INTERNATIONAL STANDARD

ISO 13918

First edition
1998-11-15

Welding — Studs and ceramic ferrules for arc stud welding

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

Reference number
ISO 13918:1998(E)

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

International Standard ISO 13918 was prepared by the European Committee for Standardization (CEN) in collaboration with ISO Technical Committee TC 44, *Welding and allied processes*, Subcommittee SC 10, *Unification of requirements in the field of metal welding*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this standard, read “...this European Standard...” to mean “...this International Standard...”.

Annex ZZ gives a list of corresponding International and European Standards for which equivalents are not given in the text.

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Contents

Foreword

The text of prEN ISO 13918:1998 has been prepared by Technical Committee CEN/TC 121 "Welding", the secretariat of which is held by DS, in collaboration with Technical Committee ISO/TC 44 "Welding and allied processes".

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association. This European Standard is considered to be a supporting standard to those application and product standards which in themselves support an essential safety requirement of a New Approach Directive and which make reference to this European Standard.

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 April 1999, and conflicting national standards shall be withdrawn at the latest by April 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This standard includes the most important dimensions of studs and ceramic ferrules for arc stud welding. The range of types of studs specified in this standard accounts for customary applications. Further types may be specified as required for special application. This standard can be used in all fields of the metal-working industry.

Table 1 shows types of studs and the symbols for studs and ceramic ferrules, which are used in this standard.

Table 1: Type of studs and symbols for studs and ceramic ferrules

Type of studs			Symbols for studs	Symbols for ceramic ferrules
drawn arc	drawn arc stud welding with ceramic ferrule or shielding gas	threaded stud (pitch)	PD	PF
		threaded stud with reduced shaft	RD	RF
		unthreaded stud	UD	UF
		shear connector	SD	UF
	short-cycle drawn arc stud welding	threaded stud with flange	FD	–
tip ignition		threaded stud (pitch)	PT	–
		unthreaded stud	UT	–
		stud with internal thread	IT	–

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 573-3
Aluminium and aluminium alloys – Chemical compositions and forms of wrought products – Part 3: Chemical composition

EN 10025
Hot rolled products of non-alloy structural steels – Technical delivery conditions

EN 10088-1
Stainless steels – Part 1: List of stainless steels

EN 20898-1
Mechanical properties of fasteners – Part 1: Bolts, screws and studs (ISO 898-1:1988)

EN ISO 6947
Welds – Working positions – Definitions of angles of slope and rotation (ISO 6947:1993)

prEN ISO 14555
Welding – Arc stud welding of metallic materials (ISO/FDIS 14555:1998)

ISO 426-1
Wrought copper-zinc alloys – Chemical composition and forms of wrought products – Part 1: Non-leaded and special copper-zinc alloys

ISO 724
ISO general-purpose metric screw threads – Basic dimensions

ISO 1638
Wrought copper and copper alloy wire – Technical conditions of delivery

EN ISO 3506-3
Mechanical properties of corrosion-resistant stainless-steel fasteners - Part 3: Set screws and similar fasteners not under tensile stress (ISO 3506-3:1997)

ISO 4042
Threaded components - Electroplated coatings

ISO 4759-1
Tolerances for fasteners - Part 1: Bolts, screws and nuts with thread diameters between 1,6 (inclusive) and 150 mm (inclusive) and product grades A, B and C

3 Definitions

For the purposes of this standard, the definitions listed in prEN ISO 14555 apply.

