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Ground thread taps for ISO metric threads of tolerances 4H to 8H and 4G to 6G coarse and fine pitches — Manufacturing tolerances on the threaded portion

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FOREWORD

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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.

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International Standard ISO 2857 was drawn up by Technical Committee ISO/TC 29, *Small tools*, and circulated to the Member Bodies in August 1972.

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Ground thread taps for ISO metric threads of tolerances 4H to 8H and 4G to 6G coarse and fine pitches — Manufacturing tolerances on the threaded portion

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the manufacturing tolerances on the threaded portion of taps for producing the ISO metric threads of tolerance classes 4H to 8H and 4G to 6G as defined in ISO/R 965/I to III (excluding, consequently, classes 7G and 8G considered as usually produced with ground thread taps).

It is valid for the short taps specified in ISO/R 529 as well as for any other kind of ground thread taps with the same diameters and pitches.

The internal threads produced with those taps are conventionally designated by the simplified denomination of "nut" in agreement with the word used in ISO/R 965 for the general designation of all internal threads.

Annexes A and B give, for all threads with coarse and fine pitches, the manufacturing tolerances on the threaded portion of taps for the following classes of nuts :

4H and 5H — 6H — 7H and 8H

and 4G and 5G — 6G

2 REFERENCES

ISO/R 529, *Short machine taps and hand taps.*

ISO/R 724, *ISO general purpose metric screw threads — Basic dimensions.*

ISO/R 965/I, *ISO general purpose metric screw threads — Tolerances — Principles and basic data.*

ISO/R 965/II, *ISO general purpose metric screw threads — Tolerances — Limits of sizes for commercial bolt and nut threads — Medium quality.*

ISO/R 965/III, *ISO general purpose metric screw threads — Tolerances — Deviations for constructional threads.*

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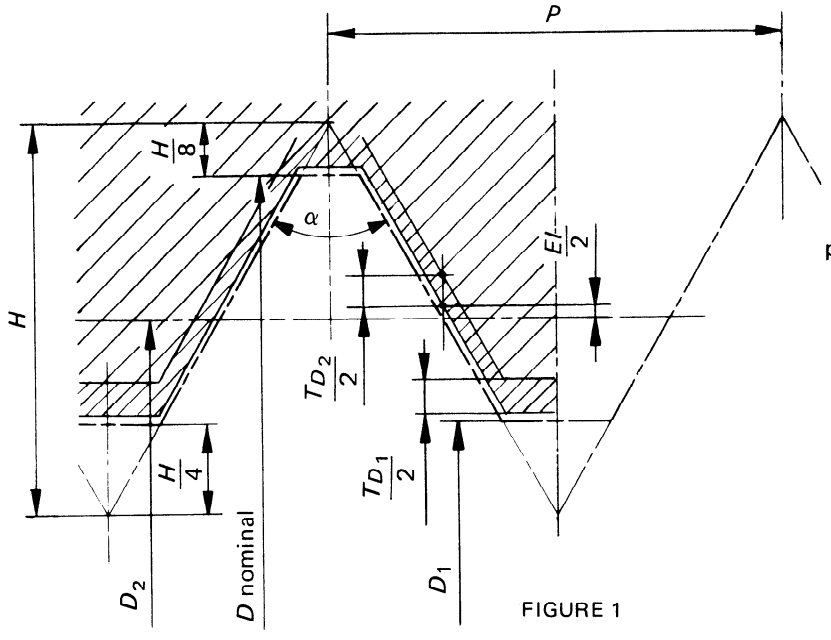
3 BASIC DATA

3.1 Thread profile of nuts : see figure 1.



Basic profile

- D = nominal diameter
- D_1 = basic minor diameter
- D_2 = pitch diameter
- P = pitch of thread
- α = included angle of thread
- H = height of fundamental triangle
- EI = minimum clearance, zero for H deviation positive for G deviation
- T_{D_1} = minor diameter tolerance
- T_{D_2} = pitch diameter tolerance

