Metric thread stud bolts

DIN 976-1

ICS 21.060.10

Supersedes September 1986 edition of DIN 976.

Descriptors: Fasteners, stud bolts.

Gewindebolzen. Teil 1: Metrisches Gewinde

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Dimensions in mm

1 Scope and field of application

This standard specifies dimensions and technical delivery conditions for stud bolts with metric thread designed to perform functions similar to those of double end studs (clamping type or interference-fit type).

This standard covers stud bolts with threads produced to tolerance 6g which is customary for bolt/nut assemblies of thread engagement group N as specified in DIN 13-14. Attention is drawn to the fact that stud bolts with lengths exceeding those specified for thread engagement group N might not be true to gauge.

For stud bolts with thread of size greater than M39, the specifications of this standard apply only with regard to dimensions and tolerances, the other properties being subject to agreement between purchaser and manufacturer.

Stud bolts may be supplied either with ends cut square (type A) or with chamfered ends (type B), as specified in DIN 78.

2 Dimensions

Type A **DIN 78—Ko type ends**



Type B **DIN 78—K type ends**
(only for nominal lengths, *l*, of 500 mm or less)



Continued on pages 2 to 6.

Table 1: Dimensions

Thread size			M2	M2,5	M3	(M3,5)	M4	M5	M6	M8	M10	M12
			–	–	–	–	–	–	–	M8 × 1	M10 × 1,25	M12 × 1,25
			–	–	–	–	–	–	–	–	M10 × 1	M12 × 1,5
Nominal size	l min	l max	Approximate mass (7,85 kg/dm³) per 1 000 units, in kg									
5	4,76	5,24	0,09	0,15								
6	5,76	6,24	0,11	0,18	0,27							
8	7,71	8,29	0,15	0,24	0,35	0,48	0,62					
10	9,71	10,29	0,19	0,30	0,44	0,60	0,78	1,24				
12	11,65	12,35	0,22	0,36	0,53	0,72	0,93	1,49	2,12			
(14)	13,65	14,35	0,26	0,42	0,62	0,84	1,09	1,73	2,47			
16	15,65	16,35	0,30	0,48	0,71	0,95	1,24	1,98	2,82	5,10		
(18)	17,65	18,35	0,34	0,54	0,79	1,07	1,40	2,23	3,18	5,73		
20	19,58	20,42	0,37	0,60	0,88	1,19	1,55	2,48	3,53	6,37	10,0	
(22)	21,58	22,42	0,41	0,66	0,97	1,31	1,71	2,72	3,88	7,01	11,0	
25	24,58	25,42	0,47	0,75	1,10	1,49	1,94	3,09	4,41	7,96	12,6	18,2
(28)	27,58	28,42	0,52	0,84	1,24	1,67	2,17	3,47	4,94	8,92	14,1	20,3
30	29,58	30,42	0,56	0,90	1,32	1,79	2,32	3,71	5,29	9,56	15,1	21,8
35	34,5	35,5	0,66	1,05	1,53	2,09	2,71	4,33	6,18	11,1	17,5	25,5
40	39,5	40,5	0,75	1,20	1,74	2,39	3,10	4,95	7,06	12,7	20,1	29,1
45	44,5	45,5		1,35	1,94	2,69	3,49	5,57	7,94	14,3	22,5	32,7
50	49,5	50,5		1,50	2,15	2,99	3,88	6,19	8,82	15,9	25,1	36,4
55	54,4	55,6			2,36	3,29	4,27	6,81	9,71	17,5	27,5	40,0
60	59,4	60,6			2,58	3,59	4,66	7,43	10,6	19,1	30,1	43,7
65	64,4	65,6				3,89	5,05	8,05	11,5	20,7	32,5	47,3
70	69,4	70,6				4,20	5,44	8,67	12,4	22,3	35,2	50,9
75	74,4	75,6					5,83	9,29	13,3	23,9	37,7	54,7
80	79,4	80,6					6,22	9,91	14,2	25,5	40,2	58,2
(85)	84,3	85,7						10,5	15,1	27,1	42,7	61,8
90	89,3	90,7						11,2	15,9	28,7	45,2	65,5
(95)	94,3	95,7						11,8	16,8	30,3	47,7	69,1
100	99,3	100,7						12,4	17,7	31,9	50,2	72,8
110	109,3	110,7							19,5	35,1	55,2	80,0
120	119,3	120,7							21,3	38,3	60,2	87,3
130	129,2	130,8								41,5	65,1	94,6
140	139,2	140,8								44,7	70,1	102
150	149,2	150,8								47,9	75,1	109
160	159,2	160,8								51,1	80,1	117
170	169,2	170,8									85,0	124
180	179,2	180,8									90,0	131
190	189,075	190,925									95,0	138
200	199,075	200,925									99,9	146
220	219,075	220,925										160
240	239,075	240,925										175
1 000	995,5	1 004,5	19,0	30,0	43,0	59,8	77,6	124	177	319	502	728
2 000	1 992,5	2 007,5	38,0	60,0	86,0	120	155	248	354	638	1 004	1 456
3 000	2 989,5	3 010,5	57,0	90,0	129	179	233	372	531	957	1 506	2 184