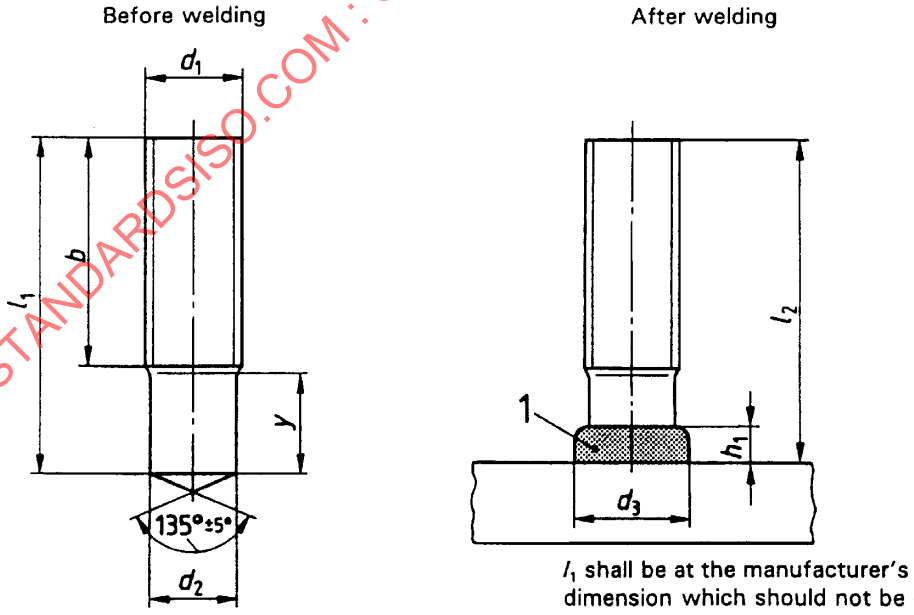
4 Dimensions and mass for studs

4.1 General

Dimensions are given in millimetres. Details left unspecified are at the manufacturer's discretion. Nominal dimensions are listed in the following tables.

The dimensions of stud collars shown in figures 1, 2, 3 and 5 may be generally achieved in welding position PA according to EN ISO 6947.

4.2 Threaded stud (PD)



Key: 1 = weld collar

l_1 shall be at the manufacturer's discretion. It is a dimension which should not be controlled by the user.
Shank diameter $d_2 \approx$ pitch diameter in accordance with ISO 724.

Figure 1: Threaded stud (PD)

Table 2: Dimensions and mass of threaded studs (PD)

d_1	M6			M8			M10			M12			M16			M20			M24		
d_2	5,35			7,19			9,03			10,86			14,7			18,38			22,05		
d_3 [1]	8,5			10			12,5			15,5			19,5			24,5			30		
h_1 [1]	3,5			3,5			4			4,5			6			7			10		
l_2 [2]	y_{min}	b	m [3]	y_{min}	b	m [3]	y_{min}	b	m [3]	y_{min}	b	m [3]	y_{min}	b	m [3]	y_{min}	b	m [3]	y_{min}	b	m [3]
15	9	–	2,6	–	–		–	–		–	–		–	–		–	–		–	–	
20	9	–	3,5	9	–	6,4	9,5	–	10,0	–	–		–	–		–	–		–	–	
25	9	–	4,4	9	–	8,0	9,5	–	12,6	11,5	–	18,2	–	–		–	–		–	–	
30	9	–	5,3	9	–	9,6	9,5	–	15,1	11,5	–	21,8	13,5	–	39,9	–	–		–	–	
35	–	20	6,2	9	–	11,1	9,5	–	17,6	11,5	–	25,4	13,5	–	46,6	15,5	–	72,9	–	–	
40	–	20	7,1	9	–	12,7	9,5	–	20,1	11,5	–	29,1	13,5	–	53,3	15,5	–	83,3	–	–	
45	–	–		9	–	14,3	9,5	–	22,6	11,5	–	32,7	13,5	–	59,9	15,5	–	93,7	–	–	
50	–	–		–	40	15,9	–	40	25,1	–	40	36,3	–	40	66,6	–	40	104,1	30	–	149,8
55	–	–		–	–		–	–		–	–		–	40	73,2	–	40	114,5	–	–	
60	–	–		–	–		–	–		–	–		–	40	79,9	–	40	124,9	–	–	
65	–	–		–	–		–	–		–	–		–	40	86,6	–	40	135,3	–	–	

(continued)