FIGURE 1

3.2 Thread profile of tap : see figure 2.

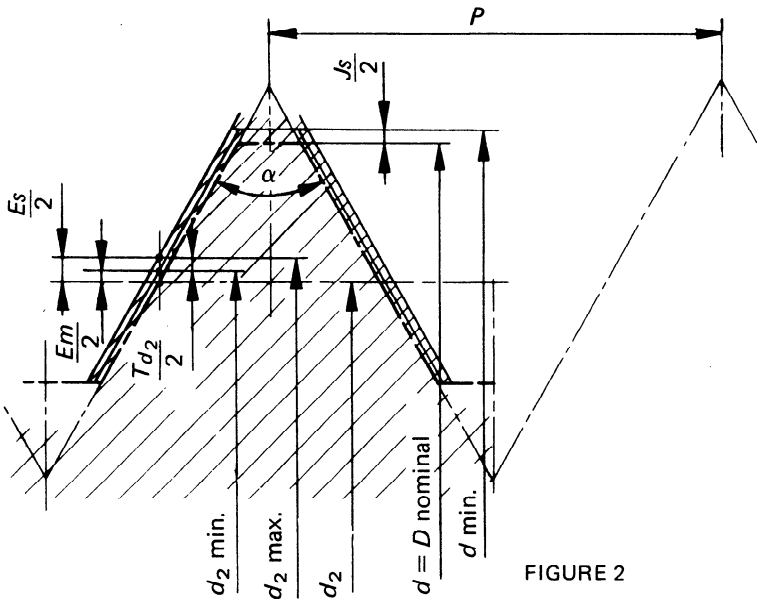


FIGURE 2

$d = D$ = nominal diameter

d min. = permissible minimum major diameter

Js = minimum clearance on major diameter

$d_2 = D_2$ = pitch diameter

d_2 min. = minimum pitch diameter

d_2 max. = maximum pitch diameter

Es = upper deviation of pitch diameter

Em = lower deviation of pitch diameter

T_{d_2} = tolerance on pitch diameter

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3.3 Tolerance classes of taps

For the production of nut classes of the following classes :

4H – 5H – 6H – 7H – 8H with zero minimum clearance,

4G – 5G – 6G with positive minimum clearance,

three tolerance classes have been accepted :

Class 1 – Class 2 – Class 3

The tolerances of these three classes are determined as indicated hereafter, in terms of a tolerance unit t, the value of which is equal to the pitch tolerance value T_{D_2}, grade 5 of the nut (extrapolated up to pitch 0,2 mm) :

$t = T_{D_2}$ grade 5 of the nut.

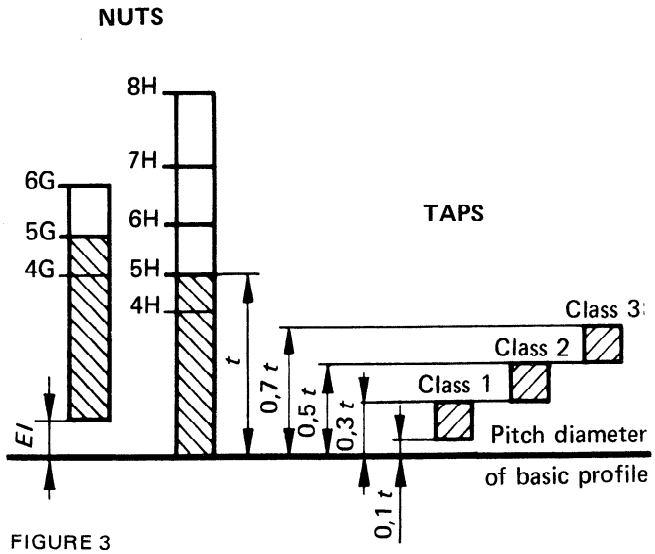

FIGURE 3

3.3.1 *Tolerance on pitch diameter*

The value for the tap pitch diameter tolerance T_{d_2} is the same for all three classes 1, 2 and 3 : it is equal to 20 % of t.

The position of the tolerance of the tap with respect to the basic pitch diameter results from the lower deviation Em, the values of which are (see figure 3) :

for tap class 1 : + 0,1 t

for tap class 2 : + 0,3 t

for tap class 3 : + 0,5 t

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3.3.2 *Choice of tolerance class of the tap with respect to the class of thread to be produced*

Unless otherwise specified, the taps of classes 1 to 3 will generally be used for the manufacture of nuts of the following classes :

– Class 1 : for nuts of classes 4H and 5H

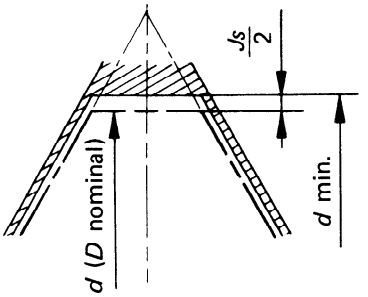
– Class 2 : for nuts of classes 6H and also 4G and 5G

