ASME B1.13M-2005
(Revision of ASME B1.13M-2001)

Metric Screw Threads: M Profile

AN AMERICAN NATIONAL STANDARD



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FOREWORD

In 1966, ANSI Standards Committee B1 — Standardization and Unification of Screw Threads — started preparation of a document for ISO Metric Screw Threads based on the current ISO recommendations and draft documents. Since there were some uncertainties as to the acceptance of this thread by American industries, the information was published in August 1967 with the title, "Interpretative Document Metric Screw Threads B1.13." This document was never approved as an ANSI standard.

A revision of the information based on the then current ISO standards and recommendations was published in April 1972 with the title "B1 Report — ISO Metric Screw Threads." Again, the document was never approved as an ANSI standard. The document number was therefore removed and the status changed to a report.

Interest in metric screw threads has grown at a rapid pace over the past several years with the advent of greater import and export business. The American National Standards Institute, in April 1971, established a committee, ANSI Special Committee to Study Development of an Optimum Metric Fastener System (OMFS). Included in the scope was metric screw threads. Recommendations were submitted to a joint ISO/TC1/TC2 working group established in September 1973 to study the OMFS proposals.

An ISO/TC1/TC2 Ad Hoc Advisory Panel meeting in April 1975 in Munich reached a compromise between the OMFS recommendations and the existing ISO screw thread system. This compromise was approved, in the main, by the ISO/TC1 in its eleventh plenary meeting in Stockholm, June 1976.

(a) The first issue of this Standard, designated ANSI B1.13M, was approved as an American National Standard on February 12, 1979. It provided a system of metric screw threads for general fastening purposes in mechanisms and structures and was in basic agreement with ISO screw thread standards and resolutions current at that time. It featured detailed information for diameter-pitch combinations selected as preferred standard sizes.

(b) The 1983 issue of this Standard was designated ANSI/ASME B1.13M-1983 and was approved as an American National Standard on August 5, 1983. It updated the 1979 issue to include

(1) the addition of the new ISO tolerance position *f*

(2) the addition of a section on dimensional accommodation of coating or plating

(3) the addition of a section on lead and flank angle tolerances

(c) The 1995 issue of this Standard was designated ASME B1.13M-1995 and was approved as an American National Standard on February 20, 1995. It updated the 1983 issue to include

(1) the addition of an 8 mm pitch series

(2) the addition of standard size M10 × 1

(3) the provision for adjustment of internal thread tolerance class for short and long lengths of thread engagement, which may be used instead of external thread class adjustment

(4) changes in rounding procedures that follow the principles of ASME B1.30M

(d) The 2001 issue of this Standard was designated ASME B1.13M-2001 and was approved as an American National Standard on May 22, 2001. It updated the 1995 issue to include

(1) incorporation of changes made in the 1998 issue of ISO 261, including addition of diameters 125, 130, and 140 in the 8 mm pitch series; and changing of the 7 mm diameter from 3rd to 2nd choice in Table 6.

(2) recognition of changes made in the 1998 issue of ISO 965-1, including the stating of when International practice permits thread designation without thread class (not USA practice); and modifying the designation of multiple lead threads to be more in line with ISO practice.

(3) incorporation of the new 1998 International Standard, ISO 965-5, by adding Nonmandatory Appendix E for Class AX threads.

(4) minor changes in some thread root diameters due to modified calculation and rounding procedures added in ASME B1.30. ASME B1.30 uses rounding upward when the digit following

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the last rounded place is a 5 followed by zeros. Prior to issue of ASME B1.30, rounding was to the nearest even digit. Tabulated values appearing in ISO Standards are not subject to rounding rules of ASME B1.30.

(5) changes in Circular Runout tolerances.

(6) other required updates and corrections.

(e) This issue updates the 2001 edition and includes

(1) addition of a new Nonmandatory Appendix F to provide a new tolerance position *E*

(2) addition of tolerance class 6h as a preferred class

(3) addition of M8 x 1.25 – 6AX to Nonmandatory Appendix E

(4) revision of section 8 on "Dimensional Accommodation of Coating or Plating..." to include allowances at thread roots and to expand the information on internal threads

(5) revision of section 7 to provide thread designations in accordance with ASME Y14.6-2001

(6) revision of some tabulated inch translation values in Nonmandatory Appendix C and the examples of calculation of thread size values in para. 9.4, in accordance with ASME B1.30-2002

(7) addition of para. 7.9 for designation of a thread with adjusted size limits

(8) other required editorial updates and corrections

Suggestions for improvement of this Standard are welcome. They should be sent to Secretary, ASME B1 Standards Committee, Three Park Avenue, New York, NY 10016-5990.

This revision was approved as an American National Standard on September 29, 2005.

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Standardization and Unification of Screw Threads

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METRIC SCREW THREADS: M PROFILE

1 GENERAL

1.1 Scope

This Standard contains general metric standards for a 60 deg symmetrical screw thread with a basic ISO 68-1 profile designated M profile. The M profile threads of tolerance class 6H/6g are intended for metric applications where inch class 2A/2B have been used. At the minimum material limits, the 6H/6g results in a looser fit than the 2A/2B. Tabular data is also provided for a tighter tolerance fit external thread of class 4g6g, which is approximately equivalent to the inch class 3A but with an allowance applied. Formulation and tolerancing data is included for applications requiring other fits.

NOTE: A 4H5H/4h6h is approximately equivalent to a class 3A/3B fit in the inch system.

1.2 Interchangeability

Threads produced to this Standard are fully interchangeable with threads conforming to other National Standards that are based on ISO 68-1 basic profile and ISO 965-1 tolerance practices.

1.2.1 Assembly. Threads produced in accordance with M profile and MJ profile (ASME B1.21M) design data will assemble with each other. However, external MJ threads will encounter interference on the root radii with internal M thread crests when both threads are at maximum material condition.

1.3 References

The latest issues of the following documents form a part of this Standard to the extent specified herein.

ASME B1.3, Screw Thread Gaging Systems for Dimensional Acceptability — Inch and Metric Screw Threads (UN, UNR, UNJ, M, and MJ)

ASME B1.7M, Nomenclature, Definitions, and Letter Symbols for Screw Threads

ASME B1.16M, Gages and Gaging for Metric M Screw Threads

ASME B1.21M, Metric Screw Threads: MJ Profile

ASME B1.30, Screw Threads — Standard Practice for Calculating and Rounding Dimensions

ASME B47.1, Gage Blanks

ASME Y14.5, Dimensioning and Tolerancing

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2900, Fairfield, NJ 07007-2900

ASTM F568M, Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

Publisher: The American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

ISO 3, Preferred Numbers — Series of Preferred Numbers

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 724, ISO Metric Screw Threads — Basic Dimensions

ISO 898-1, Mechanical Properties of Fasteners — Part 1: Bolts, Screws, and Studs

ISO 965-1, ISO General Purpose Metric Screw Threads — Tolerances — Part 1: Principles and Basic Data

Publisher: International Organization for Standardization (ISO), 1 rue de Varembé, Case Postale 56, CH-1211, Genève 20, Switzerland/Suisse

SAE J1199, Mechanical and Material Requirements for Metric Externally Threaded Steel Fasteners

Publisher: Society of Automotive Engineers (SAE), 400 Commonwealth Drive, Warrendale, PA 15096-0001

1.4 Acceptability

Acceptability of product threads shall be in accordance with ASME B1.3. Gages and gaging are in accordance with ASME B1.16M.

1.5 Reference Temperature

The reference temperature is 20°C for dimensions defined by this system.

1.6 General Symbols

The general symbols used to describe the metric screw thread forms are shown in Table 1.

1.7 Units

All dimensions and all values in the formulas are expressed in millimeters unless otherwise noted. Values in terms of sharp vee-thread height (height of fundamental triangle), H, are used to be consistent with ISO Standards, but actual formulations and calculations are based on values of pitch, P. See Table 2.

1.8 Federal Government Use

When this Standard is approved by the Department of Defense and Federal Agencies and is incorporated

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Table 1 General Symbols

Symbol [Note (1)]	Explanation	Symbol [Note (1)]	Explanation
D	Major diameter internal thread	EI	Lower deviation, internal thread allowance (fundamental deviation). See Fig. 4.
D_1	Minor diameter internal thread		
D_2	Pitch diameter internal thread	G, H	Letter designations for tolerance positions for lower deviation, internal thread
d	Major diameter external thread		
d_1	Minor diameter external thread	g, h	Letter designations for tolerance positions for upper deviation, external thread
d_2	Pitch diameter external thread		
d_3	Rounded form minor diameter external thread	es	Upper deviation, external thread allowance (fundamental deviation). See Fig. 4. In the ISO System, *es* is always negative for an allowance fit or zero for no allowance.
P	Pitch		
r	External thread root radius		
T	Tolerance	ei	Lower deviation, external thread [equals the allowance (fundamental deviation) plus the tolerance]. See Fig. 4. In the ISO system, *ei* is always negative for an allowance fit.
TD_1, TD_2	Tolerances for D_1, D_2		
Td, Td_2	Tolerances for d, d_2		
ES	Upper deviation, internal thread [equals the allowance (fundamental deviation) plus the tolerance]. See Fig. 4.	H	Height of fundamental triangle
		LE	Length of engagement
		LH	Left hand thread

NOTE:
(1) Subscripts "bsc," "max." and "min." indicate "basic," "maximum," and "minimum" sizes, respectively.

into FED-STD-H28/21, *Screw Thread Standards for Federal Services Section 21*, the use of this Standard by the Federal Government is subject to all the requirements and limitations of FED-STD-H28/21.

2 TERMINOLOGY

2.1 Definitions

allowance: the prescribed difference between the design (maximum material) size and the basic size. It is numerically equal to the absolute value of the ISO term *fundamental deviation*.

NOTE: *Allowance* is not an ISO metric screw thread term but will be used together with the ISO term *fundamental deviation*.

basic thread profile: the cyclic outline, in an axial plane, of the permanently established boundary between the provinces of the external and internal threads. All deviations are with respect to this boundary. See Figs. 1 and 4.

bolt thread (external thread): the term used in ISO metric thread standards to describe all external threads. All symbols associated with external threads are designated with lowercase letters. This Standard will refer only to *external threads* in accordance with U.S. practice.

crest diameter: the major diameter of an external thread and the minor diameter of an internal thread.

design profiles: the maximum material profiles permitted for external and internal threads for a specified tolerance class. See Figs. 2 and 3.

deviation: in ISO usage, the algebraic difference between a size (actual, maximum, minimum, etc.) and the corresponding basic size. The term *deviation* does not necessarily indicate an error.

fit: the general term used to signify range of tightness or looseness that results from application of a specific combination of allowances and tolerances in mating parts.

fundamental deviation: for standard threads, the deviation (upper or lower) closer to the basic size. It is the upper deviation, *es*, for an external thread and the lower deviation, *EI*, for an internal thread. See Fig. 4; also see *allowance* and *tolerance position*.

NOTE: The U.S. term *allowance* will be used as a primary term in this Standard, where applicable.

lower deviation: the algebraic difference between the minimum limit of size and the corresponding basic size. See para. 5.1.4.

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Table 2 Thread Data, M Profile