Table 2 (concluded)

d_1	M6			M8			M10			M12			M16			M20			M24		
d_2	5,35			7,19			9,03			10,86			14,7			18,38			22,05		
d_3 [1)]	8,5			10			12,5			15,5			19,5			24,5			30		
h_1 [1)]	3,5			3,5			4			4,5			6			7			10		
l_2 [2)]	y_{min}	b	m [3)]	y_{min}	b	m [3)]	y_{min}	b	m [3)]	y_{min}	b	m [3)]	y_{min}	b	m [3)]	y_{min}	b	m [3)]	y_{min}	b	m [3)]
70	—	—		—	—		—	—		—	—		—	—		—	40	145,7	—	—	
75	—	—		—	—		—	—		—	—		—	—		—	—		—	40	224,7
100	—	—		—	—		—	40	50,2	—	40	72,7	—	40	133,2	—	—		—	40	299,6
140	—	—		—	—		—	80	70,3	—	80	101,7	—	80	186,4	—	—		—	—	
150	—	—		—	—		—	80	75,4	—	80	109,0	—	80	199,7	—	—		—	—	
160	—	—		—	—		—	80	80,4	—	80	116,3	—	80	213,1	—	—		—	—	

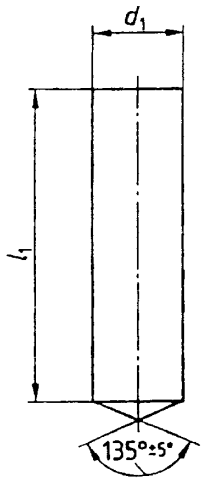
1) Guide values.

2) l_2 is the design value. By proper control of the welding it is possible to keep variations in l_2 within ± 0,5 mm.

3) Due to the tolerances, the values of mass m are only approximate (7,85 kg/dm^3) per 1000 units, in kg.

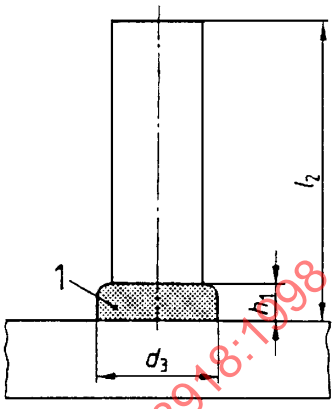
4.3 Unthreaded stud (UD)

Before welding



Key: 1 = weld collar

After welding



l_1 shall be at the manufacturer's discretion. It is a dimension which should not be controlled by the user.

Figure 2: Unthreaded stud (UD)

Table 3: Dimensions and mass of unthreaded studs (UD)

d_1	6	8	10	12	16
d_3 [1]	8,5	11	13	16	21
h_1 [1]	4	4	4	5	7
l_2 [2]	Approximate mass m[3] (7,85 kg/dm^3) per 1000 units, in kg				
20	4,7	8,2	13,1	20,2	—
25	5,7	10,7	16	23	45,9
30	6,7	12,7	19,4	27,7	49,8
40	8,8	16,7	25,6	36,7	66
50	10,9	20,5	32	45,8	81,7
60			37,9	54,4	97,2
70			44	63	113,3
80			51,5	71,9	129,3

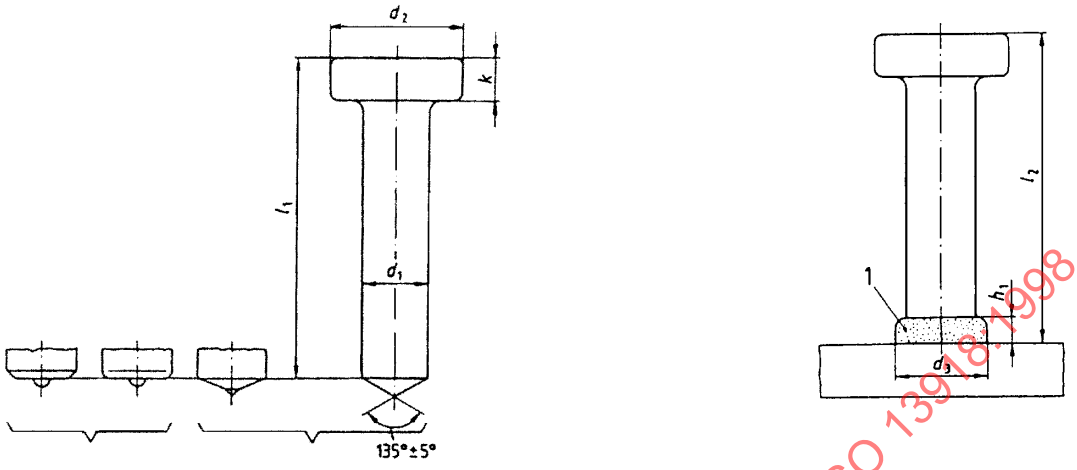
1) Guide values.

