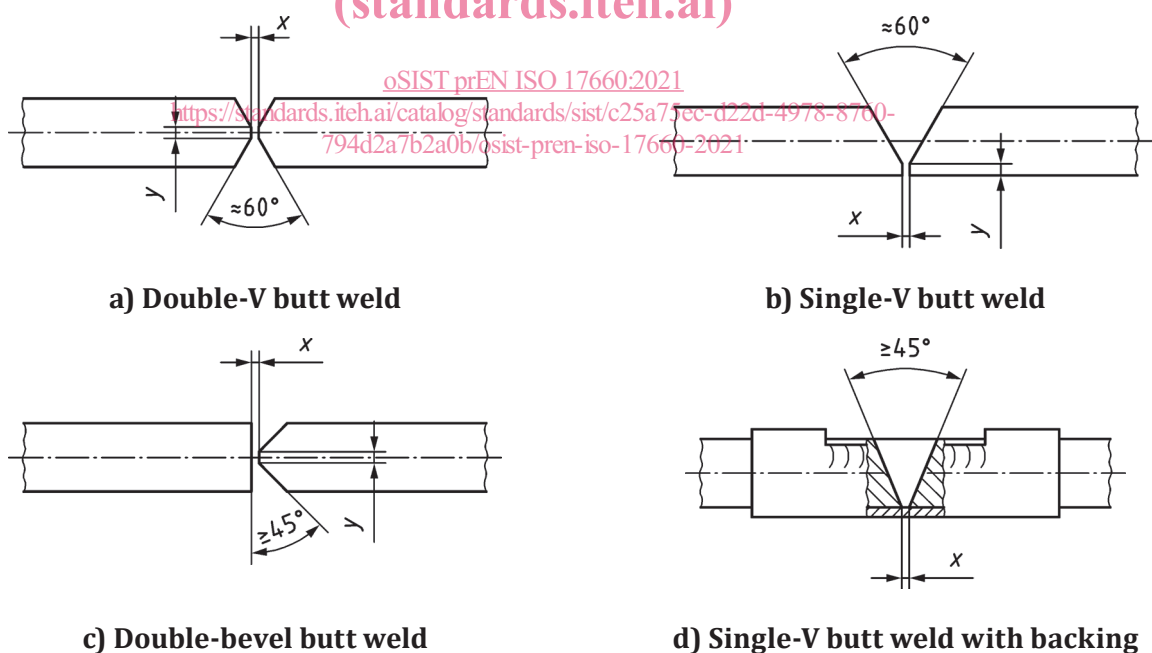
The joints specified below are examples of good practice, see from 6.2 to 6.6. Other joint configurations may be used if they can be shown to meet the requirements of Clause 11.

6.2 Butt joints

6.2.1 Butt joints welded by welding process 111, 114, 135, 136, 138 or 141

Examples of butt-joint preparation for load-bearing welded joints are given in Figure 1 a) to d). Other joint preparations or types of permanent backing may also be used.

The prepared joint shall be bevelled. The joint preparation should be carried out by grinding or flame cutting.



Key

- x root gap
- y depth of root face

NOTE x or y depends on the welding process.

Figure 1 — Examples for the preparation of butt joints