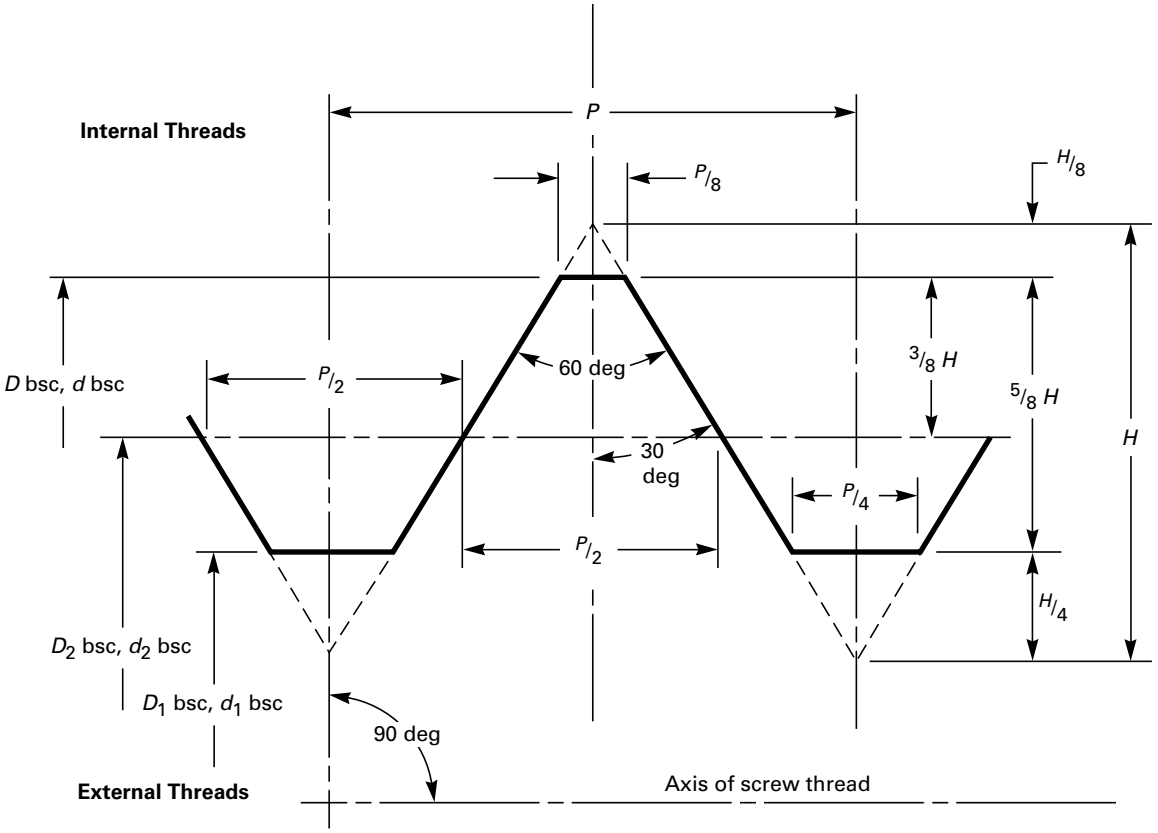
Pitch, P	Truncation of Internal Thread Root and External Thread Crest, $\frac{H}{8}$ 0.1082532P	Addendum of Internal Thread and Truncation of Internal Thread, $\frac{H}{4}$ 0.2165064P	Dedendum of Internal Thread and Addendum of External Thread, $\frac{3}{8}H$ 0.3247595P	Difference Between Max. Theoretical Pitch Diam. and Max. Minor Diam. of External Thread, and Min. Theoretical Pitch Diam. and Min. Minor Diam. of Internal Thread, $\frac{H}{2}$ 0.4330127P	Height of Internal Thread and Depth of Thread Engagement, $\frac{5}{8}H$ 0.5412659P	Difference Between Min. Theoretical Pitch Diam. and Min. Design Minor Diam. of External Thread for 0.125P Root Radius, 0.711325H 0.6160254P	Twice the External Thread Addendum, $\frac{3}{4}H$ 0.6495191P	Difference Between Max. Major and Max. Theoretical Pitch Diam. of Internal Thread, $\frac{11}{12}H$ 0.7938566P	Height of Sharp V-Thread, H 0.8660254P	Double Height of Internal Thread, $\frac{5}{4}H$ 1.0825318P
0.2	0.02165	0.04330	0.06495	0.08660	0.10825	0.12321	0.12990	0.15877	0.17321	0.21651
0.25	0.02706	0.05413	0.08119	0.10825	0.13532	0.15401	0.16238	0.19846	0.21651	0.27063
0.3	0.03248	0.06495	0.09743	0.12990	0.16238	0.18481	0.19486	0.23816	0.25981	0.32476
0.35	0.03789	0.07578	0.11367	0.15155	0.18944	0.21561	0.22733	0.27785	0.30311	0.37889
0.4	0.04330	0.08660	0.12990	0.17321	0.21651	0.24641	0.25981	0.31754	0.34641	0.43301
0.45	0.04871	0.09743	0.14614	0.19486	0.24357	0.27721	0.29228	0.35724	0.38971	0.48714
0.5	0.05413	0.10825	0.16238	0.21651	0.27063	0.30801	0.32476	0.39693	0.43301	0.54127
0.6	0.06495	0.12990	0.19486	0.25981	0.32476	0.36962	0.38971	0.47631	0.51962	0.64952
0.7	0.07578	0.15155	0.22733	0.30311	0.37889	0.43122	0.45466	0.55570	0.60622	0.75777
0.75	0.08119	0.16238	0.24357	0.32476	0.40595	0.46202	0.48714	0.59539	0.64952	0.81190
0.8	0.08660	0.17321	0.25981	0.34641	0.43301	0.49282	0.51962	0.63509	0.69282	0.86603
1	0.10825	0.21651	0.32476	0.43301	0.54127	0.61603	0.64952	0.79386	0.86603	1.08253
1.25	0.13532	0.27063	0.40595	0.54127	0.67658	0.77003	0.81190	0.99232	1.08253	1.35316
1.5	0.16238	0.32476	0.48714	0.64952	0.81190	0.92404	0.97428	1.19078	1.29904	1.62380
1.75	0.18944	0.37889	0.56833	0.75777	0.94722	1.07804	1.13666	1.38925	1.51554	1.89443
2	0.21651	0.43301	0.64952	0.86603	1.08253	1.23205	1.29904	1.58771	1.73205	2.16506
2.5	0.27063	0.54127	0.81190	1.08253	1.35316	1.54006	1.62380	1.98464	2.16506	2.70633
3	0.32476	0.64952	0.97428	1.29904	1.62380	1.84808	1.94856	2.38157	2.59808	3.24760
3.5	0.37889	0.75777	1.13666	1.51554	1.89443	2.15609	2.27332	2.77850	3.03109	3.78886
4	0.43301	0.86603	1.29904	1.73205	2.16506	2.46410	2.59808	3.17543	3.46410	4.33013
4.5	0.48714	0.97428	1.46142	1.94856	2.43570	2.77211	2.92284	3.57235	3.89711	4.87139
5	0.54127	1.08253	1.62380	2.16506	2.70633	3.08013	3.24760	3.96928	4.33013	5.41266
5.5	0.59539	1.19079	1.78618	2.38157	2.97696	3.38814	3.57236	4.36621	4.76314	5.95392
6	0.64952	1.29904	1.94856	2.59808	3.24760	3.69615	3.89711	4.76314	5.19615	6.49519
8	0.86603	1.73205	2.59808	3.46410	4.33013	4.92820	5.19615	6.35085	6.92820	8.66025

GENERAL NOTES:

(a) All dimensions are in millimeters.

(b) Rounding in accordance with ASME B1.30.

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GENERAL NOTES: $H = \sqrt{3}/2 \times P = 0.866025\ P$

$0.125\ H = 0.108253\ P$
$0.250\ H = 0.216506\ P$
$0.375\ H = 0.324760\ P$
$0.625\ H = 0.541266\ P$

Fig. 1 Basic M Thread Profile (ISO 68-1 Basic Profile)

nut thread (internal thread): a term used in ISO metric thread standards to describe all internal threads. All symbols associated with internal threads are designated with uppercase letters. This Standard will refer to the term *internal thread* in accordance with U.S. practice.

tolerance: the total amount of variation permitted for the size of a dimension. It is the difference between the maximum limit of size and the minimum limit of size (i.e., algebraical difference between the upper deviation and the lower deviation). The tolerance is an absolute value without sign. Tolerance for threads is applied to the design size in the direction of minimum material. Therefore, tolerances are applied as negative values on external threads and as positive values on internal threads.

tolerance class: the combination of a tolerance position with a tolerance grade. It specifies the allowance (fundamental deviation) and tolerance for the pitch and major diameters of external threads and the pitch and minor diameters of internal threads.

tolerance grade: a numerical symbol that designates the tolerances of crest diameters and pitch diameters applied to the design profiles.

tolerance position: a letter symbol that designates the position of the tolerance zone in relation to the basic size. This position provides the allowance (fundamental deviation).

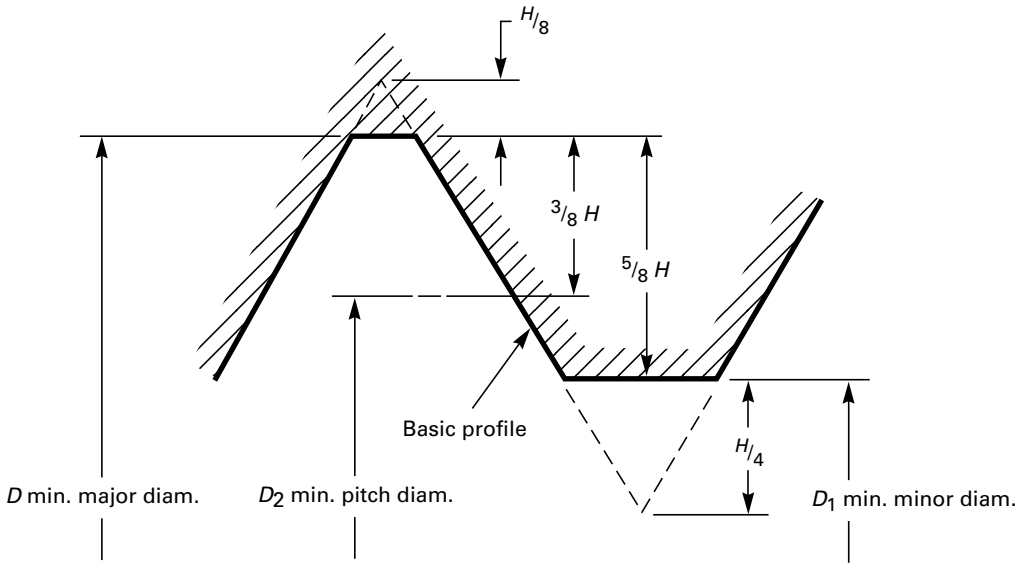
upper deviation: the algebraic difference between the maximum limit of size and the corresponding basic size. See para. 5.1.3.

3 SCREW THREAD PROFILE

3.1 Basic M Thread Profile

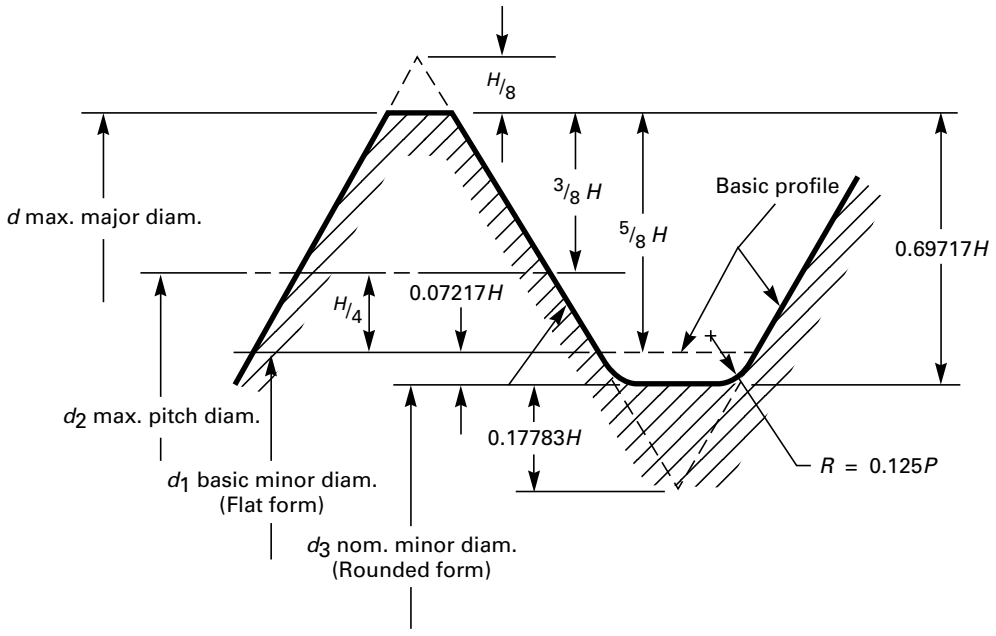
The basic M thread profile also known as the ISO 68-1 Basic Profile for metric screw threads is depicted in Fig. 1 with the associated dimensions listed in Table 2.

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GENERAL NOTE: For dimensions, see Table 2.

Fig. 2 Internal Thread, Design M Profile With No Allowance (Fundamental Deviation) (Maximum Material Condition)



GENERAL NOTE: For dimensions, see Table 2.

Fig. 3 External Thread, Design M Profile With No Allowance (Fundamental Deviation) (Flanks at Maximum Material Condition)

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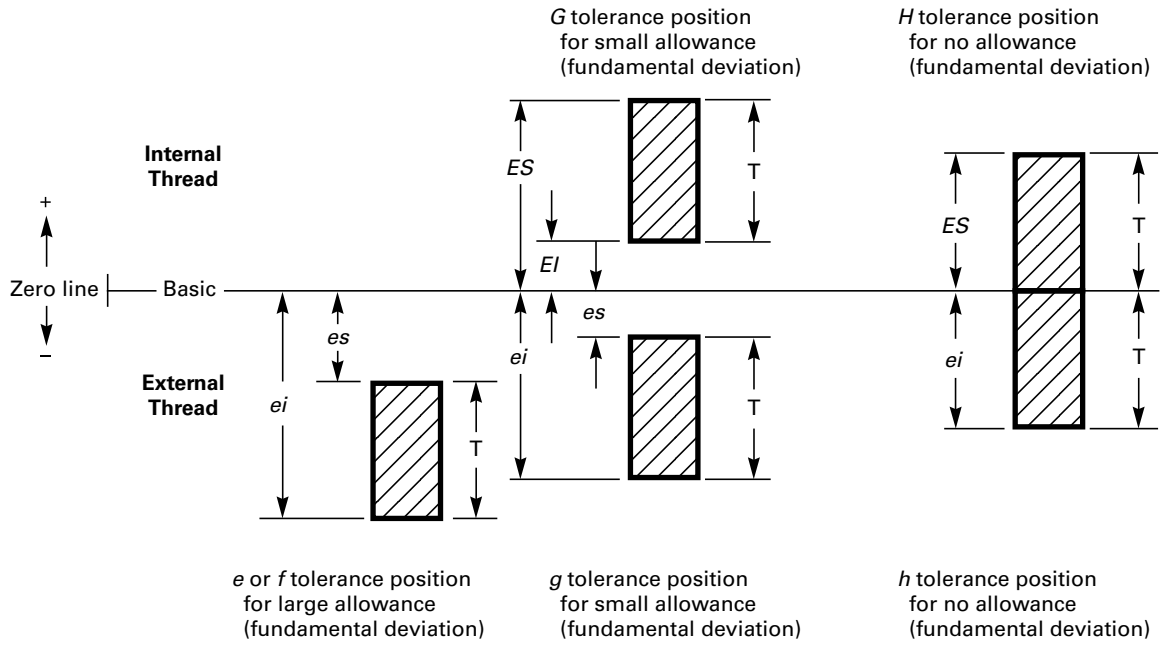


Fig. 4 Metric Tolerance System for Screw Threads

3.2 Design M Profiles

3.2.1 Internal Thread. The design M profile for the internal thread at the no allowance maximum material condition is the basic ISO 68-1 profile. See Fig. 2 and thread data in Table 2.

3.2.2 External Thread. The design M profile for the external thread at the no allowance maximum material condition is the basic ISO 68-1 profile except where a rounded root is required. For the standard 0.125*P* min. radius, the ISO 68-1 profile is modified at the root with a 0.17783*H* truncation blending into two arcs with radii of 0.125*P* tangent to the thread flanks. See Fig. 3 and thread data in Table 2.

3.3 Crest and Root Forms

3.3.1 Rounded Crest and Root Forms. The crest and root tolerance zones at the major and minor diameters will permit rounded crest and root forms in both the external and internal threads.

