

DIN 513-3



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DIN 513-3:1985-04

**Metric buttress threads –
Part 3: Deviations and tolerances,
English translation of DIN 513-3:2020-12**

Metrisches Sägewinde –
Teil 3: Abmaße und Toleranzen,
Englische Übersetzung von DIN 513-3:2020-12

Filetage métrique en dents de scie –
Partie 3: Dimensions et tolérances,
Traduction anglaise de DIN 513-3:2020-12

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In case of doubt, the German-language original shall be considered authoritative.

A comma is used as the decimal marker.

Contents

	Page
Foreword	3
Introduction	4
1 Scope	5
2 Normative references	5
3 Terms and definitions.....	5
4 Designation	5
5 Tolerance grades.....	6
6 Tolerance positions.....	6
7 Lengths of thread engagement.....	8
8 Major and minor diameter tolerances	10
8.1 Tolerances for the minor diameter of the internal thread T_{D1}	10
8.2 Tolerances for the major diameter of the internal thread T_D	11
8.3 Tolerances for the major diameter of the external thread T_d	11
8.4 Tolerances for the minor diameter of the external thread T_{d3}	12
9 Pitch diameter tolerances	14
9.1 Tolerances for the pitch diameter of the internal thread T_{D2}	14
9.2 Tolerances for the pitch diameter of the external thread T_{d2}	16
10 Recommended tolerance classes	18
10.1 General	18
10.2 Tolerance classes for the pitch diameter of the internal thread	18
10.3 Tolerance classes for the pitch diameter of the external thread.....	18
10.4 Tolerance class for the minor diameter of the internal thread.....	18
10.5 Tolerance class for the major diameter of the external thread	18
10.6 Tolerance class for the major diameter of the internal thread.....	18
10.7 Tolerance class for the minor diameter of the external thread.....	18
11 Formulae.....	19
11.1 Lengths of thread engagement.....	19
11.2 Tolerances for the pitch diameter of the internal thread T_{D2}	19
11.3 Tolerances for the minor diameter of the internal thread T_{D1}	19
11.4 Tolerances for the pitch diameter of the external thread T_{d2}	19
11.5 Tolerances for the minor diameter of the external thread T_{d3}	20
11.6 Fundamental deviation es	20
11.7 Rounding rules.....	20
12 Multiple-start buttress threads	20
Bibliography	21

Foreword

This standard has been prepared by Working Committee NA 152-02-01 AA “Screw threads” of *DIN-Normenausschuss Technische Grundlagen* (NATG) (DIN Standards Committee Technical Fundamentals).

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

DIN 513 consists of the following parts, under the general title *Metric buttress threads*:

- *Part 1: Thread profiles*
- *Part 2: General plan*
- *Part 3: Deviations and tolerances*

For current information on this document, please go to DIN’s website (www.din.de) and search for the document number in question.

Amendments

This standard differs from DIN 513-3:1985-04 as follows:

- a) the terms used have been harmonized and brought in line with DIN 2244;
- b) the Introduction has been added, and the correct use of the German terms *Teilung* (pitch) *P* and *Steigung* (pitch, lead) *Ph* has been implemented;
- c) Clause 1 “Scope”, Clause 2 “Normative references” and Clause 3 “Terms and definitions” have been added;
- d) all figures have been updated and are now without text;
- e) the standard has been editorially revised.

Previous editions

DIN 513-3: 1975-01, 1985-04

Introduction

The same tolerance system is used for single-start metric buttress threads as for ISO metric threads. This standard therefore contains extracts from DIN ISO 965-1 for threads with a pitch of up to 8 mm; for threads with pitches above 8 mm it contains values supplemented by fundamental deviations *es*, by lengths of thread engagement and by tolerances. Other preferred tolerance classes are recommended for buttress threads than for ISO metric threads. The same tolerance grades are specified for the pitch diameter as for ISO metric trapezoidal threads.

Since the buttress thread is to be centred in the major diameter, the fit H10/h9 is specified for this.

For single-start threads the pitch (*Teilung*) *P* corresponds to the pitch or lead (*Steigung*) *Ph*. In German technical terminology, the use of the term *Steigung* has been predominant for single-start threads up to now. This is not in line with international usage. In this standard, therefore, international linguistic usage is followed, and only the term *Teilung* (pitch) *P* is used for single-start threads.

