BS EN ISO 13918:2018

BSI Standards Publication

Welding - Studs and ceramic ferrules for arc stud welding

bsi.

National foreword

This British Standard is the UK implementation of EN ISO 13918:2018. It is identical to ISO 13918:2017. It supersedes BS EN ISO 13918:2008, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee WEE/36, Qualification of welding personnel and welding procedures.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2018

ISBN 978 0 580 94565 6

ICS 21.060.10; 25.160.10

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 28 February 2018.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 13918

January 2018

ICS 21.060.10; 25.160.10

Supersedes EN ISO 13918:2008

English Version

Welding - Studs and ceramic ferrules for arc stud welding (ISO 13918:2017)

Soudage - Goujons et bagues céramiques pour le soudage à l'arc des goujons (ISO 13918:2017)

Schweißen - Bolzen und Keramikringe für das Lichtbogenbolzenschweißen (ISO 13918:2017)

This European Standard was approved by CEN on 21 November 2017.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN ISO 13918:2018: E

European foreword

This document (EN ISO 13918:2018) has been prepared by Technical Committee ISO/TC 44 "Welding and allied processes" in collaboration with Technical Committee CEN/TC 121 “Welding and allied processes” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2018, and conflicting national standards shall be withdrawn at the latest by July 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 13918:2008.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 13918:2017 has been approved by CEN as EN ISO 13918:2018 without any modification.

Contents

Page

Foreword ..... **v**
Introduction ..... **vii**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **2**
4 Symbols and abbreviated terms **2**
5 Requirements **3**
5.1 Ordering information 3
5.2 Dangerous substances 3
5.3 Product requirements 3
5.3.1 Dimensions and tolerances on dimensions, form and position 3
5.3.2 Coating 3
5.3.3 Materials and mechanical characteristics 3
5.3.4 Weldability 4
5.4 Durability 5
6 Dimensions of studs **5**
6.1 General 5
6.2 Fully-threaded stud (FD) 6
6.3 Virtually fully-threaded stud (MD) 7
6.4 Partially threaded stud (PD) 8
6.5 Threaded stud with reduced shaft (RD) 9
6.6 Unthreaded stud (UD) 10
6.7 Insulation pin/nail (ND) 11
6.8 Stud with internal thread (ID) 12
6.9 Shear connector (SD) 13
6.10 Threaded stud with flange (PS) 14
6.11 Unthreaded stud (US) 16
6.12 Stud with internal thread (IS) 17
6.13 Threaded stud (PT) 18
6.14 Unthreaded stud (UT) 20
6.15 Stud with internal thread (IT) 21
7 Dimensions of ceramic ferrules **21**
8 Manufacture **23**
8.1 Fully-threaded stud (FD), virtually fully-threaded stud (MD), partially threaded stud (PD), threaded stud with reduced shaft (RD), unthreaded stud (UD), stud with internal thread (ID) 23
8.2 Shear connectors (SD) 23
9 Inspection **23**
9.1 General 23
9.2 Chemical analysis 24
9.3 Mechanical tests 24
9.4 Sample size 24
10 Marking **24**
10.1 Traceability 24
10.2 Studs 24
10.3 Ceramic ferrules 25
11 Designation **25**
11.1 Studs 25
11.2 Ceramic ferrules 25

Bibliography **26**

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 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) "$\alpha \pm 2{,}5$"has been changed to "$\alpha \pm 7$" 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.

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.

This page deliberately left blank

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 X6CrNi18-12	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.

5.4 Durability

The durability of studs is dependent on their use and the environmental exposure to which they are subject.

The mechanical durability of studs is ensured for a reasonable economic working life if the studs comply with the requirements of this document.

6 Dimensions of studs

6.1 General

Nominal dimensions are listed in Tables 3 to 16. Other lengths of studs and threads may be used by agreement between contracting parties. Divergence in outline shape, finish or dimensions shall be permitted, provided the welding area complies with the specifications of the said tables.

The length after welding, l_2, is a design value. By proper control of the welding, it is possible to keep variations in l_2 to within ±1 mm. Under special conditions, for example, through-deck stud welding, l_2 may be constantly different from the nominal value.

The form of the central part of the stud tip comprised inside the diameter $d_1/3$ for stud types FD, UD, SD ($d_2/3$ for stud types MD, PD, RD, ID) shall be at the manufacturer's discretion. The tip shall be at the manufacturer's discretion in the case of flux in the form of a press-fitted aluminium ball (e.g. flattened in the centre with a diameter not exceeding 0,5 d_1).

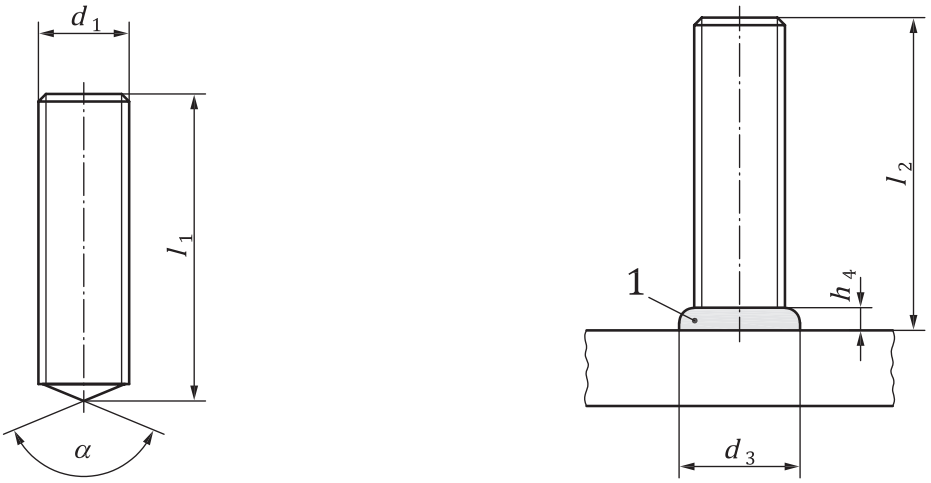
Run-in and run-out for threads is at the manufacturer’s discretion.

The dimensions of stud collars shown in Figures 1 to 8 and given in Tables 3 to 7 and 9 and 10 are guidance values and may generally be achieved in welding position PA in accordance with ISO 6947. The weld collars shown in Figures 1 to 8 are subject to variations regarding evenness and shape.

Details left unspecified shall be at the manufacturer's discretion. This shall apply to any modification of the shape of the stud outside the welding area, e.g. drillings and slots, provided the weldability is not affected.

As long as no tolerances are specified for special dimensions in this document, tolerances on dimensions, form and position shall be such as to comply with product grade A as specified in ISO 4759-1.

