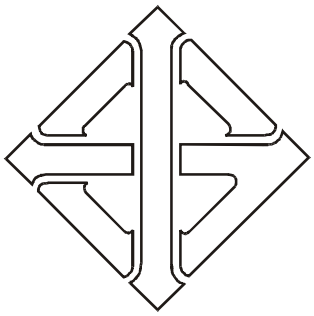

มาตรฐานผลิตภัณฑ์อุตสาหกรรม

THAI INDUSTRIAL STANDARD

มอก. 2410 – 2551

ISO 5864:1993

เกลียวนิ้วไอเอสโอ – ความเผื่อและเกณฑ์ความคลาดเคลื่อน

ISO INCH SCREW THREADS – ALLOWANCES AND TOLERANCES

สำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม

กระทรวงอุตสาหกรรม

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มาตรฐานผลิตภัณฑ์อุตสาหกรรม
เกลียวนิ้วไอเอสโอ –
ความเผื่อและเกณฑ์ความคลาดเคลื่อน

มอก. 2410 –2551

สำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม
กระทรวงอุตสาหกรรม ถนนพระรามที่ 6 กรุงเทพฯ 10400
โทรศัพท์ 0 2202 3300

ประกาศในราชกิจจานุเบกษา ฉบับประกาศและงานทั่วไป เล่ม 126 ตอนพิเศษ 48 ง
วันที่ 1 เมษายน พุทธศักราช 2552

มาตรฐานผลิตภัณฑ์อุตสาหกรรมกำหนดขึ้นโดยรับ ISO 5864:1993 ISO inch screw threads − Allowances and tolerances มาใช้ในระดับเหมือนกันทุกประการ (identical) โดยใช้ ISO ฉบับภาษาอังกฤษเป็นหลัก

คณะกรรมการมาตรฐานผลิตภัณฑ์อุตสาหกรรมได้พิจารณามาตรฐานนี้แล้ว เห็นสมควรเสนอรัฐมนตรีประกาศตามมาตรา 15 แห่งพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม พ.ศ. 2511

ประกาศกระทรวงอุตสาหกรรม

ฉบับที่ 3933 (พ.ศ. 2551)

ออกตามความในพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม

พ.ศ. 2511

เรื่อง กำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม

เกลียวนิ้วไอเอสโอ – ความเผื่อและเกณฑ์ความคลาดเคลื่อน

อาศัยอำนาจตามความในมาตรา 15 แห่งพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม พ.ศ. 2511 รัฐมนตรีว่าการกระทรวงอุตสาหกรรมออกประกาศกำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม เกลียวนิ้วไอเอสโอ – ความเผื่อและเกณฑ์ความคลาดเคลื่อน มาตรฐานเลขที่ มอก. 2410-2551 ไว้ ดังมีรายละเอียดต่อท้ายประกาศนี้

ประกาศ ณ วันที่ 24 พฤศจิกายน พ.ศ. 2551

พลตำรวจเอก ประชา พรหมนอก

รัฐมนตรีว่าการกระทรวงอุตสาหกรรม

มาตรฐานผลิตภัณฑ์อุตสาหกรรม
เกลียวนิ้วไอเอสโอ –
ความเผื่อและเกณฑ์ความคลาดเคลื่อน

บทนำ

มาตรฐานผลิตภัณฑ์อุตสาหกรรมกำหนดขึ้นโดยรับ ISO 5864:1993 ISO inch screw threads – Allowances and tolerances มาใช้ในระดับเหมือนกันทุกประการ (identical) โดยใช้ ISO ฉบับภาษาอังกฤษเป็นหลัก

ขอบข่าย

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ กำหนดระบบของความเผื่อและเกณฑ์ความคลาดเคลื่อนสำหรับอนุกรมเกลียวมาตรฐาน ซึ่งครอบคลุมเส้นผ่านศูนย์กลางเกลียวตั้งแต่ 0.06 นิ้ว ถึง 6 นิ้ว และพิตช์ตั้งแต่ 80 เกลียวต่อนิ้ว ถึง 4 เกลียวต่อนิ้ว

เอกสารอ้างอิง

เอกสารอ้างอิงที่ระบุต่อไปนี้ใช้ประกอบกับมาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ เอกสารอ้างอิงฉบับที่ระบุปีที่พิมพ์ให้ใช้ฉบับที่ระบุ ส่วนเอกสารที่ไม่ระบุปีที่พิมพ์นั้นให้ใช้ฉบับล่าสุด (รวมถึงฉบับแก้ไขเพิ่มเติม)

มอก.2409-2551 มาตรฐานผลิตภัณฑ์อุตสาหกรรมเกลียวนิ้วไอเอสโอ-ข้อกำหนดทั่วไปและการเลือกสำหรับหมุดเกลียว สลักเกลียว และแป้นเกลียว-ขนาดเส้นผ่านศูนย์กลางตั้งแต่ 0.06 นิ้ว ถึง 6 นิ้ว

IS0 725:1978, *IS0 inch screw threads – Basic dimensions.*

มอก. 2405-2551 มาตรฐานผลิตภัณฑ์อุตสาหกรรม หมุดเกลียวทรงกระบอก- คำศัพท์

บทนิยาม

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนดบทนิยาม รายละเอียดตาม มอก. 2405-2551

สัญลักษณ์และคำย่อ

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนดสัญลักษณ์และคำย่อ รายละเอียดตาม ISO 5864:1993 ข้อ 4

ขนาดและอนุกรม

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนด ขนาดและอนุกรม รายละเอียดตาม ISO5864:1993 ข้อ 5

ประเภทเกลียว

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนด ประเภทเกลียว รายละเอียดตาม ISO5864:1993 ข้อ 6

ความเผื่อและสูตรคำนวณ

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนด ความเผื่อและสูตรคำนวณ รายละเอียดตาม ISO5864:1993 ข้อ 7

เกณฑ์ความคลาดเคลื่อนและสูตรคำนวณ

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนด เกณฑ์ความคลาดเคลื่อนและสูตรคำนวณ รายละเอียดตาม ISO5864:1993 ข้อ 8

ความแม่น

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนด ความแม่น รายละเอียดตาม ISO5864:1993 ข้อ 9

รูปร่างตามแบบ (รูปร่างจริงสูงสุด) และการกำหนดเกณฑ์ความคลาดเคลื่อน

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนด รูปร่างตามแบบ (รูปร่างจริงสูงสุด) และการกำหนด เกณฑ์ความคลาดเคลื่อน รายละเอียดตาม ISO5864:1993 ข้อ 10

เกลียวปรับแต่ง

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนด เกลียวปรับแต่ง รายละเอียดตาม ISO5864:1993 ข้อ 11

ความยาวของการกินเกลียว

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนด ความยาวของการกินเกลียว รายละเอียดตาม ISO5864:1993 ข้อ 12

การควบคุมรัศมีที่รากเกลียว

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนด การควบคุมรัศมีที่รากเกลียว รายละเอียดตาม ISO5864:1993 ข้อ 13

การระบุ

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนด การระบุ รายละเอียดตาม ISO5864:1993 ข้อ 14

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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.

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.

International Standard ISO 5864 was prepared by Technical Committee ISO/TC 1, *Screw threads*, Sub-Committee SC 2, *Tolerances*.

This second edition cancels and replaces the first edition (ISO 5864:1978), tables 2 and 4 of which have been technically revised.