1 Scope

This standard specifies deviations and tolerances for metric buttress threads with profiles as in DIN 513-1.

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.

DIN 323-1, *Preferred Numbers and Series of Preferred Numbers; Basic Values, Calculated Values, Rounded Values*

DIN 513-1, *Metric buttress threads — Part 1: Thread profiles*

DIN 513-2, *Metric buttress threads — Part 2: General plan*

DIN 2244, *Screw threads — Terms and screw thread elements for parallel screw threads*

DIN EN ISO 286-1, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 1: Basis of tolerances, deviations and fits*

DIN EN ISO 286-2, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in DIN 2244 apply.

DIN and DKE provide terminology databases for use in standardization at the following addresses:

— DIN-TERMinology Portal: available at <https://www.din.de/en/services/din-term>

— DKE-IEV: available at <http://www.dke.de/DKE-IEV>

4 Designation

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 class.

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

The symbol for the metric buttress thread tolerance class refers only to the pitch diameter tolerance, as only one tolerance class 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 class consists of a number indicating the tolerance grade, and 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 an internal thread S40 × 7 – 7H

Example of an external thread S40 × 7 – 7e

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

EXAMPLE S40 × 7 – 7H/7e

5 Tolerance grades

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

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

Diameters	Tolerance grades
Major diameter of internal thread	10 ^a
Major diameter of external thread	9 ^a
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

^a Tolerance grade as in DIN EN ISO 286-1 and DIN EN ISO 286-2.

6 Tolerance positions

The following tolerance positions have been specified:

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

Internal thread: the fundamental deviation for the major, and minor diameters is always 0. The fundamental deviation for the pitch diameter is always $EI = 3,175\,8 \cdot a$. Despite this fundamental deviation, the tolerance position for internal threads is indicated as H.

Figure 1 shows an internal thread with tolerance position H.

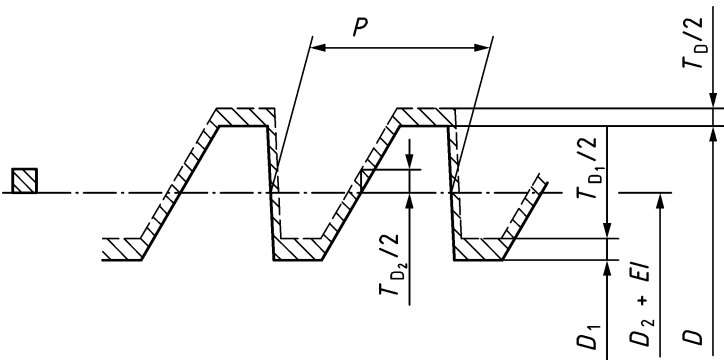
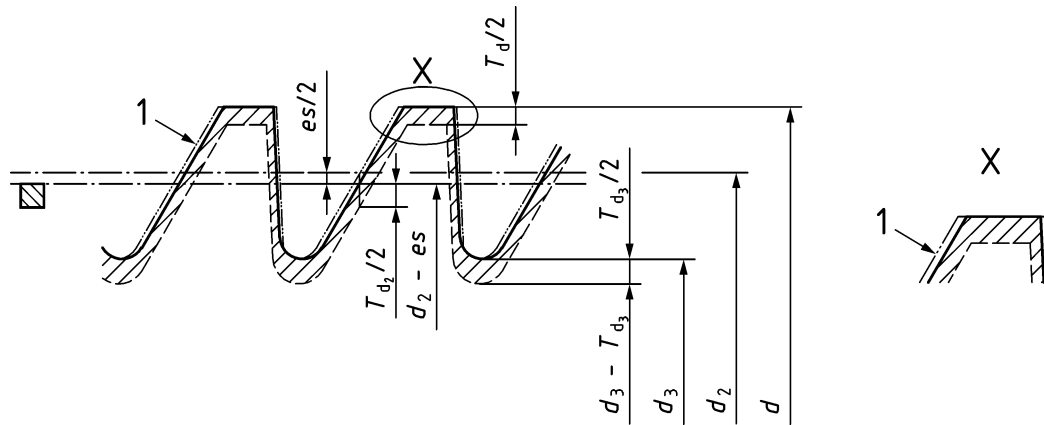


Figure 1 — Internal thread with tolerance position H



Key

es fundamental deviation (= upper deviation) for external thread on pitch diameter

1 nominal profile

Figure 2 — External thread with tolerance position c or e for the pitch diameter and h for the major and minor diameters

Table 2 gives the fundamental deviations es for the pitch diameter of the external thread.

