

Metric buttress threads  
Deviations and tolerances

DIN

513

Part 3

Metrisches Sägewinde; Abmaße und Toleranzen

Supersedes January 1975 edition.

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.

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1 Introduction

The same tolerance system is used for single-start metric buttress threads as for ISO metric screw threads. Thus, this standard includes extracts from DIN 13 Part 15 for threads up to 8 mm pitch and values supplemented by fundamental deviations  $A_0$ , by lengths of thread engagement and by tolerances for threads with pitches greater than 8 mm. The tolerance zones recommended for buttress threads are different from those for screw threads, whilst the tolerance grades 1) specified for the pitch diameter are identical with those specified for metric trapezoidal screw threads. As the buttress thread is supposed to be centred round the major diameter, the circular fit H10/h9 has been specified for it.

2 Designations

The complete designation of a screw thread includes information on the thread system, the nominal size of the thread and a symbol for the thread tolerance.

The designation for the metric buttress thread is given in DIN 513 Part 2.

The symbol for the metric buttress thread tolerance refers only to the pitch diameter tolerance as only one tolerance is fixed for the minor diameter of the internal thread and one for the major diameter of the internal and external threads.

Each symbol for the thread tolerance consists of a number indicating the tolerance grade, a letter giving the tolerance position, with an upper case letter for the internal thread and a lower case letter for the external thread.

Example of designation for an internal thread: S 40 x 7 – 7 H

Example of designation for an external thread: S 40 x 7 – 7 e

A fit is indicated by the symbol for the internal thread tolerance followed by the symbol for the external thread tolerance, both separated by an oblique stroke.

Example: S 40 x 7 – 7 H/7 e

3 Tolerance grades

Table 1. Tolerance grades for major, pitch and minor diameters

Diameters	Tolerance grades		
Major diameter of internal thread		H10*)	
Major diameter of external thread	9	h 9*)	
Minor diameter of internal thread	4		
Minor diameter of external thread	7	8	9
Pitch diameter of internal thread	7	8	9
Pitch diameter of external thread	7	8	9
*) Tolerance zone as specified in DIN 7160 or DIN 7161.			

1) Previously referred to as "tolerance quality". This term does not comply with the definition of the concept "quality" as established in DIN 55350 Part 11, however.

Continued on pages 2 to 8

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4 Tolerance positions (fundamental deviations)

The following tolerance positions shall apply for external and internal threads:

external thread: c for the pitch diameter tolerance and h in all cases for the major and minor diameter tolerances, i.e. the fundamental deviation for these two diameters is always 0;

internal thread: the fundamental deviation for the major, pitch and minor diameters is always 0, i.e. only tolerance position H is applicable.

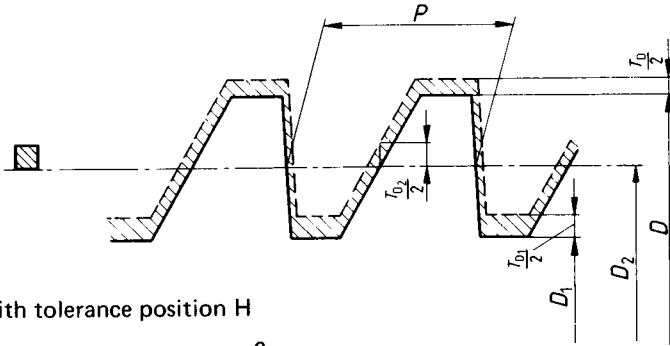
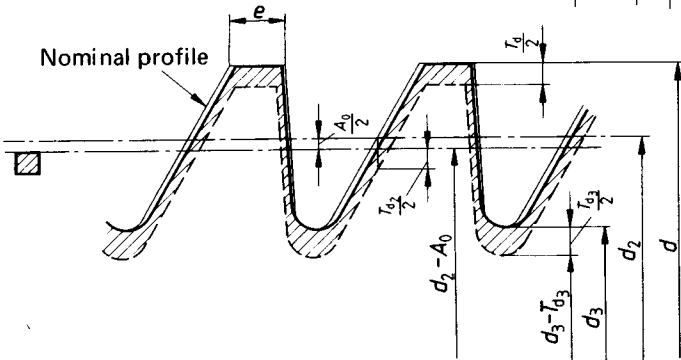


Figure 1. Internal thread with tolerance position H



$A_0$  = fundamental deviation (= upper deviation) for external thread on the pitch diameter.