2) l_2 is the design value. By proper control of the welding it is possible to keep variations in l_2 within ± 0,5 mm.

3) Due to the tolerances, the values of mass are only approximate.

4.4 Shear connector (SD)

Before welding After welding



Type A Type B
of the shape of tip (examples)

l_1 shall be at the manufacturer's discretion. It is a dimension which should not be controlled by the user.

Key: 1 = weld collar

Figure 3: Shear connector (SD)

Table 4: Dimensions and mass of shear connectors (SD)

Designation	Shear connectors					
$d_{1\ -0,4}$ [1]	10	13	16	19	22	25
$d_2 \pm 0,3$	19	25	32	32	35	40
d_3 [4]	13	17	21	23	29	31
h_1 [4]	2,5	3	4,5	6	6	7
$k \pm 0,5$	7	8	8	10	10	12
$l_{2\ -2}^{+1}$ [2]	Approximate mass m [3] (7,85 kg/dm^3) per 100 units, in kg					
50	5	8	12	16	20	
75	6	10	16	21	28	37
100	8	13	20	27	35	47
125	9	16	24	33	43	57
150	11	18	28	38	50	66
175	12	21	32	44	58	76
200		23	36	49	65	85
225			40	55	73	95
250			44	60	80	105
275				66	88	114
300				72	95	124
325				77	102	134
350				83	110	143

1) Stud diameters up to 0,5 mm too large or production markings measuring up to 0,5 mm are permissible in the shank area below the head, provided they do not hinder plunging.

2) l_2 is the design value. For special application, e.g. through deck stud welding l_2 will be shorter.

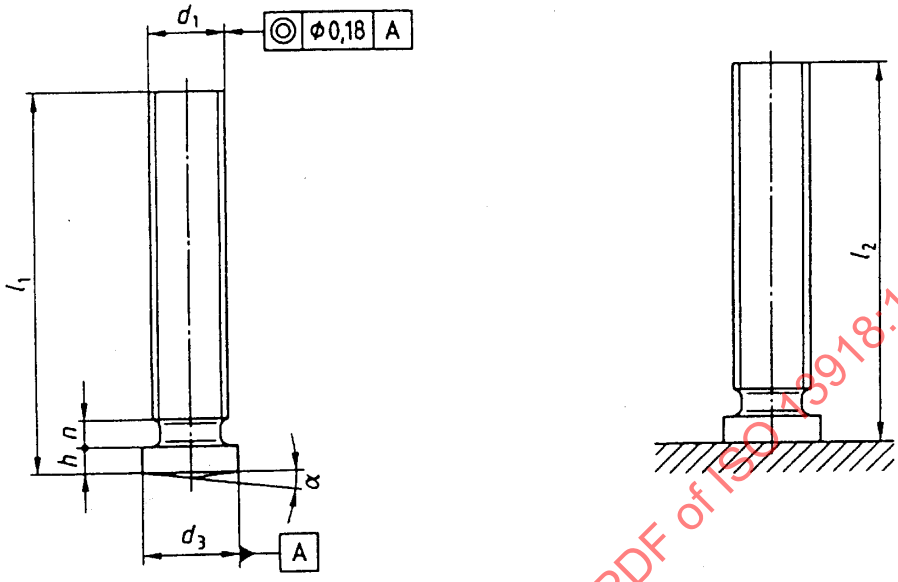
3) Due to the tolerances, the values of mass are only approximate.

4) Guide values. In special applications, e.g. through deck stud welding the dimensions may vary.