(continued)

Table 1 (continued)

Thread size			(M14)	M16	(M18)	M20	(M22)	M24	(M27)	M30	(M33)	M36
			(M14 × 1,5)	M16 × 1,5	(M18 × 1,5)	M20 × 1,5	(M22 × 1,5)	M24 × 2	(M27 × 2)	M30 × 2	(M33 × 2)	M36 × 3
Nominal size	l min.	l max.	Approximate mass (7,85 kg/dm³) per 1 000 units, in kg									
30	29,58	30,42	29,8	40,0								
35	34,5	35,5	34,8	46,6	57,9							
40	39,5	40,5	39,8	53,3	66,1	83,3						
45	44,5	45,5	44,8	60,0	74,4	93,7	115					
50	49,5	50,5	49,7	66,6	82,7	104	128	150				
55	54,4	55,6	54,7	73,3	90,9	115	141	165	213			
60	59,4	60,6	59,7	80,0	99,2	125	154	180	232	284		
65	64,4	65,6	64,6	86,6	107	135	166	195	251	308	378	
70	69,4	70,6	69,6	93,3	116	146	179	210	271	332	407	482
75	74,4	75,6	74,6	100	124	156	192	225	290	355	437	516
80	79,4	80,6	79,6	107	132	167	205	240	310	379	466	550
(85)	84,3	85,7	84,5	113	141	177	218	255	329	403	495	585
90	89,3	90,7	89,5	120	149	187	230	270	348	427	524	619
(95)	94,3	95,7	94,5	127	157	198	243	285	368	450	553	653
100	99,3	100,7	99,5	133	165	208	256	300	387	474	582	688
110	109,3	110,7	109	147	182	229	282	330	426	521	640	757
120	119,3	120,7	119	160	198	250	307	360	464	569	698	825
130	129,2	130,8	129	173	215	271	333	390	503	616	757	894
140	139,2	140,8	139	187	231	291	358	420	542	664	815	963
150	149,2	150,8	149	200	248	312	383	450	580	711	873	1032
160	159,2	160,8	159	213	265	333	410	480	619	758	931	1101
170	169,2	170,8	169	226	281	354	435	510	658	806	990	1169
180	179,2	180,8	180	239	298	375	461	540	696	853	1048	1238
190	189,075	190,925	190	252	315	396	486	570	735	901	1106	1307
200	199,075	200,925	199	265	332	416	512	600	774	948	1164	1376
220	219,075	220,925	218	291	366	456	563	660	851	1043	1281	1513
240	239,075	240,925	237	317	400	496	614	720	929	1138	1397	1651
260	258,95	261,05	256	343	434	535	665	780	1006	1232	1513	1788
280	278,95	281,05	275	369	468	575	716	840	1083	1327	1630	1926
300	298,95	301,05		395	502	615	767	900	1161	1422	1746	2064
320	318,85	321,15		421	536	655	818	960	1239	1517	1862	2202
340	338,85	341,15			570	694	869	1020	1317	1612	1978	2340
360	358,85	361,15			604	734	920	1080	1395	1707	2094	2478
380	378,85	381,15				774	971	1140	1473	1802	2210	2616
400	388,85	401,15				815	1022	1200	1551	1897	2326	2754
420	418,75	421,25					1073	1260	1629	1992	2442	2892
440	438,75	441,25					1124	1320	1707	2087	2548	3030
460	458,75	461,25						1380	1785	2182	2674	3168
480	478,75	481,25						1440	1863	2277	2790	3306
500	498,75	501,25							1941	2372	2906	3444
1000	995,5	1004,5	995	1330	1650	2080	2560	3000	3882	4744	5812	6888
2000	1992,5	2007,5	1990	2660	3300	4160	5120	6000	7764	9488	11624	13776
3000	2989,5	3010,5	2985	3990	4950	6240	7680	9000	11646	14232	17436	20664