ISO inch screw threads — Allowances and tolerances

1 Scope

This International Standard specifies a system of allowances and tolerances for standard thread series, covering the range of diameters from 0,06 in to 6 in, and pitches from 80 to 4 threads per inch.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 263:1973, *ISO inch screw threads — General plan and selection for screws, bolts and nuts — Diameter range 0.06 to 6 in.*

ISO 725:1978, *ISO inch screw threads — Basic dimensions.*

ISO 5408:1983, *Cylindrical screw threads — Vocabulary.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 5408 apply.

In this International Standard, the terms "external threads" and "internal threads" are synonymous with bolt threads and nut threads, respectively, as used in some other International Standards.

4 Symbols and abbreviations

d	Major diameter of external thread (nominal diameter)
d_2	Pitch diameter of external thread
d_1	Minor diameter of external thread
D	Major diameter of internal thread (nominal diameter)
D_2	Pitch diameter of internal thread
D_1	Minor diameter of internal thread
P	Pitch
n	Number of threads per inch
L_e	Length of thread engagement (for formula)
LE	Length of thread engagement (for designation)
SE	Special length of thread engagement (for designation)
PD	Pitch diameter (for designation)
MOD	Modified diameter limits (for designation)
H	Height of fundamental triangle
T_d, T_{d2}, T_{D2}, T_{D1}	Tolerances for d, d_2, D_2 and D_1

5 Sizes and series

Nominal sizes, basic dimensions and the thread pitches available in each size and the pitch series in which they are classified appear in ISO 263 and ISO 725.

Thread series are groups of diameter-pitch combinations distinguished from each other by the number of threads per inch applied to series of specific diameters. The various diameter-pitch combinations are of three series with graded pitches, coarse (UNC), fine (UNF) and extra fine (UNEF) and eight series with constant pitches, 4 UN, 6 UN, 8 UN, 12 UN, 16 UN, 20 UN, 28 UN and 32 UN.

6 Thread classes

6.1 Thread classes are distinguished from each other by the amounts of tolerance and allowance. The function of these classes is to provide for various grades of fit when threaded parts are assembled. Three classes of external threads (1A, 2A and 3A) and three classes of internal threads (1B, 2B and 3B) have been established for general purpose use.

Thread classes 1A and 1B are applicable for bolts and nuts where easy assembly is required or where rough handling and foreign material may restrict assembly of a closer tolerance class. This class provides a liberal tolerance and is applicable only to sizes 0,25 inch and over the UNC and UNF series.

Thread classes 2A and 2B are applicable to general usage, including production of bolts, screws, nuts and similar threaded fasteners. The maximum material diameters of class 2A (external) uncoated threads are less than basic by the amount of the allowance.

Customarily, for class 2A threads having an additive finish, the maximum allowable diameter is increased to the basic size, the value being the same as for class 3A. The allowance minimizes galling and seizing in high-cycle wrench assembly, or it can be used to accommodate plated finishes or other coatings.

Thread classes 3A and 3B are applicable where closeness of fit and accuracy of lead and angle of thread are important. They are obtainable consistently only by the use of high quality production equipment supported by a very efficient system of gauging and inspection. No allowance is provided.

6.2 Fits other than that obtained with class 2A with class 2B, for example, may be obtained by using class 2A with 1B or 3B, or class 2B with 1A or 3A.

7 Allowances and formulae

The allowance is applied negatively to the basic size to give a maximum material size below basic. An allowance is applied only to the classes 1A and 2A (external threads).

The allowance, in inches, for the thread classes 1A and 2A is calculated from the following formula:

$$0{,}3\left(0{,}001\ 5\sqrt[3]{D} + 0{,}001\ 5\sqrt{L_e} + 0{,}015\sqrt[3]{P^2}\right)$$

Class 3A: zero allowance.

8 Tolerances and formulae

8.1 Major diameter tolerances

The major diameter tolerance T_d varies with the pitch and the thread series, but is independent of the length of engagement.

The tolerance for the major diameter for the thread classes indicated is calculated from the following.

a) External thread

T_d, class 1A: $0{,}09\sqrt[3]{P^2}$

T_d, classes 2A and 3A: $0{,}06\sqrt[3]{P^2}$

b) Internal thread

No tolerance is given for the major diameter of the nut thread. (See clause 13.)

8.2 Pitch diameter tolerances

The pitch diameter tolerances T_{d2} and T_{D2} vary with the diameter, pitch length of engagement and thread class.

The tolerance for the pitch diameter for the thread classes indicated is calculated from the following.

a) **External thread**

T_{d2}, class 2A:

$$0{,}001\ 5\sqrt[3]{D} + 0{,}001\ 5\sqrt{L_e} + 0{,}015\sqrt[3]{P^2}$$

T_{d2}, class 1A: 1,5 (tolerance of class 2A)

T_{d2}, class 3A: 0,75 (tolerance of class 2A)

b) **Internal thread**

T_{D2} class 1B: 1,95 (tolerance of class 2A)

T_{D2} class 2B: 1,30 (tolerance of class 2A)

T_{D2} class 3B: 0,975 (tolerance of class 2A)

8.3 Minor diameter tolerances

The minor diameter tolerance, T_{D1}, varies with diameter, pitch and thread class but is independent of the length of engagement. Modifications may be made for special applications.

The tolerance for the minor diameter for lengths of engagement up to $1{,}5D$ of the thread classes indicated is calculated from the following formulae.

a) **External thread**

No tolerance is given for the minor diameter of the bolt thread. For root radius control, see clause 13.

b) **Internal thread**

T_{D1}, classes 1B and 2B for all sizes below 0,25 in:

$$\left(0{,}05\sqrt[3]{P^2}+\frac{0{,}03}{D}P\right)-0{,}002$$

The resultant value should not exceed $0{,}394P$, or be less than $0{,}25P-0{,}4P^2$.

T_{D1}, classes 1B and 2B for all sizes 0,25 in and larger: $0{,}25P-0{,}4P^2$

T_{D1}, class 3B: $\left(0{,}05\sqrt[3]{P^2}+\frac{0{,}03}{D}P\right)-0{,}002$

The resultant value for class 3B should not exceed $0{,}394P$, or be less than $0{,}23P-1{,}5P^2$ for 80 to 13 threads per inch. For 12 threads per inch and coarser, the tolerance shall not be less than $0{,}12P$, which is, in effect, the tolerance for all sizes 1 in and larger having 12 threads per inch and coarser.

For applications having lengths of thread engagement less than $0{,}667D$ or more than $1{,}5D$, the values should be modified in accordance with rules given in clause 11.

9 Accuracy

The final dimension is rounded off by standard conventional means, after actual calculation to the eighth decimal place, giving the final answer to the fourth place; for example, 0,003 291 81 is rounded off to 0,003 3 when the dimension is required to the fourth decimal place.

10 Design profiles (maximum material profile) and disposition of tolerances

10.1 The design profiles are the maximum material limit of the class 3A external and classes 1B, 2B and 3B internal threads and are shown in figure 1 (nut) and figure 2 (bolt).

10.2 For classes 1A and 2A, the maximum material limit differs from the design profile by the amount of the allowance.

10.3 Tolerances are applied to the maximum material limit to determine the minimum material limit.

10.4 The dispositions of tolerances, allowances and crest clearances are shown in figure 3 (class 1A, 2A, 1B and 2B) and figure 4 (classes 3A and 3B).

10.5 The root contours of the design profiles are designed to clear a crest width of $0{,}125P$ on the external threads and crest width of $0{,}250P$ on the internal thread (see clause 13).