Table 2 — Fundamental deviations es for the pitch diameter of the external thread

Pitch P mm	es Tolerance position	
	c μm	e μm
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

Table 2 (continued)

Pitch <i>P</i> mm	<i>es</i> Tolerance position	
	c	e
	µm	µm
32	−530	−265
36	−560	−280
40	−600	−300
44	−630	−315

7 Lengths of thread engagement

The lengths of thread engagement (see Table 3) are divided into groups N (normal) and L (long).

Table 3 — Lengths of thread engagement

Dimensions in millimetres

Nominal thread diameter		Pitch <i>P</i>	Lengths of thread engagement for group		
over <i>d</i>	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
		8	30	85	85
22,4	45	3	12	36	36
		5	21	63	63
		6	25	75	75
		7	30	85	85
		8	34	100	100
		10	42	125	125
		12	50	150	150
45	90	3	15	45	45
		4	19	56	56
		8	38	118	118
		9	43	132	132
		10	50	140	140
		12	60	170	170
		14	67	200	200
		16	75	236	236
		18	85	265	265

Table 3 (continued)

Dimensions in millimetres

Nominal thread diameter <i>d</i>		Pitch <i>P</i>	Lengths of thread engagement for group N		
over	up to		from	up to	L over
90	180	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
		20	112	335	335
		22	118	355	355
		24	132	400	400
		28	150	450	450
180	355	8	50	150	150
		12	75	224	224
		18	112	335	335
		20	125	375	375
		22	140	425	425
		24	150	450	450
		32	200	600	600
		36	224	670	670
		40	250	750	750
		44	280	850	850
355	640	12	87	260	260
		18	132	390	390
		24	174	520	520
		44	319	950	950

8 Major and minor diameter tolerances

8.1 Tolerances for the minor diameter of the internal thread T_{D1}

Tolerances for the minor diameter of the internal thread T_{D1} are given in Table 4.

Table 4 — Tolerances for the minor diameter of the internal thread T_{D1}

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

8.2 Tolerances for the major diameter of the internal thread T_D

Tolerances for the major diameter of the internal thread T_D are given in Table 5.

Table 5 — Tolerances for the major diameter of the internal thread T_D

Nominal thread diameter		T_D
mm		H10
over	up to	μm
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

8.3 Tolerances for the major diameter of the external thread T_d

Tolerances for the major diameter of the external thread T_d are given in Table 6.

Table 6 — Tolerances for the major diameter of the external thread T_d

Nominal thread diameter		T_d
mm		h9
over	up to	μm
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

8.4 Tolerances for the minor diameter of the external thread T_{d3}

Tolerances for the minor diameter of the external thread T_{d3} are given in Table 7.

Table 7 — Tolerances for the minor diameter of the external thread T_{d3}

Nominal thread diameter		Pitch	T_{d3} at tolerance position c of the pitch diameter			T_{d3} at tolerance position e of the pitch diameter		
over mm	up to mm	P mm	Tolerance grade			Tolerance grade		
			7 μm	8 μm	9 μm	7 μm	8 μm	9 μm
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	1 015	601	726	882
		10	800	925	1 087	650	775	937
		12	866	998	1 223	691	823	1 048
45	90	3	501	589	701	416	504	616
		4	565	659	784	470	564	689
		8	765	890	1 052	632	757	919
		9	811	943	1 118	671	803	978
		10	831	963	1 138	681	813	988
		12	929	1 085	1 273	754	910	1 098
		14	970	1 142	1 355	805	967	1 180
		16	1 038	1 213	1 438	853	1 028	1 253
		18	1 100	1 288	1 525	900	1 088	1 320

Table 7 (continued)