3.3.2 External Thread Root. The root profile of the thread shall lie within the section lined tolerance zone shown in Fig. 5. For the rounded root thread, the root profile of the external thread shall lie within the section lined rounded root tolerance zone shown in Fig. 5. The profile shall be a continuous smoothly blended nonreversing curve, no part of which shall have a radius of less than 0.125*P*, which is tangential to the thread flank. The profile may comprise tangent flank arcs that are joined by a tangential flat at the root. The limit values of the root radius *r* are specified in Table 3. The maximum truncation is:

$$\frac{H}{4} - r \text{ min.} \left\{ 1 - \cos \left[60 \text{ deg} - \arccos \left(1 - \frac{Td_2}{4\, r \text{ min.}} \right) \right] \right\}$$

and the minimum truncation is 0.14434*H*. (See Fig. 5.) The M profile with a minimum root radius of 0.125*P* on the external thread is desirable for all threads but is required for threaded mechanical fasteners of SAE J1199, ASTM F 568M, and ISO 898-1 property class 8.8 (minimum tensile strength 800 MPa) and stronger. (See Fig. 5.)

3.3.3 Internal Thread Root. The root profile shall not be smaller than the basic profile. The maximum major diameter shall not be sharp.

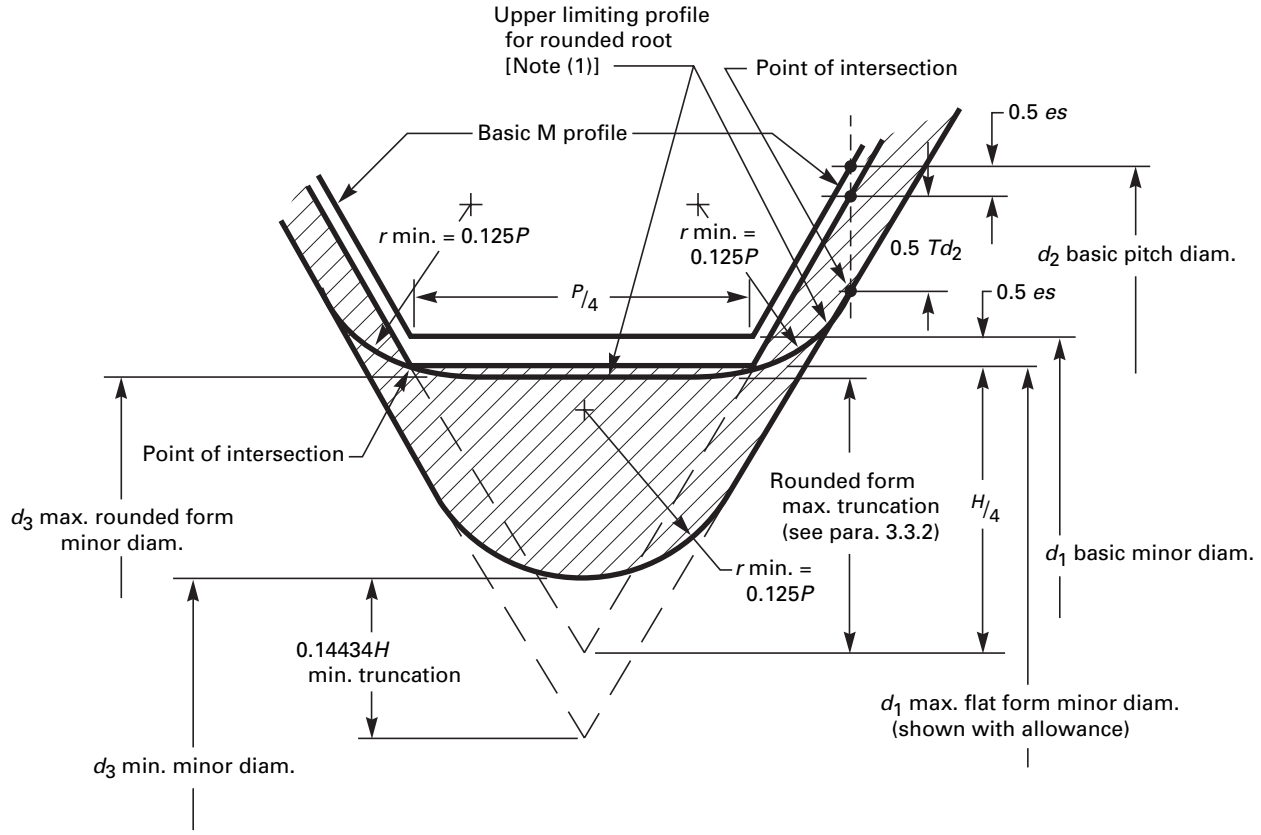
4 SERIES OF THREADS

4.1 Standard Coarse Pitch General Purpose and Mechanical Fastener Series, M Profile

The standard metric screw thread series for general purpose equipment's threaded components design and mechanical fasteners is a coarse thread series. Their diameter/pitch combinations are listed in Table 4.

NOTE: The words *coarse* and *fine* are given in order to conform to usage. No concept of quality shall be associated with these

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GENERAL NOTE: Section-lined portions identify tolerance zone and unshaded portions identify allowance (fundamental deviation).

NOTE:

(1) The upper limiting profile for rounded root form allows no tolerance for flank wear of a tool producing it and is therefore not to be used as a design profile. Rather, it is an indication of the limiting acceptable condition for the rounded root form which will pass a GO thread gage.

Fig. 5 M Profile, External Thread Root, Upper and Lower Limiting Profiles for *r* min. = 0.125*P* and for Flat Root Form (Shown for Tolerance Position *g*)

words. Coarse pitches only indicate the largest metric pitches used in current practice.

4.2 Standard Fine Pitch M Profile Screw Threads

Table 5 lists additional diameter/pitch combinations that are standard for general purpose equipment's threaded components design.

4.3 Preferred Sizes

Diameter/pitch combinations shown in Table 4 are the preferred sizes and should be the first choice, as applicable.

4.4 ISO Metric Thread Series

The Thread Series given in Table 6 are identical to those published in ISO 261 for diameters of 1.6 mm and larger. Diameter/pitch combinations from Tables 4 and 5 are shown in boldface. Selection of series shown in regular type shall be limited to unusual requirements where the selections in accordance with paras. 4.1, 4.2, and 4.3 cannot be used.

5 ALLOWANCES AND TOLERANCES

5.1 ISO System of Limits and Fits as Applied to Screw Threads

5.1.1 General. The international metric tolerance system is based on a system of limits and fits. The limits of the tolerances on the mating parts and their allowances (fundamental deviations) determine the fit of the assembly. For simplicity, the system is described for cylindrical parts. Holes are equivalent to internally threaded surfaces and shafts to externally threaded surfaces.

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Table 3 Limit Values for M Profile Minimum Rounded Root Radius

P	Min. Root Radius, 0.125*P*	*P*	Min. Root Radius, 0.125*P*
0.2	0.025	1.25	0.156
0.25	0.031	1.5	0.188
0.3	0.038	1.75	0.219
		2	0.250
0.35	0.044	2.5	0.313
0.4	0.050	3	0.375
0.45	0.056	3.5	0.438
0.5	0.063	4	0.500
0.6	0.075	4.5	0.563
0.7	0.088	5	0.625
		5.5	0.688
0.75	0.094	6	0.750
0.8	0.100		
1	0.125	8	1.000

GENERAL NOTE: All dimensions are in millimeters.

Table 4 Standard Coarse Pitch M Profile General Purpose and Mechanical Fastener Series

Nominal Size	Pitch	Nominal Size	Pitch
1.6	0.35	20	2.5
2	0.4	22	2.5 [Note (1)]
2.5	0.45	24	3
		27	3 [Note (1)]
3	0.5	30	3.5
3.5	0.6		
4	0.7	36	4
		42	4.5
5	0.8	48	5
6	1		
8	1.25	56	5.5
		64	6
10	1.5	72	6 [Note (2)]
12	1.75		
14	2	80	6 [Note (2)]
16	2	90	6 [Note (2)]
		100	6 [Note (2)]

GENERAL NOTE: All dimensions are in millimeters.

NOTES:

(1) For high strength structural steel fasteners only.

(2) Designated as part of 6 mm fine pitch series in ISO 261.

5.1.2 Basic Size. This is the zero line or surface at assembly, where the interface of the two mating parts have a common reference.

5.1.3 Upper Deviation. This is the algebraic difference between the maximum limit of size and the basic size. It is designated by the French term *écart superieur* (*ES* for holes and *es* for shafts).

Table 5 Standard Fine Pitch M Profile Screw Threads

Nominal Size	Pitch			Nominal Size	Pitch	
				55	1.5	...
8	1	...	...	56	...	2
10	0.75	1	1.25	60	1.5	...
12	1	1.5	1.25	64	...	2
14	...	...	1.5	65	1.5	...
15	1	...	...	70	1.5	...
16	...	...	1.5	72	...	2
17	1	...	...	75	1.5	...
18	...	...	1.5	80	1.5	2
20	1	...	1.5	85	...	2
22	...	...	1.5	90	...	2
24	...	...	2	95	...	2
25	1.5	...	...	100	...	2
27	...	...	2	105	...	2
30	1.5	...	2	110	...	2
33	...	...	2	120	...	2
35	1.5	...	...	130	...	2
36	...	...	2	140	...	2
39	...	...	2	150	...	2
40	1.5	...	...	160	...	3
42	...	...	2	170	...	3
45	1.5	...	...	180	...	3
48	...	...	2	190	...	3
50	1.5	...	...	200	...	3

GENERAL NOTE: All dimensions are in millimeters.

5.1.4 Lower Deviation. This is the algebraic difference between the minimum limit of size and the basic size. It is designated by the French term *écart inferieur* (*EI* for holes and *ei* for shafts).

5.1.5 Fundamental Deviations (Allowances). These are the deviations that are closest to the basic size. In Fig. 4 they would be *EI* and *es*. Fundamental deviations are designated by alphabetical letters. See para. 5.3.

5.1.6 Fits. Fits are determined by the fundamental deviation, which may be positive or negative, assigned to the mating parts. The selected fits can be clearance, transition, and interference. To illustrate fits schematically, a zero line is drawn to represent the basic size. By convention, the shaft always lies below the zero line and the hole lies above the zero line (except for interference fits). This makes the fundamental deviation negative for the shaft and equal to its upper deviation, *es*. The fundamental deviation is positive for the hole and equal to its lower deviation, *EI*. See Fig. 4.

5.1.7 Tolerance. Defined by a series of numerical grades, each grade provides numerical values for nominal sizes corresponding to the standard tolerance. See para. 5.2. When the tolerance is applied to the schematic

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Table 6 ISO 261 Diameter/Pitch Combinations From Which the Standards Were Selected

Nominal Diameters			Pitches										
				Fine									
Col. 1 1st Choice	Col. 2 2nd Choice	Col. 3 3rd Choice	Coarse	3	2	1.5	1.25	1	0.75	0.5	0.35	0.25	0.2
1.6			**0.35**	...	...	...	...	...	...	...	...	...	0.2
	1.8		0.35	...	...	...	...	...	...	...	...	...	0.2
2			**0.4**	...	...	...	...	...	...	...	...	0.25	...
	2.2		0.45	...	...	...	...	...	...	...	...	0.25	...
2.5			**0.45**	...	...	...	...	...	...	...	0.35	...	...
3			**0.5**	...	...	...	...	...	...	...	0.35	...	...
	3.5		**0.6**	...	...	...	...	...	...	...	0.35	...	...
4			**0.7**	...	...	...	...	...	...	0.5	...	...	...
	4.5		0.75	...	...	...	...	...	...	0.5	...	...	...
5			**0.8**	...	...	...	...	...	...	0.5	...	...	...
		5.5	...	...	...	...	...	...	...	0.5	...	...	...
6			**1**	...	...	...	...	...	0.75	...	...	...	...
	7		1	...	...	...	...	...	0.75	...	...	...	...
8			**1.25**	...	...	...	...	**1**	0.75	...	...	...	...
		9	1.25	...	...	...	...	1	0.75	...	...	...	...
10			**1.5**	...	...	...	**1.25**	**1**	**0.75**	...	...	...	...
		11	1.5	...	...	...	...	1	0.75	...	...	...	...
12			**1.75**	...	...	**1.5**	**1.25**	**1**	...	...	...	...	...
	14		**2**	...	...	**1.5**	1.25 [Note (1)]	1	...	...	...	...	...
		15	...	...	...	1.5	...	**1**	...	...	...	...	...
16			**2**	...	...	**1.5**	...	1	...	...	...	...	...
		17	...	...	...	1.5	...	**1**	...	...	...	...	...
	18		2.5	...	2	**1.5**	...	1	...	...	...	...	...
20			**2.5**	...	2	**1.5**	...	**1**	...	...	...	...	...
	22		**2.5** [Note (2)]	...	2	**1.5**	...	1	...	...	...	...	...
24			**3**	...	**2**	1.5	...	1	...	...	...	...	...
		25	...	...	2	**1.5**	...	1	...	...	...	...	...
		26	...	...	...	1.5	...	...	...	...	...	...	...
	27		**3** [Note (2)]	...	**2**	1.5	...	1	...	...	...	...	...
		28	...	...	2	1.5	...	1	...	...	...	...	...
30			**3.5**	(3) [Note (3)]	**2**	**1.5**	...	1	...	...	...	...	...
		32	...	...	2	1.5	...	...	...	...	...	...	...
	33		3.5	(3) [Note (3)]	**2**	1.5	...	...	...	...	...	...	...
		35 [Note (4)]	...	...	...	**1.5**	...	...	...	...	...	...	...
36			**4**	3	**2**	1.5	...	...	...	...	...	...	...
		38	...	...	...	1.5	...	...	...	...	...	...	...
	39		4	3	**2**	1.5	...	...	...	...	...	...	...