11 Modified threads

Modification of minor diameter tolerances of the internal thread is permitted for special lengths of engagement.

Occasionally, there are applications where the length of engagement of the mating threads, or the combinations of materials used for mating threads, are such that the internal maximum minor diameter may not provide the desired strength of the threads. Experience has shown that for length of engagement less than $0{,}667D$ (the minimum thickness of standard nuts), the minor diameter tolerance can be reduced without causing tapping difficulties.

In other applications, the length of engagement of mating threads may exceed $1{,}5D$ because of design considerations or the combination of materials used for mating. As the threads engaged increase in number, their depth of engagement can be shallower and still develop stripping strength greater than the external thread breaking strength. In these cases, the internal thread minor diameter tolerance is increased. By working to the minimum permissible material limit, the possibility of tapping difficulties is reduced.

To reduce the number of minor diameter tolerances to a practical minimum, tolerances for a selection of recommended diameters, lengths of engagement and pitches are given in table 2 for thread classes 1B and 2B, and tables 3 and 4 for thread class 3B.

In these tables, the tolerances for lengths of engagement less than $0{,}333D$ are 0,5 of the formula values. For lengths of engagement from $0{,}333D$ to $0{,}667D$, the tolerances are 0,75 of the formula values; for lengths of engagement from $0{,}667D$ to $1{,}5D$ the tolerances are equal to the formula values; and for lengths of engagement $1{,}5D$ to $3{,}0D$, the tolerances are 1,25 times the formula values. Where the tolerance value so computed is more than $0{,}394P$, which corresponds to a resulting minimum thread height of 53 % of $0{,}75H$, the value is adjusted to equal $0{,}394P(=0{,}455H)$. (See clause 8.)

Nut threads requiring modified minor diameters for lengths of thread engagement less than $0{,}667D$ to develop the optimum strength of the fastening, or longer than $1{,}5D$ to reduce tapping difficulties, should be designated MOD in the screw thread designation. (See clause 14.)

12 Lengths of thread engagement

The pitch diameter tolerances for the UNC, UNF, 4 UN, 6 UN and 8 UN thread series are based on a length of engagement equal to the basic major (nom-

inal) diameter and are applicable for lengths of engagement up to 1,5 diameters.

The pitch diameter tolerances for the UNEF, 12 UN, 16 UN, 20 UN, 28 UN and 32 UN thread series are based on a length of engagement of 9 pitches and are applicable for lengths of engagement up to 15 pitches.

Where the length of engagement exceeds that for which these tolerances are applicable, the tolerances shall be calculated by the method shown in table 1.

Table 1 — Pitch diameter tolerances

Thread series	Length of thread engagement		Tolerance
	Above	Up to and including	
UNC, UNF, 4 UN, 6 UN and 8 UN	—	1,5*D*	Formula value calculated from 8.2
	1,5*D*	3*D*	1,25 times the formula value
	3*D*	—	1,5 times the formula value
UNEF, 12 UN, 16 UN, 20 UN, 28 UN and 32 UN	—	15*P*	Formula value calculated from 8.2
	15*P*	30*P*	1,25 times the formula value
	30*P*	—	1,5 times the formula value

13 Root radius control

13.1 General

Where there is no allowance, the design profile establishes the maximum material profiles of both the external and internal threads.

At the maximum material limits of the internal and external threads, the roots are shown as rounded contours approximating tool crest wear. These contours are sometimes represented by uniform radii tangent to the flanks of the thread. The maximum value of such a radius for the root contour of the internal thread is 0,072*P*. For the root contour of the external thread it is 0,144*P*.

The root contour for the internal thread is designed to clear the design profile of the external thread which is a flat of width 0,125*P* but, in practice, to avoid sharp corners, is normally rounded and cleared beyond the flat. Similarly, the maximum material profile of the root of external thread is designed to clear the design profile of the crest of the internal thread which is a flat of width 0,25*P*.

At the maximum and minimum material limits of the internal thread, the contour of the root is bounded by flats of 0,125*P* and 0,041 7*P* respectively. In practice, crest form of the threading tool is relied upon for compliance with these limits.

13.2 Internal thread root contour

The major (root) diameter of internal threads is considered satisfactory if it will accept external threads having a major diameter and a crest conforming to the design profile (maximum material profile).

13.3 External thread root contour

13.3.1 The minor (root) diameter of external threads is generally considered satisfactory if it will accept internal threads having a minor diameter and a crest conforming to the design profile. However, when a radius root is required, the contour may be checked for compliance with its minimum radius limit.

13.3.2 For applications requiring high strength and resistance to fatigue, it is recommended that the root of the external thread should be a smoothly rounded radius (a faired curved root) without reverse curvature or flats within the limits on minimum radius 0,108*P* and maximum radius 0,144*P*, the former being tangent to a root flat of 0,125*P* and tangent to the thread flank.

13.4 Specification of tolerances and symbols

13.4.1 In view of the above discussion, root diameter tolerances as such are not provided in this International Standard.

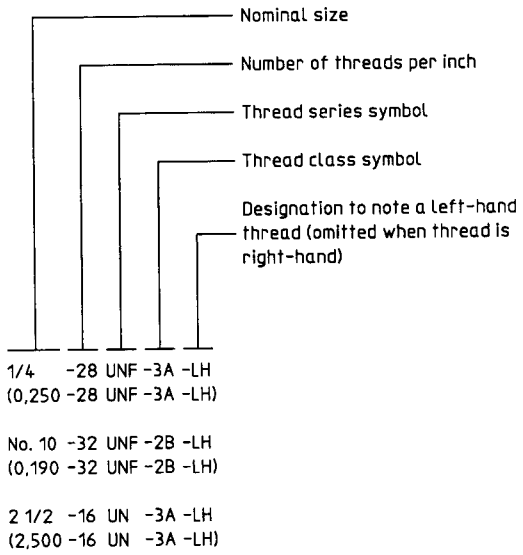
13.4.2 The designation for specifying the rounded root is at the discretion of the user; however, some countries have established the symbol UNR as the method of designating a thread with a mandatory rounded root.

14 Designation

A complete designation for a screw thread for standard length of engagement comprises the nominal size, threads per inch, and designations for the thread series and thread class. To this may be appended other supplementary symbols for threads with modified major (crest) diameter limits, long lengths of engagement, etc, when and as applicable.

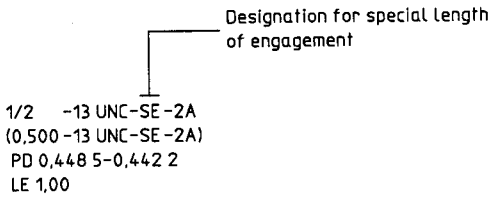
EXAMPLES

a) **For standard lengths of engagement** (see clause 12)



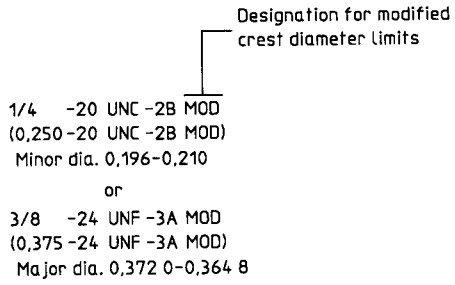
b) **For special lengths of engagement** (see clause 12)

(Actual pitch diameter and length of engagement are shown.)



c) **For threads with modified crest diameter limits** (see clause 11)

(Actual minor and major diameter limits are shown.)



