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2903

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ISO metric trapezoidal screw threads — Tolerances

Filetages métriques trapézoïdaux ISO — Tolérances

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2903 was developed by Technical Committee ISO/TC 1, *Screw threads*, and was circulated to the member bodies in June 1976.

It has been approved by the member bodies of the following countries:

Austria	India	Romania
Belgium	Ireland	South Africa, Rep. of
Brazil	Italy	Spain
Canada	Korea, Rep. of	Sweden
Denmark	Mexico	Switzerland
Finland	Netherlands	U.S.A.
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The member bodies of the following countries expressed disapproval of the document on technical grounds:

Japan
United Kingdom

ISO metric trapezoidal screw threads – Tolerances

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a tolerance system for metric trapezoidal screw threads according to ISO 2902. The tolerances refer to the basic profile according to ISO 2901.

The tolerance system does not apply to trapezoidal screw threads with special requirements on axial displacement, for example lead screws.

2 REFERENCES

ISO 965/1, ISO general purpose metric screw threads – Tolerances – Principles and basic data.

ISO 2901, ISO metric trapezoidal screw threads – Basic profile and maximum material profiles.

ISO 2902, ISO metric trapezoidal screw threads – General plan.

3 STRUCTURE OF THE TOLERANCE SYSTEM

The system is based on the tolerance system for ISO general purpose metric screw threads of ISO 965/1, completed with tolerance positions c and e, and with values for pitches above 6 mm.

The recommended tolerance classes are, however, not the same as those for ISO metric screw threads in ISO 965/1.

4 TERMINOLOGY AND SYMBOLS

4.1 Terminology

The term “bolt threads” is used for external screw threads, the term “nut threads” for internal screw threads.

4.2 Symbols

The following symbols are used :

Symbol	Explanation
D_4	basic major diameter of nut thread
D_1	basic minor diameter of nut thread
D_2	basic pitch diameter of nut thread
d	basic major diameter of bolt thread
d_3	basic minor diameter of bolt thread
d_2	basic pitch diameter of bolt thread
P	pitch
N	designation for thread engagement group Normal
L	designation for thread engagement group Long
T	tolerance
$T_{D_1} T_{D_2}$ $T_d T_{d_3} T_{d_2}$	tolerances for D_1, D_2, d, d_3, d_2 (for D_4 no tolerances are specified)
$ei EI$	lower deviations (EI for the nut threads is equal to zero)
$es ES$	upper deviations

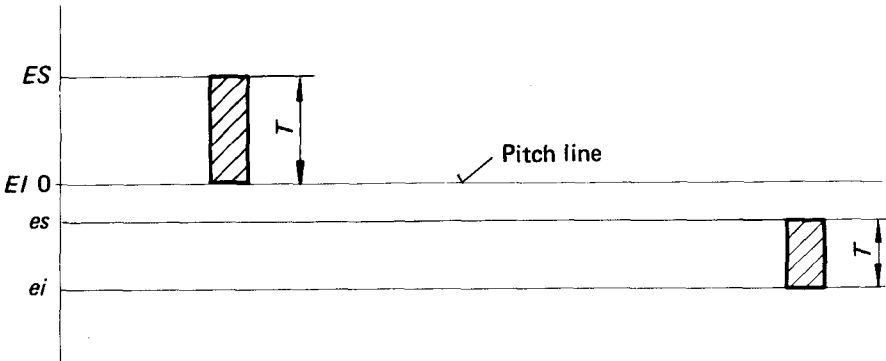


FIGURE 1 – Tolerance positions with respect to zero line (basic size)

5 DESIGNATION

A complete designation for a screw thread shall comprise a designation for the thread system and size, and a designation for the thread tolerance.

The thread designation appears in ISO 2902.

The tolerance designation consists of a symbol for the pitch diameter tolerance only.

There is no need to designate the crest diameter tolerance since

- the tolerance position is always the same;
- only one tolerance grade is established for the minor diameter of nut threads (D_1) and for the major diameter of bolt threads (d).

Each tolerance designation shall comprise :

- a figure indicating the grade of the pitch diameter tolerance;
- a letter indicating the position of the pitch diameter tolerance, capital for nuts, small for bolts.

Examples :

for nut threads :

Tr 40 x 7 – 7H

for bolt threads :

Tr 40 x 7 – 7e

for two starts left-hand bolt threads :

Tr 40 x 14 (P7) LH – 7e

A fit between threaded parts is indicated by the nut thread tolerance designation followed by the bolt thread tolerance designations separated by a stroke.