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Table 6 ISO 261 Diameter/Pitch Combinations From Which the Standards Were Selected (Cont'd)

Nominal Diameters			Pitches						
				Fine					
Col. 1 1st Choice	Col. 2 2nd Choice	Col. 3 3rd Choice	Coarse	8	6	4	3	2	1.5
		40	...	...	...	...	3	2	**1.5**
42			**4.5**	...	...	4	3	**2**	1.5
	45		4.5	...	...	4	3	2	**1.5**
48			**5**	...	...	4	3	**2**	1.5
		50	...	...	...	...	3	2	**1.5**
	52		5	...	...	4	3	2	1.5
		55	...	...	...	4	3	2	**1.5**
56			**5.5**	...	...	4	3	**2**	1.5
		58	...	...	...	4	3	2	1.5
	60		5.5	...	...	4	3	2	**1.5**
		62	...	...	...	4	3	2	1.5
64			**6**	...	...	4	3	**2**	1.5
		65	...	...	...	4	3	2	**1.5**
	68		6	...	...	4	3	2	1.5
		70	...	...	6	4	3	2	**1.5**
72			...	...	**6**	4	3	**2**	1.5
		75	...	...	...	4	3	2	**1.5**
	76		...	...	6	4	3	2	1.5
		78	...	...	...	...	...	2	...
80			...	...	**6**	4	3	**2**	**1.5**
		82	...	...	...	...	...	2	...
	85		...	...	6	4	3	**2**	...
90			...	...	**6**	4	3	**2**	...
	95		...	...	6	4	3	**2**	...
100			...	...	**6**	4	3	**2**	...
	105		...	...	6	4	3	**2**	...
110			...	...	6	4	3	**2**	...
	115		...	...	6	4	3	2	...
	120		...	...	6	4	3	**2**	...
125			...	8	6	4	3	2	...
	130		...	8	6	4	3	**2**	...
		135	...	...	6	4	3	2	...
140			...	8	6	4	3	**2**	...
		145	...	...	6	4	3	2	...
	150		...	8	6	4	3	**2**	...
		155	...	...	6	4	3	...	...
160			...	8	6	4	**3**	...	...
		165	...	...	6	4	3	...	...
	170		...	8	6	4	**3**	...	...
		175	...	...	6	4	3	...	...
180			...	8	6	4	**3**	...	...

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Table 6 ISO 261 Diameter/Pitch Combinations From Which the Standards Were Selected (Cont'd)

Nominal Diameters			Pitches						
				Fine					
Col. 1 1st Choice	Col. 2 2nd Choice	Col. 3 3rd Choice	Coarse	8	6	4	3	2	1.5
		185	...	...	6	4	3	...	...
	190		...	8	6	4	**3**	...	...
		195	...	...	6	4	3	...	...
200			...	8	6	4	**3**	...	...
		205	...	...	6	4	3	...	...
	210		...	8	6	4	3	...	...
		215	...	...	6	4	3	...	...
220			...	8	6	4	3	...	...
		225	...	...	6	4	3	...	...
		230	...	8	6	4	3	...	...
		235	...	...	6	4	3	...	...
	240		...	8	6	4	3	...	...
		245	...	...	6	4	3	...	...
250			...	8	6	4	3	...	...
		255	...	...	6	4	...	...	...
	260		...	8	6	4	...	...	...
		265	...	...	6	4	...	...	...
		270	...	8	6	4	...	...	...
		275	...	...	6	4	...	...	...
280			...	8	6	4	...	...	...
		285	...	...	6	4	...	...	...
		290	...	8	6	4	...	...	...
		295	...	...	6	4	...	...	...
	300		...	8	6	4	...	...	...

GENERAL NOTE: All dimensions are in millimeters.

NOTES:

(1) Only for spark plugs for engines.
(2) Only for high strength structural steel fasteners.
(3) Pitches shown in parentheses are to be avoided as far as possible.
(4) Only for nuts for bearings.

diagram, the tolerance for the part (shaft) continues to be negative. Thus, the tolerance plus the fit define the lower deviation, *ei*. The tolerance for the mating part (hole) continues to be positive. Thus, the tolerance plus the fit define the upper deviation, *ES*. A schematic example of the metric tolerance system as applied to metric screw threads is shown in Fig. 4.

5.2 Tolerance Grade

(a) This is indicated by a number. The system provides for a series of tolerance grades for each of the four screw thread parameters (D_1, d, D_2, d_2). The tolerance grades for this Standard were selected from those given in ISO 965-1.

(b) The underlined tolerance grades are used with normal length of thread engagement.

Characteristic	Tolerance Grade	Applicable Table
Minor diameter of internal threads	4, 5, <u>6</u>, 7, 8	Table 9
Major diameter of external threads	4, <u>6</u>, 8	Table 10
Pitch diameter of internal threads	4, 5, <u>6</u>, 7, 8	Table 12
Pitch diameter of external threads	3, <u>4</u>, 5, <u>6</u>, 7, 8, 9	Table 11

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5.3 Tolerance Position

(a) This is indicated by a letter. This position is the allowance (fundamental deviation). A capital letter is used for internal threads and a lowercase letter for external threads. The system provides a series of tolerance positions for internal and external threads. These tolerance positions are as follows with the numerical values given in the appropriate table.

(b) The underlined letters are used in this Standard.

Internal Threads	G, H	Table 13
External Threads	e, f, g, h	Table 13

5.4 Allowance/Tolerance Formulas and Tables

(a) See section 6 for pitch and crest diameter allowance/tolerance formulas and tables.

(b) Functional diameter size includes the effects of all variations in pitch diameter, thread form, and profile. The variations in the individual thread characteristics such as flank angle, lead, taper, and roundness on a given thread, cause the measurements of the pitch diameter and functional diameter to vary from one another on most threads. The pitch diameter and functional diameter on a given thread are equal to one another only when the thread form is perfect. When required to inspect either the pitch diameter, the functional diameter, or both, for thread acceptance (see ASME B1.3), use the same limits of size for the appropriate thread size and class.

5.5 Selected Tolerance Classes

5.5.1 External Thread Tolerance Classes. Small allowance (fundamental deviation)

(a) for normal tolerance — tolerance class 6g6g

(b) for tighter tolerance — tolerance class 4g6g

(c) for a no-allowance fit at maximum material, such as for a plated 6g6g — tolerance class 6h6h

5.5.2 Internal Thread Tolerance Class. No allowance (fundamental deviation). Tolerance class 6H6H. Internal threads with allowance are not standard practice.

5.6 Length of Thread Engagement

5.6.1 Normal Length of Thread Engagement. The pitch diameter tolerances specified herein are applicable to the limits of the normal length of thread engagement *LE* in Table 7. The limits were calculated by formulas given in para. 6.4.

5.6.2 Short and Long Lengths of Thread Engagement When Gaged With Normal Length Contacts. For short *LE* length of thread engagement, reduce the pitch diameter tolerance of the external thread by one tolerance grade number. For long *LE* length of thread engagement, increase the allowance (fundamental deviation) at the pitch diameter of the external thread. For internal threads with long *LE* length of thread engagement, provide an allowance (fundamental deviation) corresponding to the next larger tolerance position. Thus, for the standard *H* position (no allowance), a tolerance position *G* would be provided. For assemblies with short or long lengths of engagement, the tolerance class adjustment may be applied to only one member. See Table 8.

5.7 Circular Runout

Circular runout is the full indicator movement (FIM) (see ASME Y14.5). Runout of the crest (minor diameter of internal thread or major diameter of external thread) relative to the pitch cylinder shall not be so great that the basic profile is transgressed.

5.7.1 Internal Thread. When measurement is specified, the runout of the minor diameter cylinder relative to the pitch cylinder on the internal thread shall not exceed the difference between the measured minor diameter and the basic minor diameter. An out-of-round pitch cylinder may reduce the available runout.

5.7.2 External Thread. When measurement is specified, the runout of the major diameter cylinder relative to the pitch cylinder on the external thread shall not exceed the difference between the measured major diameter and the basic major diameter. An out-of-round pitch cylinder may reduce the available runout.

5.8 Lead and Flank Angle Tolerances

See section 10.

5.9 Coated or Plated Threads

See section 8 for dimensional accommodation and limits for coated threads.

6 DESIGN FORMULAS AND TABULATED VALUES FOR ALLOWANCES AND TOLERANCES

6.1 General

This section provides the formulas and tabulated values for ISO allowances and tolerances in accordance with ISO 965-1. It is to be used for size limit calculation for non-standard threads, when required. See para. 9.2 for applications and limitations of formulas and tables.

6.2 Rounding Procedure for Tabulated Values

(a) The values for crest and pitch diameter tolerances (Tables 9, 10, 11, and 12), for length of engagement (Table 7), and for allowances/fundamental deviations (Table 13) have been calculated from formulas and then rounded off to the nearest values in the R40 series of preferred numbers in accordance with ISO 3 for the three decimal places required. If a fourth decimal place results, it is further rounded.

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Table 7 Length of Thread Engagement (ISO 965-1)

Basic Major Diameter, *d* bsc			Length of Thread Engagement			
			Short *LE*	Normal *LE*		Long *LE*
Over	Up to and Including	Pitch, *P*	Up to and Including	Over	Up to and Including	Over
1.5	2.8	0.2	0.5	0.5	1.5	1.5
		0.25	0.6	0.6	1.9	1.9
		0.35	0.8	0.8	2.6	2.6
		0.4	1	1	3	3
		0.45	1.3	1.3	3.8	3.8
2.8	5.6	0.35	1	1	3	3
		0.5	1.5	1.5	4.5	4.5
		0.6	1.7	1.7	5	5
		0.7	2	2	6	6
		0.75	2.2	2.2	6.7	6.7
		0.8	2.5	2.5	7.5	7.5
5.6	11.2	0.75	2.4	2.4	7.1	7.1
		1	3	3	9	9
		1.25	4	4	12	12
		1.5	5	5	15	15
11.2	22.4	1	3.8	3.8	11	11
		1.25	4.5	4.5	13	13
		1.5	5.6	5.6	16	16
		1.75	6	6	18	18
		2	8	8	24	24
		2.5	10	10	30	30
22.4	45	1	4	4	12	12
		1.5	6.3	6.3	19	19
		2	8.5	8.5	25	25
		3	12	12	36	36
		3.5	15	15	45	45
		4	18	18	53	53
		4.5	21	21	63	63
45	90	1.5	7.5	7.5	22	22
		2	9.5	9.5	28	28
		3	15	15	45	45
		4	19	19	56	56
		5	24	24	71	71
		5.5	28	28	85	85
		6	32	32	95	95
90	180	2	12	12	36	36
		3	18	18	53	53
		4	24	24	71	71
		6	36	36	106	106
		8	45	45	132	132
180	355	3	20	20	60	60
		4	26	26	80	80
		6	40	40	118	118
		8	50	50	150	150

GENERAL NOTE: All dimensions are in millimeters.

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Table 8 Examples of Tolerance Classes Required for Normal Gage Length Contacts With Various Thread Engagement Lengths

Normal *LE*	Short *LE*	Long *LE*
6g	5g6g	6e6g
4g6g	3g6g	4e6g
6h [Note (1)]	5h6h	6g6h
4h6h [Note (1)]	3h6h	4g6h
6H	5H	6G
4H6H	3H6H	4G6G

GENERAL NOTE: See para. 5.6.2.

NOTE:

(1) Applies to maximum material functional size (*GO* Thread gage) for plated 6g and 4g6g class threads, respectively.

Table 9 Minor Diameter Tolerances of Internal Thread, TD_1 (ISO 965-1)

Pitch, *P*	Tolerance Grade				
	4	5	6 [Note (1)]	7	8
0.2	0.038	...	...	...	...
0.25	0.045	0.056	...	...	...
0.3	0.053	0.067	0.085	...	...
0.35	0.063	0.080	0.100	...	...
0.4	0.071	0.090	0.112	...	...
0.45	0.080	0.100	0.125	...	...
0.5	0.090	0.112	0.140	0.180	...
0.6	0.100	0.125	0.160	0.200	...
0.7	0.112	0.140	0.180	0.224	...
0.75	0.118	0.150	0.190	0.236	...
0.8	0.125	0.160	0.200	0.250	0.315
1	0.150	0.190	0.236	0.300	0.375
1.25	0.170	0.212	0.265	0.335	0.425
1.5	0.190	0.236	0.300	0.375	0.475
1.75	0.212	0.265	0.335	0.425	0.530
2	0.236	0.300	0.375	0.475	0.600
2.5	0.280	0.355	0.450	0.560	0.710
3	0.315	0.400	0.500	0.630	0.800
3.5	0.355	0.450	0.560	0.710	0.900
4	0.375	0.475	0.600	0.750	0.950
4.5	0.425	0.530	0.670	0.850	1.060
5	0.450	0.560	0.710	0.900	1.120
5.5	0.475	0.600	0.750	0.950	1.180
6	0.500	0.630	0.800	1.000	1.250
8	0.630	0.800	1.000	1.250	1.600

GENERAL NOTE: All dimensions are in millimeters.

NOTE:

(1) Tabulated in this Standard for M Internal Threads.

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Table 10 Major Diameter Tolerances of External Thread, *Td* (ISO 965-1)

Pitch, *P*	Tolerance Grade		
	4	6 [Note (1)]	8
0.2	0.036	0.056	...
0.25	0.042	0.067	...
0.3	0.048	0.075	...
0.35	0.053	0.085	...
0.4	0.060	0.095	...
0.45	0.063	0.100	...
0.5	0.067	0.106	...
0.6	0.080	0.125	...
0.7	0.090	0.140	...
0.75	0.090	0.140	...
0.8	0.095	0.150	0.236
1	0.112	0.180	0.280
1.25	0.132	0.212	0.335
1.5	0.150	0.236	0.375
1.75	0.170	0.265	0.425
2	0.180	0.280	0.450
2.5	0.212	0.335	0.530
3	0.236	0.375	0.600
3.5	0.265	0.425	0.670
4	0.300	0.475	0.750
4.5	0.315	0.500	0.800
5	0.335	0.530	0.850
5.5	0.355	0.560	0.900
6	0.375	0.600	0.950
8	0.450	0.710	1.180

GENERAL NOTE: All dimensions are in millimeters.

NOTE:
(1) Tabulated in this Standard for M External Threads.

(b) These rules of rounding have not always been used in order to produce a smooth progression. Same as ISO 965-1.

(c) The above procedures often result in a variation by one or more numerals in the last decimal place when comparing table and formula values.

6.3 Allowances (Fundamental Deviations)

The allowances (fundamental deviations) for internal and external threads have been calculated according to the following formulas and their rounded values given in Table 13. Allowance is the absolute value of fundamental deviation.