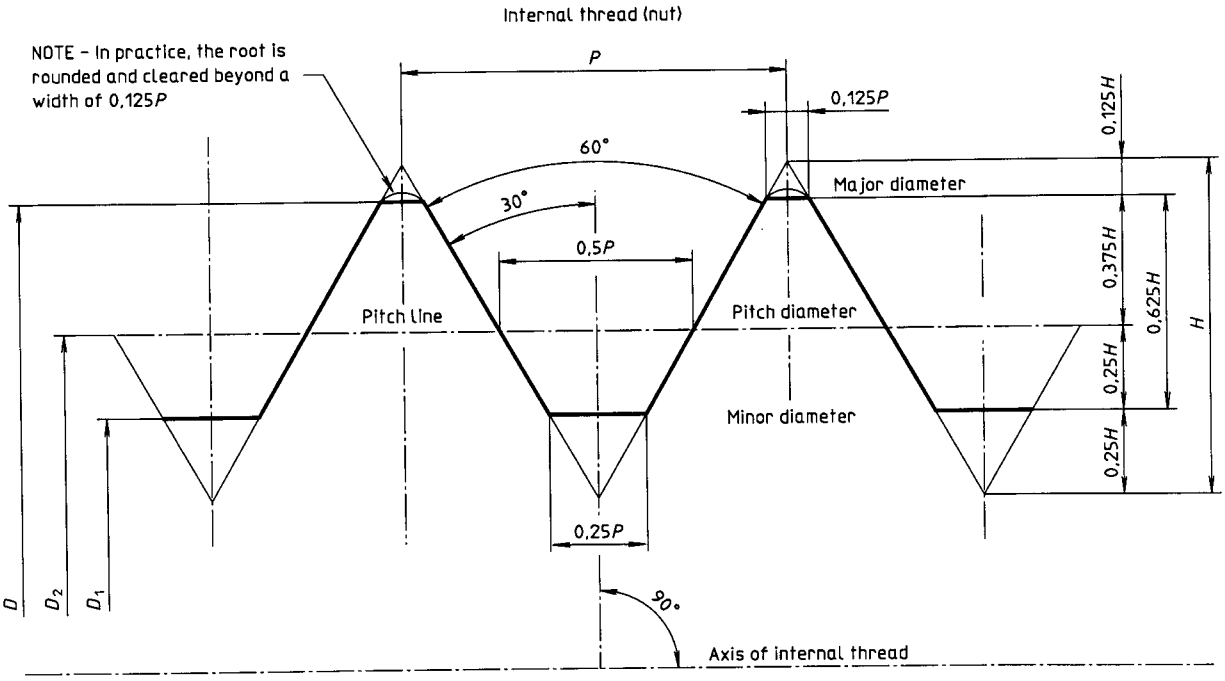


Figure 1 — Unified internal thread design profile (same as basic profile given in ISO 68) (maximum material condition MMC)

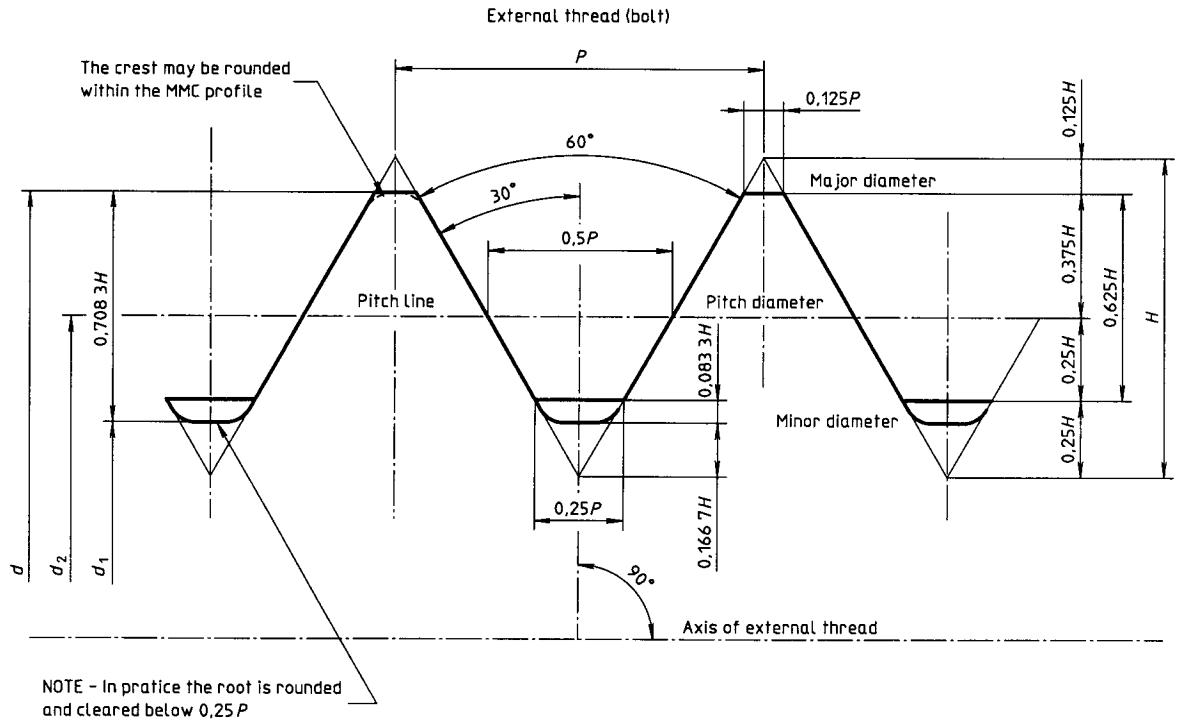


Figure 2 — Unified external thread design profile (maximum material condition MMC)