(continued)

Table 1 (concluded)

Thread size			(M39)	M42	(M45)	M48	(M52)	M56	(M60)	M64	(M68)	–
			(M39×3)	M42×3	(M45×3)	M48×3	(M52×3)	M56×4	(M60×4)	M64×4	(M68×4)	M72×6
Nominal size	l min.	l max.	Approximate mass (7,85 kg/dm³) per 1 000 units, in kg									
80	79,4	80,6	654									
(85)	84,3	85,7	694									
90	89,3	90,7	735	847								
(95)	94,3	95,7	776	894								
100	99,3	100,7	817	941	1 091	1 235						
110	109,3	110,7	899	1 036	1 201	1 358						
120	119,3	120,7	980	1 131	1 310	1 482	1 758	2 034				
130	129,2	130,8	1 062	1 224	1 419	1 605	1 905	2 203	2 552	2 895		
140	139,2	140,8	1 143	1 318	1 528	1 729	2 052	2 372	2 748	3 118	3 547	
150	149,2	150,8	1 225	1 412	1 637	1 852	2 198	2 542	2 945	3 341	3 800	4 289
160	159,2	160,8	1 307	1 506	1 747	1 976	2 345	2 711	3 141	3 563	4 054	4 575
170	169,2	170,8	1 389	1 600	1 856	2 099	2 491	2 881	3 337	3 786	4 307	4 861
180	179,2	180,8	1 471	1 695	1 965	2 223	2 637	3 050	3 533	4 009	4 560	5 147
190	189,075	190,925	1 552	1 789	2 074	2 346	2 784	3 219	3 729	4 232	4 814	5 433
200	199,075	200,925	1 634	1 883	2 183	2 470	2 931	3 389	3 926	4 455	5 067	5 719
220	219,075	220,925	1 797	2 071	2 401	2 716	3 224	3 728	4 319	4 901	5 574	6 291
240	239,075	240,925	1 961	2 260	2 620	2 963	3 517	4 067	4 712	5 347	6 080	6 863
260	258,95	261,05	2 124	2 448	2 838	3 210	3 810	4 406	5 104	5 793	6 587	7 435
280	278,95	281,05	2 288	2 636	3 056	3 457	4 103	4 745	5 497	6 239	7 094	8 007
300	298,95	301,05	2 451	2 824	3 275	3 704	4 396	5 084	5 889	6 682	7 600	8 579
320	318,85	321,15	2 614	3 013	3 493	3 951	4 689	5 423	6 282	7 127	8 107	9 150
340	338,85	341,15	2 778	3 201	3 711	4 198	4 982	5 762	6 675	7 572	8 614	9 722
360	358,85	361,15	2 941	3 389	3 930	4 445	5 275	6 101	7 067	8 017	9 121	10 294
380	378,85	381,15	3 104	3 578	4 148	4 692	5 568	6 440	7 460	8 462	9 627	10 866
400	388,85	401,15	3 267	3 766	4 366	4 939	5 861	6 779	7 853	8 908	10 134	11 438
420	418,75	421,25	3 430	3 954	4 585	5 186	6 155	7 118	8 245	9 354	10 641	12 009
440	438,75	441,25	3 593	4 142	4 803	5 433	6 448	7 457	8 638	9 799	11 147	12 582
460	458,75	461,25	3 756	4 330	5 021	5 680	6 741	7 796	9 030	10 245	11 654	13 154
480	478,75	481,25	3 919	4 518	5 239	5 927	7 034	8 134	9 423	10 690	12 161	13 726
500	498,75	501,25	4 082	4 706	5 457	6 174	7 327	8 473	9 816	11 136	12 667	14 298
1 000	995,5	1 004,5	8 164	9 412	10 914	12 348	14 654	16 946	19 632	22 272	25 334	28 596
2 000	1 992,5	2 007,5	16 328	18 824	21 828	24 696	29 308	33 892	39 264	44 544	50 668	57 192
3 000	2 989,5	3 010,5	24 492	28 236	32 742	37 044	43 962	50 838	58 896	66 816	76 002	85 788