4.5 Threaded stud with flange (FD)

Before welding

After welding



l_2 (lengths after welding) depents on l_1 and the weld energy

Figure 4: Threaded stud with flange (FD)

Table 5: Dimensions of threaded studs with flange (FD)

d_1 [1]	l_1 $^{+0,6}_{0}$ [2]	$d_3 \pm 0,2$	h	$n_{max.}$	$\alpha \pm 1°$ [3]
M3	6 8 10 12 16 20	4	0,7 to 1,4	1,5	7°
M4	8 10 12 16 20 25	5			
M5	10 12 16 20 25 30	6	0,8 to 1,4	2	
M6		7			
M8	12 16 20 25 30 35 40	9			
M10	16 20 25 30 35 40	11			

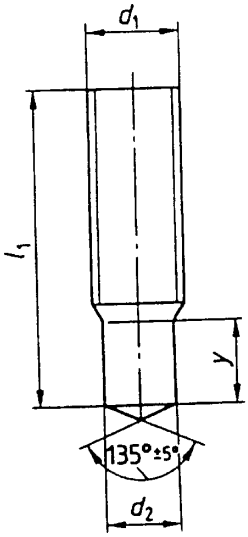
1) Other type of threads subject to agreement.

2) Other lengths subject to agreement.

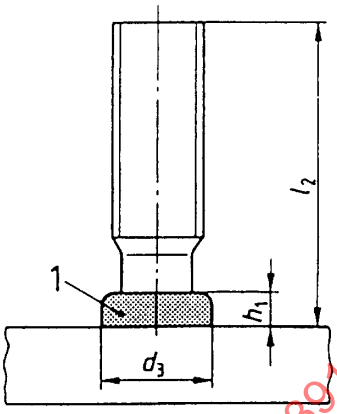
3) For applications using sheet thicknesses equal or more than 2 mm and welding times more than 60 ms the angle α may be increased up to 14 °.

4.6 Threaded stud with reduced shaft (RD)

Before welding



After welding



Key: 1 = weld collar

l_1 shall be at the manufacturer's discretion. It is a dimension which should not be controlled by the user.

Shank diameter $d_2 \approx$ pitch diameter in accordance with ISO 724.

Figure 5: Threaded stud with reduced shaft (RD)

Table 6: Dimensions and mass of threaded studs with reduced shaft (RD)

d_1	M6	M8	M10	M12	M16	M20	M24
d_2	4,7	6,2	7,9	9,5	13,2	16,5	20
d_3 [1)]	7	9	11,5	13,5	18	23	28
h_1 [1)]	2,5	2,5	3	4	5	6	7
y_{max}	4	4	5	6	7,5/11 [4)]	9/13 [4)]	12/15 [4)]
l_2 [2)]	Approximate mass m [3)] (7,85 kg/dm^3) per 1000 units, in kg						
15	2,3						
20	3,2	5,7	9,0				
25	4,1	7,3	11,5	16,5			
30	5,0	8,9	14,0	20,2	36,9		
35	5,9	10,5	16,5	23,9	43,5	67,3	
40	6,8	12,1	19,0	27,5	50,2	77,8	
45		13,7	21,6	31,2	56,9	88,2	
50		15,3	24,1	34,8	63,5	98,6	124,4
55			26,6	38,5	70,2	109,1	
60				42,2	76,8	119,5	
65					83,5	129,9	
70						140,4	
75							186,7
100							249,0

1) Guide values.

2) l_2 is the design value. By proper control of the welding it is possible to keep variations in l_2 within ± 0,5 mm.

3) Due to the tolerances, the values of mass are only approximate.

4) These dimensions shall be used when ceramic ferrules according to table 12 described by footnote 1 are used.