Internal	External
$EI_G = +(0.015 + 0.011P)$	$es_e = -(0.05 + 0.011P)$ [Note (1)]
$EI_H = 0$	$es_f = -(0.03 + 0.011P)$
	$es_g = -(0.015 + 0.011P)$
	$es_h = 0$

NOTE:
(1) Exceptions are values for threads with $P \le 0.45$ mm.

6.4 Length of Thread Engagement

For the calculation of the limits of the normal length of thread engagement in Table 7, the following formulas have been used and their values rounded.

For each pitch, *P*, within a certain diameter range, *d* has been set equal to the smallest diameter within the table range.

$$\text{Normal } LE \text{ min.} = 2.24Pd^{0.2}$$

$$\text{Normal } LE \text{ max.} = 6.7Pd^{0.2}$$

6.5 Crest Diameter Tolerances

6.5.1 Tolerances for Minor Diameter of Internal Thread, TD_1. The TD_1 tolerances for grade 6 are calculated according to the following formulas and rounded:

(a) Pitches 0.2 mm to 0.8 mm

$$TD_1\ (6) = 0.433P - 0.190P^{1.22}$$

(b) Pitches 1 mm and coarser

$$TD_1\ (6) = 0.230P^{0.7}$$

6.5.1.1 The following rounded TD_1 tolerance values for the other grades are obtained from the TD_1 (6) values (in Table 9):

Tolerance Grade	Tolerance
4	$TD_1\ (4) = 0.63TD_1\ (6)$
5	$TD_1\ (5) = 0.8TD_1\ (6)$
6	$TD_1\ (6)$
7	$TD_1\ (7) = 1.25TD_1\ (6)$
8	$TD_1\ (8) = 1.6TD_1\ (6)$

6.5.2 Tolerances for Major Diameter of External Thread, *Td*, Grade 6. The *Td* tolerances for grade 6 are calculated according to the following formula and rounded:

$$Td\ (6) = 0.18\sqrt[3]{P^2} - \frac{0.00315}{\sqrt{P}}$$

6.5.2.1 The following rounded *Td* tolerance values for the other grades are obtained from the *Td* (6) values (see Table 10):

Tolerance Grade	Tolerance
4	$Td\ (4) = 0.63Td\ (6)$
6	$Td\ (6)$
8	$Td\ (8) = 1.6Td\ (6)$

6.6 Pitch Diameter Tolerances

6.6.1 Tolerances for Pitch Diameter of External Thread, Td_2. Td_2 (6) values in Table 11 are calculated according to the following formula and rounded. (*d* is equal to the

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Table 11 Pitch Diameter Tolerance of External Thread, Td_2 (ISO 965-1)

Basic Major Diameter, *d*			Tolerance Grade						
Over	Up to and Including	Pitch, *P*	3	4 [Note (1)]	5	6 [Note (1)]	7	8	9
1.5	2.8	0.2	0.025	0.032	0.040	0.050	...	...	...
		0.25	0.028	0.036	0.045	0.056	...	...	...
		0.35	0.032	0.040	0.050	0.063	0.080	...	...
		0.4	0.034	0.042	0.053	0.067	0.085	...	...
		0.45	0.036	0.045	0.056	0.071	0.090	...	...
2.8	5.6	0.35	0.034	0.042	0.053	0.067	0.085	...	...
		0.5	0.038	0.048	0.060	0.075	0.095	...	...
		0.6	0.042	0.053	0.067	0.085	0.106	...	...
		0.7	0.045	0.056	0.071	0.090	0.112	...	...
		0.75	0.045	0.056	0.071	0.090	0.112	...	...
		0.8	0.048	0.060	0.075	0.095	0.118	0.150	0.190
5.6	11.2	0.75	0.050	0.063	0.080	0.100	0.125	...	...
		1	0.056	0.071	0.090	0.112	0.140	0.180	0.224
		1.25	0.060	0.075	0.095	0.118	0.150	0.190	0.236
		1.5	0.067	0.085	0.106	0.132	0.170	0.212	0.265
11.2	22.4	1	0.060	0.075	0.095	0.118	0.150	0.190	0.236
		1.25	0.067	0.085	0.106	0.132	0.170	0.212	0.265
		1.5	0.071	0.090	0.112	0.140	0.180	0.224	0.280
		1.75	0.075	0.095	0.118	0.150	0.190	0.236	0.300
		2	0.080	0.100	0.125	0.160	0.200	0.250	0.315
		2.5	0.085	0.106	0.132	0.170	0.212	0.265	0.335
22.4	45	1	0.063	0.080	0.100	0.125	0.160	0.200	0.250
		1.5	0.075	0.095	0.118	0.150	0.190	0.236	0.300
		2	0.085	0.106	0.132	0.170	0.212	0.265	0.335
		3	0.100	0.125	0.160	0.200	0.250	0.315	0.400
		3.5	0.106	0.132	0.170	0.212	0.265	0.335	0.425
		4	0.112	0.140	0.180	0.224	0.280	0.355	0.450
		4.5	0.118	0.150	0.190	0.236	0.300	0.375	0.475
45	90	1.5	0.080	0.100	0.125	0.160	0.200	0.250	0.315
		2	0.090	0.112	0.140	0.180	0.224	0.280	0.355
		3	0.106	0.132	0.170	0.212	0.265	0.335	0.425
		4	0.118	0.150	0.190	0.236	0.300	0.375	0.475
		5	0.125	0.160	0.200	0.250	0.315	0.400	0.500
		5.5	0.132	0.170	0.212	0.265	0.335	0.425	0.530
		6	0.140	0.180	0.224	0.280	0.355	0.450	0.560
90	180	2	0.095	0.118	0.150	0.190	0.236	0.300	0.375
		3	0.112	0.140	0.180	0.224	0.280	0.355	0.450
		4	0.125	0.160	0.200	0.250	0.315	0.400	0.500
		6	0.150	0.190	0.236	0.300	0.375	0.475	0.600
		8	0.170	0.212	0.265	0.335	0.425	0.530	0.670
180	355	3	0.125	0.160	0.200	0.250	0.315	0.400	0.500
		4	0.140	0.180	0.224	0.280	0.355	0.450	0.560
		6	0.160	0.200	0.250	0.315	0.400	0.500	0.630
		8	0.180	0.224	0.280	0.355	0.450	0.560	0.710

GENERAL NOTE: All dimensions are in millimeters.

NOTE:

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Table 12 Pitch Diameter Tolerance of Internal Thread, TD_2 (ISO 965-1)

Basic Major Diameter, *D*			Tolerance Grade				
Over	Up to and Including	Pitch, *P*	4	5	6 [Note (1)]	7	8
1.5	2.8	0.2	0.042	...	...	...	...
		0.25	0.048	0.060	...	...	...
		0.35	0.053	0.067	0.085	...	...
		0.4	0.056	0.071	0.090	...	...
		0.45	0.060	0.075	0.095	...	...
2.8	5.6	0.35	0.056	0.071	0.090	...	...
		0.5	0.063	0.080	0.100	0.125	...
		0.6	0.071	0.090	0.112	0.140	...
		0.7	0.075	0.095	0.118	0.150	...
		0.75	0.075	0.095	0.118	0.150	...
		0.8	0.080	0.100	0.125	0.160	0.200
5.6	11.2	0.75	0.085	0.106	0.132	0.170	...
		1	0.095	0.118	0.150	0.190	0.236
		1.25	0.100	0.125	0.160	0.200	0.250
		1.5	0.112	0.140	0.180	0.224	0.280
11.2	22.4	1	0.100	0.125	0.160	0.200	0.250
		1.25	0.112	0.140	0.180	0.224	0.280
		1.5	0.118	0.150	0.190	0.236	0.300
		1.75	0.125	0.160	0.200	0.250	0.315
		2	0.132	0.170	0.212	0.265	0.335
		2.5	0.140	0.180	0.224	0.280	0.355
22.4	45	1	0.106	0.132	0.170	0.212	...
		1.5	0.125	0.160	0.200	0.250	0.315
		2	0.140	0.180	0.224	0.280	0.355
		3	0.170	0.212	0.265	0.335	0.425
		3.5	0.180	0.224	0.280	0.355	0.450
		4	0.190	0.236	0.300	0.375	0.475
		4.5	0.200	0.250	0.315	0.400	0.500
45	90	1.5	0.132	0.170	0.212	0.265	0.335
		2	0.150	0.190	0.236	0.300	0.375
		3	0.180	0.224	0.280	0.355	0.450
		4	0.200	0.250	0.315	0.400	0.500
		5	0.212	0.265	0.335	0.425	0.530
		5.5	0.224	0.280	0.355	0.450	0.560
		6	0.236	0.300	0.375	0.475	0.600
90	180	2	0.160	0.200	0.250	0.315	0.400
		3	0.190	0.236	0.300	0.375	0.475
		4	0.212	0.265	0.335	0.425	0.530
		6	0.250	0.315	0.400	0.500	0.630
		8	0.280	0.355	0.450	0.560	0.710
180	355	3	0.212	0.265	0.335	0.425	0.530
		4	0.236	0.300	0.375	0.475	0.600
		6	0.265	0.335	0.425	0.530	0.670
		8	0.300	0.375	0.475	0.600	0.750

GENERAL NOTE: All dimensions are in millimeters.

NOTE:

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Table 13 Allowance (Fundamental Deviation) for Internal and External Threads (ISO 965-1)

	Allowance (Fundamental Deviation) [Note (1)]					
	Internal Thread, D_2, D_1		External Thread, d, d_2			
Pitch, *P*	*G*, *EI*	*H* [Note (2)], *EI*	*e*, *es*	*f*, *es*	*g* [Note (3)], *es*	*h*, *es*
0.2	+0.017	0	...	...	−0.017	0
0.25	+0.018	0	...	...	−0.018	0
0.3	+0.018	0	...	...	−0.018	0
0.35	+0.019	0	...	−0.034	−0.019	0
0.4	+0.019	0	...	−0.034	−0.019	0
0.45	+0.020	0	...	−0.035	−0.020	0
0.5	+0.020	0	−0.050	−0.036	−0.020	0
0.6	+0.021	0	−0.053	−0.036	−0.021	0
0.7	+0.022	0	−0.056	−0.038	−0.022	0
0.75	+0.022	0	−0.056	−0.038	−0.022	0
0.8	+0.024	0	−0.060	−0.038	−0.024	0
1	+0.026	0	−0.060	−0.040	−0.026	0
1.25	+0.028	0	−0.063	−0.042	−0.028	0
1.5	+0.032	0	−0.067	−0.045	−0.032	0
1.75	+0.034	0	−0.071	−0.048	−0.034	0
2	+0.038	0	−0.071	−0.052	−0.038	0
2.5	+0.042	0	−0.080	−0.058	−0.042	0
3	+0.048	0	−0.085	−0.063	−0.048	0
3.5	+0.053	0	−0.090	−0.070	−0.053	0
4	+0.060	0	−0.095	−0.075	−0.060	0
4.5	+0.063	0	−0.100	−0.080	−0.063	0
5	+0.071	0	−0.106	−0.085	−0.071	0
5.5	+0.075	0	−0.112	−0.090	−0.075	0
6	+0.080	0	−0.118	−0.095	−0.080	0
8	+0.100	0	−0.140	−0.118	−0.100	0

NOTES:
(1) Allowance is the absolute value of Fundamental Deviation.
(2) Tabulated in this Standard for M Internal Threads.
(3) Tabulated in this Standard for M External Threads.

geometrical mean value of the diameter range limits, i.e., the square root of the product of smallest and largest diameters.)

$$Td_2\ (6) = 0.09P^{0.4}d^{0.1}$$

6.6.1.1 The following rounded Td_2 tolerance values for the other grades are obtained from the Td_2 (6) values (see Table 11). No Td_2 values are given in Table 11 when values calculated according to the given formula exceed the Td values in the tolerance grades, which are combined in the tables for recommended tolerance classes.

Tolerance Grade	Tolerance
3	$Td_2\ (3) = 0.5Td_2\ (6)$
4	$Td_2\ (4) = 0.63Td_2\ (6)$
5	$Td_2\ (5) = 0.8Td_2\ (6)$
6	$Td_2\ (6)$
7	$Td_2\ (7) = 1.25Td_2\ (6)$
8	$Td_2\ (8) = 1.6Td_2\ (6)$
9	$Td_2\ (9) = 2Td_2\ (6)$

6.6.2 Tolerances for Pitch Diameter of Internal Thread, TD_2. The rounded TD_2 tolerance values in Table 12 are calculated using formulas below and Td_2 (6) values from

--`,,```,,,,````-`-`,,`,,`,`,,`---

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Table 11. No TD_2 values are given in Table 12 when values calculated according to the given formula exceed 0.25*P*.

Tolerance Grade	Tolerance
4	TD_2 (4) = 0.85Td_2 (6)
5	TD_2 (5) = 1.06Td_2 (6)
6	TD_2 (6) = 1.32Td_2 (6)
7	TD_2 (7) = 1.7Td_2 (6)
8	TD_2 (8) = 2.12Td_2 (6)

7 DESIGNATION OF SCREW THREADS

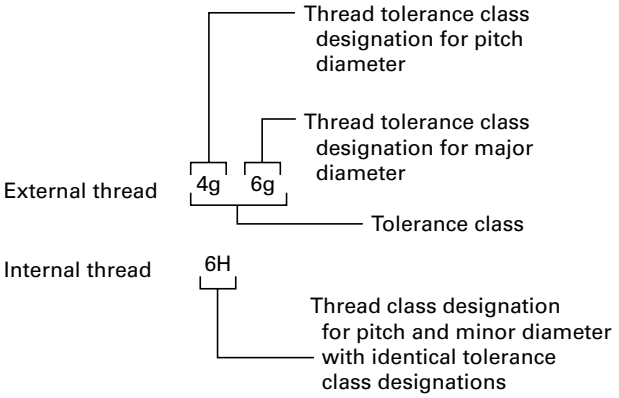
7.1 General

(a) The complete designation of a screw thread gives the thread symbol, the nominal size, the pitch, and the thread tolerance class.

(b) The tolerance class designation gives the class designation for the pitch diameter tolerance followed by a class designation for the crest diameter (major diameter for external thread and minor diameter for internal thread) tolerances.