6.2 Fully-threaded stud (FD)



a) Before welding **b) After welding**

Key

1 weld collar

Figure 1 — Fully-threaded stud (FD)

Table 3 — Dimensions of fully-threaded studs (FD)

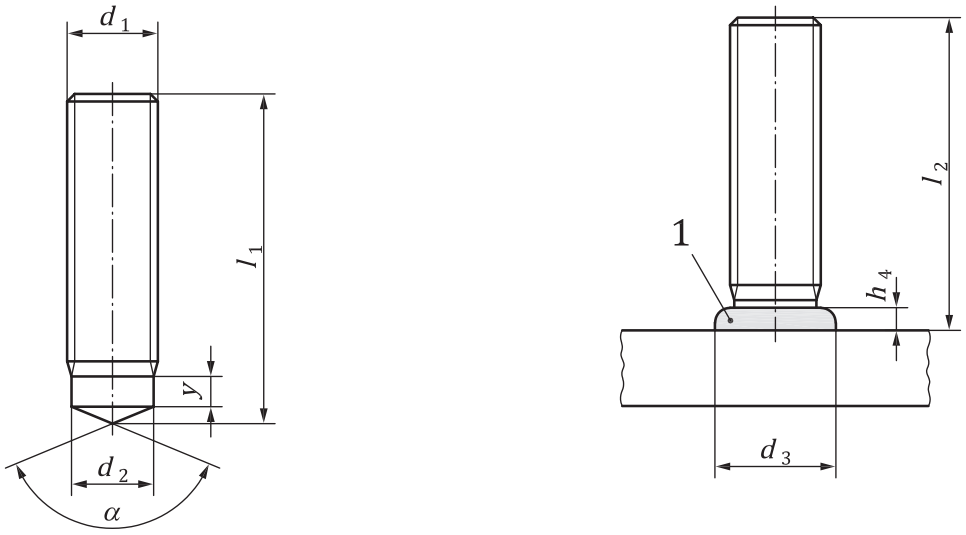
Dimensions in millimetres

d_1	M6	M8	M10	M12	M16	M20
d_3[b]	8,5	11,0	13	16	21	26
h_4[b]	4	4	4	5	7	7
$\alpha \pm 7°$	140°					
$l_1 \pm 1$[a]	l_2 + 2,1	l_2 + 2,2	l_2 + 2,3	l_2 + 2,8	l_2 + 3,5	l_2 + 3,8
l_2	15 – 100	15 – 100	15 – 100	25 – 100	30 – 100	40 – 100

a Length l_1 applies to angle 140° only (without tolerance).

b The given values are for guidance only.

6.3 Virtually fully-threaded stud (MD)



a) Before welding **b) After welding**

Key

1 weld collar

Figure 2 — Virtually fully-threaded stud (MD)

Table 4 — Dimensions of virtually fully-threaded stud (MD)

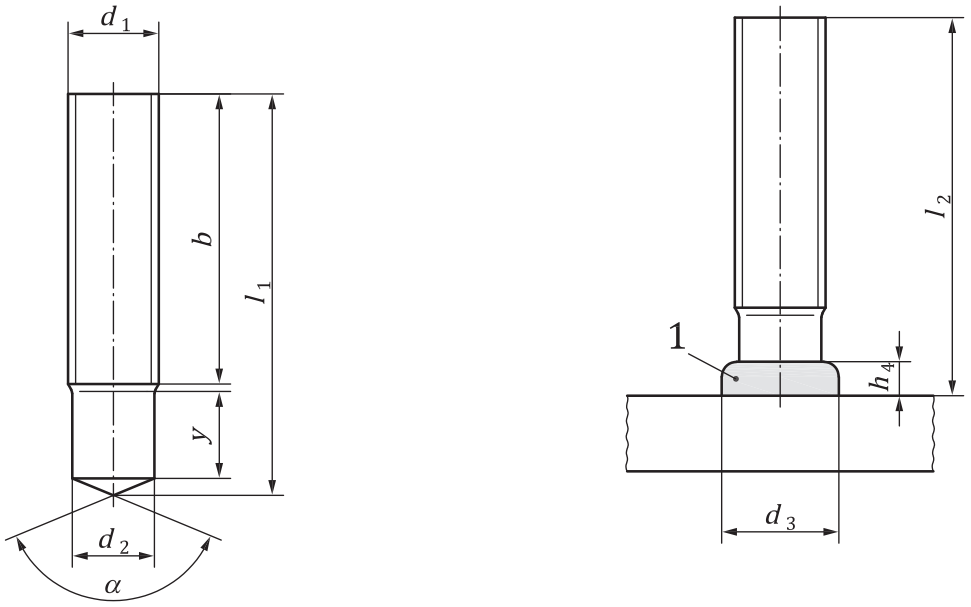
Dimensions in millimetres

d_1	M6	M8	M10	M12	M16
$d_2 \pm 0{,}1$	5,35	7,19	9,03	10,86	14,6
d_3[b]	9,0	9,9	12,5	14,5	17,8
y	5,5	6	6,5	7,5	11
h_4[b]	3,5	3,0	3,4	4,2	5,8
$\alpha \pm 7°$	140				
$l_1 \pm 1$[a]	l_2 + 2,1	l_2 + 2,2	l_2 + 2,3	l_2 + 2,8	l_2 + 3,5
l_2	15 – 100	15 – 100	15 – 100	20 – 100	25 – 100

[a] Length l_1 applies to angle 140° only (without tolerance).

[b] The given values are for guidance only.

6.4 Partially threaded stud (PD)



a) Before welding **b) After welding**

Key

1 weld collar

Figure 3 — Partially threaded stud (PD)

Table 5 — Dimensions of partially threaded studs (PD)

Dimensions in millimetres

d_1	M6		M8		M10		M12		M16		M20		M24	
$d_2 \pm 0{,}1$	5,35		7,19		9,03		10,86		14,6		18,38		22,05	
d_3[b]	8,5		10		12,5		15,5		19,5		24,5		30	
h_4[b]	3,5		3,5		4		4,5		6		7		10	
$\alpha \pm 7°$	140°													
$l_1 \pm 1$[a]	l_2 + 2,1		l_2 + 2,2		l_2 + 2,3		l_2 + 2,8		l_2 + 3,5		l_2 + 3,8		l_2 + 4,5	
l_2	$y + 2P$	b	$y + 2P$	b	$y + 2P$	b	$y + 2P$	b	$y + 2P$	b	$y + 2P$	b	$y + 2P$	b
15	9	—	—	—	—	—	—	—	—	—	—	—	—	—
20	9	—	9	—	9,5	—	—	—	—	—	—	—	—	—
25	9	—	9	—	9,5	—	11,5	—	—	—	—	—	—	—
30	9	—	9	—	9,5	—	11,5	—	13,5	—	—	—	—	—
35	—	20	9	—	9,5	—	11,5	—	13,5	—	15,5	—	—	—
40	—	20	9	—	9,5	—	11,5	—	13,5	—	15,5	—	—	—
45	—	20	9	—	9,5	—	11,5	—	13,5	—	15,5	—	—	—
50	—	20	—	40	—	40	—	40	13,5	—	—	35	20	—
55	—	20	—	40	—	40	—	40	—	40	—	40	—	—
60	—	20	—	40	—	40	—	40	—	40	—	40	—	—
65	—	—	—	40	—	40	—	40	—	40	—	40	—	—

[a] Length l_1 applies to angle 140° only (without tolerance).