Nominal thread diameter		Pitch <i>P</i> mm	<i>T</i> _{d3} at tolerance position c of the pitch diameter			<i>T</i> _{d3} at tolerance position e of the pitch diameter		
<i>d</i>			Tolerance grade			Tolerance grade		
over mm	up to mm		7 μm	8 μm	9 μm	7 μm	8 μm	9 μm
90	180	4	584	690	815	489	595	720
		6	705	830	986	587	712	868
		8	796	928	1 103	663	795	970
		12	960	1 122	1 335	785	947	1 160
		14	1 018	1 193	1 418	843	1 018	1 243
		16	1 075	1 263	1 500	890	1 078	1 315
		18	1 150	1 338	1 588	950	1 138	1 388
		20	1 175	1 363	1 613	962	1 150	1 400
		22	1 232	1 450	1 700	1 011	1 224	1 474
		24	1 313	1 538	1 800	1 074	1 299	1 561
		28	1 388	1 625	1 900	1 138	1 375	1 650
180	355	8	828	965	1 153	695	832	1 020
		12	998	1 173	1 398	823	998	1 223
		18	1 187	1 400	1 650	987	1 200	1 450
		20	1 263	1 488	1 750	1 050	1 275	1 537
		22	1 288	1 513	1 775	1 062	1 287	1 549
		24	1 363	1 600	1 875	1 124	1 361	1 636
		32	1 530	1 780	2 092	1 265	1 515	1 827
		36	1 623	1 885	2 210	1 343	1 605	1 930
		40	1 663	1 925	2 250	1 363	1 625	1 950
		44	1 755	2 030	2 380	1 440	1 715	2 065
		355	640	12	1 035	1 223	1 460	870
18	1 238			1 462	1 725	1 038	1 263	1 525
24	1 363			1 600	1 875	1 124	1 361	1 636
44	1 818			2 155	2 530	1 503	1 840	2 215

9 Pitch diameter tolerances

9.1 Tolerances for the pitch diameter of the internal thread T_{D2}

Tolerances for the pitch diameter of the internal thread T_{D2} are given in Table 8.

Table 8 — Tolerances for the pitch diameter of the internal thread T_{D2}

Nominal thread diameter		Pitch P mm	T_{D2} Tolerance grade		
over mm	d up to mm		7 μm	8 μm	9 μm
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
		8	475	600	750
22,4	45	3	335	425	530
		5	400	500	630
		6	450	560	710
		7	475	600	750
		8	500	630	800
		10	530	670	850
		12	560	710	900
45	90	3	355	450	560
		4	400	500	630
		8	530	670	850
		9	560	710	900
		10	560	710	900
		12	630	800	1 000
		14	670	850	1 060
		16	710	900	1 120
		18	750	950	1 180

Table 8 (continued)

Nominal thread diameter		Pitch P mm	T_{D2} Tolerance grade		
over mm	d up to mm		7 μm	8 μm	9 μm
90	180	4	425	530	670
		6	500	630	800
		8	560	710	900
		12	670	850	1 060
		14	710	900	1 120
		16	750	950	1 180
		18	800	1 000	1 250
		20	800	1 000	1 250
		22	850	1 060	1 320
		24	900	1 120	1 400
		28	950	1 180	1 500
180	355	8	600	750	950
		12	710	900	1 120
		18	850	1 060	1 320
		20	900	1 120	1 400
		22	900	1 120	1 400
		24	950	1 180	1 500
		32	1 060	1 320	1 700
		36	1 120	1 400	1 800
		40	1 120	1 400	1 800
		44	1 250	1 500	1 900
355	640	12	760	950	1 200
		18	900	1 120	1 400
		24	950	1 180	1 480
		44	1 290	1 610	2 000

9.2 Tolerances for the pitch diameter of the external thread T_{d2}

Tolerances for the pitch diameter of the external thread T_{d2} are given in Table 9.

Table 9 — Tolerances for the pitch diameter of the external thread T_{d2}

Nominal thread diameter		Pitch P mm	T_{d2} Tolerance grade			
over mm	up to mm		6 μm	7 μm	8 μm	9 μm
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
		8	280	355	450	560
22,4	45	3	200	250	315	400
		5	236	300	375	475
		6	265	335	425	530
		7	280	355	450	560
		8	300	375	475	600
		10	315	400	500	630
		12	335	425	530	710
45	90	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
		18	450	560	710	900

Table 9 (continued)

Nominal thread diameter		Pitch P mm	T_{d2} Tolerance grade			
over mm	d up to mm		6 μm	7 μm	8 μm	9 μm
90	180	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
		20	475	600	750	950
		22	500	630	800	1 000
		24	530	670	850	1 060
180	355	28	560	710	900	1 120
		8	355	450	560	710
		12	425	530	670	850
		18	500	630	800	1 000
		20	530	670	850	1 060
		22	530	670	850	1 060
		24	560	710	900	1 120
		32	630	800	1 000	1 250
		36	670	850	1 060	1 320
		40	670	850	1 060	1 320
355	640	44	710	900	1 120	1 400
		12	450	560	710	900
		18	530	670	850	1 060
		24	560	710	900	1 120
		44	760	950	1 220	1 520

10 Recommended tolerance classes

10.1 General

In order to reduce the number of gauges and tools, only the tolerance classes given in Tables 10 and 11 should be selected.