4.7 Threaded stud (PT)

Before welding After welding

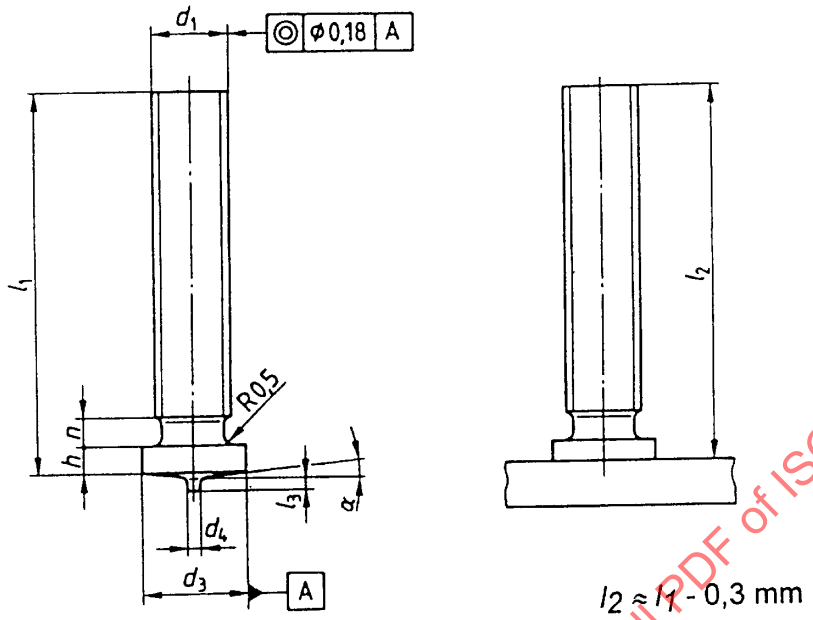


Figure 6: Threaded stud (PT)

Table 7: Dimensions of threaded studs (PT)

d_1	l_1 $^{+0,6}_{0}$ 1)	d_3 ± 0,2	d_4 ± 0,08	l_3 ± 0,05	h	n max.	α ± 1°
M3	6 8 10 12 16 20	4,5	0,60	0,55	0,7 to 1,4	1,5	3°
M4	8 10 12 16 20 25	5,5	0,65				
M5	10 12 16 20 25 30	6,5	0,75	0,80	0,8 to 1,4	2	
M6		7,5					
M8	12 16 20 25 30	9		0,85	0,8 to 1,4	3	

1) Other lengths are subject to agreement.

4.8 Unthreaded stud (UT)

Before welding

After welding

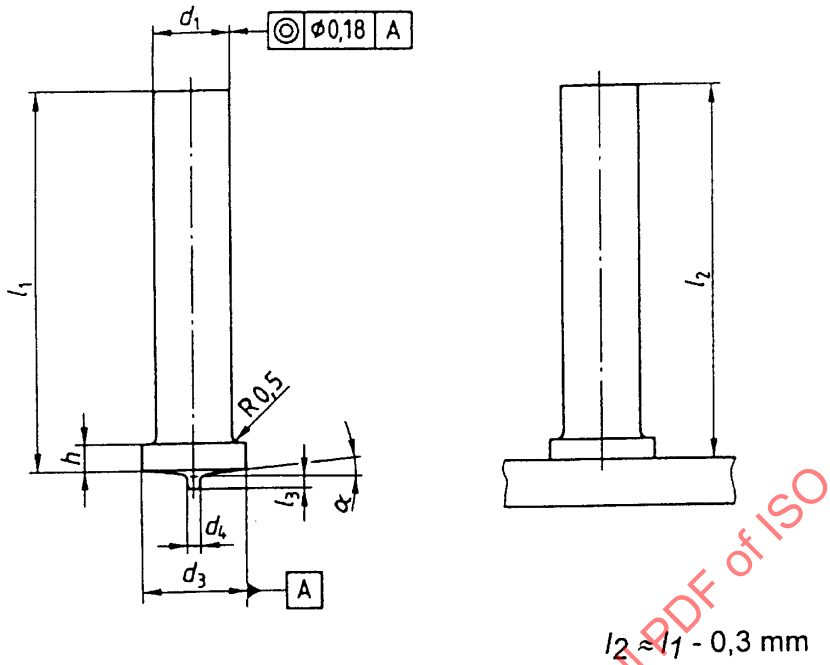


Figure 7: Unthreaded stud (UT)