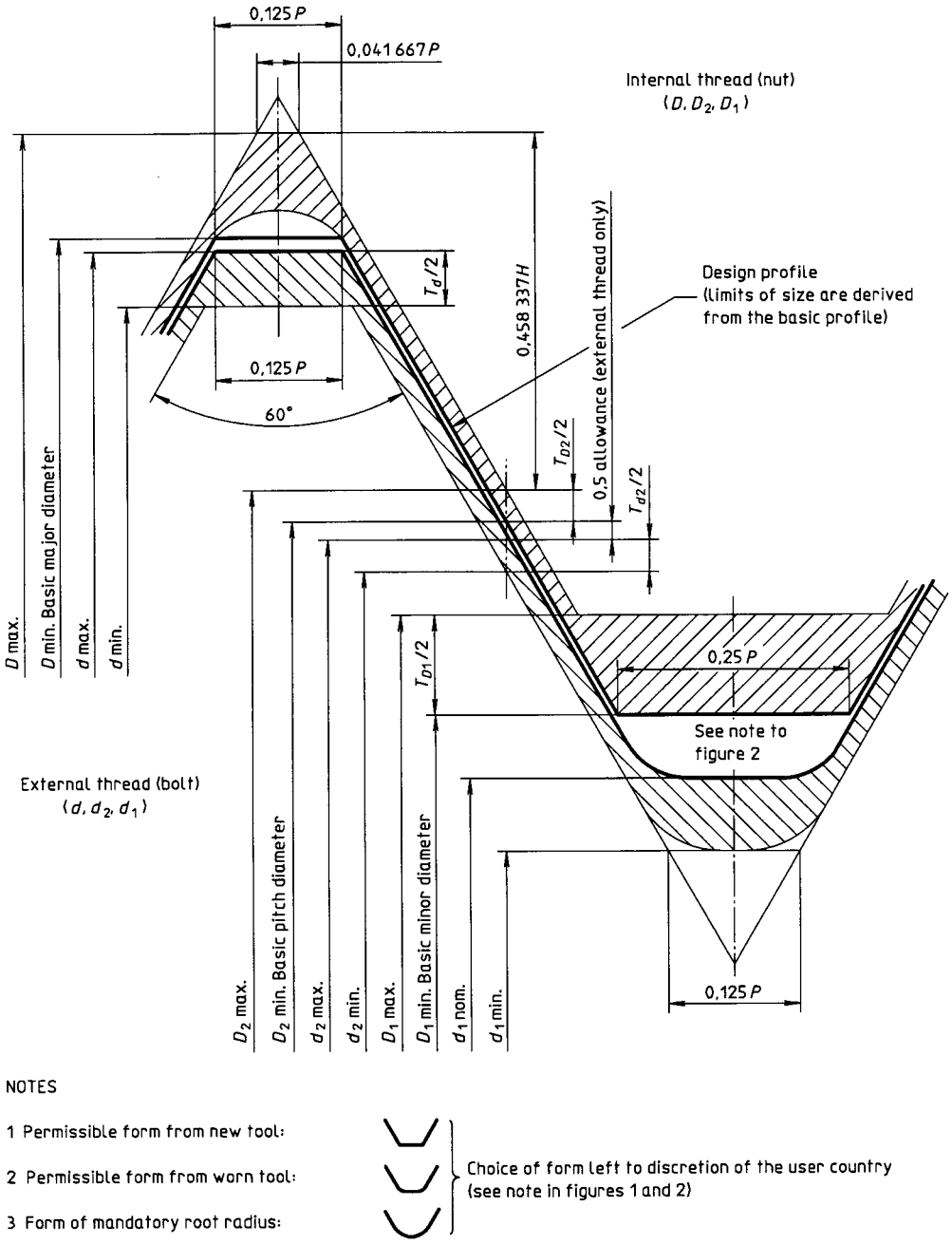
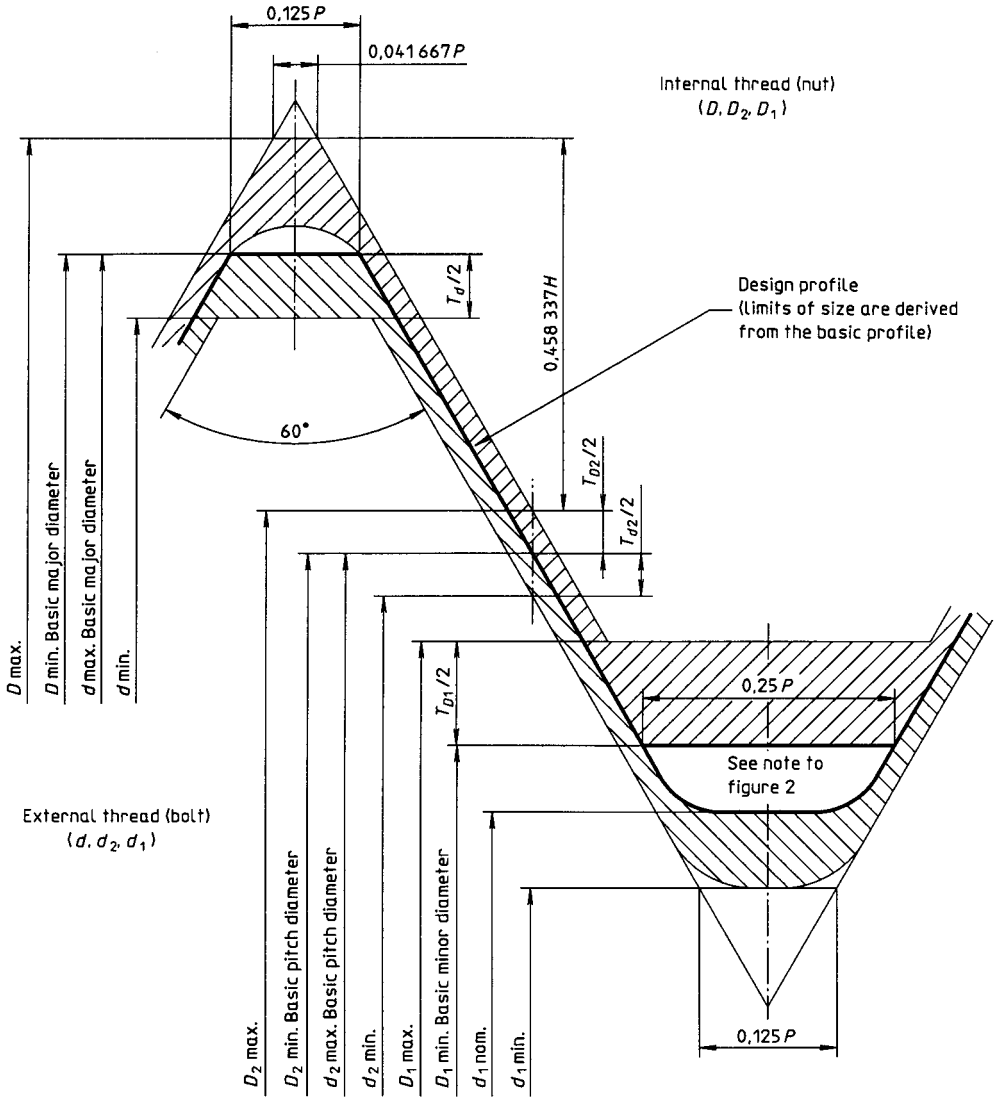


Figure 3 — Disposition of tolerances, allowances and crest clearances for classes 1A, 2A, 1B and 2B.



NOTES

1 Permissible form from new tool:

2 Permissible form from worn tool:

3 Form of mandatory root radius:

Choice of form left to discretion of the user country
(see note in figures 1 and 2)

Figure 4 — Disposition of tolerances and crest clearances for classes 3A and 3B

Table 2 — Minor diameter tolerances for internal threads, T_{D1}, for special length of engagement: Classes 1B and 2B