Figure 2. External thread with tolerance position c for the pitch diameter tolerance and h for the major and minor diameter tolerances

Table 2. Fundamental deviations  $A_0$  for pitch diameter of external thread

Pitch $P$  mm	$A_0$ Tolerance position	
	c $\mu\text{m}$	e $\mu\text{m}$
2	−150	− 71
3	−170	− 85
4	−190	− 95
5	−212	−106
6	−236	−118
7	−250	−125
8	−265	−132
9	−280	−140
10	−300	−150
12	−335	−170
14	−355	−180
16	−375	−190
18	−400	−200
20	−425	−212
22	−450	−224
24	−475	−236
28	−500	−250
32	−530	−265
36	−560	−280
40	−600	−300
44	−630	−315

## 5 Lengths of thread engagement

The lengths of thread engagement are divided into groups N (normal) and L (long)

Table 3. Dimensions in mm

Nominal thread diameter $d$		Pitch $P$	Lengths of thread engagement for group		
Over	Up to		N		L
			From	Up to	Over
5,6	11,2	2	6	19	19
		3	10	28	28
11,2	22,4	2	8	24	24
		3	11	32	32
		4	15	43	43
		5	18	53	53
22,4	45	8	30	85	85
		3	12	36	36
		5	21	63	63
		6	25	75	75
		7	30	85	85
		8	34	100	100
45	90	10	42	125	125
		12	50	150	150
		3	15	45	45
		4	19	56	56
		8	38	118	118
		9	43	132	132
90	180	10	50	140	140
		12	60	170	170
		14	67	200	200
		16	75	236	236
		18	85	265	265
		4	24	71	71
		6	36	106	106
		8	45	132	132
		12	67	200	200
		14	75	236	236
		16	90	265	265
		18	100	300	300
180	355	20	112	335	335
		22	118	355	355
		24	132	400	400
		28	150	450	450
		8	50	150	150
		12	75	224	224
		18	112	335	335
		20	125	375	375
		22	140	425	425
		24	150	450	450
355	640	32	200	600	600
		36	224	670	670
		40	250	750	750
		44	280	850	850
		12	87	260	260
		18	132	390	390
		24	174	520	520
		44	319	950	950

## 6 Major and minor diameter tolerances

### 6.1 Minor diameter tolerances $T_{D1}$ for internal threads

Table 4.

Pitch $P$ mm	$T_{D1}$ Tolerance quality 4 $\mu\text{m}$	Pitch $P$ mm	$T_{D1}$ Tolerance quality 4 $\mu\text{m}$
2	236	18	1120
3	315	20	1180
4	375	22	1250
5	450	24	1320
6	500	28	1500
7	560	32	1600
8	630	36	1800
9	670	40	1900
10	710	44	2000
12	800		
14	900		
16	1000		

### 6.2 Major diameter tolerances $T_D$ for internal threads

Table 5.

Nominal thread diameter mm		$T_D$ H10 $\mu\text{m}$
Over	Up to	
6	10	58
10	18	70
18	30	84
30	50	100
50	80	120
80	120	140
120	180	160
180	250	185
250	315	210
315	400	230
400	500	250
500	630	280

### 6.3 Major diameter tolerances $T_d$ for external threads

Table 6.

Nominal thread diameter mm		$T_d$ h9 $\mu\text{m}$
Over	Up to	
6	10	36
10	18	43
18	30	52
30	50	62
50	80	74
80	120	87
120	180	100
180	250	115
250	315	130
315	400	140
400	500	155
500	630	175

6.4 Minor diameter tolerances  $T_{d3}$  for external threads

Table 7.