(c) The class designation consists of a number indicating the tolerance grade followed by a letter indicating the tolerance position.

EXAMPLE:



7.2 Designation of Standard Screw Threads

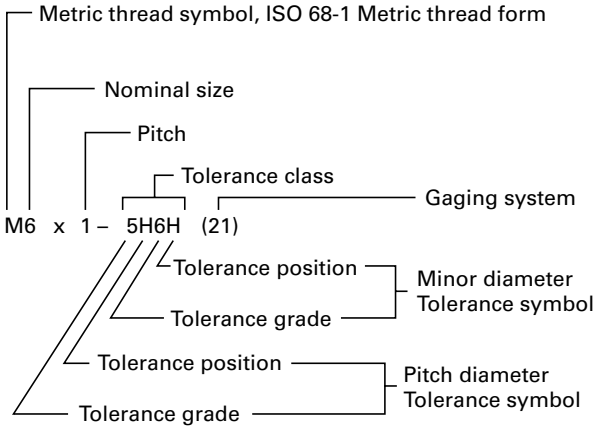
Metric screw threads are identified by the letter (M) for the thread form profile, followed by the nominal diameter size and the pitch expressed in millimeters, separated by the sign (×) and followed by the tolerance class separated by a dash (–) from the pitch.

The simplified international practice for designating coarse pitch M profile screw threads is to leave off the pitch. Thus a M14 × 2 thread is designated as just M14. To prevent misunderstanding, it is mandatory to use the value for pitch in all designations.

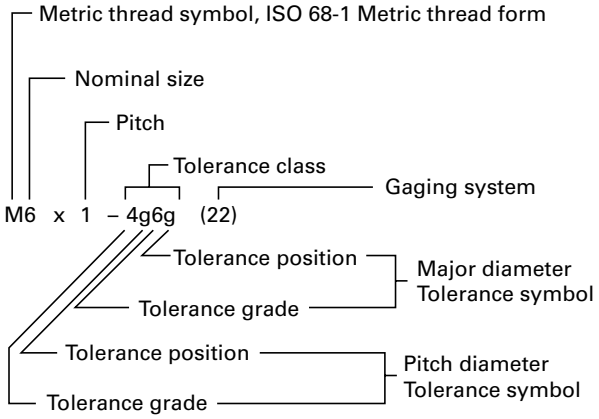
International practice permits a thread designation with tolerance class not specified for classes 6H and 6g. To prevent misunderstanding, it is mandatory to specify the tolerance class for all thread designations.

Thread acceptability gaging system requirements of ASME B1.3 may be added to the thread size designation as noted in examples or as specified in pertinent documentation, such as the drawing or procurement document.

(a) Internal Thread M Profile, Right Hand



(b) External Thread M Profile, Right Hand



Unless otherwise specified in the designation, the screw thread helix is right hand.

7.2.1 Designation of Left-Hand Thread. When left-hand thread is specified, the tolerance class designation is followed by a dash and LH.

EXAMPLE:

M6 × 1 – 5H6H – LH (23)

7.2.2 Designation of Identical Tolerance Classes. If the two tolerance class designations for a thread are identical, it is not necessary to repeat the symbols.

EXAMPLE:

M6 × 1 – 6H (21)

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7.2.3 Designations Using All Capital Letters. When computer and teletype thread designations use all capital letters, the external or internal thread may need further identification. Thus the tolerance class identification is followed by the abbreviations EXT or INT in capital letters.

EXAMPLES:

M6 × 1 – 4G6G EXT
M6 × 1 – 6H INT

7.3 Designation of Thread Fit

A fit between mating threads is indicated by the internal thread tolerance class followed by the external thread tolerance class separated by a slash.

EXAMPLES:

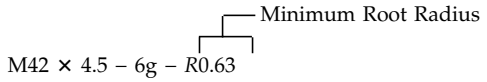
M6 × 1 – 6H/6g
M6 × 1 – 6H/4g6g

7.4 Designation of Rounded Root External Thread

7.4.1 Modified ISO 68-1 Thread With Radius Root *r* min. = 0.125*P*. For the mandatory condition-external fasteners of property class 8.8 and stronger (see para. 3.3.2), no special designation is required. Other parts requiring a 0.125*P* root radius must specify that radius as in para. 7.4.2.

7.4.2 Designation of Special Rounded Root Thread. When a special rounded root thread is required, its external thread designation is suffixed by the letter *R* and the minimum root radius value in millimeters.

EXAMPLE:



7.5 Designation of Threads Having Modified Crests

Where the limits of size of the major diameter of an external thread or the minor diameter of an internal thread are modified, the thread designation is suffixed by the letters MOD followed by the modified diameter limits.

EXAMPLE: External thread M profile, major diameter reduced 0.075 mm.

M6 × 1 – 4h6h MOD
MAJOR DIA 5.745 – 5.925 MOD

EXAMPLE: Internal thread M profile, minor diameter increased 0.075 mm.

M6 × 1 – 4H5H MOD
MINOR DIA 5.101 – 5.291 MOD

7.6 Designation of Special Threads

Special diameter-pitch threads, developed in accordance with this Standard, shall be identified by the letters SPL following the tolerance class. Below the designation shall be specified the limits of size for major diameter, pitch diameter, and minor diameter.

EXAMPLE: External thread

M6.5 × 1 – 4h6h – SPL (22)
MAJOR DIA 6.320 – 6.500
PD 5.779 – 5.850
MINOR DIA 5.163 – 5.386

EXAMPLE: Internal thread

M6.5 × 1 – 4H5H – SPL (23)
MAJOR DIA 6.500 MIN.
PD 5.850 – 5.945
MINOR DIA 5.417 – 5.607

7.7 Designation of Multiple Start Threads

When a thread is required with a multiple start, it is designated by specifying sequentially M for metric thread, nominal diameter size, ×, L for lead, lead value, *P* for pitch, pitch value, parenthesis, number of starts, and the word "Starts," close parenthesis, dash, tolerance class.

EXAMPLES:

M16 × L4P2 (2 STARTS) – 4h6h
M14 × L6P2 (3 STARTS) – 6H

7.8 Designation of Coated or Plated Threads

7.8.1 Designation of Coated or Plated M Threads. Specify if the tolerance class is after coating or after plating. If no designation of after coating or after plating is specified, the tolerance class applies before coating or plating in accordance with ISO practice. After plating, the thread profile shall not transgress the maximum material limits for the tolerance position *H/h*.

EXAMPLES:

M6 × 1 – 6h AFTER COATING or AFTER PLATING
M6 × 1 – 6g AFTER COATING or AFTER PLATING

7.8.2 Where the tolerance position *G/g* is insufficient relief for the application to hold the threads within product limits, the coating or plating allowance may be specified as the maximum and minimum limits of size for threads before coating or plating. See section 8.

EXAMPLE: Allowance on external thread M profile based on 0.010 mm min. coating thickness

M6 × 1 – 4h6h – AFTER COATING

BEFORE COATING

MAJOR DIA 5.800 – 5.970
PD 5.239 – 5.290
MINOR DIA 4.887 MAX.

7.9 Designation of Threads With Adjusted Size Limits

If a standard thread requires adjustment of size limits of thread elements, so that standard allowances or tolerances do not apply, designation shall include the individual element sizes; each special size shall be identified as "SPL."

EXAMPLE: External thread with allowance of 0.100 and pitch/major diameter tolerance grade of 4

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M24 × 3 – SPL – EXT (22)
MAJOR DIA 23.664 – 23.900 SPL
PD 21.826 – 21.951 SPL
MINOR DIA 20.652 MAX. SPL

EXAMPLE: Internal thread with no allowance but with tolerance class 4G limits at minimum material.

M24 × 3 – SPL – INT (22)
MINOR DIA 20.752 – 21.115 SPL
PD 22.051 – 22.269 SPL
MAJOR DIA 24.000 MIN.

8 DIMENSIONAL ACCOMMODATION OF COATING OR PLATING FOR 60 deg THREADS

8.1 Introduction

It is not within the scope of this Standard to make recommendations for thickness of, or to specify limits for coatings. However, it will aid mechanical interchangeability if certain principles are followed wherever conditions permit. The following guides should be helpful in determining the amount and direction of the alterations to establish applicable limits of size before coating. Some commonly used and firmly established processes for heavy coatings, such as hot-dip galvanizing, do not fall within the scope of the section. Appendix E contains information on internal threads of tolerance class 6AX, which follow USA practice of overtapping to accommodate as-coated hot-dip galvanized external threads. Appendix F contains information on internal thread tolerance position *E*, which may be used where *G* does not provide sufficient allowance, but where AX would be excessive.

NOTE: The term *coating* refers to one or more applications of additive material to the threads, but not limited to, electroplated deposits, anodized deposits, dry film lubricants, dip-spin applied materials, and mechanically applied platings. It does not include soft or liquid lubricants that are readily displaced in assembly and gaging. Plating is therefore included as coating in the text.

8.2 Material Limits for Coated Threads

Unless otherwise specified, size limits for standard external thread tolerance classes 6g and 4g6g apply prior to coating. The external thread allowance may thus be used to accommodate the coating thickness on coated parts, provided that the maximum coating thickness is not more than $\frac{1}{4}$ of the allowance. Thus, a 6g thread after coating is subject to acceptance using a basic size 6h GO thread gage and a 4g6g thread, a 4h6h or 6h GO thread gage. (Basic thread sizes, tolerance position *h*, are tabulated in Appendix D and size limits for 6h threads are included in Table 14.) Minimum material, LO or NOT-GO gages would be 6g and 4g6g, respectively. Where external thread has no allowance or allowance must be maintained after coating, and for standard internal threads, sufficient allowance must be provided prior to coating to ensure that finished product threads do not exceed the maximum material limits specified. For thread classes with tolerance position *H* or *h*, coating allowances in accordance with Table 13 for positions *G* or *g* respectively, should be applied whenever possible. See paras. 8.4, 8.5, and 8.6.

8.3 Dimensional Effects of Coating

(a) On a cylindrical surface, the effect of coating is to change the diameter by twice the coating thickness — one coating thickness on each side of the cylinder. On a screw thread, this would apply to the major and minor diameters.

(b) Because the coating thickness is measured perpendicular to the coated surface, while the pitch diameter is measured perpendicular to the thread axis, the effect of a uniformly coated thread flank on the pitch diameter is a change 4 times the thickness of coating on the flank. (see Fig. 6). The diameters of external threads before coating will be smaller while the diameters of internal threads before coating will be larger than the coated diameters.

(c) Most coatings and platings do not apply uniformly on threads (see para. 8.7 and Fig. 7). Different coating materials and processes have different application characteristics. The threaded part's overall length and other configuration characteristics also affect the way coatings build up on the threads. Paragraphs 8.4, 8.5, and 8.6 provide general guidelines for calculating precoating thread size to allow for coating build-up while preventing interference in assembly. The exact precoating thread size for a given part with a given type of coating will frequently have to be developed by the producer experimentally.

8.4 External Thread With Allowance Available for Coating

8.4.1 Maximum and Minimum Coating Thickness Specified. The amount of the allowance on the pitch diameter is sufficient if 4 times the maximum coating thickness is equal to or less than the allowance tabulated in Table 13 or 14 or, if not in these tables, calculated per formula in para. 6.3.

8.4.2 Only Nominal or Minimum Coating Thickness Specified. If no coating thickness tolerance is given, it is recommended that a tolerance of plus 50% of the nominal or minimum thickness be assumed. Then, the amount of the allowance on the pitch diameter is sufficient if 6 times the specified coating thickness is equal to or less than the allowance tabulated in Table 13 or 14 or, if not in these tables, calculated per formula in para. 6.3.