Tolerances in 0,000 1 in

Threads per inch	Length of thread engagement		Thread sizes										
			0	1	2	3	4	5	6	8	10	12	
n	above	up to and including	0,060	0,073	0,086	0,099	0,112	0,125	0,138	0,164	0,190	0,216	0,250 to 6
			T_{D1}										
80	—	0,333D	35	29	25	22	20	18	17	16	16	16	16
	0,333D	0,667D	49	44	38	34	30	28	26	23	23	23	23
	0,667D	1,5D	49	49	49	45	40	37	34	31	31	31	31
	1,5D	3,0D	49	49	49	49	49	46	43	39	39	39	39
72	—	0,333D	39	33	29	26	23	21	20	17	17	17	17
	0,333D	0,667D	55	49	43	38	35	32	29	26	26	26	26
	0,667D	1,5D	55	55	55	51	46	42	39	34	34	34	34
	1,5D	3,0D	55	55	55	55	55	53	49	43	42	42	42
64	—	0,333D	45	38	33	29	27	24	23	20	19	19	19
	0,333D	0,667D	62	57	49	44	40	37	34	20	28	28	28
	0,667D	1,5D	62	62	62	59	53	49	45	40	38	38	38
	1,5D	3,0D	62	62	62	62	62	61	57	50	48	48	48
56	—	0,333D	—	44	38	34	31	29	26	23	22	22	22
	0,333D	0,667D	—	66	57	51	46	43	40	35	32	32	32
	0,667D	1,5D	—	70	70	68	62	57	53	47	43	43	43
	1,5D	3,0D	—	70	70	70	70	70	66	59	54	54	54
48	—	0,333D	—	—	45	40	37	34	32	28	25	25	25
	0,333D	0,667D	—	—	68	61	55	51	47	42	38	38	38
	0,667D	1,5D	—	—	82	81	74	68	63	56	51	50	50
	1,5D	3,0D	—	—	82	82	82	82	79	70	63	62	62
44	—	0,333D	—	—	50	44	40	38	35	31	28	28	28
	0,333D	0,667D	—	—	75	67	61	56	52	46	42	41	41
	0,667D	1,5D	—	—	90	89	81	75	50	62	56	55	55
	1,5D	3,0D	—	—	89	89	89	89	88	78	70	69	69
40	—	0,333D	—	—	—	49	45	41	39	34	31	30	30
	0,333D	0,667D	—	—	—	74	67	62	58	51	47	45	45
	0,667D	1,5D	—	—	—	98	90	83	77	68	62	60	60
	1,5D	3,0D	—	—	—	98	98	98	96	86	78	75	75
36	—	0,333D	—	—	—	—	50	46	43	38	35	33	33
	0,333D	0,667D	—	—	—	—	75	69	65	58	52	50	50
	0,667D	1,5D	—	—	—	—	100	93	86	80	70	66	66
	1,5D	3,0D	—	—	—	—	109	109	108	96	87	82	82

Threads per inch	Length of thread engagement		Thread sizes										
			0	1	2	3	4	5	6	8	10	12	
n	above	up to and including	0,060	0,073	0,086	0,099	0,112	0,125	0,138	0,164	0,190	0,216	0,250 to 6
			T_{D1}										
32	—	0,333*D*	—	—	—	—	—	—	49	43	39	37	37
	0,333*D*	0,667*D*	—	—	—	—	—	—	73	65	59	79	75
	0,667*D*	1,5*D*	—	—	—	—	—	—	98	87	79	74	74
	1,5*D*	3,0*D*	—	—	—	—	—	—	122	108	99	92	92
28	—	0,333*D*	—	—	—	—	—	—	—	—	45	42	42
	0,333*D*	0,667*D*	—	—	—	—	—	—	—	—	68	63	63
	0,667*D*	1,5*D*	—	—	—	—	—	—	—	—	91	90	84
	1,5*D*	3,0*D*	—	—	—	—	—	—	—	—	113	105	105
24	—	0,333*D*	—	—	—	—	—	—	—	—	53	49	48
	0,333*D*	0,667*D*	—	—	—	—	—	—	—	—	79	73	73
	0,667*D*	1,5*D*	—	—	—	—	—	—	—	—	106	98	97
	1,5*D*	3,0*D*	—	—	—	—	—	—	—	—	132	122	121
20	—	0,333*D*	—	—	—	—	—	—	—	—	—	—	53
	0,333*D*	0,667*D*	—	—	—	—	—	—	—	—	—	—	86
	0,667*D*	1,5*D*	—	—	—	—	—	—	—	—	—	—	115
	1,5*D*	3,0*D*	—	—	—	—	—	—	—	—	—	—	144
18	—	0,333*D*	—	—	—	—	—	—	—	—	—	—	64
	0,333*D*	0,667*D*	—	—	—	—	—	—	—	—	—	—	95
	0,667*D*	1,5*D*	—	—	—	—	—	—	—	—	—	—	127
	1,5*D*	3,0*D*	—	—	—	—	—	—	—	—	—	—	159
16	—	0,333*D*	—	—	—	—	—	—	—	—	—	—	70
	0,333*D*	0,667*D*	—	—	—	—	—	—	—	—	—	—	106
	0,667*D*	1,5*D*	—	—	—	—	—	—	—	—	—	—	141
	1,5*D*	3,0*D*	—	—	—	—	—	—	—	—	—	—	176
14	—	0,333*D*	—	—	—	—	—	—	—	—	—	—	79
	0,333*D*	0,667*D*	—	—	—	—	—	—	—	—	—	—	118
	0,667*D*	1,5*D*	—	—	—	—	—	—	—	—	—	—	158
	1,5*D*	3,0*D*	—	—	—	—	—	—	—	—	—	—	198
13	—	0,333*D*	—	—	—	—	—	—	—	—	—	—	85
	0,333*D*	0,667*D*	—	—	—	—	—	—	—	—	—	—	128
	0,667*D*	1,5*D*	—	—	—	—	—	—	—	—	—	—	170
	1,5*D*	3,0*D*	—	—	—	—	—	—	—	—	—	—	213

Threads per inch	Length of thread engagement		Thread sizes										
			0	1	2	3	4	5	6	8	10	12	
n	above	up to and including	0,060	0,073	0,086	0,099	0,112	0,125	0,138	0,164	0,190	0,216	0,250 to 6
			T_{D1}										
12	—	0,333D	—	—	—	—	—	—	—	—	—	—	90
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	—	135
	0,667D	1,5D	—	—	—	—	—	—	—	—	—	—	181
	1,5D	3,0D	—	—	—	—	—	—	—	—	—	—	226
11	—	0,333D	—	—	—	—	—	—	—	—	—	—	97
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	—	146
	0,667D	1,5D	—	—	—	—	—	—	—	—	—	—	194
	1,5D	3,0D	—	—	—	—	—	—	—	—	—	—	242
10	—	0,333D	—	—	—	—	—	—	—	—	—	—	105
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	—	158
	0,667D	1,5D	—	—	—	—	—	—	—	—	—	—	210
	1,5D	3,0D	—	—	—	—	—	—	—	—	—	—	262
9	—	0,333D	—	—	—	—	—	—	—	—	—	—	114
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	—	171
	0,667D	1,5D	—	—	—	—	—	—	—	—	—	—	228
	1,5D	3,0D	—	—	—	—	—	—	—	—	—	—	286
8	—	0,333D	—	—	—	—	—	—	—	—	—	—	125
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	—	188
	0,667D	1,5D	—	—	—	—	—	—	—	—	—	—	250
	1,5D	3,0D	—	—	—	—	—	—	—	—	—	—	312
7	—	0,333D	—	—	—	—	—	—	—	—	—	—	138
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	—	207
	0,667D	1,5D	—	—	—	—	—	—	—	—	—	—	276
	1,5D	3,0D	—	—	—	—	—	—	—	—	—	—	344
6	—	0,333D	—	—	—	—	—	—	—	—	—	—	153
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	—	230
	0,667D	1,5D	—	—	—	—	—	—	—	—	—	—	306
	1,5D	3,0D	—	—	—	—	—	—	—	—	—	—	382
5	—	0,333D	—	—	—	—	—	—	—	—	—	—	170
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	—	255
	0,667D	1,5D	—	—	—	—	—	—	—	—	—	—	340
	1,5D	3,0D	—	—	—	—	—	—	—	—	—	—	425

Threads per inch	Length of thread engagement		Thread sizes										
			0	1	2	3	4	5	6	8	10	12	
n	above	up to and including	0,060	0,073	0,086	0,099	0,112	0,125	0,138	0,164	0,190	0,216	0,250 to 6
			T_{D1}										
4,5	—	0,333*D*	—	—	—	—	—	—	—	—	—	—	179
	0,333*D*	0,667*D*	—	—	—	—	—	—	—	—	—	—	268
	0,667*D*	1,5*D*	—	—	—	—	—	—	—	—	—	—	358
	1,5*D*	3,0*D*	—	—	—	—	—	—	—	—	—	—	448
4	—	0,333*D*	—	—	—	—	—	—	—	—	—	—	183
	0,333*D*	0,667*D*	—	—	—	—	—	—	—	—	—	—	281
	0,667*D*	1,5*D*	—	—	—	—	—	—	—	—	—	—	375
	1,5*D*	3,0*D*	—	—	—	—	—	—	—	—	—	—	469

NOTE — If the minor diameter tolerance provided by this table is less than the pitch diameter tolerance, use the latter.