Stud bolts are generally manufactured in the sizes for which a value of mass has been specified.
Lengths between 500 mm and 1 000 mm shall be graded in 20 mm steps.
Bracketed sizes should be avoided if possible.

3 Technical delivery conditions

Table 2

Material		Steel	Stainless steel	Nonferrous metal
General requirements		As specified in ISO 8992.		
Thread	Tolerance	6g		
	As specified in	DIN 13-15.		
Mechanical properties	Property class (material)	For sizes up to M39: 4.8, 5.8, 8.8 or 10.9 For sizes above M39: subject to agreement.	For sizes up to M39: A2-50 or A4-50 For sizes above M39: subject to agreement.	CuZn[1]) Al[2])
	As specified in	DIN EN 20 898-1. (test programme B)	ISO 3506	DIN EN 28 839
Limit deviations and geometrical tolerances	Product grade	A		
	As specified in	ISO 4759-1.		
Surface finish		As processed. DIN 267-2 shall apply with regard to surface roughness. DIN EN 26 157-1 shall apply with regard to limits for surface discontinuities for property class 5.8 or less and DIN EN 26 157-3 for property class 8.8 or higher. ISO 4042 shall apply with regard to electroplating. DIN 267-10 shall apply with regard to hot-dip galvanizing.	Bright. —	Bright. —
Acceptance inspection		As specified in ISO 3269.		

[1]) Copper-zinc alloy CU2 or CU3 (as in DIN EN 28 839), at the manufacturer's discretion.
[2]) Aluminium alloy AL1 or AL2 (as in DIN EN 28 839), at the manufacturer's discretion.
[3]) For type A stud bolts and nominal lengths exceeding 1 000 mm, the tolerance on length shall be js17 (product grade B as in ISO 4759-1).

4 Designation

Designation of a type A M10 stud bolt with a nominal length, *l*, of 80 mm, and assigned to property class 8.8:

Stud bolt DIN 976-1 — M10 × 80 — A — 8.8

Designation of an M10 stud bolt with a nominal length, *l*, of 1 000 mm, and assigned to property class 8.8:

Stud bolt DIN 976 — M10 × 1 000 — 8.8

The DIN 4000 — 2 — 3 tabular layout of article characteristics shall apply to studs as covered in this standard.

5 Marking

One end of steel stud bolts of size M5 or greater shall be marked with the symbol for the property class and of stainless steel stud bolts of size M5 or greater, with the symbol denoting the material grade (A2 or A4), omitting the symbol for property class 50.

Marking of nonferrous metal stud bolts is not required.