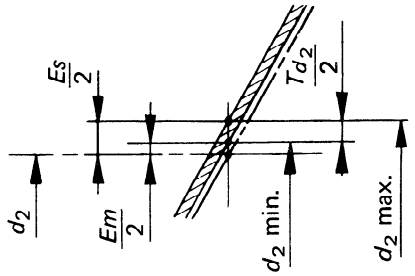
– Class 3 : for nuts of classes 7H – 8H and also 6G

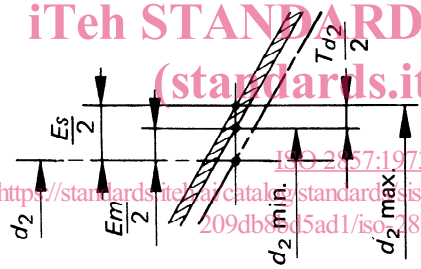
This correspondance has, however, only an indicative nature, since the accuracy of tapping can vary as a function of a series of factors such as : the material to be tapped, the condition of the machine tool, the tapping attachment, the tapping speed, the lubricant, etc.

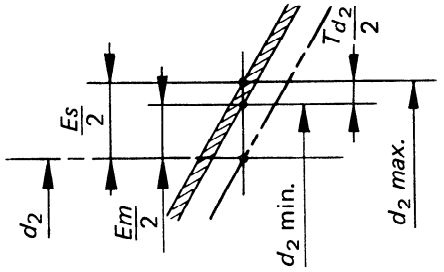
Users are therefore recommended to select in each case the most suitable class of tap for the manufacture of the required class of nut.

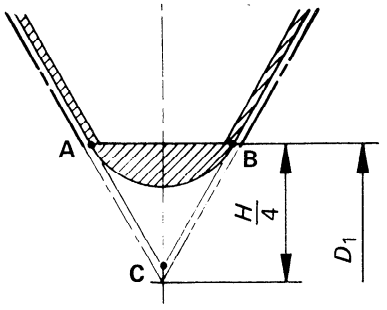
3.4 Calculation of tap thread dimensions of classes 1, 2 and 3

<table>
<tr><th>Class of tap</th><th>Minimum tolerance on tap major diameter $d = D$ of tap</th></tr>
<tr><td>all</td><td> 

$d = D$ nominal diameter of tap
$Js = 0{,}4\ t^*$
d min. $= D + Js$</td></tr>
<tr><td></td><td>Tolerance on tap pitch diameter d_2</td></tr>
<tr><td>1</td><td> 

$Em = 0{,}1\ t^*$
$Es = 0{,}3\ t^*$
d_2 min. $= d_2{}^{**} + Em$
d_2 max. $= d_2{}^{**} + Es$</td></tr>
<tr><td>2</td><td> 

$Em = 0{,}3\ t^*$
$Es = 0{,}5\ t^*$
d_2 min. $= d_2{}^{**} + Em$
d_2 max. $= d_2{}^{**} + Es$</td></tr>
<tr><td>3</td><td> 

$Em = 0{,}5\ t^*$
$Es = 0{,}7\ t^*$
d_2 min. $= d_2{}^{**} + Em$
d_2 max. $= d_2{}^{**} + Es$</td></tr>
<tr><td></td><td>Tolerance on tap minor diameter</td></tr>
<tr><td>all</td><td> 

No tolerance is specified on this diameter. The thread root is generally, but not mandatorily, with a rounded form and the profile of the radius blending with the flanks of the thread should lie, in principle, under the line AB which corresponds with the internal diameter D_1 of the basic ISO profile.</td></tr>
</table>

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* t = tolerance unit = TD_2 pitch tolerance, grade 5 of the nut.
The values are given in ISO/R 965/I, section 9.

** The d_2 values correspond to the values of the pitch diameter D_2 of the nut in conformity with ISO/R 724.

4 MANUFACTURING TOLERANCES ON TAP THREADS

4.1 Major diameter *d*

The minimum major diameter *d* min. shall be equal to the nominal diameter *D* of the nut, plus deviation *Js*. Deviation *Js* shall be greater than or equal to 0,4 *t*.*

The maximum major diameter *d* max. is not fixed and is left to the manufacturer's judgement.