Nominal thread diameter		Pitch $P$ mm	$T_{d3}$ at tolerance position c of the pitch diameter Tolerance grade			$T_{d3}$ at tolerance position e of the pitch diameter Tolerance grade		
Over mm	Up to mm		7 $\mu\text{m}$	8 $\mu\text{m}$	9 $\mu\text{m}$	7 $\mu\text{m}$	8 $\mu\text{m}$	9 $\mu\text{m}$
5,6	11,2	2	388	445	525	309	366	446
		3	435	501	589	350	416	504
11,2	22,4	2	400	462	544	321	383	465
		3	450	520	614	365	435	529
		4	521	609	690	426	514	595
		5	562	656	775	456	550	669
		8	709	828	965	576	695	832
22,4	45	3	482	564	670	397	479	585
		5	587	681	806	481	575	700
		6	655	767	899	537	649	781
		7	694	813	950	569	688	825
		8	734	859	1015	601	726	882
		10	800	925	1087	650	775	937
		12	866	998	1223	691	823	1048
		12	866	998	1223	691	823	1048
45	90	3	501	589	701	416	504	616
		4	565	659	784	470	564	689
		8	765	890	1052	632	757	919
		9	811	943	1118	671	803	978
		10	831	963	1138	681	813	988
		12	929	1085	1273	754	910	1098
		14	970	1142	1355	805	967	1180
		16	1038	1213	1438	853	1028	1253
		18	1100	1288	1525	900	1088	1320
		18	1100	1288	1525	900	1088	1320
		20	1175	1363	1613	962	1150	1400
		22	1232	1450	1700	1011	1224	1474
90	180	4	584	690	815	489	595	720
		6	705	830	980	587	712	868
		8	796	928	1103	663	795	970
		12	960	1122	1335	785	947	1160
		14	1018	1193	1418	843	1018	1243
		16	1075	1263	1500	890	1078	1315
		18	1150	1338	1588	950	1138	1388
		20	1175	1363	1613	962	1150	1400
		22	1232	1450	1700	1011	1224	1474
		24	1313	1538	1800	1074	1299	1561
		28	1388	1625	1900	1138	1375	1650
		28	1388	1625	1900	1138	1375	1650
180	355	8	828	965	1153	695	832	1020
		12	998	1173	1398	823	998	1223
		18	1187	1400	1650	987	1200	1450
		20	1263	1488	1750	1050	1275	1537
		22	1288	1513	1775	1062	1287	1549
		24	1363	1600	1875	1124	1361	1636
		32	1530	1780	2092	1265	1515	1827
		36	1623	1885	2210	1343	1605	1930
		40	1663	1925	2250	1363	1625	1950
		44	1755	2030	2380	1440	1715	2065
		44	1755	2030	2380	1440	1715	2065
		44	1755	2030	2380	1440	1715	2065
355	640	12	1035	1223	1460	870	1058	1295
		18	1238	1462	1725	1038	1263	1525
		24	1363	1600	1875	1124	1361	1636
		44	1818	2155	2530	1503	1840	2215

## 7 Pitch diameter tolerances

### 7.1 Pitch diameter tolerances $T_{D2}$ for internal threads

Table 8.

Nominal thread diameter		Pitch	$T_{D2}$		
$d$		$P$	Tolerance grade		
Over mm	Up to mm	mm	7 $\mu$ m	8 $\mu$ m	9 $\mu$ m
5,6	11,2	2	250	315	400
		3	280	355	450
11,2	22,4	2	265	335	425
		3	300	375	475
		4	355	450	560
		5	375	475	600
22,4	45	8	475	600	750
		3	335	425	530
		5	400	500	630
		6	450	560	710
45	90	7	475	600	750
		8	500	630	800
		10	530	670	850
		12	560	710	900
		3	355	450	560
		4	400	500	630
		8	530	670	850
		9	560	710	900
90	180	10	560	710	900
		12	630	800	1000
		14	670	850	1060
		16	710	900	1120
		18	750	950	1180
		4	425	530	670
		6	500	630	800
		8	560	710	900
180	355	12	670	850	1060
		14	710	900	1120
		16	750	950	1180
		18	800	1000	1250
		20	800	1000	1250
		22	850	1060	1320
		24	900	1120	1400
		28	950	1180	1500
355	640	8	600	750	950
		12	710	900	1120
		18	850	1060	1320
		20	900	1120	1400
		22	900	1120	1400
		24	950	1180	1500
		32	1060	1320	1700
		36	1120	1400	1800
355	640	40	1120	1400	1800
		44	1250	1500	1900
		12	760	950	1200
		18	900	1120	1400
355	640	24	950	1180	1480
		44	1290	1610	2000

### 7.2 Pitch diameter tolerances $T_{d2}$ for external threads

Table 9.

Nominal thread diameter		Pitch  $P$  mm	$T_{d2}$  Tolerance grade			
$d$  Over mm	Up to mm		6  $\mu\text{m}$	7  $\mu\text{m}$	8  $\mu\text{m}$	9  $\mu\text{m}$
5,6	11,2	2	150	190	236	300
		3	170	212	265	335
11,2	22,4	2	160	200	250	315
		3	180	224	280	355
		4	212	265	335	400
		5	224	280	355	450
22,4	45	8	280	355	450	560
		3	200	250	315	400
		5	236	300	375	475
		6	265	335	425	530
45	90	7	280	355	450	560
		8	300	375	475	600
		10	315	400	500	630
		12	335	425	530	710
90	180	3	212	265	335	425
		4	236	300	375	475
		8	315	400	500	630
		9	335	425	530	670
		10	335	425	530	670
		12	375	475	600	750
		14	400	500	630	800
		16	425	530	670	850
180	355	18	450	560	710	900
		4	250	315	400	500
		6	300	375	475	600
		8	335	425	530	670
		12	400	500	630	800
		14	425	530	670	850
		16	450	560	710	900
		18	475	600	750	950
355	640	20	475	600	750	950
		22	500	630	800	1000
		24	530	670	850	1060
		28	560	710	900	1120
		8	355	450	560	710
		12	425	530	670	850
		18	500	630	800	1000
		20	530	670	850	1060
640	1250	22	530	670	850	1060
		24	560	710	900	1120
		32	630	800	1000	1250
		36	670	850	1060	1320
1250	1520	40	670	850	1060	1320
		44	710	900	1120	1400
		12	450	560	710	900
		18	530	670	850	1060
1520	1820	24	560	710	900	1120
		44	760	950	1220	1520