Standards referred to

DIN 13-14	ISO metric screw threads; tolerance system for threads 1 mm in diameter and larger
DIN 13-15	ISO metric screw threads; fundamental deviations and tolerances for screw threads of 1 mm diameter and larger
DIN 78	Stud ends and lengths of projection of bolt ends for ISO metric screw threads in accordance with DIN 13
DIN 267-2	Fasteners; technical delivery conditions; design and dimensional accuracy
DIN 267-10	Fasteners; technical delivery conditions; hot-dip galvanized components
DIN 4000-2	Tabular layouts of article characteristics for bolts, screws and nuts
DIN EN 20 898-1	Mechanical properties of fasteners; bolts, screws and studs (ISO 898-1 : 1988)
DIN EN 26 157-1	Fasteners; surface discontinuities. Part 1: Bolts, screws and studs for general requirements
DIN EN 26 157-3	Fasteners; surface discontinuities; bolts, screws and studs for special requirements (ISO 6157-3 : 1988)
DIN EN 28 839	Mechanical properties of fasteners; bolts, screws, studs and nuts made of nonferrous metals
ISO 3269 : 1988	Fasteners; acceptance inspection
ISO 3506 : 1979	Corrosion-resistant stainless steel fasteners; specifications
ISO 4042 : 1989	Threaded components; electroplated coatings
ISO 4759-1 : 1978	Tolerances for fasteners; bolts, screws and nuts with thread diameters from 1,6 to 150 mm; product grades A, B and C
ISO 8992 : 1986	Fasteners; general requirements for bolts, screws, studs and nuts

Other relevant standard

DIN 976-2	Metric interference-fit thread stud bolts

Previous editions

DIN 976 : 1970-01, 1986-09.

Amendments

The following amendments have been made to the September 1986 edition of DIN 976.

a) The range of commercial sizes for stud bolts of thread size smaller than M45 has been amended.

b) For type A stud bolts, the range of nominal lengths, *l*, has been extended to include 1000 mm, 2000 mm and 3000 mm.

c) For stainless steel stud bolts, property class 50 and for steel stud bolts, property classes 4.8, 8.8 and 10.9 have been specified.

d) The marking of steel and stainless steel stud bolts has been made mandatory.

e) The standard has been editorially revised.

Metric interference-fit thread stud bolts

DIN 976-2

ICS 21.060.10

Descriptors: Fasteners, stud bolts.

Gewindebolzen. Teil 2: Metrisches Festsitzgewinde MFS

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Dimensions in mm

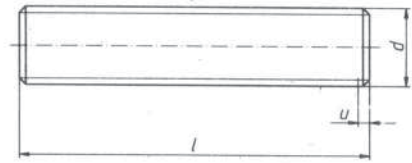
1 Scope and field of application

This standard specifies dimensions and technical delivery conditions for stud bolts intended for use in light metals, including aluminium.

Attention is drawn to the possibility of stud bolts with lengths exeeding those specified for the lengths of engagement in DIN 8141-1 not being true to gauge.

2 Dimensions

Stud bolts shall be provided with DIN 78 — K type ends.



u (incomplete thread): 1,5 P maximum.

Continued on pages 2 to 4.

Table 1: Dimensions

Thread size			MFS 5 —	MFS 6 —	(MFS 7) —	MFS 8 MFS 8× 1	MFS 10 MFS 10× 1,25	MFS 12 MFS 12× 1,5	(MFS 14) (MFS 14× 1,5)	MFS 16 MFS 16× 1,5
Nominal size	l min.	l max.	Approximate mass (7,85 kg/dm³) per 1 000 units, in kg							
12	11,65	12,35								
(14)	13,65	14,35								
16	15,65	16,35								
(18)	17,65	18,35								
20	19,58	20,42	2,48							
(22)	21,58	22,42	2,72							
25	24,58	25,42	3,09	4,41						
(28)	27,58	28,42	3,47	4,94						
30	29,58	30,42	3,71	5,29	7,46					
35	34,5	35,5	4,33	6,18	8,70	11,1				
40	39,5	40,5	4,95	7,06	9,94	12,7	20,1			
45	44,5	45,5	5,57	7,94	11,2	14,3	22,6			
50	49,5	50,5	6,19	8,82	12,4	15,9	25,1	36,4		
55	54,4	55,6		9,71	13,7	17,5	27,6	40,0		
60	59,4	60,6		10,6	14,9	19,1	30,1	43,7	59,7	
65	64,4	65,6			16,2	20,7	32,6	47,3	64,6	86,6
70	69,4	70,6			17,4	22,3	35,2	50,9	69,6	93,3
75	74,4	75,6				23,9	37,7	54,6	74,6	99,9
80	79,4	80,6				25,5	40,2	58,2	79,6	107
(85)	84,3	85,7					42,7	61,8	84,5	113
90	89,3	90,7					45,2	65,5	89,5	120
(95)	94,3	95,7					47,7	69,1	94,5	127
100	99,3	100,7					50,2	72,8	99,5	133
110	109,3	110,7						80,0	109	147
120	119,3	120,7						87,3	119	160
130	129,2	130,8							129	173
140	139,2	140,8							139	186
150	149,2	150,8								200
160	159,2	160,8								213

Lengths above 160 mm shall be graded in 10 mm steps.