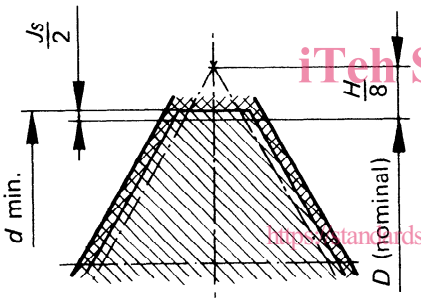

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TABLE 1 – **Minimum deviation *Js* in micrometres**

Nominal diameter		Pitch	Minimum deviation *Js*
over	up to and including		
0,99	1,4	0,2	+ 20
		0,25	+ 22
		0,3	+ 24
1,4	2,8	0,2	+ 21
		0,25	+ 24
		0,35	+ 27
		0,4	+ 28
		0,45	+ 30
2,8	5,6	0,35	+ 28
		0,5	+ 32
		0,6	+ 36
		0,7	+ 38
		0,75	
		0,8	+ 40
5,6	11,2	0,75	+ 42
		1	+ 47
		1,25	+ 50
		1,5	+ 56
11,2	22,4	1	+ 50
		1,25	+ 56
		1,5	+ 60
		1,75	+ 64
		2	+ 68
		2,5	+ 72
22,4	45	1	+ 53
		1,5	+ 64
		2	+ 72
		3	+ 85
		3,5	+ 90
		4	+ 94
		4,5	+ 100
45	90	1,5	+ 68
		2	+ 76
		3	+ 90
		4	+ 100
		5	+ 106
		5,5	+ 112
		6	+ 120

* *t* = tolerance unit = TD_2, pitch tolerance, grade 5 of the nut.
(See ISO/R 965/I. The values given for the pitch of 0,2 have been obtained by extrapolation.)

4.2 Pitch diameter d_2

The maximum and minimum permissible values on the pitch diameters, d_2 max. and d_2 min., of the taps are calculated in terms of the deviations *Em* and *Es* given in Table 2.

TABLE 2 — **Values of deviations *Em* and *Es* in micrometres**

Nominal diameter		Pitch	Deviations for pitch diameters *Em* and *Es*		
over	up to and including		classes 1	2	3
0,99	1,4	0,2	+ 15 + 5	—	—
		0,25	+ 17 + 6	—	—
		0,3	+ 18 + 6	+ 30 + 18	—
1,4	2,8	0,2	+ 16 + 5	—	—
		0,25	+ 18 + 6	—	—
		0,35	+ 20 + 7	+ 34 + 20	—
		0,4	+ 21 + 7	+ 36 + 21	—
		0,45	+ 23 + 8	+ 38 + 23	—
2,8	5,6	0,35	+ 21 + 7	+ 36 + 21	—
		0,5	+ 24 + 8	+ 40 + 24	+ 56 + 40
		0,6	+ 27 + 9	+ 45 + 27	+ 63 + 45
		0,7	+ 29 + 10	+ 48 + 29	+ 67 + 48
		0,75			
		0,8	+ 30 + 10	+ 50 + 30	+ 70 + 50
5,6	11,2	0,75	+ 32 + 11	+ 53 + 32	+ 74 + 53
		1	+ 35 + 12	+ 59 + 35	+ 83 + 59
		1,25	+ 38 + 13	+ 63 + 38	+ 88 + 63
		1,5	+ 42 + 14	+ 70 + 42	+ 98 + 70
11,2	22,4	1	+ 38 + 13	+ 63 + 38	+ 88 + 63
		1,25	+ 42 + 14	+ 70 + 42	+ 98 + 70
		1,5	+ 45 + 15	+ 75 + 45	+ 105 + 75
		1,75	+ 48 + 16	+ 80 + 48	+ 112 + 80
		2	+ 51 + 17	+ 85 + 51	+ 119 + 85
		2,5	+ 54 + 18	+ 90 + 54	+ 126 + 90
22,4	45	1	+ 40 + 13	+ 66 + 40	+ 92 + 66
		1,5	+ 48 + 16	+ 80 + 48	+ 112 + 80
		2	+ 54 + 18	+ 90 + 54	+ 126 + 90
		3	+ 64 + 21	+ 106 + 64	+ 148 + 106
		3,5	+ 67 + 22	+ 112 + 67	+ 157 + 112
		4	+ 71 + 24	+ 118 + 71	+ 165 + 118
		4,5	+ 75 + 25	+ 125 + 75	+ 175 + 125
45	90	1,5	+ 51 + 17	+ 85 + 51	+ 119 + 85
		2	+ 57 + 19	+ 95 + 57	+ 133 + 95
		3	+ 67 + 22	+ 112 + 67	+ 157 + 112
		4	+ 75 + 25	+ 125 + 75	+ 175 + 125
		5	+ 80 + 27	+ 133 + 80	+ 186 + 133
		5,5	+ 84 + 28	+ 140 + 84	+ 196 + 140
		6	+ 90 + 30	+ 150 + 90	+ 210 + 150