8 Recommended tolerance zones

In order to reduce the number of gauges and tools, only the tolerance zones given in tables 10 and 11 shall be selected.  
If a length of thread engagement is not known, thread engagement group N is recommended.  
Tools and gauges shall always be marked with the tolerance zone in order to avoid confusion with tools used previously.

8.1 Tolerance zones for pitch diameters of internal threads

Table 10.

Tolerance quality	Tolerance zones for pitch diameters	
	Thread engagement group	
	N	L
Medium	7H	8H
Coarse	8H	9H

8.2 Tolerance zones for pitch diameters of external threads

Table 11.

Tolerance quality	Tolerance zones for pitch diameters	
	Thread engagement group	
	N	L
Medium	7e	8e
Coarse	8c	9c

8.3 Tolerance zone for minor diameters of internal threads

Only tolerance zone 4H shall apply for the minor diameter of the internal thread.

8.4 Tolerance zone for major diameters of external threads

Only tolerance zone h9 (see DIN 7160) shall apply for the major diameter of the external thread.

8.5 Tolerance zone for major diameters of internal threads

Only tolerance zone H10 (see DIN 7161) shall apply for the major diameter of the internal thread.

8.6 Tolerance zone for minor diameters of external threads

The minor diameter tolerance  $T_{d3}$  is a function of the pitch diameter tolerance  $T_{d2}$  (see subclause 9.5).

9 Formulae

9.1 Lengths of thread engagement

The lengths of thread engagement are to be calculated in accordance with table 12.

Table 12.

Thread engagement group	Length of thread engagement
N	$2,24 P \cdot d^{0,2}$ up to $6,7 P \cdot d^{0,2}$
L	Over $6,7 P \cdot d^{0,2}$

In table 12,  $d$  is the smallest nominal thread diameter in a series of nominal diameters given in table 3.

9.2 Tolerances  $T_{D2}$

The pitch diameter tolerances  $T_{D2}$  are obtained by multiplying the pitch diameter tolerances for external threads  $T_{d2}$  of tolerance grade 6 by the factors given in table 13.

Table 13.

Tolerance grade	7	8	9
Multiple of $T_{d2}$ of tolerance grade 6	1,7	2,12	2,65

9.3 Tolerances  $T_{D1}$

The minor diameter tolerances  $T_{D1}$  of tolerance grade 4 are to be calculated using the following formula:

$$T_{D1} = 0,63 (230 \cdot P^{0,7})$$

with  $T_{D1}$  in  $\mu\text{m}$  and  $P$  in mm.

9.4 Tolerance  $T_{d2}$

The pitch diameter tolerances  $T_{d2}$  of tolerance grade 6 are to be calculated using the following formula:

$$T_{d2} = 90 P^{0,4} \cdot d^{0,1}$$

with  $T_{d2}$  in  $\mu\text{m}$  and  $P$  and  $d$  in mm.

In the formula,  $d$  is the geometric mean of the range of nominal diameters.

The pitch diameter tolerances  $T_{d2}$  for other tolerance grades are obtained by multiplying the pitch diameter tolerances for external threads of tolerance grade 6 by the factors given in table 14.

Table 14.

Tolerance grade	7	8	9
Multiple of $T_{d2}$ of tolerance grade 6	1,25	1,6	2

9.5 Tolerances  $T_{d3}$

The minor diameter tolerances  $T_{d3}$  are to be calculated using the following formula:

$$T_{d3} = (1,25 \cdot T_{d2}) + A_0$$

with  $A_0$  (absolute value),  $T_{d2}$  and  $T_{d3}$  in  $\mu\text{m}$ .

9.6 Fundamental deviation  $A_0$

For tolerance position c up to  $P = 2 \text{ mm}$ ,  
 $A_0 = - (125 + 11 P) \mu\text{m}$ .