Example :

Tr 40 x 7 – 7H/7e

Tr 40 x 14 (P7) – 7H/7e

6 TOLERANCE GRADES

The following tolerance grades are established :

	Tolerance grades		
Minor diameter of nut threads D_1 :	4		
Major diameter of bolt threads d :	4		
Pitch diameter of nut threads D_2 :	7	8	9
Pitch diameter of bolt threads d_2 :	(6) ¹⁾	7	8 9
Minor diameter of bolt threads d_3 :	7	8	9

The tolerance grade for the minor diameter (d_3) of the bolt thread is always the same as for the pitch diameter (d_2).

However, the values for T_{d_3} and T_{d_2} are not the same for a same grade because $T_{d_3} = 1,25 T_{d_2} + |es|$.

7 TOLERANCE POSITIONS

The following tolerance positions are standardized for the pitch diameter :

- for nut threads : H with zero fundamental deviation;
- for bolt threads : c and e with negative fundamental deviation.

The tolerance position for the minor diameter D_1 and the major diameter D_4 of the nut threads is always H, i.e. with zero fundamental deviation. The tolerance position for the major diameter d and minor diameter d_3 of the bolt threads is in all cases h, i.e. with zero fundamental deviation, and it is independent of the tolerance position of the pitch diameter.

TABLE 1 – Fundamental deviations for the pitch diameter of nut threads and bolt threads

Pitch P mm	Fundamental deviation		
	Nut thread	Bolt thread	
	D_2	d_2	
	H El	c es	e es
	μm	μm	μm
1,5	0	– 140	– 67
2	0	– 150	– 71
3	0	– 170	– 85
4	0	– 190	– 95
5	0	– 212	– 106
6	0	– 236	– 118
7	0	– 250	– 125
8	0	– 265	– 132
9	0	– 280	– 140
10	0	– 300	– 150
12	0	– 335	– 170
14	0	– 355	– 180
16	0	– 375	– 190
18	0	– 400	– 200
20	0	– 425	– 212
22	0	– 450	– 224
24	0	– 475	– 236
28	0	– 500	– 250
32	0	– 530	– 265
36	0	– 560	– 280
40	0	– 600	– 300
44	0	– 630	– 315

1) Tolerance grade 6 has been included only as a means to establish the pitch diameter tolerances of grades 7, 8 and 9. See 13.4.2.