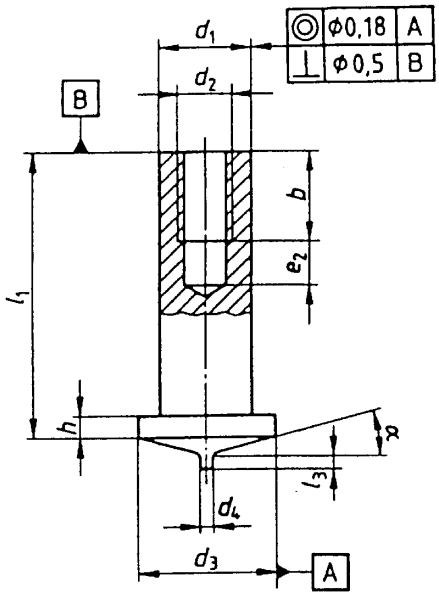
Table 8: Dimensions on unthreaded studs (UT)

d_1 ± 0,1	l_1 $^{+0,6}_{0}$ 1)	d_3 ± 0,2	d_4 ± 0,08	l_3 ± 0,05	h	α ± 1°
3	8 10 12 16 20	4,5	0,60	0,55	0,7 to 1,4	3°
4		5,5	0,65			
5	12 16 20 25	6,5	0,75	0,80	0,8 to 1,4	
6		7,5				

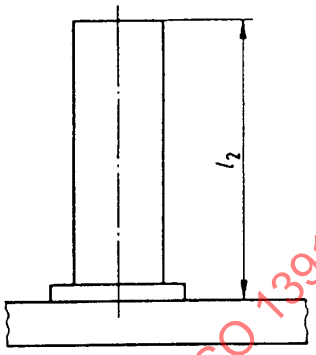
1) Other lengths are subject to agreement.

4.9 Stud with internal thread (IT)

Before welding



After welding



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

Figure 8: Stud with internal thread (IT)

Table 9: Dimensions of studs with internal thread (IT)

d_1 ± 0,1	d_2	l_1 $^{+0,6}_{0}$ 1)	b $^{+0,5}_{0}$	e_2 min.	d_3 ± 0,2	d_4 ± 0,08	l_3 ± 0,05	h	α ± 1°
5	M3	10 12 16 20 25	5	2,5	6,5	0,75	0,80	0,8 to 1,4	3°
6	M4	12 16 20	6	3	7,5				
7,1	M5	12 16 20 25	7,5	3	9		0,85	0,8 to 1,4	

1) Other lengths are subject to agreement, but minimum l_1 at least 1,5 x d_1.

5 Dimensions of ceramic ferrules

5.1 General

Dimensions are given in millimetres. Details left unspecified are to be selected, to obtain d_3 and h_1 of tables 2, 3, 4 and 6.

5.2 Ceramic ferrule for threaded stud (PF)

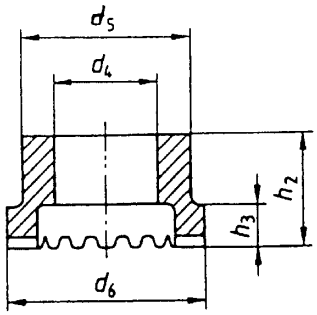


Figure 9: Ceramic ferrule for threaded stud (PF)

Table 10: Dimensions of ceramic ferrules for threaded studs (PF)

Type	d_4	d_5 ± 1	d_6 ± 1	h_2 ≈	h_3 ≈
PF 6	$5{,}6^{+0{,}5}_{0}$	9,5	11,5	6,5	3,3
PF 8	$7{,}4^{+0{,}5}_{0}$	11,5	15	6,5	4,5
PF 10	$9{,}2^{+0{,}5}_{0}$	15	17,8	6,5	4,5
PF 12	$11{,}1^{+0{,}5}_{0}$	16,5	20	9	5,5
PF 16	$15{,}0^{+0{,}5}_{0}$	20	26	11	7
PF 20	$18{,}6^{+0{,}5}_{0}$	30,7	33,8	10	6
PF 24	$22{,}4^{+1}_{0}$	30,7	38,5	18,5	14

5.3 Ceramic ferrule for unthreaded stud and shear connector (UF)

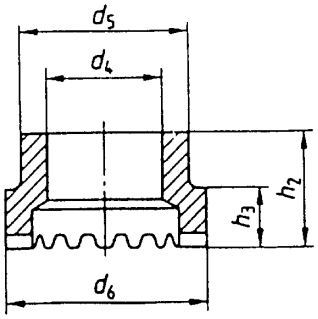


Figure 10: Ceramic ferrule for unthreaded stud and shear connector (UF)