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ISO miniature screw threads

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 1501 was prepared by Technical Committee ISO/TC 1, *Screw threads*.

This first edition of ISO 1501 is a technical revision of ISO/R 1501:1970, which was cancelled in 1998.

ISO miniature screw threads

1 Scope

This International Standard specifies the profiles, diameter-pitch combinations, basic dimensions, tolerances, limits of size and designation for ISO miniature screw threads with nominal diameters from 0,3 mm to 1,4 mm. These threads are applicable to timepieces, optical instruments, electrical meters, measuring instruments, etc.

The profiles and tolerance system for ISO miniature screw threads (S) differ from the profile and tolerance system for ISO general purpose metric screw threads (M).

For threads with nominal diameters from 1 mm to 1,4 mm, designers shall decide to use ISO general purpose metric screw threads (M) or ISO miniature screw threads (S). ISO miniature screw threads are shown in Annex A.

Annex C illustrates the differences in miniature screw threads between the ISO International Standards and those of certain countries.

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 5408:—[1)], *Screw threads — Vocabulary*

3 Terms and definitions

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

4 Symbols

The following symbols are used:

Symbol	Term
D	basic major diameter of internal thread; nominal diameter
D_2	basic pitch diameter of internal thread
D_1	basic minor diameter of internal thread
d	basic major diameter of external thread; nominal diameter

1) To be published. (Revision of ISO 5408:1983)

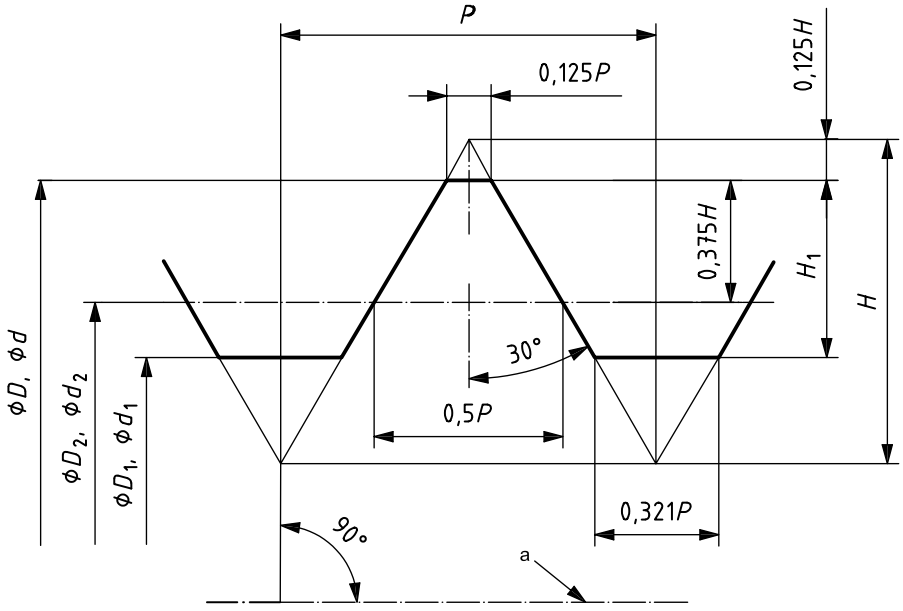
d_2	basic pitch diameter of external thread
d_1	basic minor diameter of external thread on basic profile
d_3	basic minor diameter of external thread on design profile
P	pitch
H	height of fundamental triangle
H_1	height of thread on basic profile; flank overlap
h_3	height of external thread on design profile
a_c	clearance between minor diameters on design profile
EI	lower deviations of internal thread on design profile
es	upper deviations of external thread on design profile
T	tolerances
T_{D2}	tolerances for D_2
T_{D1}	tolerances for D_1
T_d	tolerances for d
T_{d2}	tolerances for d_2
T_{d3}	tolerances for d_3

5 Profiles

5.1 Basic profile

The basic profile is shown as a thick line in Figure 1.

The dimensions of the basic profile are given in Table 1.



