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ISO general purpose metric screw threads — Tolerances —

Part 1: Principles and basic data

Filetages métriques ISO pour usages généraux — Tolérances —

Partie 1: Principes et données fondamentales

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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The committee responsible for this document is ISO/TC ISO 965-1 was prepared by Technical Committee ISO/TC 1, *Screw Threads*.

This fourth edition cancels and replaces the third edition (ISO 965-1:1998), which has been technically revised. It also incorporates the Technical Corrigendum ISO 965-1:1998/Cor.1:2009.

ISO 965 consists of the following parts, under the general title *ISO general purpose metric screw threads — Tolerances*:

— *Part 1: Principles and basic data*

— *Part 2: Limits of sizes for general purpose external and internal screw threads — Medium quality*

— *Part 3: Deviations for constructional screw threads*

— *Part 4: Limits of sizes for hot-dip galvanized external threads to mate with internal screw threads tapped with tolerance position H or G after galvanizing*

— *Part 5: Limits of sizes for internal screw threads to mate with hot-dip galvanized external screw threads with maximum size of tolerance position h before galvanizing*

ISO general purpose metric screw threads — Tolerances —

Part 1: Principles and basic data

1 Scope

This part of ISO 965 specifies a tolerance system for ISO general purpose metric screw threads (M) according to ISO 261.

The tolerance system refers to the basic profile according to ISO 68-1.

2 Normative references

The following referenced documents are indispensable for the application 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.

ISO 68-1, *ISO general purpose screw threads — Basic profile — Part 1: Metric screw threads*

ISO 261, *ISO general purpose metric screw threads — General plan*

ISO 1502, *ISO general-purpose metric screw threads — Gauges and gauging*

ISO 5408, *Screw threads — Vocabulary*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5408 apply.

3.2 Symbols

For the purposes of this document, the following symbols apply.

Symbol	Meaning
D	basic major diameter of internal thread
D_1	basic minor diameter of internal thread
D_2	basic pitch diameter of internal thread
d	basic major diameter of external thread
d_1	basic minor diameter of external thread
d_2	basic pitch diameter of external thread
d_3	minor diameter of external thread (see Figure 6)
P	pitch

Ph	lead
H	height of fundamental triangle
S	designation for “short” thread engagement group
N	designation for “normal” thread engagement group
L	designation for “long” thread engagement group
T	tolerance
T_{D1}, T_{D2}, T_d, T_{d2}	tolerances for D_1, D_2, d and d_2
ei, EI	lower limit deviations (see Figure 1)
es, ES	upper limit deviations (see Figure 1)
R	root radius of external thread (see Figure 6)
C	root truncation of external thread (see Figure 6)

Figure 1 — Position of tolerances with respect to zero line (basic size)

4 Tolerance system

The tolerance system consists of tolerance grades and tolerance positions. The tolerance grades are expressed by number, such as 4, 6 and 8. The tolerance positions are expressed by letter, such as H, G, h and g. The tolerance class designation shall be the combination of the number and the letter, for example 6H and 6g.

5 Tolerance positions

The following tolerance positions are standardized:

— for internal threads:

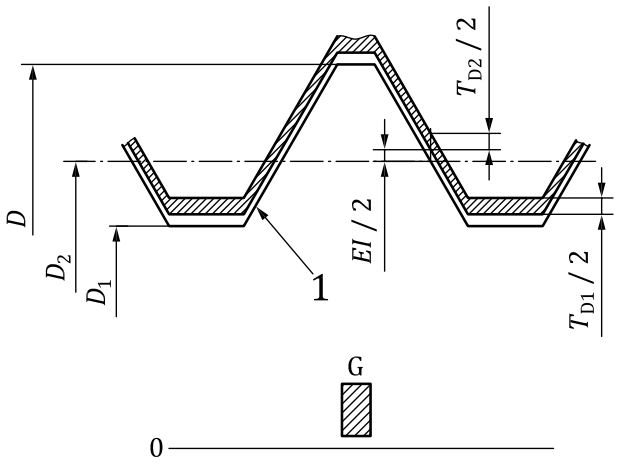
  — G with positive fundamental deviation (EI), shown in Figure 2;

  - H with zero fundamental deviation (*EI*), shown in Figure 3.

- for external threads:
  - a, b, c, d, e, f and g with negative fundamental deviation (*es*), shown in Figure 4;
  - h with zero fundamental deviation (*es*), shown in Figure 5.

The established tolerance positions comply with the needs of coating thickness and with the demands of easy assembly.

The fundamental deviations for internal threads and external threads are given in Table 1.



