INTERNATIONAL STANDARD

ISO 13918

Third edition
2017-11

Corrected version
2018-05

Welding — Studs and ceramic ferrules for arc stud welding

Soudage — Goujons et bagues céramiques pour le soudage à l'arc des goujons

Reference number
ISO 13918:2017(E)

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Published in Switzerland

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

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 ISO/TC 44, *Welding and allied processes*, Subcommittee SC 10, *Quality management in the field of welding.*

This third edition cancels and replaces the second edition (ISO 13918:2008), which has been technically revised.

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

a) everything according conformity evaluation has been deleted from this document;

b) fully-threaded stud (FD), virtually fully-threaded stud (MD) and insulation pin/nail (ND) have been introduced;

c) threaded stud has been renamed to partially threaded stud (PD);

d) abbreviation *P* for pitch has been introduced;

e) that a stud may consist of two different materials combined by friction welding has been introduced in 5.3.3.1;

f) value for CEV (CEV ≤ 0,38) in Table 2 has been changed;

g) SD3 materials according ISO 15510 have been introduced in Table 2;

h) PT, UT and IT materials according ISO/TR 15608 have been introduced in Table 2;

i) where applicable, the dimensions d_3 and h_4 are now for guidance only.

j) "y_{min}" has been changed to "$y + 2P$" in Table 5, column l_2;

k) "$y_{min} + 1$" has been changed to "$y + 2P$ in Table 6, column d_1";

l) "$\alpha \pm 2{,}5°$" has been changed to "$\alpha \pm 7°$" in Table 6,column d_1;

m) "α ± 2,5°" has been changed to "α ± 7°" in Table 9, column D_6;

n) "b" has been changed to "$b + 2P$" and values for M 5 and M 8 have been changed to 7,5 mm and 12 mm in Table 9, column D_6;

o) the column header "$d_1 - 0{,}4$" has been changed to "$d_1 \pm 0{,}4$" in Table 10;

p) "α ± 2,5"has been changed to "α ± 7" in Table 10;

q) the column header "b_{min}" has been changed to "$b_{min} + 2P$" in Table 13;

r) the column header "b" has been changed to "$b_{min} + 2P$" in Table 16;

s) a nominal diameter ($d_1 \pm 0{,}1$) of 8 mm has been introduced with an internal thread diameter (D_6) of M5 and M6 in Table 16;

t) in all tables for the dimensions of ceramic ferrules, the values for the nominal diameter (D_7), the grip diameter (d_8), the base diameter (d_9) and the height (h_2) have been deleted;

u) Table 17 has been introduced;

v) a note that stud and ceramic ferrule are generally a coordinated system from the same manufacturer has been introduced in Clause 7;

w) 10.1 has been introduced;

x) Annex A has been deleted;

y) figures, normative references and layout have been editorially revised.

Requests for official interpretations of any aspect of this document should be directed to the Secretariat of ISO/TC 44 via your national standards body. A complete listing of these bodies can be found at www.iso.org.

This corrected version of ISO 13918:2017 incorporates the following correction:

— footnote [b] in Table 11 has been modified.

Introduction

The range of types of studs specified in this document represents customary applications.

This document can be used in all fields of the metal-working industry.

Welding — Studs and ceramic ferrules for arc stud welding

1 Scope

This document specifies the following:

— requirements for studs and ceramic ferrules for arc stud welding;

— dimensions, materials and mechanical properties.

Table 1 shows types of studs and the symbols for studs and ceramic ferrules that are covered by this document.

Table 1 — Types of studs and symbols for studs and ceramic ferrules

Welding technique	Type of stud[a]	Symbol for studs	Symbol for ceramic ferrules
Drawn arc stud welding with ceramic ferrule or shielding gas	Fully-threaded stud	FD	UF
	Virtually fully-threaded stud[b]	MD	MF
	Partially threaded stud	PD	PF
	Threaded stud with reduced shaft	RD	RF
	Unthreaded stud	UD	UF
	Insulation pin/nail	ND	UF
	Stud with internal thread	ID	UF
	Shear connector	SD	UF/DF
Short-cycle drawn arc stud welding	Threaded stud with flange	PS	—
	Unthreaded stud	US	—
	Stud with internal thread	IS	—
Stud welding with tip ignition	Threaded stud	PT	—
	Unthreaded stud	UT	—
	Stud with internal thread	IT	—

[a] Further types of stud and ceramic ferrules can be specified as required for special applications.

[b] Also called MPF, stud with a nearly full thread and a minimum length of the unthreaded part.

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 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread*

ISO 3506-1, *Mechanical properties of corrosion-resistant stainless steel fasteners — Part 1: Bolts, screws and studs*

ISO 4042, *Fasteners — Electroplated coatings*

ISO 4759-1, *Tolerances for fasteners — Part 1: Bolts, screws, studs and nuts — Product grades A, B and C*

ISO 6947, *Welding and allied processes — Welding positions*

ISO 15510, *Stainless steels — Chemical composition*

ISO/TR 15608, *Welding — Guidelines for a metallic materials grouping system*

ISO 16120-2, *Non-alloy steel wire rod for conversion to wire — Part 2: Specific requirements for general purpose wire rod*

3 Terms and definitions

No terms and definitions are listed in this document.