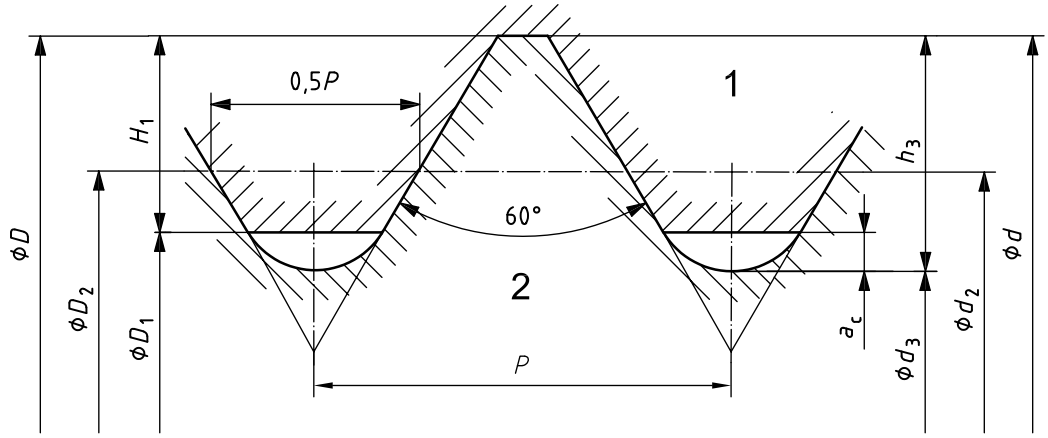
a Axis of screw thread.

Figure 1 — Basic profile

5.2 Design profile

The design profile is shown as a thick line in Figure 2.

The dimensions of the design profile are given in Table 1.



Key

1 internal thread
2 external thread

Figure 2 — Design profile

Table 1 — Dimensions of profiles

Dimensions in millimetres

Pitch P	H 0,866 025P	H_1 0,48P	0,375H 0,324 760P	h_3 0,56P	a_c 0,08P
0,08	0,069 282	0,038 400	0,025 981	0,044 800	0,006
0,09	0,077 942	0,043 200	0,029 228	0,050 400	0,007
0,1	0,086 603	0,048 000	0,032 476	0,056 000	0,008
0,125	0,108 253	0,060 000	0,040 595	0,070 000	0,010
0,15	0,129 904	0,072 000	0,048 714	0,084 000	0,012
0,175	0,151 554	0,084 000	0,056 833	0,098 000	0,014
0,2	0,173 205	0,096 000	0,064 952	0,112 000	0,016
0,225	0,194 856	0,108 000	0,073 071	0,126 000	0,018
0,25	0,216 506	0,120 000	0,081 190	0,140 000	0,020
0,3	0,259 808	0,144 000	0,097 428	0,168 000	0,024

6 Diameter-pitch combinations and basic dimensions

The diameter-pitch combinations and basic dimensions are given in Table 2.

For threads with nominal diameters from 1 mm to 1,4 mm, diameter-pitch combinations and basic dimensions are given in Annex A.

Choose, preferably, diameters in column 1 of Table 2.

Table 2 — Diameter-pitch combinations and basic dimensions

Dimensions in millimetres

Nominal diameter D, d		Pitch P	Pitch diameter D_2, d_2	Minor diameter	
First choice	Second choice			Internal thread D_1	External thread d_3
0,3		0,08	0,248	0,223	0,210
	0,35	0,09	0,292	0,264	0,249
0,4		0,1	0,335	0,304	0,288
	0,45	0,1	0,385	0,354	0,338
0,5		0,125	0,419	0,380	0,360
	0,55	0,125	0,469	0,430	0,410
0,6		0,15	0,503	0,456	0,432
	0,7	0,175	0,586	0,532	0,504
0,8		0,2	0,670	0,608	0,576
	0,9	0,225	0,754	0,684	0,648
NOTE See Annex A for threads with nominal diameters from 1 mm to 1,4 mm.					

The basic dimensions given in Table 2 are calculated using Equations (1), (2) and (3):

$$D_2 = d_2 = d - 0{,}649\,52P \quad (1)$$

$$D_1 = d - 0{,}96P \quad (2)$$

$$d_3 = d - 1{,}12P \quad (3)$$

NOTE The formula for d_3 given in Equation (3) is based upon a root radius equal to $0{,}2P$ approximately.