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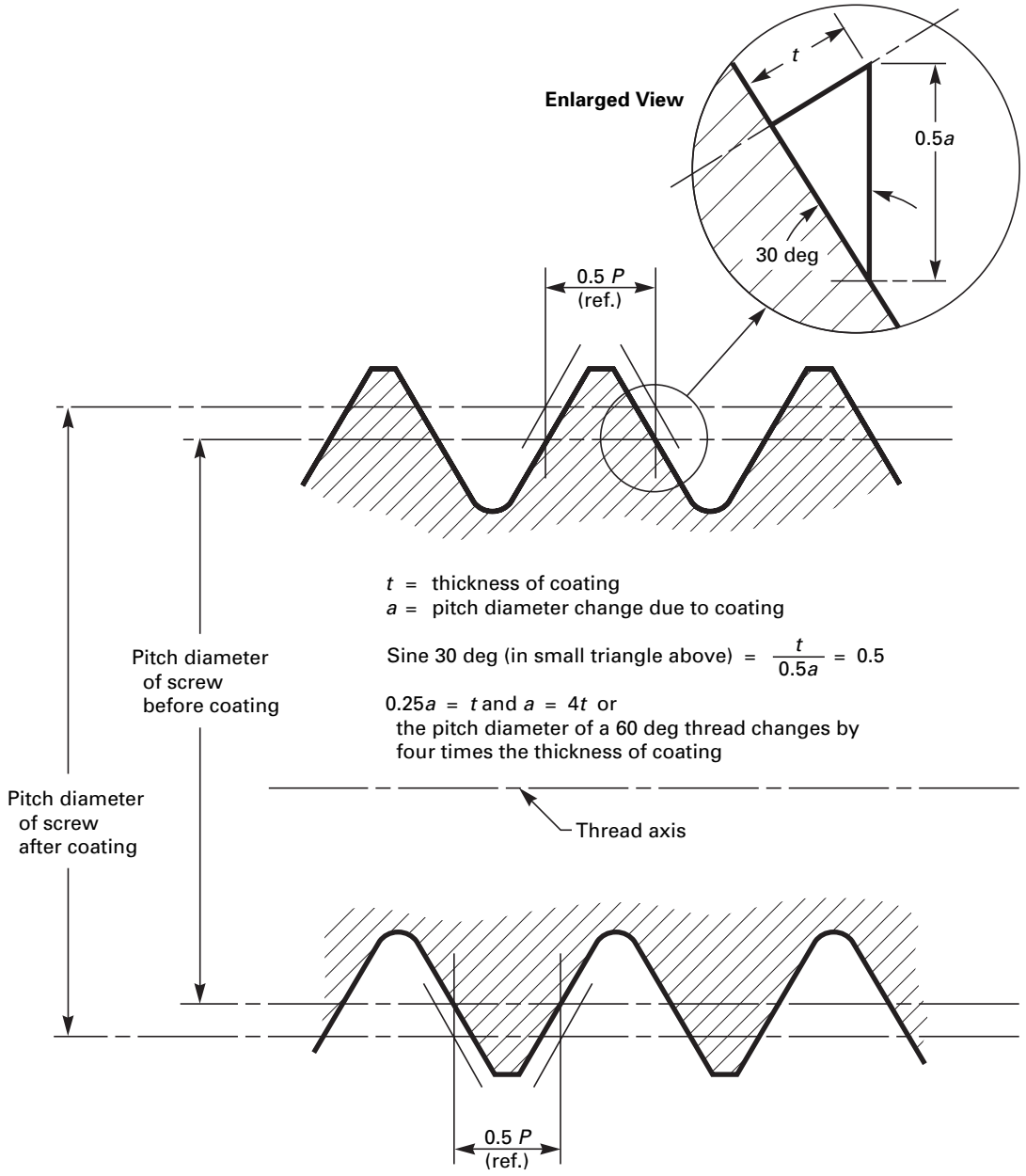
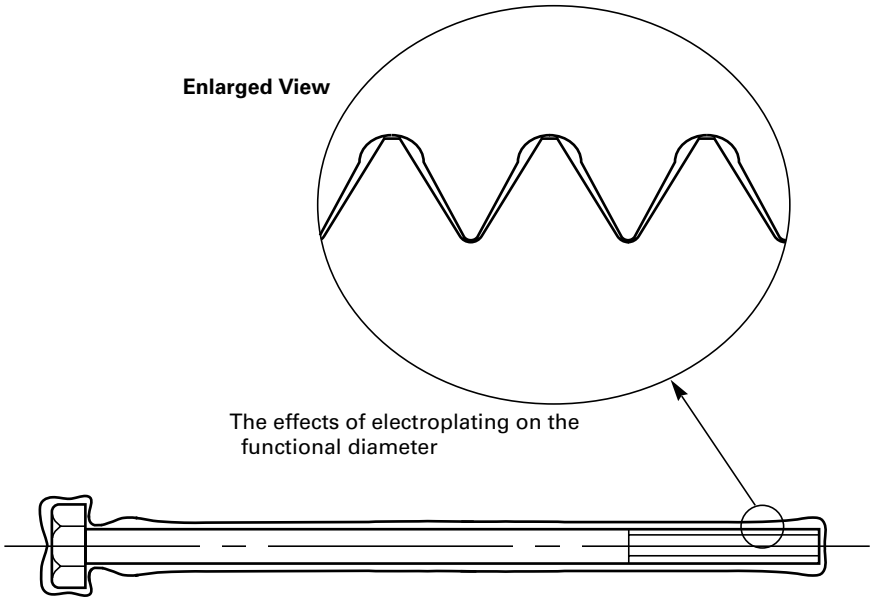


Fig. 6 Ratio of Pitch Diameter Change to Thickness of Coating on 60 deg Threads

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GENERAL NOTE: Electrodeposited coating builds up more heavily at sharp corners, is greater at the the extreme ends and edges of a length, and is least in the center and recessed areas.

Fig. 7 Effects of Electrodeposited Coating on 60 deg External Threads

8.5 External Thread With No Allowance for Coating

8.5.1 Maximum and Minimum Coating Thickness Specified. To determine before coating product limits, decrease

(a) maximum pitch diameter by 4 times maximum coating thickness

(b) minimum pitch diameter by 4 times minimum coating thickness

(c) maximum major diameter by 2 times maximum coating thickness

(d) minimum major diameter by 2 times minimum coating thickness

(e) maximum minor diameter by 2 times maximum coating thickness

EXAMPLE:

M10 × 1.5 – 6g After Coating
Coating Thickness 0.005 – 0.008

To determine the before coating maximum material sizes, decrease the maximum pitch diameter of 8.994 by 0.032 (4 × 0.008) to 8.962, the maximum major diameter of 9.968 by 0.016 (2 × 0.008) to 9.952, and the maximum minor diameter of 8.344 by 0.016 (2 × 0.008) to 8.328. For the before coating minimum sizes, decrease the minimum pitch diameter of 8.862 by 0.020 (4 × 0.005) to 8.842 and the minimum major diameter of 9.732 by 0.010 (2 × 0.005) to 9.722. The before coating sizes should be included in the thread designation. (See para. 7.8.2.)

8.5.2 Only Nominal or Minimum Coating Thickness Specified. If no coating thickness tolerance is given, it is recommended that a tolerance of plus 50% of the nominal or minimum thickness be assumed. Then, to determine before coating product limits, decrease

(a) maximum pitch diameter by 6 times coating thickness

(b) minimum pitch diameter by 4 times coating thickness

(c) maximum major diameter by 3 times coating thickness

(d) minimum major diameter by 2 times coating thickness

(e) maximum minor diameter by 3 times coating thickness

EXAMPLE:

M14 × 2 – 4h6h Coating Thickness 0.008

Since allowance for tolerance position *g* is 0.038, the maximum thickness of coating that may be applied is equal to 0.038 divided by 6 or 0.0063. This is not sufficient for the required coating of 0.008 so additional adjustments must be made.

To determine the before coating maximum material sizes, decrease the maximum pitch diameter of 12.701 by 0.048 (6 × 0.008) to 12.653, the maximum major diameter of 14.000 by 0.024 (3 × 0.008) to 13.976, and the maximum minor diameter of 11.835 by 0.024 (3 × 0.008) to 11.811. For the before coating minimum sizes, decrease the minimum pitch diameter of 12.601 by 0.032 (4 × 0.008) to 12.569 and the minimum major diameter

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of 13.720 by 0.016 (2 × 0.008) to 13.704. The before coating sizes should be included in the thread designation. (See para. 7.8.2.)

8.5.3 Adjusted Size Limits. It should be noted in the above examples that the before coating material limit tolerances are less than the tolerances after coating. This is because the coating tolerance consumes some of the product tolerance. In some instances there may be insufficient pitch diameter tolerance available in the before coating condition so that additional adjustments and controls will be necessary.

8.5.4 Strength. On small thread sizes (5 mm and smaller) there is a possibility that coating thickness adjustments will cause base material minimum material conditions that may significantly affect the strength of externally threaded parts. Limitations on coating thickness or part redesign may be necessary.

8.6 Internal Threads

8.6.1 Maximum and Minimum Coating Thickness Specified. Standard internal threads provide no allowance for coating thickness. Use the allowance provided by tolerance position *G* (see Table 13) if 4 times the maximum coating thickness specified is equal or less than this allowance. Otherwise, to determine before coating product limits, increase

(a) minimum pitch diameter by 4 times maximum coating thickness

(b) maximum pitch diameter by 4 times minimum coating thickness

(c) minimum minor diameter by 2 times maximum coating thickness

(d) maximum minor diameter by 2 times minimum coating thickness

(e) minimum major diameter by 2 times maximum coating thickness

EXAMPLE:

M12 × 1.75 − 6H Coating Thickness 0.006 − 0.010

Allowance provided by tolerance position *G* is 0.034. But 4 times the maximum coating thickness, the maximum diametral increase, is 0.040 (4 × 0.010). This is larger than the allowance provided by tolerance position *G* so additional adjustments must be made to the thread limits.

To determine the before coating minimum product sizes, increase the minimum pitch diameter of 10.863 by 0.040 (4 × 0.010) to 10.903, the minimum minor diameter of 10.106 by 0.020 (2 × 0.010) to 10.126, and the minimum major diameter of 12.000 by 0.020 (2 × 0.010) to 12.020. For the before coating maximum sizes, increase the maximum pitch diameter of 11.063 by 0.024 (4 × 0.006) to 11.087 and the maximum minor diameter of 10.441 by 0.012 (2 × 0.006) to 10.453. The before coating sizes should be included in the thread designation. (See para. 7.8.2.)

8.6.2 Only Nominal or Minimum Coating Thickness Specified. If no thickness tolerance is given, it is recommended that a tolerance of plus 50% of the nominal or minimum thickness be assumed. Since standard internal threads provide no allowance for coating thickness, use the allowance provided by tolerance position *G* (see Table 13) if 6 times the nominal or minimum coating thickness specified is equal or less than this allowance. Otherwise, to determine before coating product limits, increase

(a) minimum pitch diameter by 6 times the minimum or nominal coating thickness

(b) maximum pitch diameter by 4 times the minimum or nominal coating thickness

(c) minimum minor diameter by 3 times the minimum or nominal coating thickness

(d) maximum minor diameter by 2 times the minimum or nominal coating thickness

(e) minimum major diameter by 3 times the minimum or nominal coating thickness

EXAMPLE:

M20 × 2.5 − 6H Coating Thickness 0.010

Allowance provided by tolerance position *G* is 0.042. But 6 times the minimum or nominal coating thickness, the maximum diametral increase, is 0.060 (6 × 0.010). This is larger than the allowance provided by tolerance position *G* so additional adjustments must be made to the thread limits.

To determine the before coating minimum product sizes, increase the minimum pitch diameter of 18.376 by 0.060 (6 × 0.010) to 18.436, the minimum minor diameter of 17.294 by 0.030 (3 × 0.010) to 17.324, and the minimum major diameter of 20.000 by 0.030 (3 × 0.010) to 20.030. For the before coating maximum sizes, increase the maximum pitch diameter of 18.600 by 0.040 (4 × 0.010) to 18.640 and the maximum minor diameter of 17.744 by 0.020 (2 × 0.010) to 17.764. The before coating sizes should be included in the thread designation. (See para. 7.8.2.)

8.6.3 Adjusted Size Limits. It should be noted in the above examples that the before coating material limit tolerances are less than the tolerances after coating. This is because the coating tolerance consumes some of the product tolerance. In some instances there may be insufficient pitch diameter tolerance available in the before coating condition so that additional adjustments and controls will be necessary.

8.6.4 Strength. There is a possibility that coating thickness adjustments will cause base material minimum material conditions that may seriously affect strength of threaded parts. Limitations on coating thickness or part redesign may be necessary.

8.7 Electrodeposited Coatings

Electroplated coatings do not cover threads uniformly. Deposits build up more on thread crests than on thread

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flanks and coating thickness is greater on the lead end of a thread than on threads in the center of a part. The guidelines for calculating precoating thread sizes for uniformly coated threads can be used as a starting place in determining the precoating thread sizes on a given part, but the exact sizes for any given part may have to be determined by trial and error experimentation. One of the effects of electrodeposited coatings not applying uniformly is that the functional diameter of an external thread will generally increase by a greater magnitude than the increase of the pitch diameter on a given part. Depending on an externally threaded part's configuration, an electrodeposited coating of 0.0025 mm on a thread flank will probably result in a growth of the pitch diameter of approximately 0.0100 mm or more, but the functional diameter may change by as much as 0.0150 mm or more. In the case of internally threaded parts, electrodeposited coatings cause the pitch diameter and functional diameter to decrease in size, with the pitch diameter decreasing less than the functional diameter on a given part.

Another effect of the nonuniform build-up of electrodeposited coatings is that the coating thickness on the lead end of a thread is commonly greater than the thickness on the threads in the center of the part. This results in the pitch diameter and the functional diameter of a thread to be considerably larger on the end of the part than their comparable measurements away from the end. The longer the part, in the case of external threads, or the thicker the part, in the case of internal threads, the greater these differences tend to be. The part producer and the plater cannot control this phenomenon. It is the nature of electrodeposited coatings on threaded parts. It is conceivable that a part's dimensions can measure within limits on the lead threads and be beyond their limits on the threads away from the lead threads.

8.8 Other Considerations

It is essential to adequately review all possibilities and consider limitations in the threading and coating production processes before finalizing the coating process and the allowance required to accommodate the coating. A no-allowance thread after coating shall not transgress the basic profile and is, therefore, subject to acceptance using a basic (tolerance position *H/h*) size GO thread gage. Basic sizes for ISO series threads appear in Appendix D.

9 LIMITS OF SIZE

9.1 Standard Thread Series

(a) The limiting M profile for internal threads is shown in Fig. 8 with the associated dimensions in Table 15.

(b) The limiting M profiles for external threads are shown in Fig. 9 with the associated dimensions listed in Table 14.

(c) For information, basic dimensions of all ISO series metric screw threads, including the standard series, appear in Appendix D.

9.2 Determination of Size Limits

(a) Values listed in Tables 14 and 15 shall be used to determine limits of size.

(b) If required values are not listed in Tables 14 and 15, they shall be calculated using ISO data in Tables 7, 9, 10, 11, 12, and 13 and formulas in para. 9.3.

(c) If required data is not included in any of the tables listed above, calculate the missing data from formulas given in section 6 and in para. 9.3. Round in accordance with ASME B1.30, which includes rounding rules and examples.

(d) Examples in paras. 9.4.1 and 9.4.2, demonstrate the use of tabulated values of allowances and tolerances for calculating size limits for standard ISO 261 sizes (see Table 6). Examples in paras. 9.4.3 and 9.4.4, demonstrate the use of formulas for calculating values of allowances and tolerances for determining size limits for nonstandard thread sizes.

NOTE: If any tabulated values for allowance and tolerance are available, do not use formulas for calculation of these values. Calculate from formulas only when tabulated values do not exist.

9.3 Formulas for Calculating Limiting Dimensions for M Profile Screw Threads

9.3.1 Internal Thread

(a) Minimum major diameter = basic major diameter + *EI* (Table 13)

(b) Minimum pitch diameter = basic major diameter − 0.6495191*P* (Table 2) + *EI* for D_2 (Table 13)

(c) Maximum pitch diameter = minimum pitch diameter + TD_2 (Table 12)

(d) Maximum major diameter = maximum pitch diameter + 0.7938566*P* (Table 2)

(e) Minimum minor diameter = minimum major diameter − 1.0825318*P* (Table 2)

(f) Maximum minor diameter = minimum minor diameter + TD_1 (Table 9)

9.3.2 External Thread

(a) Maximum major diameter = basic major diameter − *es* (Table 13)

NOTE: *es* is absolute value.