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 and abbreviated terms

b length of the thread

c_d depth of the crack in the head

d_1 nominal diameter

d_2 diameter at the weld area

d_3 diameter of the weld collar

d_4 diameter of the ignition tip

d_5 head diameter of shear connector

D_6 internal thread diameter

h_1 height of the flange

h_3 height of the head on shear connector

h_4 height of the weld collar

h_5 height of the thread run-out part of stud types PS and PT

l_1 overall length of the stud (excluding aluminium ball or ignition tip)

l_2 nominal length of the stud

l_3 length of the ignition tip

P pitch

y length of the unthreaded part

α face angle

5 Requirements

5.1 Ordering information

At the time of order, the manufacturer shall obtain the following information:

a) a reference to this document if the purchaser demands compliance;

b) quantities to be delivered;

c) complete product designation;

d) other requirements as agreed with the purchaser (e.g. low-temperature requirements).

5.2 Dangerous substances

Materials used in products shall not release any dangerous substances in excess of the maximum levels permitted in the relevant regulations of the state of destination.

5.3 Product requirements

5.3.1 Dimensions and tolerances on dimensions, form and position

Dimensions and tolerances on dimensions form and position shall be in accordance with the requirements given in Clause 6.

For coated threaded studs, the tolerances shall apply before coating.

Studs shall be free of defects which can affect the application.

5.3.2 Coating

Unless otherwise specified, studs PS, US, IS, PT, UT, IT of property class 4.8 shall be supplied with electroplated copper coating (C1E).

5.3.3 Materials and mechanical characteristics

5.3.3.1 General

The materials listed in Table 2 shall be used, under the provisions of 5.3.4.

The mechanical characteristics of the studs shall comply with the specifications in Table 2.

Studs may consist of two different materials combined by friction welding (dual-material stud).

NOTE The welding part corresponds to the parent metal to avoid problems with dissimilar materials in fusion welding, the rest generally consists of high alloy steel for enhanced corrosion resistance.

5.3.3.2 Shear strength

Shear strength shall be checked by testing the minimum tensile strength of the studs.

Table 2 — Materials and mechanical characteristics of finished studs

Symbol	Material/ material group/ property class	Standard	Mechanical properties of the finished stud
FD MD PD RD UD ID	4.8	ISO 898-1[c]	See ISO 898-1
	A2-50, A2-70, A4-50, A4-70, A5-50, A5-70	ISO 3506-1[c]	See ISO 3506-1
ND	Mild steel, copper coated C2E	ISO 16120-2	R_m < 450 N/mm²
	Austenitic stainless steel	ISO 15510	R_m < 700 N/mm²
SD1	Material group 1 with the limits: C ≤ 0,2 %[a] CEV ≤ 0,38[a] Al ≥ 0,02 %[a,b]	ISO/TR 15608	R_m ≥ 450 N/mm² R_{eH} ≥ 350 N/mm² A_5 ≥ 15 %
SD2	Material group 1 with the limits: C ≤ 0,2 %[a] CEV ≤ 0,35[a] Al ≥ 0,02 %[a,b]		R_m = 400 N/mm² to 550 N/mm² R_{eH} ≥ 235 N/mm² $R_{p0,2}$ ≥ 235 N/mm² A_5 ≥ 20 %
SD3	X5CrNi18-10 X6CrNiTi18-12	ISO 15510	R_m = 500 N/mm² to 780 N/mm² $R_{p0,2}$ ≥ 350 N/mm² A_5 ≥ 25 %
PS US IS	4.8	ISO 898-1[c]	See ISO 898-1
	A2-50, A2-70, A4-50, A4-70, A5-50, A5-70	ISO 3506-1[c]	See ISO 3506-1
PT	4.8	ISO 898-1[c]	See ISO 898-1
UT	A2-50, A2-70, A4-50, A4-70, A5-50, A5-70	ISO 3506-1[c]	See ISO 3506-1
	Group 32	ISO/TR 15608	R_m ≥ 370 N/mm²
IT	Group 21	ISO/TR 15608	R_m ≥ 100 N/mm²
	Group 22.3	ISO/TR 15608	R_m ≥ 230 N/mm²

[a] Values from the ladle analysis.

[b] If other elements for killing are used, they shall be reported in the inspection document.

[c] Only weldable materials shall be used for studs.

5.3.4 Weldability

Only weldable materials shall be used for studs.

Non-alloyed steel studs are weldable if the hardness increase is low. In general, this is the case when the carbon content is ≤0,20 %. Free-cutting steel studs are generally not weldable. Killed materials shall be used.

Austenitic stainless steel studs are generally weldable. Free-cutting stainless steel studs are generally not weldable.