Table 3 — Minor diameter tolerance for internal threads, T_{D1}, for special length of engagement: Class 3B — Sizes 0 to 12

Tolerances in 0,000 1 in

Threads per inch	Length of thread engagement		Thread sizes									
			0	1	2	3	4	5	6	8	10	12
n	above	up to and including	0,060	0,073	0,086	0,099	0,112	0,125	0,138	0,164	0,190	0,216
			T_{D1}									
80	—	0,333*D*	35	29	25	22	20	18	17	15	13	13
	0,333*D*	0,667*D*	49	44	38	34	30	28	26	22	20	20
	0,667*D*	1,5*D*	49	49	49	45	40	37	34	30	27	26
	1,5*D*	3,0*D*	49	49	49	49	49	46	43	37	33	33
72	—	0,333*D*	39	33	29	26	23	21	20	17	15	15
	0,333*D*	0,667*D*	55	49	43	38	35	32	29	26	23	22
	0,667*D*	1,5*D*	55	55	55	51	46	42	39	34	31	29
	1,5*D*	3,0*D*	55	55	55	55	55	53	49	43	39	36
64	—	0,333*D*	45	38	33	29	27	24	23	20	18	16
	0,333*D*	0,667*D*	62	57	49	44	40	37	34	30	27	25
	0,667*D*	1,5*D*	62	62	62	59	53	49	45	40	36	33
	1,5*D*	3,0*D*	62	62	62	62	62	61	57	50	45	41
56	—	0,333*D*	—	44	38	34	31	29	26	23	21	19
	0,333*D*	0,667*D*	—	66	57	51	46	43	40	35	32	29
	0,667*D*	1,5*D*	—	70	70	68	62	57	53	47	42	39
	1,5*D*	3,0*D*	—	70	70	70	70	70	66	59	53	49

Threads per inch	Length of thread engagement		Thread sizes									
	above	up to and including	0 0,060	1 0,073	2 0,086	3 0,099	4 0,112	5 0,125	6 0,138	8 0,164	10 0,190	12 0,216
n			T_{D1}									
48	—	0,333D	—	—	45	40	37	34	32	28	25	23
	0,333D	0,667D	—	—	68	61	55	51	47	42	38	35
	0,667D	1,5D	—	—	82	81	74	68	63	56	51	47
	1,5D	3,0D	—	—	82	82	82	82	79	70	63	59
44	—	0,333D	—	—	50	44	40	37	35	31	28	26
	0,333D	0,667D	—	—	75	67	61	56	52	46	42	39
	0,667D	1,5D	—	—	90	89	81	75	70	62	56	52
	1,5D	3,0D	—	—	90	90	90	90	87	77	70	65
40	—	0,333D	—	—	—	49	45	41	39	34	31	29
	0,333D	0,667D	—	—	—	74	67	62	58	51	47	43
	0,667D	1,5D	—	—	—	98	90	83	76	68	62	57
	1,5D	3,0D	—	—	—	98	98	98	96	86	78	72
36	—	0,333D	—	—	—	—	50	46	43	38	35	32
	0,333D	0,667D	—	—	—	—	75	69	65	58	52	43
	0,667D	1,5D	—	—	—	—	100	93	86	76	70	64
	1,5D	3,0D	—	—	—	—	109	109	108	96	87	81
32	—	0,333D	—	—	—	—	—	—	49	43	39	36
	0,333D	0,667D	—	—	—	—	—	—	73	65	59	55
	0,667D	1,5D	—	—	—	—	—	—	98	87	79	73
	1,5D	3,0D	—	—	—	—	—	—	122	108	99	91
28	—	0,333D	—	—	—	—	—	—	—	—	45	42
	0,333D	0,667D	—	—	—	—	—	—	—	—	68	63
	0,667D	1,5D	—	—	—	—	—	—	—	—	91	84
	1,5D	3,0D	—	—	—	—	—	—	—	—	113	105
24	—	0,333D	—	—	—	—	—	—	—	—	53	49
	0,333D	0,667D	—	—	—	—	—	—	—	—	79	73
	0,667D	1,5D	—	—	—	—	—	—	—	—	106	98
	1,5D	3,0D	—	—	—	—	—	—	—	—	132	122

NOTE — If the minor diameter tolerance as provided by this table is less than the pitch diameter tolerance, use the latter.

Table 4 — Minor diameter tolerance for internal thread, T_{D1}, for special length of engagement: Class 3B — Sizes 0,250 to 6,000

Tolerances in 0,000 1 in

Threads per inch	Length of thread engagement		Thread sizes												
n	above	up to and including	0,250	0,312 5	0,375	0,437 5	0,500	0,562 5	0,625	0,687 5	0,750	0,812 5	0,875	0,937 5	1,0 to 6
			T_{D1}												
80	—	0,333D	13	13	—	—	—	—	—	—	—	—	—	—	—
	0,333D	0,667D	20	20	—	—	—	—	—	—	—	—	—	—	—
	0,667D	1,500D	26	26	—	—	—	—	—	—	—	—	—	—	—
	1,500D	3,000D	33	33	—	—	—	—	—	—	—	—	—	—	—
72	—	0,333D	15	15	15	15	—	—	—	—	—	—	—	—	—
	0,333D	0,667D	22	22	22	22	—	—	—	—	—	—	—	—	—
	0,667D	1,500D	29	29	29	29	—	—	—	—	—	—	—	—	—
	1,500D	3,000D	36	36	36	36	—	—	—	—	—	—	—	—	—
64	—	0,333D	16	16	16	16	16	16	—	—	—	—	—	—	—
	0,333D	0,667D	24	24	24	24	24	24	—	—	—	—	—	—	—
	0,667D	1,500D	32	32	32	32	32	32	—	—	—	—	—	—	—
	1,500D	3,000D	40	40	40	40	40	40	—	—	—	—	—	—	—
56	—	0,333D	18	18	18	18	18	18	18	18	18	18	18	—	—
	0,333D	0,667D	27	27	27	27	27	27	27	27	27	27	27	—	—
	0,667D	1,500D	36	36	36	36	36	36	36	36	36	36	36	—	—
	1,500D	3,000D	45	45	45	45	45	45	45	45	45	45	45	—	—
48	—	0,333D	21	21	21	21	21	21	21	21	21	21	21	—	—
	0,333D	0,667D	32	31	31	31	31	31	31	31	31	31	31	—	—
	0,667D	1,500D	43	41	41	41	41	41	41	41	41	41	41	—	—
	1,500D	3,000D	54	52	52	52	52	52	52	52	52	52	52		
44	—	0,333D	24	22	22	22	22	22	22	22	22	22	22	—	—
	0,333D	0,667D	36	33	33	33	33	33	33	33	33	33	33	—	—
	0,667D	1,500D	47	45	45	45	45	45	45	45	45	45	45	—	—
	1,500D	3,000D	59	56	56	56	56	56	56	56	56	56	56	56	—
40	—	0,333D	26	24	24	24	24	24	24	24	24	24	24	24	24
	0,333D	0,667D	40	36	36	36	36	36	36	36	36	36	36	36	36
	0,667D	1,500D	58	48	48	48	48	48	48	48	48	48	48	48	48
	1,500D	3,000D	66	62	62	60	60	60	60	60	60	60	60	60	60
36	—	0,333D	30	26	26	26	26	26	26	26	26	26	26	26	26
	0,333D	0,667D	44	39	39	39	39	39	39	39	39	39	39	39	39
	0,667D	1,500D	59	53	52	52	52	52	52	52	52	52	52	52	52
	1,500D	3,000D	74	66	65	65	65	65	65	65	65	65	65	65	65
32	—	0,333D	34	30	29	29	29	29	29	29	29	29	29	29	29
	0,333D	0,667D	50	45	43	43	43	43	43	43	43	43	43	43	43
	0,667D	1,500D	67	60	57	57	57	57	57	57	57	57	57	57	57
	1,500D	3,000D	84	75	72	72	72	72	72	72	72	72	72	72	72
28	—	0,333D	39	34	32	32	32	32	32	32	32	32	32	32	32
	0,333D	0,667D	58	51	47	47	47	47	47	47	47	47	47	47	47
	0,667D	1,500D	77	69	63	63	63	63	63	63	63	63	63	63	63
	1,500D	3,000D	96	86	79	79	79	79	79	79	79	79	79	79	79