Key

1 basic profile

Figure 2 — Internal threads with tolerance position G

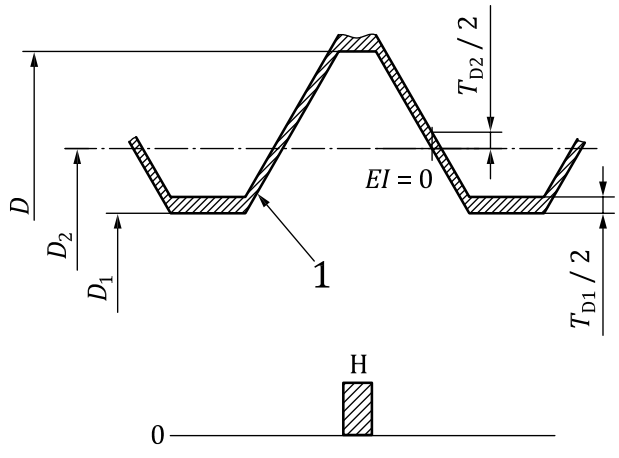


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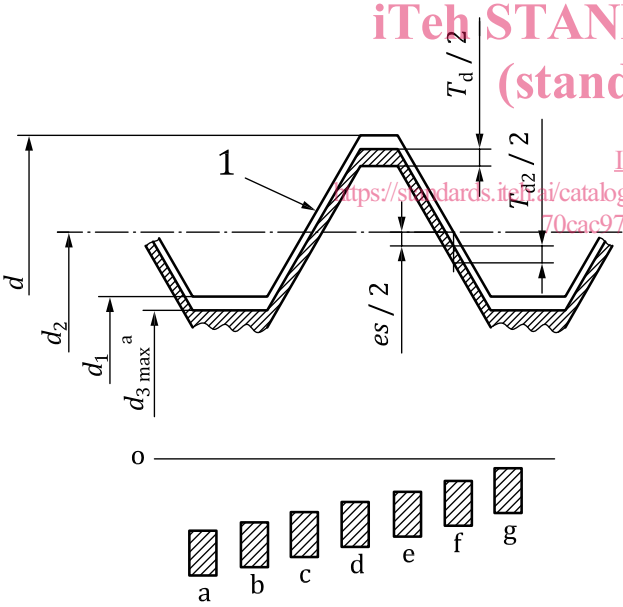
Figure 3 — Internal threads with tolerance position H

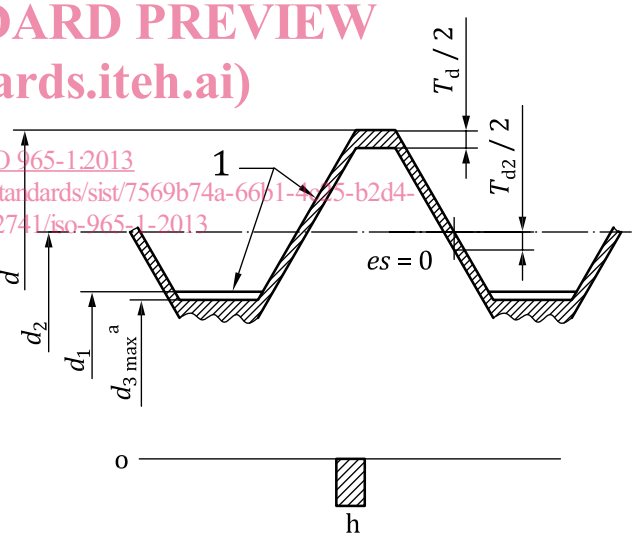


Key

1 basic profile

a Application only in connection with minimum material limits ($d_{2\,min}$); see Clause 11, Figure 6.

Figure 4 — External threads with tolerance positions a, b, c, d, e, f and g



Key

1 basic profile

a Application only in connection with minimum material limits ($d_{2\,min}$); see Clause 11, Figure 6.