Bracketed sizes should be avoided if possible.

The zone between the continuous thick lines indicates the range of commercial sizes of stud bolts with interference-fit thread.

Below the dashed line those sizes of stud bolts of property class 10.9 are given which have the minimum length required to ensure a length of engagement equal to 2,5 d.

3 Technical delivery conditions

Table 2

Material		Steel
General requirements		As specified in ISO 8992.
Thread	Type	Interference-fit thread (MFS)
	As specified in	DIN 8141-1.
Mechanical properties	Property class[1]) (material)	5.6, 8.8 or 10.9
	As specified in	DIN EN 20 898-1.
Limit deviations, geometrical tolerances	Product grade	A
	As specified in	ISO 4759-1.
Surface finish		As processed. DIN 267-2 shall apply with regard to surface roughness. DIN EN 26 157-3 shall apply with regard to limits for surface discontinuities. ISO 4042 shall apply with regard to electroplating (cf. DIN 8141-1).
Acceptance inspection		As specified in ISO 3269.
[1]) Other property classes or materials shall be subject to agreement.		

4 Designation

Designation of a stud bolt with a series MFS 12 interference-fit thread, with a nominal length, l, of 80 mm, and assigned to property class 8.8:

Stud bolt DIN 976-2 — MFS 12 × 80 — 8.8

The DIN 4000 — 2 — 3 tabular layout of article characteristics shall apply to studs as covered in this standard.

5 Marking

One of the ends of steel stud bolts shall be marked with the property class as specified in DIN EN 20 898-1.

6 Use

In order to achieve a tight fit, the studs specified in this standard shall be installed in holes produced to DIN 8141-1.

Nuts provided with a DIN 13-13 metric thread may also be used, without this requiring an increased assembly torque or resulting in loosening or breakage of the assembly.

The length of thread engagement for property classes 5.6 and 8.8 stud bolts shall be approximately equal to 2 d, that for property class 10.9, equal to 2,5 d.

Standards referred to

DIN 13-13	ISO metric screw threads; series of preferred sizes for bolts, screws and nuts from 1 mm to 52 mm diameter and limits of size
DIN 78	Thread ends and lengths of projection of bolt ends for ISO metric screw threads in accordance with DIN 13
DIN 267-2	Fasteners; technical delivery conditions; design and dimensional accuracy
DIN 4000-2	Tabular layouts of article characteristics for bolts, screws and nuts
DIN 8141-1	ISO metric coarse and fine pitch screw threads for interference fits in aluminium cast alloys with diameters from 5 to 16 mm; nominal sizes, tolerances and limits of size
DIN EN 20 898-1	Mechanical properties of fasteners; bolts, screws and studs (ISO 898-1 : 1988)
DIN EN 26 157-3	Fasteners; surface discontinuities; bolts, screws and studs for special requirements (ISO 6157-3 : 1988)
ISO 3269 : 1988	Fasteners; acceptance inspection
ISO 4042 : 1989	Threaded components; electroplated coatings
ISO 4759-1 : 1978	Tolerances for fasteners; bolts, screws and nuts with thread diameters from 1,6 to 150 mm; product grades A, B and C
ISO 8992 : 1986	Fasteners; general requirements for bolts, screws, studs and nuts

Other relevant standard

DIN 976-1	Metric thread stud bolts

Explanatory notes

Where small studs with interference-fit thread are to be employed, it is recommended that, for economic reasons, stud bolts with an interference-fit thread be used. However, care should be taken that the required depth of thread engagement is ensured, since stud bolts are not provided with a thread run-out, which normally determines the depth of thread engagement.