Threads per inch	Length of thread engagement		Thread sizes												
n	above	up to and including	0,250	0,312 5	0,375	0,437 5	0,500	0,562 5	0,625	0,687 5	0,750	0,812 5	0,875	0,937 5	1,0 to 6
			T_{D1}												
24	—	0,333D	45	40	37	35	35	35	35	35	35	35	35	35	35
	0,333D	0,667D	68	60	55	52	52	52	52	52	52	52	52	52	52
	0,667D	1,500D	90	80	73	70	70	70	70	70	70	70	70	70	70
	1,500D	3,000D	113	100	92	87	87	87	87	87	87	87	87	87	87
20	—	0,333D	54	48	44	41	39	39	39	39	39	39	39	39	39
	0,333D	0,667D	81	72	66	62	58	58	58	58	58	58	58	58	58
	0,667D	1,500D	108	96	88	82	78	78	78	78	78	78	78	78	78
	1,500D	3,000D	135	120	110	103	97	97	97	97	97	97	97	97	97
18	—	0,333D	—	53	49	45	43	41	41	41	41	41	41	41	41
	0,333D	0,667D	—	80	73	68	65	62	61	61	61	61	61	61	61
	0,667D	1,500D	—	106	97	91	86	82	81	81	81	81	81	81	81
	1,500D	3,000D	—	133	122	114	108	103	102	102	102	102	102	102	102
16	—	0,333D	—	—	54	51	48	46	44	43	43	43	43	43	43
	0,333D	0,667D	—	—	82	76	72	69	67	64	64	64	64	64	64
	0,667D	1,500D	—	—	109	102	96	92	89	86	85	85	85	85	85
	1,500D	3,000D	—	—	136	127	120	115	111	108	106	106	106	106	106
14	—	0,333D	—	—	—	58	54	52	50	49	47	46	45	44	44
	0,333D	0,667D	—	—	—	86	82	78	75	73	71	69	68	67	66
	0,667D	1,500D	—	—	—	115	109	104	100	97	95	92	91	89	88
	1,500D	3,000D	—	—	—	144	136	130	125	122	118	116	113	111	110
13	—	0,333D	—	—	—	—	58	56	54	52	50	50	49	48	47
	0,333D	0,667D	—	—	—	—	87	83	80	78	76	74	73	71	70
	0,667D	1,500D	—	—	—	—	117	111	107	104	101	99	97	95	94
	1,500D	3,000D	—	—	—	—	146	139	134	130	126	124	122	119	118
12	—	0,333D	—	—	—	—	63	60	58	56	54	53	52	51	50
	0,333D	0,667D	—	—	—	—	94	90	87	84	82	80	78	77	75
	0,667D	1,500D	—	—	—	—	125	120	115	112	109	106	104	102	100
	1,500D	3,000D	—	—	—	—	157	150	144	140	136	133	130	128	125
11	—	0,333D	—	—	—	—	—	—	62	60	58	58	56	55	54
	0,333D	0,667D	—	—	—	—	—	—	94	91	88	86	84	82	82
	0,667D	1,500D	—	—	—	—	—	—	125	121	117	115	112	110	109
	1,500D	3,000D	—	—	—	—	—	—	156	151	146	144	140	138	136
10	—	0,333D	—	—	—	—	—	—	—	66	64	62	61	60	60
	0,333D	0,667D	—	—	—	—	—	—	—	99	96	93	92	90	90
	0,667D	1,500D	—	—	—	—	—	—	—	131	128	125	122	120	120
	1,500D	3,000D	—	—	—	—	—	—	—	164	160	156	153	150	150
9	—	0,333D	—	—	—	—	—	—	—	—	—	68	67	66	66
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	103	100	100	100
	0,667D	1,500D	—	—	—	—	—	—	—	—	—	137	134	133	133
	1,500D	3,000D	—	—	—	—	—	—	—	—	—	171	168	166	166
8	—	0,333D	—	—	—	—	—	—	—	—	—	75	75	75	75
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	112	112	112	112
	0,667D	1,500D	—	—	—	—	—	—	—	—	—	150	150	150	150
	1,500D	3,000D	—	—	—	—	—	—	—	—	—	188	188	188	188

Threads per inch	Length of thread engagement		Thread sizes												
n	above	up to and including	0,250	0,312 5	0,375	0,437 5	0,500	0,562 5	0,625	0,687 5	0,750	0,812 5	0,875	0,937 5	1,0 to 6
			T_{D1}												
7	—	0,333D	—	—	—	—	—	—	—	—	—	—	—	86	86
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	—	—	129	129
	0,667D	1,500D	—	—	—	—	—	—	—	—	—	—	—	171	171
	1,500D	3,000D	—	—	—	—	—	—	—	—	—	—	—	214	214
6	—	0,333D	—	—	—	—	—	—	—	—	—	—	—	—	100
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	—	—	—	150
	0,667D	1,500D	—	—	—	—	—	—	—	—	—	—	—	—	200
	1,500D	3,000D	—	—	—	—	—	—	—	—	—	—	—	—	250
5	—	0,333D	—	—	—	—	—	—	—	—	—	—	—	—	120
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	—	—	—	180
	0,667D	1,500D	—	—	—	—	—	—	—	—	—	—	—	—	240
	1,500D	3,000D	—	—	—	—	—	—	—	—	—	—	—	—	300
4,5	—	0,333D	—	—	—	—	—	—	—	—	—	—	—	—	133
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	—	—	—	200
	0,667D	1,500D	—	—	—	—	—	—	—	—	—	—	—	—	267
	1,500D	3,000D	—	—	—	—	—	—	—	—	—	—	—	—	333
4	—	0,333D	—	—	—	—	—	—	—	—	—	—	—	—	150
	0,333D	0,667D	—	—	—	—	—	—	—	—	—	—	—	—	225
	0,667D	1,500D	—	—	—	—	—	—	—	—	—	—	—	—	300
	1,500D	3,000D	—	—	—	—	—	—	—	—	—	—	—	—	375

NOTE — If the minor diameter tolerance as provided by this table is less than the pitch diameter tolerance, use the latter.