7 Tolerances

7.1 Tolerance position

The tolerance positions for diameters D, D_2, D_1, d, d_2 and d_3 are given in Table 3.

The fundamental deviations of diameters are given in Table 4.

7.2 Tolerance grades

The tolerance grades for diameters D_2, D_1, d, d_2 and d_3 are given in Table 5.

The tolerances of diameters are given in Table 6.

There is no tolerance requirement for diameters D.

7.3 Grade-position combinations and tolerance zones

For internal threads, tolerance Grade 3 of pitch diameter shall be used for the tolerance position G and thread tolerance Grade 4 of pitch diameter shall be used for the tolerance position H.

For internal threads, there are four tolerance classes, 3G5, 3G6, 4H5 and 4H6. See Figure 3.

For external threads, there is only one tolerance class, 5h3. See Figure 4.

NOTE For the symbol designating tolerance class, see Clause 8.

Table 3 — Tolerance positions

Thread	Diameter	Position
Internal thread	Major diameter D	G, H
	Pitch diameter D_2	
	Minor diameter D_1	H
External thread	Major diameter d	h
	Pitch diameter d_2	
	Minor diameter d_3	
NOTE The tolerance positions of major diameter D and pitch diameter D_2 for internal thread are always the same.		

Table 4 — Fundamental deviations

Deviations in micrometres

Pitch P mm	Internal thread		External thread
	D, D_2	D, D_2, D_1	d, d_2, d_3
	G	H	h
	EI	EI	es
0,08	+6	0	0
0,09	+6	0	0
0,1	+6	0	0
0,125	+8	0	0
0,15	+8	0	0
0,175	+10	0	0
0,2	+10	0	0
0,225	+10	0	0
NOTE See Annex A for threads with nominal diameters from 1 mm to 1,4 mm.			

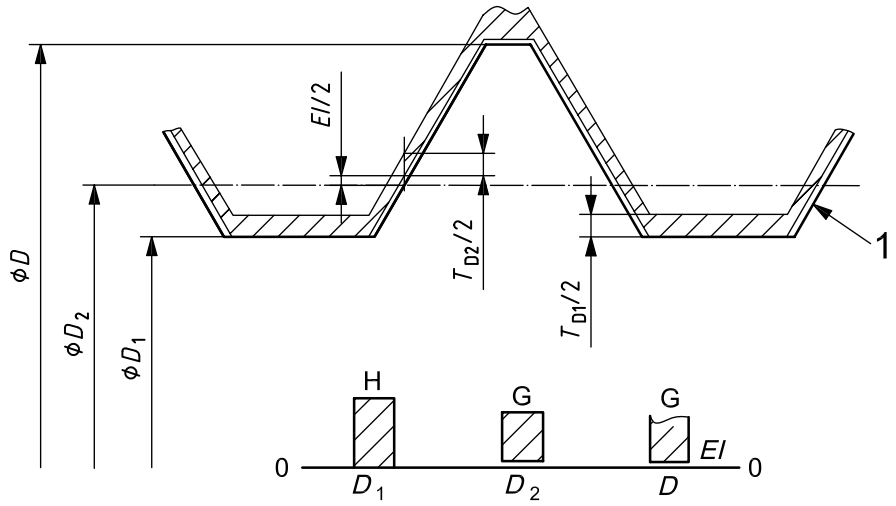
Table 5 — Tolerance grades

Thread	Diameter	Grade
Internal thread	Pitch diameter D_2	3, 4
	Minor diameter D_1	5, 6
External thread	Major diameter d	3
	Pitch diameter d_2	5
	Minor diameter d_3	4
NOTE Usually there is no requirement to check d_3 for conformance.		