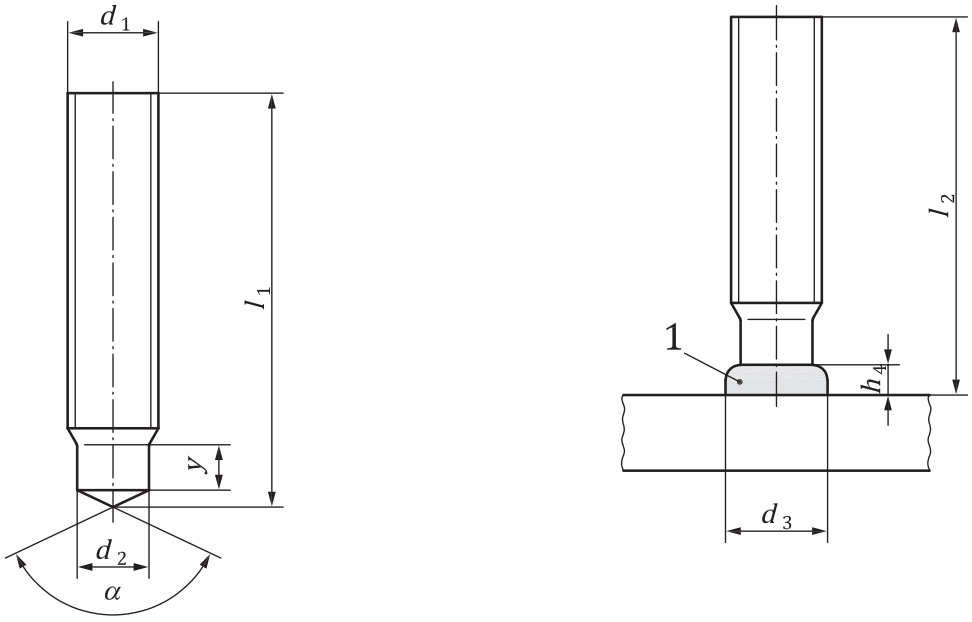
[b] The given values are for guidance only.

d_1	M6		M8		M10		M12		M16		M20		M24	
d_2 ± 0,1	5,35		7,19		9,03		10,86		14,6		18,38		22,05	
d_3[b]	8,5		10		12,5		15,5		19,5		24,5		30	
h_4[b]	3,5		3,5		4		4,5		6		7		10	
α ± 7°	140°													
l_1 ± 1[a]	l_2 + 2,1		l_2 + 2,2		l_2 + 2,3		l_2 + 2,8		l_2 + 3,5		l_2 + 3,8		l_2 + 4,5	
l_2	y + 2P	b	y + 2P	b	y + 2P	b	y + 2P	b	y + 2P	b	y + 2P	b	y + 2P	b
70	—	—	—	40	—	40	—	40	—	50	—	50	—	50
80	—	—	—	40	—	40	—	40	—	50	—	50	—	50
100	—	—	—	40	—	40	—	40	—	80	—	70	—	70
140	—	—	—	40	—	80	—	80	—	80	—	70	—	70
150	—	—	—	40	—	80	—	80	—	80	—	70	—	100
160	—	—	—	—	—	80	—	80	—	80	—	70	—	100

[a] Length l_1 applies to angle 140° only (without tolerance).

[b] The given values are for guidance only.

6.5 Threaded stud with reduced shaft (RD)



a) Before welding **b) After welding**

Key

1 weld collar

Figure 4 — Threaded stud with reduced shaft (RD)

Table 6 — Dimensions of threaded studs with reduced shaft (RD)

Dimensions in millimetres

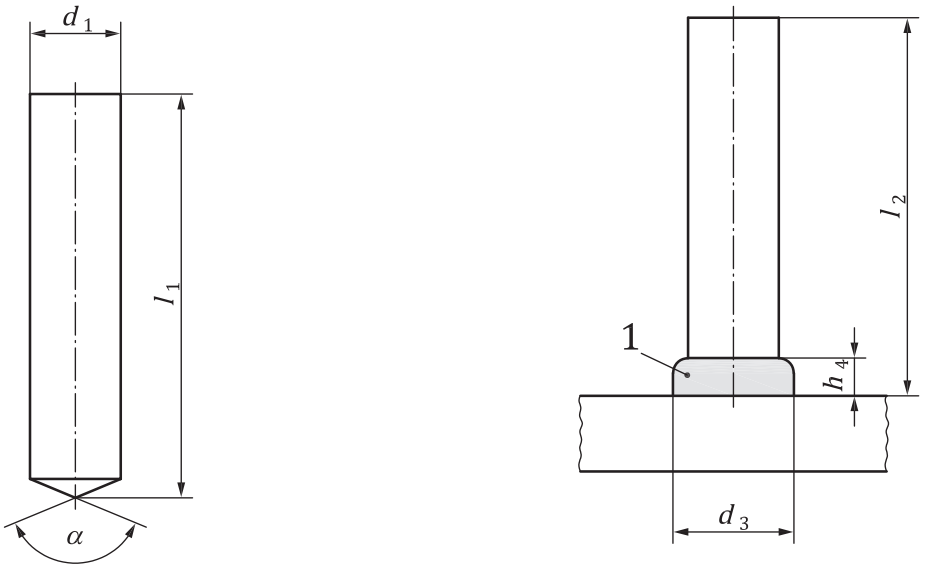
d_1	M6	M8	M10	M12	M16	M20	M24
$d_2 \pm 0{,}1$	4,7	6,2	7,9	9,5	13,2	16,5	20
d_3[c]	7	9	11,5	13,5	18	23	28
h_4[c]	2,5	2,5	3	4	5	6	7
$y + 2P$	4	4	5	6	7,5/11[a]	9/13[a]	12/15[a]
$\alpha \pm 7°$	140°						
$l_1 \pm 1$[b]	$l_2 + 2{,}0$	$l_2 + 2{,}2$	$l_2 + 2{,}4$	$l_2 + 2{,}8$	$l_2 + 3{,}6$	$l_2 + 3{,}9$	$l_2 + 4{,}7$
l_2	15 – 100	15 – 100	15 – 100	20 – 100	25 – 100	30 – 100	40 – 100

[a] The dimensions after the oblique stroke shall apply if ceramic ferrules, according to the values following the oblique stroke in Table 17, are used.

[b] Length l_1 applies to angle 140° only (without tolerance).

[c] The given values are for guidance only.

6.6 Unthreaded stud (UD)



a) Before welding **b) After welding**

Key

1 weld collar

Figure 5 — Unthreaded stud (UD)

Table 7 — Dimensions of unthreaded studs (UD) for $l_2 \geq 20$ mm

Dimensions in millimetres

$d_1 \pm 0{,}1$	6	8	10	12	14,6	16
d_3[b]	8,5	11	13	16	18,5	21
h_4[b]	4	4	4	5	6	7
$\alpha \pm 7°$	140°					

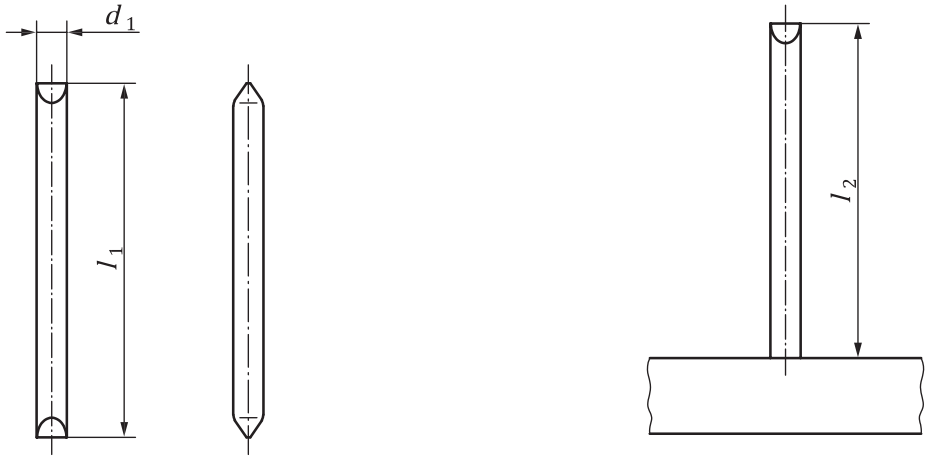
[a] Length l_1 applies to angle 140° only (without tolerance).