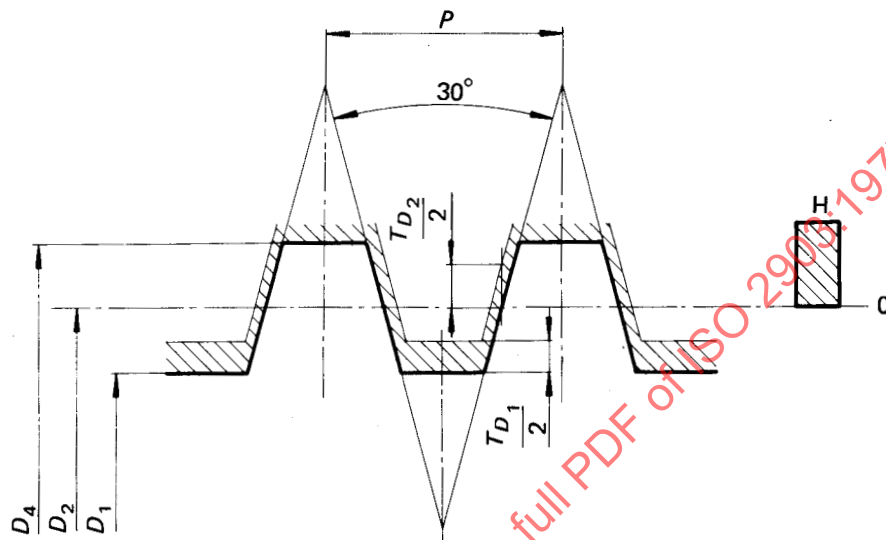


FIGURE 2 – Nut threads with tolerance position H for the pitch diameter

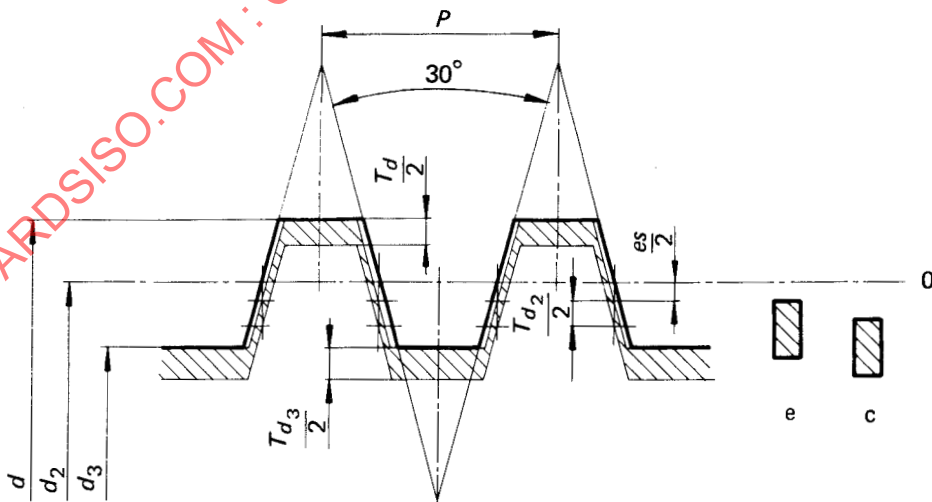


FIGURE 3 – Bolt threads with tolerance positions c and e for the pitch diameter

8 LENGTHS OF THREAD ENGAGEMENT

The length of thread engagement is classified into the groups N or L, in accordance with table 2.

TABLE 2 — Length of thread engagement

Dimensions in millimetres

Basic major diameter		Pitch <i>P</i>	Groups of lengths of thread engagement, <i>l</i>		
<i>d</i>			N		L
over	up to and incl.		over	up to and incl.	over
5,6	11,2	1,5	5	15	15
		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
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		

9 CREST AND ROOT DIAMETER TOLERANCES

9.1 Minor diameter tolerance of nut thread (T_{D_1})

For the minor diameter tolerance of the nut thread, T_{D_1} , there is only one tolerance grade, 4 (see table 3).

TABLE 3 – Minor diameter tolerance of nut threads (T_{D_1})

Pitch <i>P</i>	Tolerance grade 4
mm	μm
1,5	190
2	236
3	315
4	375
5	450
6	500
7	560
8	630
9	670
10	710
12	800
14	900
16	1 000
18	1 120
20	1 180
22	1 250
24	1 320
28	1 500
32	1 600
36	1 800
40	1 900
44	2 000

9.2 Major diameter tolerance of bolt thread (T_d)

For the major diameter tolerance of the bolt thread, T_d , there is only one tolerance grade, 4 (see table 4).

TABLE 4 – Major diameter tolerance of bolt thread (T_d)

Pitch <i>P</i>	Tolerance grade 4
mm	μm
1,5	150
2	180
3	236
4	300
5	335
6	375
7	425
8	450
9	500
10	530
12	600
14	670
16	710
18	800
20	850
22	900
24	950
28	1 060
32	1 120
36	1 250
40	1 320
44	1 400

9.3 Minor diameter tolerance of bolt thread (T_{d_3})

For the minor diameter tolerance of the bolt thread, T_{d_3} , there are three tolerance grades, 7, 8, and 9, in accordance with table 5.

TABLE 5 — Minor diameter tolerance of bolt thread (T_{d_3})

Basic major diameter d		Pitch P	Tolerance position c of the pitch diameter tolerance			Tolerance position e of the pitch diameter tolerance		
over	up to		tolerance grade			tolerance grade		
			7	8	9	7	8	9
mm	mm	mm	μm	μm	μm	μm	μm	μm
5,6	11,2	1,5	352	405	471	279	332	398
		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
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

10 PITCH DIAMETER TOLERANCES

For the pitch diameter tolerances there are three tolerance grades, 7, 8, and 9, for nut threads, in accordance with table 6, and four tolerance grades, 6, 7, 8 and 9, for bolt threads, in accordance with table 7.

TABLE 6 — Pitch diameter tolerance of nut thread (T_{D_2})

Basic major diameter d		Pitch P	Tolerance grade		
over	up to and incl.		7	8	9
mm	mm		μm	μm	μm
5,6	11,2	1,5	224	280	355
		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
		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
90	180	18	750	950	1 180
		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

TABLE 7 — Pitch diameter tolerance of bolt thread (T_{d_2})

Basic major diameter d		Pitch P	Tolerance grade			
over	up to and incl.		6	7	8	9
mm	mm		μm	μm	μm	μm
5,6	11,2	1,5	132	170	212	265
		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
		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
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
		44	710	900	1 120	1 400