Table 6 — Tolerances

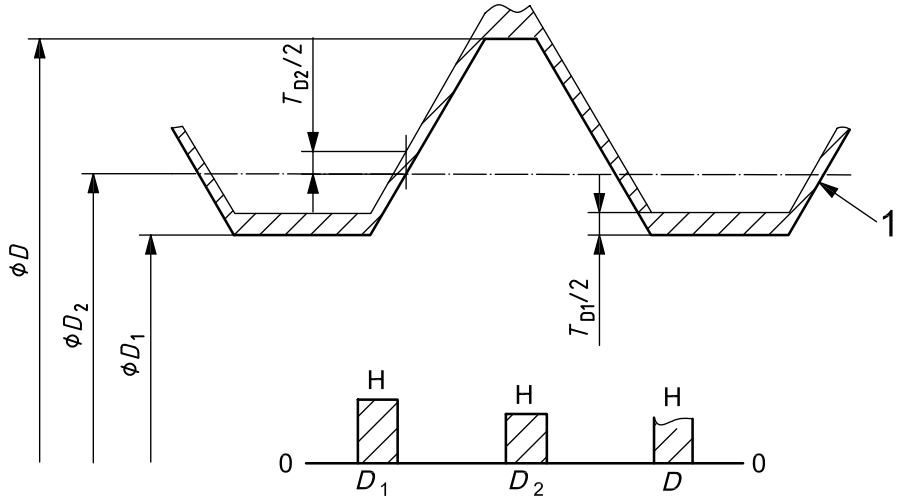
Tolerances in micrometres

Pitch P mm	Internal thread				External thread		
	T_{D2}		T_{D1}		T_d	T_{d2}	T_{d3}
	Grade 3	Grade 4	Grade 5	Grade 6	Grade 3	Grade 5	Grade 4
0,08	14	20	17	—	16	20	20
0,09	16	22	22	—	18	22	22
0,1	18	24	26	38	20	24	24
0,125	18	26	35	55	20	26	28
0,15	20	28	46	66	25	28	32
0,175	22	32	53	73	25	32	36
0,2	26	36	57	77	30	36	40
0,225	30	40	61	81	30	40	44
NOTE 1 See Annex A for threads with nominal diameters from 1 mm to 1,4 mm.							
NOTE 2 Usually there is no requirement to check d_3 for conformance.							



a) Tolerance class 3G5 and 3G6

Figure 3 (*continued*)

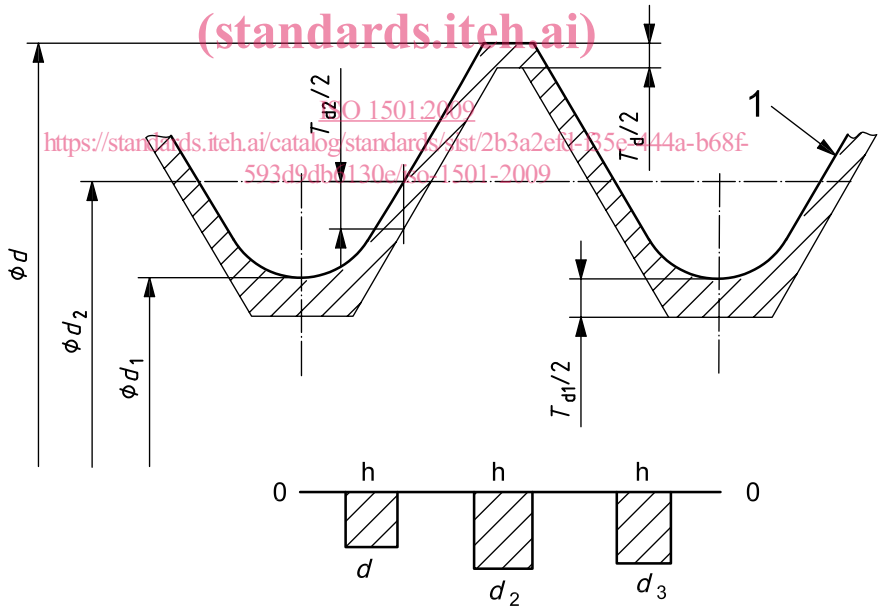


b) Tolerance class 4H5 and 4H6

Key

1 design profile

Figure 3 — Tolerance zone of internal thread



Tolerance class 5h3

Key

1 design profile

Figure 4 — Tolerance zone of external thread