Figure 5 — External threads with tolerance position h

Table 1 — Fundamental deviations for internal threads and external threads

Pitch P mm	Fundamental deviation									
	Internal thread		External thread							
	G EI µm	H EI µm	a es µm	b es µm	c es µm	d es µm	e es µm	f es µm	g es µm	h es µm
0,2	+17	0	–	–	–	–	–	–	–17	0
0,25	+18	0	–	–	–	–	–	–	–18	0
0,3	+18	0	–	–	–	–	–	–	–18	0
0,35	+19	0	–	–	–	–	–	–34	–19	0
0,4	+19	0	–	–	–	–	–	–34	–19	0
0,45	+20	0	–	–	–	–	–	–35	–20	0
0,5	+20	0	–	–	–	–	–50	–36	–20	0
0,6	+21	0	–	–	–	–	–53	–36	–21	0
0,7	+22	0	–	–	–	–	–56	–38	–22	0
0,75	+22	0	–	–	–	–	–56	–38	–22	0
0,8	+24	0	–	–	–	–	–60	–38	–24	0
1	+26	0	–290	–200	–130	–85	–60	–40	–26	0
1,25	+28	0	–295	–205	–135	–90	–63	–42	–28	0
1,5	+32	0	–300	–212	–140	–95	–67	–45	–32	0
1,75	+34	0	–310	–220	–145	–100	–71	–48	–34	0
2	+38	0	–315	–225	–150	–105	–71	–52	–38	0
2,5	+42	0	–325	–235	–160	–110	–80	–58	–42	0
3	+48	0	–335	–245	–170	–115	–85	–63	–48	0
3,5	+53	0	–345	–255	–180	–125	–90	–70	–53	0
4	+60	0	–355	–265	–190	–130	–95	–75	–60	0
4,5	+63	0	–365	–280	–200	–135	–100	–80	–63	0
5	+71	0	–375	–290	–212	–140	–106	–85	–71	0
5,5	+75	0	-385	–300	–224	–150	–112	–90	–75	0
6	+80	0	–395	–310	–236	–155	–118	–95	–80	0
8	+100	0	–425	–340	–265	–180	–140	–118	–100	0

6 Tolerance grades

The tolerance grades for the following screw thread diameters are standardized:

	Tolerance grade
D_1	4, 5, 6, 7, 8
d	4, 6, 8
D_2	4, 5, 6, 7, 8
d_2	3, 4, 5, 6, 7, 8, 9

Clause 8 shows details of tolerance grades and combinations of tolerance grades for pitch and crest diameters according to the tolerance quality and length of engagement group required, with the order of preference.

In some grades, certain tolerance values for small pitches are not shown in tolerance tables because of insufficient thread overlap or the requirement that the pitch diameter tolerance not exceed the crest diameter tolerance.

The minor diameter tolerances of internal thread, T_{D1}, are given in Table 2.

Table 2 — Minor diameter tolerances of internal thread (T_{D1})

Pitch	Tolerance grade				
P	4	5	6	7	8
mm	µm	µm	µm	µm	µm
0,2	38	–	–	–	–
0,25	45	56	–	–	–
0,3	53	67	85	–	–
0,35	63	80	100	–	–
0,4	71	90	112	–	–
0,45	80	100	125	–	–
0,5	90	112	140	180	–
0,6	100	125	160	200	–
0,7	112	140	180	224	–
0,75	118	150	190	236	–
0,8	125	160	200	250	315
1	150	190	236	300	375
1,25	170	212	265	335	425
1,5	190	236	300	375	475
1,75	212	265	335	425	530
2	236	300	375	475	600
2,5	280	355	450	560	710
3	315	400	500	630	800
3,5	355	450	560	710	900
4	375	475	600	750	950
4,5	425	530	670	850	1 060
5	450	560	710	900	1 120
5,5	475	600	750	950	1 180
6	500	630	800	1 000	1 250
8	630	800	1 000	1 250	1 600

The major diameter tolerances of external thread, T_d, are given in Table 3. The tolerance grades 5 and 7 do not exist for them.

Table 3 — Major diameter tolerances of external thread (T_d)

Pitch	Tolerance grade		
P	4	6	8
mm	µm	µm	µm
0,2	36	56	–
0,25	42	67	–
0,3	48	75	–
0,35	53	85	–
0,4	60	95	–
0,45	63	100	–
0,5	67	106	–
0,6	80	125	–
0,7	90	140	–
0,75	90	140	–
0,8	95	150	236
1	112	180	280
1,25	132	212	335
1,5	150	236	375
1,75	170	265	425
2	180	280	450
2,5	212	335	530
3	236	375	600
3,5	265	425	670
4	300	475	750
4,5	315	500	800
5	335	530	850
5,5	355	560	900
6	375	600	950
8	450	710	1 180

The pitch diameter tolerances of internal thread, T_{D2}, are given in Table 4.

The pitch diameter tolerances of external thread, T_{d2}, are given in Table 5.

Table 4 — Pitch diameter tolerances of internal thread (T_{D2})

Basic major diameter D		Pitch P	Tolerance grade				
over	up to and including		4	5	6	7	8
mm	mm	mm	µm	µm	µm	µm	µm
0,99	1,4	0,2	40	–	–	–	–
		0,25	45	56	–	–	–
		0,3	48	60	75	–	–
1,4	2,8	0,2	42	–	–	–	–
		0,25	48	60	–	–	–
		0,35	53	67	85	–	–
		0,4	56	71	90	–	–
		0,45	60	75	95	–	–