For tolerance position c at  $P = 44 \text{ mm}$ ,  
 $A_0 = 630 \mu\text{m}$ .

The values of  $A_0$  for intermediate pitches have been determined on the basis of empirical values (see table 2).

### 9.7 Rounding rules

The major, pitch and minor diameter tolerance values are to be calculated using the formulae given in the above clauses and then rounded to the nearest value of the R 40 series of preferred numbers, except for the tolerances  $T_{d3}$  for the minor diameter of the external thread.

### 10 Multiple-start buttress threads

In the case of multiple-start buttress threads, the pitch  $P$  = lead  $P$  (axial distance between two neighbouring flanks being in the same direction) of the single-start buttress thread is used as the basis for the fundamental deviation  $A_0$  and the minor diameter tolerances for the internal thread  $T_{D1}$ . On the other hand, the tolerances for the pitch diameter of the internal thread,  $T_{D2}$ , and external thread,  $T_{d2}$ , of the multiple-start thread of lead  $P_h$  (axial advance

at one turn) are to be increased. The basis for this is the pitch diameter tolerance of the single-start buttress thread with pitch  $P$ . These tolerances are to be multiplied by a factor from the R 20 series of preferred numbers associated with the number of starts, in accordance with table 15.

Table 15.

Number of starts	1	2	3	4	5 and above
(R20) factor	1	1,12	1,25	1,4	1,6

If multiple-start threads are fabricated with large pitches for which it is no longer possible to read off the tolerances  $T_{D2}$  and  $T_{d2}$  in tables 8 and 9, the values of  $T_{D2}$  and  $T_{d2}$  shall be calculated using the formulae given in sub-clauses 9.2 and 9.4.

### Standards referred to

DIN 13 Part 14	ISO metric screw threads; principles of a tolerance system for screw threads from 1 mm diameter upwards
DIN 13 Part 15	ISO metric screw threads; fundamental deviations and tolerances for screw threads from 1 mm diameter upwards
DIN 513 Part 2	Metric buttress threads; general plan
DIN 7160	ISO deviations for external dimensions (shafts) for nominal sizes from 1 to 500 mm
DIN 7161	ISO deviations for internal dimensions (holes) for nominal sizes from 1 to 500 mm
DIN 55350 Part 11	Terminology in quality assurance and statistics; concepts relating to quality assurance; basic concepts

### Other relevant standards

DIN 513 Part 1	Metric buttress threads; thread profiles
DIN 2244	Screw threads; concepts

### Previous editions

DIN 513 Part 3: 01.75

### Amendments

The following amendments have been made in comparison with the January 1975 edition:

- The status of the standard is no longer that of a preliminary standard.
- The standard has been editorially revised.

### Explanatory notes

(See also Explanatory notes to DIN 513 Part 1.)

The application of a standard tolerance system to all types of screw thread is of great economic benefit in practice. Therefore, the ISO tolerances recommended for screw threads with pitches up to 6 mm have also been adopted for buttress threads. For pitches over 6 mm, the tolerance system for buttress threads has been extended correspondingly.

One main advantage of applying a standard tolerance system to all types of screw thread is that the designation of the tolerance zones is the same for all threads and the numerical values expressed by the tolerance symbol are the same.

The relevant series have been selected from the extended ISO system of tolerances for screw threads.

This standard specifies a tolerance system for buttress threads in which the tolerance qualities, tolerance positions and lengths of thread engagement have been reduced considerably compared with the tolerance system for screw threads. The fundamental deviations for tolerance position c have been specified for the first time on the basis of the relationship

– (125 + 11  $P$ ) for  $P = 1,5$ .

The tolerances for the minor diameter,  $T_{d3}$ , of the external thread have been increased by the upper deviation  $A_0$  in order to obtain the same maximum size for the minor diameter  $d_3$  for all tolerance positions of the external thread.

The following limitations have been applied compared with the tolerances for screw threads:

- a) Only thread engagement groups N and L have been specified.
- b) The "fine" tolerance quality has been deleted.
- c) Only the tolerance positions or fundamental deviations H have been specified for the pitch diameter of the stressed flanks of the internal thread and h and c for those of the external thread.
- d) For the pitch diameter tolerances,  $T_{D2}$  and  $T_{d2}$ , only tolerance grades 7, 8 and 9 have been specified. Grade 6 has been included for  $T_{d2}$  as it is the basis for calculating the pitch diameter tolerances.
- e) Only tolerance grade 4 has been specified for the minor diameter tolerances  $T_{D1}$ .
- f) An H10/h9 circular fit has been specified for the major diameter.

### International Patent Classification

F 16 B 33/02