[b] The given values are for guidance only.

d_1 ± 0,1	6	8	10	12	14,6	16
l_1 ± 1[a]	l_2 + 2,4	l_2 + 2,6	l_2 + 2,8	l_2 + 3,4	l_2 + 3,9	l_2 + 3,9
[a] Length l_1 applies to angle 140° only (without tolerance).						
[b] The given values are for guidance only.						

6.7 Insulation pin/nail (ND)

The shape of the ends are at the manufacturer's discretion. Chisel point to penetrate shop primer at the manufacturer's discretion. Weld area not defined.



a) Before welding **b) After welding**

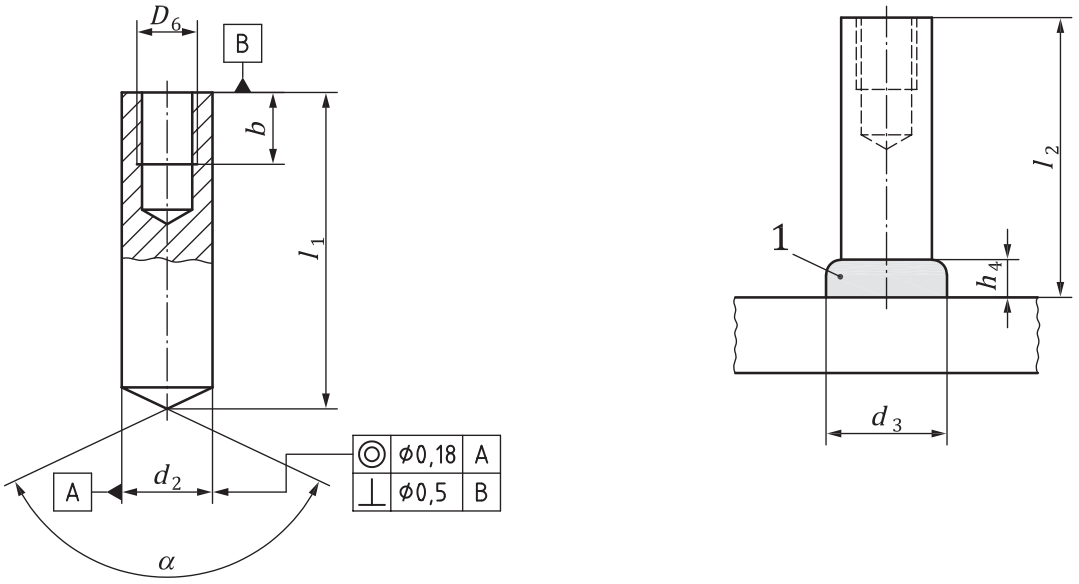
Figure 6 — Insulation pin/nail (ND)

Table 8 — Dimensions of insulation pin/nail (ND)

Dimensions in millimetres

d_1 ± 0,1	3	4	5
l_2 ± 1	25 – 300	25 – 500	25 – 500
l_1	l_2 + 3	l_2 + 3	l_2 + 3

6.8 Stud with internal thread (ID)



a) Before welding **b) After welding**

Key

1 weld collar

Figure 7 — Stud with internal thread (ID)

Table 9 — Dimensions of studs with internal thread (ID)

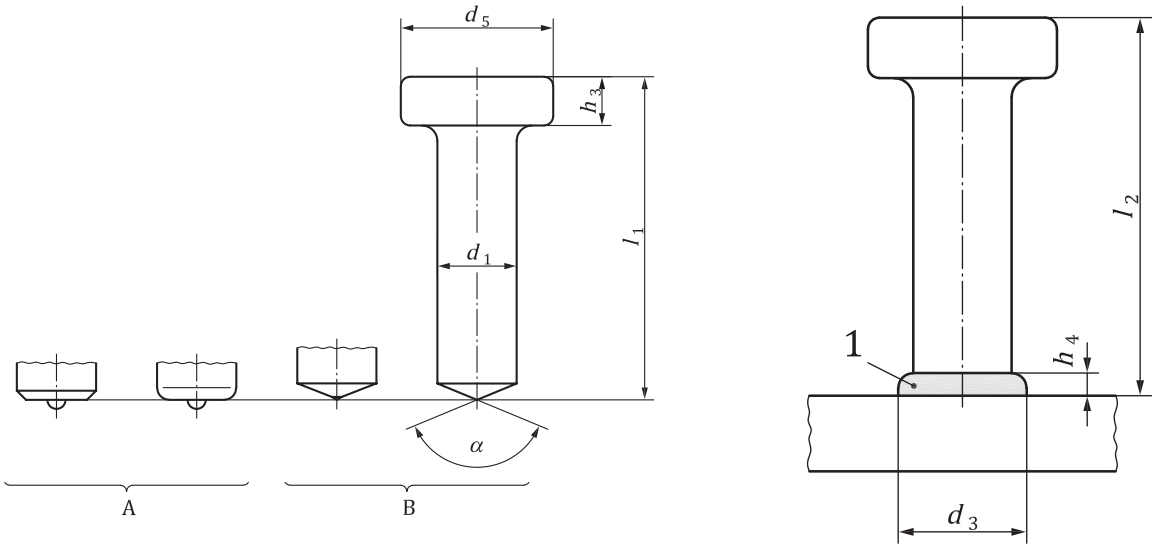
Dimensions in millimetres

D_6	M5	M6	M8	M8	M10	M10	M12
$d_2 \pm 0{,}1$	10	10	12	14,6	14,6	16	18,38
d_3[b]	13	13	16	18,5	18,5	21	23
b+2P	7,5	9	12	15	15	15	18
h_4[b]	4	4	5	6	6	7	7
$l_{2\,\min}$	15	15	20	25	25	25	30
$\alpha \pm 7°$	140°						
$l_1 \pm 1$[a]	$l_{2\,\min} + 2{,}3$	$l_{2\,\min} + 2{,}3$	$l_{2\,\min} + 2{,}8$	$l_{2\,\min} + 3{,}5$	$l_{2\,\min} + 3{,}5$	$l_{2\,\min} + 3{,}5$	$l_{2\,\min} + 3{,}7$

[a] Length l_1 applies to angle 140° only (without tolerance).

[b] The given values are for guidance only.