If the length of thread engagement is not known, thread engagement group N is recommended.

Tools and gauges shall always be marked with the tolerance class in order to avoid confusion.

10.2 Tolerance classes for the pitch diameter of the internal thread

Tolerance classes for the pitch diameter of the internal thread are given in Table 10.

Table 10 — Tolerance classes for the pitch diameter of the internal thread

	Tolerance classes	
	Thread engagement group	
	N	L
medium	7H	8H
coarse	8H	9H

10.3 Tolerance classes for the pitch diameter of the external thread

Tolerance classes for the pitch diameter of the external thread are given in Table 11.

Table 11 — Tolerance classes for the pitch diameter of the external thread

	Tolerance classes	
	Thread engagement group	
	N	L
medium	7e	8e
coarse	8c	9c

10.4 Tolerance class for the minor diameter of the internal thread

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

10.5 Tolerance class for the major diameter of the external thread

Only tolerance class h9 as in DIN EN ISO 286-2 shall apply for the major diameter of the external thread.

10.6 Tolerance class for the major diameter of the internal thread

Only tolerance class H10 as in DIN EN ISO 286-2 shall apply for the major diameter of the internal thread.

10.7 Tolerance class for the minor diameter of the external thread

The tolerance for the minor diameter T_{d3} is a function of the tolerance for the pitch diameter T_{d2} (see 11.5).

11 Formulae

11.1 Lengths of thread engagement

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

Table 12 — Lengths of thread engagement

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 $6,7 P \cdot d^{0,2}$
d is the smallest nominal thread diameter in the corresponding range of nominal diameters given in Table 3.	

11.2 Tolerances for the pitch diameter of the internal thread T_{D2}

The tolerances for the pitch diameter of the internal thread 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 — Factors for tolerance grades 7, 8, 9

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

11.3 Tolerances for the minor diameter of the internal thread T_{D1}

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

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

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

11.4 Tolerances for the pitch diameter of the external thread T_{d2}

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

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

$$T_{d2} \text{ in } \mu\text{m}, P \text{ und } d \text{ in mm}$$

where

d is the geometric mean of the range of nominal thread diameters.

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

Table 14 — Factors for tolerance grades 7, 8, 9

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

11.5 Tolerances for the minor diameter of the external thread T_{d3}

The tolerances for the minor diameter of the external thread T_{d3} are calculated using the following formula:

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

es , T_{d2} and T_{d3} in μm .

11.6 Fundamental deviation es

es (for tolerance position e and up to $P = 6 \text{ mm}$) = $-(50 + 11 P)$

es (for tolerance position e and for $P = 7 \text{ mm}$ up to 44 mm) = $-47,48 \sqrt{P}$

es (for tolerance position c and up to $P = 2 \text{ mm}$) = $-(125 + 11 P)$

es (for tolerance position c and for $P = 3 \text{ mm}$ up to 44 mm) = $-(5 + 94,12 \sqrt{P})$

es in μm

The values specified in Table 2 are empirical values. They differ from the values calculated using the above formulae by no more than 3 %.

11.7 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 as in DIN 323-1, except for the tolerances T_{d3} for the minor diameter of the external thread.

12 Multiple-start buttress threads

For multiple-start buttress threads with the pitch P , the pitch P of the single-start buttress thread is used as the basis for

- the fundamental deviation es and
- the tolerances for the minor diameter of the internal thread T_{D1} .

On the other hand, the tolerances for the pitch diameter of the internal thread T_{D2} and the external thread T_{d2} of the multiple-start thread with the pitch P 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 as in DIN 323-1 associated with the number of starts, in accordance with Table 15.

Table 15 — Factors for multiple-start threads

Number of starts	1	2	3	4	5 and more
(R 20) factor	1	1,12	1,25	1,4	1,6

Bibliography

DIN ISO 965-1, *ISO general purpose metric screw threads — Tolerances — Part 1: Principles and basic data*