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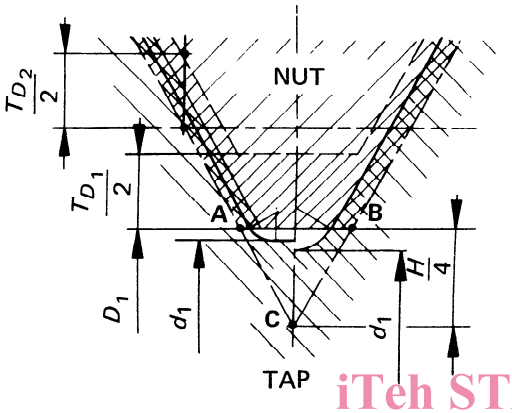
4.3 Minor diameter of tap d_1

No tolerance is specified on this diameter which is governed by the wear on the tool used to produce this thread.

The profile of the radius blending with the flanks of the thread should however lie, in principle, under the line AB which corresponds with the internal diameter D_1 of the basic ISO profile.



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4.4 Tolerance on the angle α and the half-angle $\alpha/2$ of thread

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The values for these tolerances are based on the pitch of the thread; they apply both to the angle α and to the half-angle $\alpha/2$ and shall be in accordance with the values of Table 3.

TABLE 3 – **Tolerances on the angles**

Pitch ranges *P*		**Tolerances on angle α and 1/2 angle $\alpha/2$**
Over	Up to and including	
0,2	0,4	± 40′
0,4	0,8	± 30′
0,8	1,5	± 25′
1,5	3	± 20′
3	6	± 15′

4.5 Cumulative pitch error T_p over any number of threads

This error is fixed at ± 0,05 % of the considered measuring length with a minimum of ± 0,008 mm.

5 DESIGNATION AND MARKING OF TAPS

The taps shall bear, after their dimensional designation (as indicated in ISO/R 529), the nominal diameter and, if necessary, the pitch of the thread, and the symbol ISO followed by the class of the tap, a dash being placed before the ISO symbol.

Examples :

For an M6 coarse pitch tap of class 2 :

M 6 – ISO 2

For an M 20 tap with pitch of 2 of class 1 :

M 20 × 2 – ISO 1

6 EXAMPLE OF CALCULATION OF THE DIMENSIONS OF THE THREADED PORTION OF A TAP

GROUND THREAD TAPS FOR ISO METRIC PITCHES

Example for an M 14 tap, class 2

Tap designation	M 14 – ISO 2
Tap characteristics	D = nominal diameter = 14 mm Pitch = 2 mm Threaded length = 30 mm
Basic data taken from ISO/R 724	$d_2 = D_2$ = ... 12,701 mm
Minimum major diameter (d min.)	d min. = D + Js (0,4 t) D = ... 14,000 mm Js (0,4 t) = ... 0,068 mm d min. = 14,000 + 0,068 = 14,068 mm (see 4.1)
Minimum pitch diameter (d_2 min.)	d_2 min. = d_2 + Em (0,3 t) d_2 (basic) = ... 12,701 mm Em (0,3 t) = ... 0,051 mm d_2 min. = 12,701 + 0,051 = 12,752 mm (see 4.2)
Maximum pitch diameter (d_2 max.)	d_2 max. = d_2 + Es (0,5 t) d_2 (basic) = ... 12,701 mm Es (0,5 t) = ... 0,085 mm d_2 max. = 12,701 + 0,085 = 12,786 mm (see 4.2)
Minor diameter	Not specified (see 4.3)
Tolerance on the angle (α) **or half-angle** ($\alpha/2$) **of pitch**	For a pitch of 2 mm ± 20′ (see 4.4)
Cumulative pitch error T_p over any number of threads	(see 4.5)

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$t = T_{D2}$: pitch tolerance, grade 5 of the nut. (See 3.4.)