6.9 Shear connector (SD)



a) Before welding **b) After welding**

Key

1 weld collar

A shape A of tip (example)s

B shape B of tip (example)

Figure 8 — Shear connector (SD)

Table 10 — Dimensions of shear connectors (SD) with l_2[g]

Dimensions in millimetres

$d_1 \pm 0{,}4$[a,e]	9,5	10	12,7	13	16	19	22	25	25,4
$d_5 \pm 0{,}3$[e]	19		25		32[d]	32	35	40	41
d_3[c,f]	13		17		21	23	29	31	
$h_{3\,-0,5}^{+1}$	7		8		8	10	10	12	
h_4[c,f]	2,5		3		4,5	6	6	7	
$\alpha \pm 7°$	140°								
$l_1 \pm 1{,}5$	l_2[b,c] + 3		l_2[b,c] + 3		l_2[b,c] + 4	l_2[b,c] + 4,5	l_2[b,c] + 5	l_2[b,c] + 5,5	

[a] Excess diameter or production impressions in the shaft area below the head are permitted up to 0,5 mm, provided they do not affect proper plunge.

[b] Tolerance on l_2 is $^{+1,5}_{-2}$ mm .

[c] For special conditions, e.g. through-deck stud welding, the dimensions and the tolerances are not applicable.

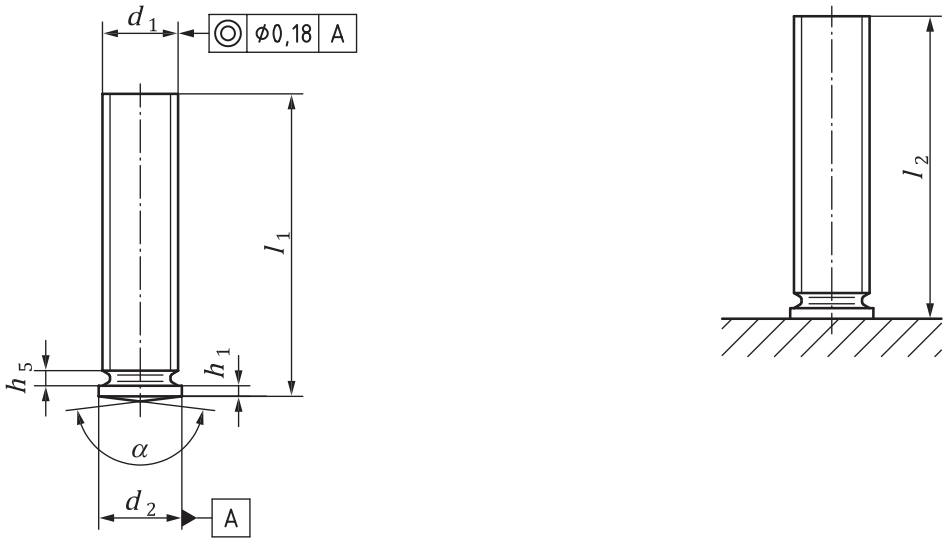
[d] May be reduced to 29 mm for shear application.

[e] Use of the optional dimension depends on national regulations.

[f] The given values are for guidance only.

[g] The minimum of l_2 is approximately three times d_1.

6.10 Threaded stud with flange (PS)



a) Before welding **b) After welding**

NOTE l_2 (length after welding) depends on l_1 and the weld energy.

Figure 9 — Threaded stud with flange (PS)

Table 11 — Dimensions of threaded studs with flange (PS)

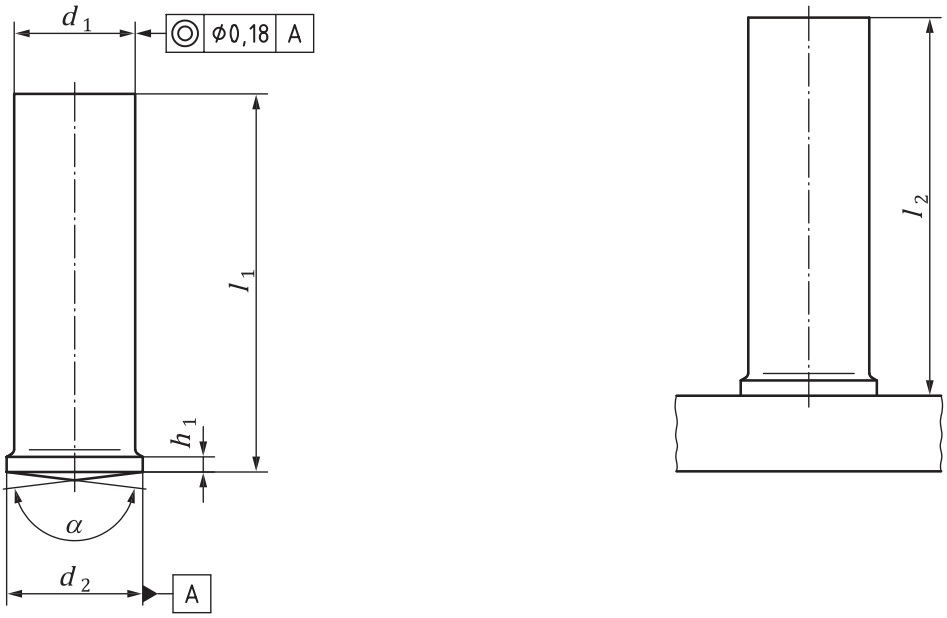
Dimensions in millimetres

d_1 [a]	l_1+0,6	d_2 ± 0,2	max. h_5	h_1	α ± 2° [b]
M3	6 8 10 12 16 20	4	0,6	0,7 to 1,4	166°
M4	8 10 12 16 20 25	5			
M5	10	6	1,0		
M6	12 16 20 25 30	7			
M8	12 16 20 25 30 35 40	9	1,5	0,8 to 1,4	
M10	16 20 25 30 35 40	11	2,0		

[a] Other types of thread are subject to agreement.

[b] For applications using sheet thicknesses ≥2 mm and welding times >60 ms, the angle, α, may be increased up to 14°.

6.11 Unthreaded stud (US)



a) Before welding **b) After welding**

NOTE l_2 (length after welding) depends on l_1 and the weld energy.

Figure 10 — Unthreaded stud (US)

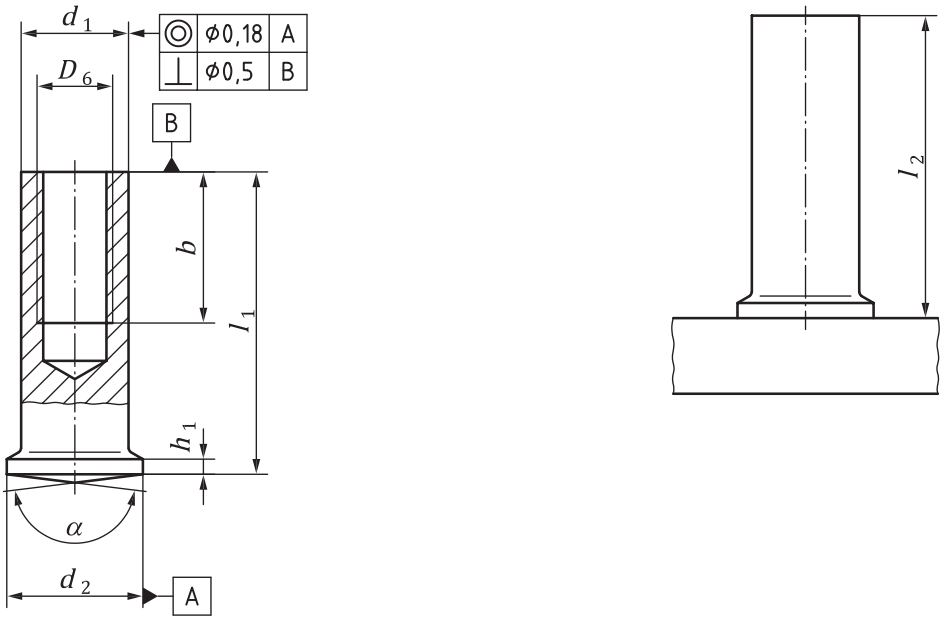
Table 12 — Dimensions of unthreaded studs (US)

Dimensions in millimetres

d_1 ± 0,1	$l_{1\min}$ +0,6	d_2 ± 0,2	h_1	α ± 2°[a]
3	8	4	0,7 to 1,4	166°
4		5		
5	12	6		
6		7		
7,1	15	9	0,8 to 1,4	
8				

[a] For applications using sheet thicknesses ≥2 mm and welding times >60 ms, the angle, α, may be reduced up to 152°.

6.12 Stud with internal thread (IS)



a) Before welding **b) After welding**

Figure 11 — Stud with internal thread (IS)

l_2 (length after welding) depends on l_1 and the weld energy. The depth of the hole shall be at the discretion of the manufacturer.

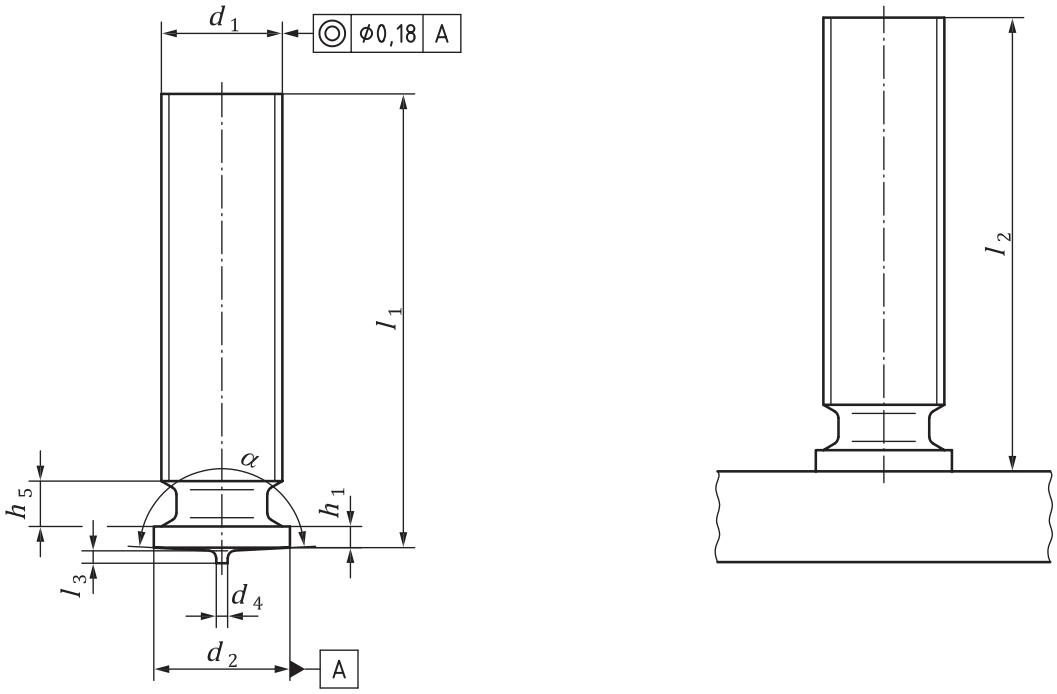
Table 13 — Dimensions of studs with internal thread (IS)

Dimensions in millimetres

D_6	$l_{1\min}$ +0,6	$b_{\min} + 2P$	$d_2 \pm 0,2$	$d_1 \pm 0,1$	h_1	$\alpha \pm 2°$[a]
M3	10	5	6,0	5,0	0,7 to 1,4	166°
M4		6	7,0	6,0		
M5			9,0	7,1	0,8 to 1,4	
M5	15	7,5		8,0		
M6		9				

[a] For applications using sheet thicknesses ≥2 mm and welding times >60 ms, the angle, α, may be reduced up to 152°.

6.13 Threaded stud (PT)



$l_2 \approx l_1 - 0{,}3$ mm

a) Before welding **b) After welding**

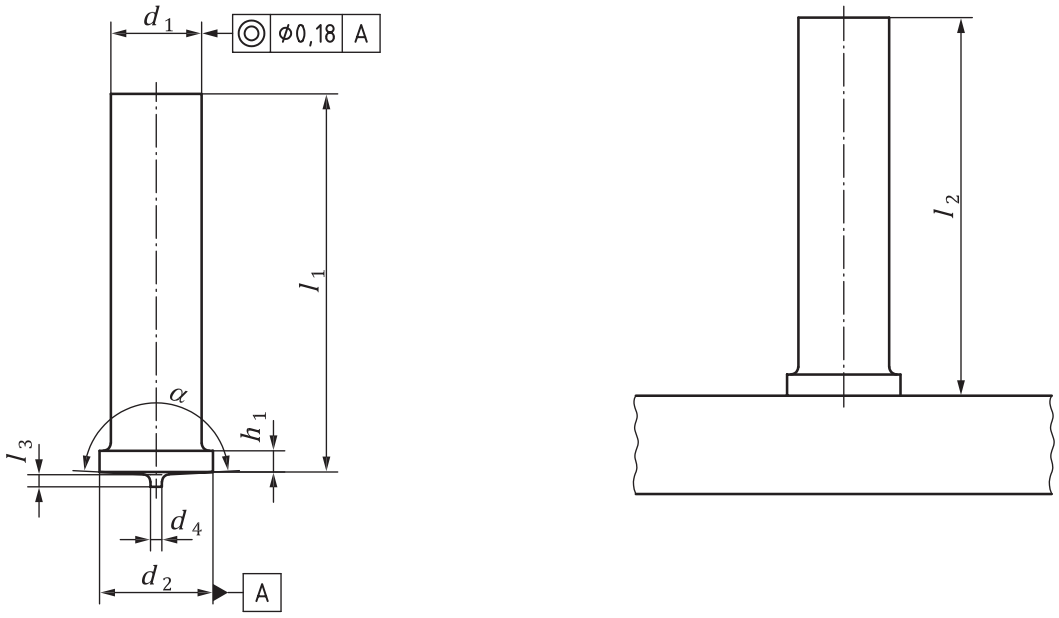
Figure 12 — Threaded stud (PT)

Table 14 — Dimensions of threaded studs (PT)

Dimensions in millimetres

d_1	l_1+0,6	d_2 ± 0,2	d_4 ± 0,08	l_3 ± 0,05	max. h_5	h_1	α ± 2°
M3	6 8 10 12 16 20	4,5	0,60	0,55	0,6	0,7 to 1,4	174°
M4	8 10 12 16 20 25	5,5	0,65				
M5	10 12 16	6,5	0,75	0,80	1,0		
M6	20 25 30	7,5					
M8	12 16 20 25 30	9		0,85	1,5	0,8 to 1,4	

6.14 Unthreaded stud (UT)



$l_2 \approx l_1 - 0{,}3$ mm

a) Before welding **b) After welding**

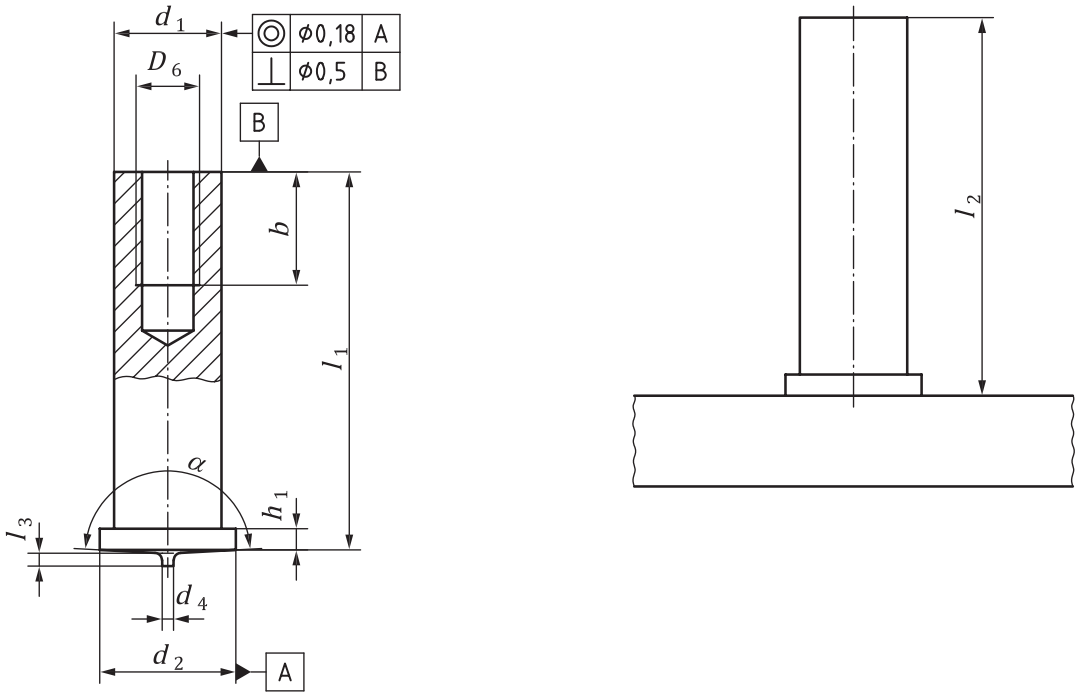
Figure 13 — Unthreaded stud (UT)

Table 15 — Dimensions of unthreaded studs (UT)

Dimensions in millimetres

$d_1 \pm 0{,}1$	$l_{1\min} + 0{,}6$	$d_2 \pm 0{,}2$	$d_4 \pm 0{,}08$	$l_3 \pm 0{,}05$	h_1	$\alpha \pm 2°$
3	8	4,5	0,60	0,55	0,7 to 1,4	174°
4		5,5	0,65			
5	12	6,5	0,75	0,80		
6		7,5				
7,1	15	9		0,85	0,8 to 1,4	

6.15 Stud with internal thread (IT)



$l_2 \approx l_1 - 0{,}3$ mm

a) Before welding **b) After welding**

Figure 14 — Stud with internal thread (IT)

The depth of the hole shall be to the discretion of the manufacturer.

Table 16 — Dimensions of studs with internal thread (IT)

Dimensions in millimetres

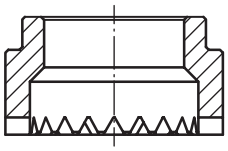
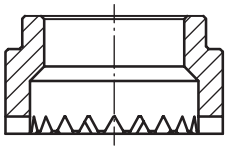
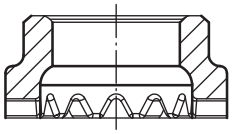
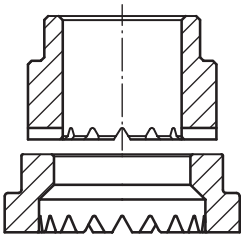
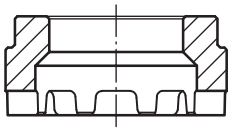
D_6	$l_{1\min}$ +0,6	$b_{\min} + 2P$	$d_2 \pm 0{,}2$	$d_1 \pm 0{,}1$	$d_4 \pm 0{,}08$	$l_3 \pm 0{,}05$	h_1	$\alpha \pm 2°$
M3	10	5	6,5	5,0	0,75	0,80	0,7 to 1,4	174°
M4		6	7,5	6,0				
M5			9	7,1		0,85	0,8 to 1,4	
M5	15	7,5	9	8,0		0,85	0,8 to 1,4	
M6		9	9	8,0		0,85	0,8 to 1,4	

7 Dimensions of ceramic ferrules

A list of ceramic ferrules is given in Table 17. The diameter of the ceramic ferrule shall be suitable for the welding task.

NOTE Stud and ceramic ferrule are generally a coordinated system from the same manufacturer.

Table 17 — List of ceramic ferrules

Designation	Overall height (mm) ±2	Overall diameter (mm) ±2	Used for (type of stud)	Sketch
UF 4	9	10	ND	
UF 5	8	11,5	ND	
UF 6	8	11,5	FD, UD, ID, SD	
UF 8	8,5	15,5	FD, UD, ID	
UF 10	10	18	FD, UD, ID	
UF 12	10,5	20	FD, UD, ID	
UF 12,7	11	22	SD	
UF 13	11	22/26[a]	SD	
UF 16	13	30	FD, UD, ID, SD	
UF 19	16,5	31	SD	
UF 20	16,5	31	FD, UD, ID	
UF 22	19	39	SD	
MF 6	—	—	MD	
MF 8	4,5	18	MD	
MF 10	5,5	20	MD	
MF 12	6	23	MD	
MF 16	9,0	29,0	MD	
MF 20	9,0	32,5	MD	
PF 6	6,5	11,5	PD	
PF 8	6,5	15	PD	
PF 10	6,5	18	PD	
PF 12	9	20	PD	
PF 16	11	26	PD	
PF 20	10	34	PD	
PF 24	18,5	39	PD	
RF 6	10	12	RD	
RF 8	9	15	RD	
RF 10	11,5	18	RD	
RF 12	13	20	RD	
RF 16	15,5/9[b]	30	RD	
RF 20	22/9	32	RD	
RF 24	25/13[b]	33/36[a]	RD	
DF 16[c]	17	30	SD	
DF 19[c]	15	34	SD	
DF 22[c]	19	39	SD	

[a] At the manufacturer's discretion.

[b] The dimensions after the oblique stroke shall apply if studs, according to values following the oblique stroke in Table 6, are used (shallow form).

[c] For stud welding through decking sheet (through-deck stud welding).

8 Manufacture

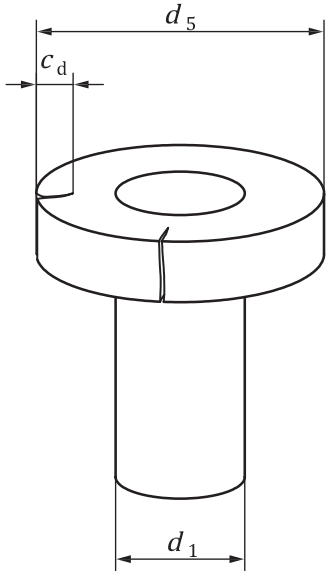
8.1 Fully-threaded stud (FD), virtually fully-threaded stud (MD), partially threaded stud (PD), threaded stud with reduced shaft (RD), unthreaded stud (UD), stud with internal thread (ID)

The stud tip shall be supplied with flux in the form of a press-fitted aluminium ball or aluminium spray coating. This may be dispensed with in the case of stainless-steel studs and diameters ≤10 mm and stud welding with inert gas.

8.2 Shear connectors (SD)

The tip shape of the shear connector may be chosen by the manufacturer. The stud tip shall be supplied with flux in the form of a press-fitted aluminium ball or aluminium spray coating.

Cracks in the head shall be permissible, but may not exceed the value given in Figure 15.



$$c_d \leq 0{,}25 \times (d_5 - d_1)$$

Key

c_d depth of the crack in the head

d_1 nominal diameter

d_5 head diameter of shear connector

Figure 15 — Permissible head cracks for shear connectors

9 Inspection

9.1 General

The manner and extent of and the responsibility for the inspection shall be defined by agreement when placing an order. Provided a specific material certificate (e.g. 3.1 according to EN 10204 or a more significant reference) is required, the tests described in 9.2 to 9.3 shall be carried out.

9.2 Chemical analysis

Chemical analysis may be carried out on the delivery unit or on the raw material, comprising all utilized heats. The specifications of the standards specified in Table 2 shall apply.

9.3 Mechanical tests

The mechanical properties of the finished stud according to Table 2 shall be proven for every test lot, dimensions of the studs permitting.

All samples of the sample size shall meet the requirements of Table 2.

Notch impact tests may not be carried out on cold-formed material as there is a considerable variation in the results.

9.4 Sample size

The sample size shall comply with Table 18.

Table 18 — Sample size

Number of units per testing lot	Sample size[a]
≤8 000	2
>8 000 to 35 000	3
>35 000	5

[a] All samples of the sample size shall meet the requirements of Table 2.

10 Marking

10.1 Traceability

Studs shall be identifiable and traceable with regard to their production origin. The manufacturer shall have written procedures ensuring that processes related to affixing traceability codes and/or markings are inspected regularly.

Shear connectors shall be marked with the manufacturer's identification. Other studs do not have a manufacturer’s mark. Traceability can be ensured by labelling on the packaging unit only.

10.2 Studs

The following information shall be marked permanently on the packaging unit of the studs:

a) a reference to this document, i.e. ISO 13918;

b) symbol of the stud (see Table 1);

c) nominal diameter and length, l_1 or l_2 (the length used shall be marked);

d) material (see Table 2);

e) finish (if necessary, symbol in accordance with ISO 4042);

f) traceability information (see 10.1).

10.3 Ceramic ferrules

The following information shall be marked permanently on the packaging unit of the ceramic ferrules:

a) a reference to this document, i.e. ISO 13918;

b) symbol of the ceramic ferrule and nominal diameter of the stud (see Table 17).

11 Designation

11.1 Studs

The designation for studs shall contain the following information:

— for threaded studs (PD), (PT) and threaded stud with reduced shaft (RD)

EXAMPLE 1 An M12 threaded stud (PD) made of steel of property class 4.8, with a length, l_2, of 40 mm, is designated as follows:

Stud ISO 13918:2017 – PD M12×40 – 4.8

— for unthreaded studs (UD), (UT)

EXAMPLE 2 An unthreaded stud (UD) made of steel of property class 4.8, with a diameter, d_1, of 12 mm and a length, l_2, of 40 mm, is designated as follows:

Stud ISO 13918:2017 – UD 12×40 – 4.8

— for shear connector (SD)

EXAMPLE 3 A shear connector type 1 (SD1) made of mild steel type 1, with a diameter, d_1, of 16 mm and a length, l_2, of 75 mm with shape A, is designated as follows:

Stud ISO 13918:2017 – SD1 – 16×75 – A

— for threaded stud with flange (PS)

EXAMPLE 4 An M4 threaded stud with flange (PS) made of steel of property class 4.8, with a length, l_2, of 20 mm, copper plated, is designated as follows:

Stud ISO 13918:2017 – PS M4×20 – 4.8 – C1E

— for stud with internal thread (IT)

EXAMPLE 5 A stud with internal thread (IT) made of aluminium EN AW-AlMg3 (5754), with diameters, d_1, of 5 mm, d_2, of M3 and a length, l_2, of 20 mm, is designated as follows:

Stud ISO 13918:2017 – IT 5×20×M3 – AlMg3

or

Stud ISO 13918:2017 – IT 5×20×M3 – 5754

11.2 Ceramic ferrules

The designation for ferrules shall contain the following information:

EXAMPLE A ceramic ferrule type PF 10 for threaded studs is designated as follows:

Ceramic ferrule ISO 13918:2017 – PF 10

Bibliography

[1] ISO 724, *ISO general-purpose metric screw threads — Basic dimensions*

[2] ISO 9001, *Quality management systems — Requirements*

[3] ISO 14555, *Welding — Arc stud welding of metallic materials*

[4] ISO 18265, *Metallic materials — Conversion of hardness values*

[5] EN 10025-2, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

[6] EN 10204, *Metallic materials — Types of inspection documents*

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Copyright in BSI publications

All the content in BSI publications, including British Standards, is the property of and copyrighted by BSI or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use.

Save for the provisions below, you may not transfer, share or disseminate any portion of the standard to any other person. You may not adapt, distribute, commercially exploit, or publicly display the standard or any portion thereof in any manner whatsoever without BSI's prior written consent.

Storing and using standards

Standards purchased in soft copy format:

- A British Standard purchased in soft copy format is licensed to a sole named user for personal or internal company use only.
- The standard may be stored on more than 1 device provided that it is accessible by the sole named user only and that only 1 copy is accessed at any one time.
- A single paper copy may be printed for personal or internal company use only.
- Standards purchased in hard copy format:
- A British Standard purchased in hard copy format is for personal or internal company use only.
- It may not be further reproduced – in any format – to create an additional copy. This includes scanning of the document.

If you need more than 1 copy of the document, or if you wish to share the document on an internal network, you can save money by choosing a subscription product (see 'Subscriptions').

Reproducing extracts

For permission to reproduce content from BSI publications contact the BSI Copyright & Licensing team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email subscriptions@bsigroup.com.

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Useful Contacts

Customer Services
Tel: +44 345 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 345 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

bsi.