(b) Minimum major diameter = maximum major diameter − *Td* (Table 10)

(c) Maximum pitch diameter = basic major diam. − 0.6495191*P* (Table 2) − *es* for d_2 (Table 13)

(d) Minimum pitch diameter = maximum pitch diameter − Td_2 (Table 11)

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Table 14 External Thread — Limiting Dimensions M Profile

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2) and (3)]			Max. Minor Diameter, (Flat Form), d_1 [Note (2)]	Min. Minor Diameter (Rounded Form), d_3 [Note (4)] (For Reference)
			Max.	Min.	Max.	Min.	Tol.		
M1.6 × 0.35	6g	0.019	1.581	1.496	1.354	1.291	0.063	1.202	1.075
M1.6 × 0.35	6h	0.000	1.600	1.515	1.373	1.310	0.063	1.221	1.094
M1.6 × 0.35	4g6g	0.019	1.581	1.496	1.354	1.314	0.040	1.202	1.098
M2 × 0.4	6g	0.019	1.981	1.886	1.721	1.654	0.067	1.548	1.408
M2 × 0.4	6h	0.000	2.000	1.905	1.740	1.673	0.067	1.567	1.427
M2 × 0.4	4g6g	0.019	1.981	1.886	1.721	1.679	0.042	1.548	1.433
M2.5 × 0.45	6g	0.020	2.480	2.380	2.188	2.117	0.071	1.993	1.840
M2.5 × 0.45	6h	0.000	2.500	2.400	2.208	2.137	0.071	2.013	1.860
M2.5 × 0.45	4g6g	0.020	2.480	2.380	2.188	2.143	0.045	1.993	1.866
M3 × 0.5	6g	0.020	2.980	2.874	2.655	2.580	0.075	2.438	2.272
M3 × 0.5	6h	0.000	3.000	2.894	2.675	2.600	0.075	2.458	2.292
M3 × 0.5	4g6g	0.020	2.980	2.874	2.655	2.607	0.048	2.438	2.299
M3.5 × 0.6	6g	0.021	3.479	3.354	3.089	3.004	0.085	2.829	2.634
M3.5 × 0.6	6h	0.000	3.500	3.375	3.110	3.025	0.085	2.850	2.655
M3.5 × 0.6	4g6g	0.021	3.479	3.354	3.089	3.036	0.053	2.829	2.666
M4 × 0.7	6g	0.022	3.978	3.838	3.523	3.433	0.090	3.220	3.002
M4 × 0.7	6h	0.000	4.000	3.860	3.545	3.455	0.090	3.242	3.024
M4 × 0.7	4g6g	0.022	3.978	3.838	3.523	3.467	0.056	3.220	3.036
M5 × 0.8	6g	0.024	4.976	4.826	4.456	4.361	0.095	4.110	3.868
M5 × 0.8	6h	0.000	5.000	4.850	4.480	4.385	0.095	4.134	3.892
M5 × 0.8	4g6g	0.024	4.976	4.826	4.456	4.396	0.060	4.110	3.903
M6 × 1	6g	0.026	5.974	5.794	5.324	5.212	0.112	4.891	4.596
M6 × 1	6h	0.000	6.000	5.820	5.350	5.238	0.112	4.917	4.622
M6 × 1	4g6g	0.026	5.974	5.794	5.324	5.253	0.071	4.891	4.637
M8 × 1.25	6g	0.028	7.972	7.760	7.160	7.042	0.118	6.619	6.272
M8 × 1.25	6h	0.000	8.000	7.788	7.188	7.070	0.118	6.647	6.300
M8 × 1.25	4g6g	0.028	7.972	7.760	7.160	7.085	0.075	6.619	6.315
M8 × 1	6g	0.026	7.974	7.794	7.324	7.212	0.112	6.891	6.596
M8 × 1	6h	0.000	8.000	7.820	7.350	7.238	0.112	6.917	6.622
M8 × 1	4g6g	0.026	7.974	7.794	7.324	7.253	0.071	6.891	6.637

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Table 14 External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2) and (3)]			Max. Minor Diameter, (Flat Form), d_1 [Note (2)]	Min. Minor Diameter (Rounded Form), d_3 [Note (4)] (For Reference)
			Max.	Min.	Max.	Min.	Tol.		
M10 × 1.5	6g	0.032	9.968	9.732	8.994	8.862	0.132	8.344	7.938
M10 × 1.5	6h	0.000	10.000	9.764	9.026	8.894	0.132	8.376	7.970
M10 × 1.5	4g6g	0.032	9.968	9.732	8.994	8.909	0.085	8.344	7.985
M10 × 1.25	6g	0.028	9.972	9.760	9.160	9.042	0.118	8.619	8.272
M10 × 1.25	6h	0.000	10.000	9.788	9.188	9.070	0.118	8.647	8.300
M10 × 1.25	4g6g	0.028	9.972	9.760	9.160	9.085	0.075	8.619	8.315
M10 × 1	6g	0.026	9.974	9.794	9.324	9.212	0.112	8.891	8.596
M10 × 1	6h	0.000	10.000	9.820	9.350	9.238	0.112	8.917	8.622
M10 × 1	4g6g	0.026	9.974	9.794	9.324	9.253	0.071	8.891	8.637
M10 × 0.75	6g	0.022	9.978	9.838	9.491	9.391	0.100	9.166	8.929
M10 × 0.75	6h	0.000	10.000	9.860	9.513	9.413	0.100	9.188	8.951
M10 × 0.75	4g6g	0.022	9.978	9.838	9.491	9.428	0.063	9.166	8.966
M12 × 1.75	6g	0.034	11.966	11.701	10.829	10.679	0.150	10.071	9.601
M12 × 1.75	6h	0.000	12.000	11.735	10.863	10.713	0.150	10.105	9.635
M12 × 1.75	4g6g	0.034	11.966	11.701	10.829	10.734	0.095	10.071	9.656
M12 × 1.5	6g	0.032	11.968	11.732	10.994	10.854	0.140	10.344	9.930
M12 × 1.5	6h	0.000	12.000	11.764	11.026	10.886	0.140	10.376	9.962
M12 × 1.5	4g6g	0.032	11.968	11.732	10.994	10.904	0.090	10.344	9.980
M12 × 1.25	6g	0.028	11.972	11.760	11.160	11.028	0.132	10.619	10.258
M12 × 1.25	6h	0.000	12.000	11.788	11.188	11.056	0.132	10.647	10.286
M12 × 1.25	4g6g	0.028	11.972	11.760	11.160	11.075	0.085	10.619	10.305
M12 × 1	6g	0.026	11.974	11.794	11.324	11.206	0.118	10.891	10.590
M12 × 1	6h	0.000	12.000	11.820	11.350	11.232	0.118	10.917	10.616
M12 × 1	4g6g	0.026	11.974	11.794	11.324	11.249	0.075	10.891	10.633
M14 × 2	6g	0.038	13.962	13.682	12.663	12.503	0.160	11.797	11.271
M14 × 2	6h	0.000	14.000	13.720	12.701	12.541	0.160	11.835	11.309
M14 × 2	4g6g	0.038	13.962	13.682	12.663	12.563	0.100	11.797	11.331
M14 × 1.5	6g	0.032	13.968	13.732	12.994	12.854	0.140	12.344	11.930
M14 × 1.5	6h	0.000	14.000	13.764	13.026	12.886	0.140	12.376	11.962
M14 × 1.5	4g6g	0.032	13.968	13.732	12.994	12.904	0.090	12.344	11.980
M15 × 1	6g	0.026	14.974	14.794	14.324	14.206	0.118	13.891	13.590
M15 × 1	6h	0.000	15.000	14.820	14.350	14.232	0.118	13.917	13.616
M15 × 1	4g6g	0.026	14.974	14.794	14.324	14.249	0.075	13.891	13.633

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Table 14 External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2) and (3)]			Max. Minor Diameter, (Flat Form), d_1 [Note (2)]	Min. Minor Diameter (Rounded Form), d_3 [Note (4)] (For Reference)
			Max.	Min.	Max.	Min.	Tol.		
M16 × 2	6g	0.038	15.962	15.682	14.663	14.503	0.160	13.797	13.271
M16 × 2	6h	0.000	16.000	15.720	14.701	14.541	0.160	13.835	13.309
M16 × 2	4g6g	0.038	15.962	15.682	14.663	14.563	0.100	13.797	13.331
M16 × 1.5	6g	0.032	15.968	15.732	14.994	14.854	0.140	14.344	13.930
M16 × 1.5	6h	0.000	16.000	15.764	15.026	14.886	0.140	14.376	13.962
M16 × 1.5	4g6g	0.032	15.968	15.732	14.994	14.904	0.090	14.344	13.980
M17 × 1	6g	0.026	16.974	16.794	16.324	16.206	0.118	15.891	15.590
M17 × 1	6h	0.000	17.000	16.820	16.350	16.232	0.118	15.917	15.616
M17 × 1	4g6g	0.026	16.974	16.794	16.324	16.249	0.075	15.891	15.633
M18 × 1.5	6g	0.032	17.968	17.732	16.994	16.854	0.140	16.344	15.930
M18 × 1.5	6h	0.000	18.000	17.764	17.026	16.886	0.140	16.376	15.962
M18 × 1.5	4g6g	0.032	17.968	17.732	16.994	16.904	0.090	16.344	15.980
M20 × 2.5	6g	0.042	19.958	19.623	18.334	18.164	0.170	17.251	16.624
M20 × 2.5	6h	0.000	20.000	19.665	18.376	18.206	0.170	17.293	16.666
M20 × 2.5	4g6g	0.042	19.958	19.623	18.334	18.228	0.106	17.251	16.688
M20 × 1.5	6g	0.032	19.968	19.732	18.994	18.854	0.140	18.344	17.930
M20 × 1.5	6h	0.000	20.000	19.764	19.026	18.886	0.140	18.376	17.962
M20 × 1.5	4g6g	0.032	19.968	19.732	18.994	18.904	0.090	18.344	17.980
M20 × 1	6g	0.026	19.974	19.794	19.324	19.206	0.118	18.891	18.590
M20 × 1	6h	0.000	20.000	19.820	19.350	19.232	0.118	18.917	18.616
M20 × 1	4g6g	0.026	19.974	19.794	19.324	19.249	0.075	18.891	18.633
M22 × 2.5	6g	0.042	21.958	21.623	20.334	20.164	0.170	19.251	18.624
M22 × 2.5	6h	0.000	22.000	21.665	20.376	20.206	0.170	19.293	18.666
M22 × 1.5	6g	0.032	21.968	21.732	20.994	20.854	0.140	20.344	19.930
M22 × 1.5	6h	0.000	22.000	21.764	21.026	20.886	0.140	20.376	19.962
M22 × 1.5	4g6g	0.032	21.968	21.732	20.994	20.904	0.090	20.344	19.980
M24 × 3	6g	0.048	23.952	23.577	22.003	21.803	0.200	20.704	19.955
M24 × 3	6h	0.000	24.000	23.625	22.051	21.851	0.200	20.752	20.003
M24 × 3	4g6g	0.048	23.952	23.577	22.003	21.878	0.125	20.704	20.030
M24 × 2	6g	0.038	23.962	23.682	22.663	22.493	0.170	21.797	21.261
M24 × 2	6h	0.000	24.000	23.720	22.701	22.531	0.170	21.835	21.299
M24 × 2	4g6g	0.038	23.962	23.682	22.663	22.557	0.106	21.797	21.325

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Table 14 External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2) and (3)]			Max. Minor Diameter (Flat Form), d_1 [Note (2)]	Min. Minor Diameter (Rounded Form), d_3 [Note (4)] (For Reference)
			Max.	Min.	Max.	Min.	Tol.		
M25 × 1.5	6g	0.032	24.968	24.732	23.994	23.844	0.150	23.344	22.920
M25 × 1.5	6h	0.000	25.000	24.764	24.026	23.876	0.150	23.376	22.952
M25 × 1.5	4g6g	0.032	24.968	24.732	23.994	23.899	0.095	23.344	22.975
M27 × 3	6g	0.048	26.952	26.577	25.003	24.803	0.200	23.704	22.955
M27 × 3	6h	0.000	27.000	26.625	25.051	24.851	0.200	23.752	23.003
M27 × 2	6g	0.038	26.962	26.682	25.663	25.493	0.170	24.797	24.261
M27 × 2	6h	0.000	27.000	26.720	25.701	25.531	0.170	24.835	24.299
M27 × 2	4g6g	0.038	26.962	26.682	25.663	25.557	0.106	24.797	24.325
M30 × 3.5	6g	0.053	29.947	29.522	27.674	27.462	0.212	26.158	25.306
M30 × 3.5	6h	0.000	30.000	29.575	27.727	27.515	0.212	26.211	25.359
M30 × 3.5	4g6g	0.053	29.947	29.522	27.674	27.542	0.132	26.158	25.386
M30 × 2	6g	0.038	29.962	29.682	28.663	28.493	0.170	27.797	27.261
M30 × 2	6h	0.000	30.000	29.720	28.701	28.531	0.170	27.835	27.299
M30 × 2	4g6g	0.038	29.962	29.682	28.663	28.557	0.106	27.797	27.325
M30 × 1.5	6g	0.032	29.968	29.732	28.994	28.844	0.150	28.344	27.920
M30 × 1.5	6h	0.000	30.000	29.764	29.026	28.876	0.150	28.376	27.952
M30 × 1.5	4g6g	0.032	29.968	29.732	28.994	28.899	0.095	28.344	27.975
M33 × 2	6g	0.038	32.962	32.682	31.663	31.493	0.170	30.797	30.261
M33 × 2	6h	0.000	33.000	32.720	31.701	31.531	0.170	30.835	30.299
M33 × 2	4g6g	0.038	32.962	32.682	31.663	31.557	0.106	30.797	30.325
M35 × 1.5	6g	0.032	34.968	34.732	33.994	33.844	0.150	33.344	32.920
M35 × 1.5	6h	0.000	35.000	34.764	34.026	33.876	0.150	33.376	32.952
M36 × 4	6g	0.060	35.940	35.465	33.342	33.118	0.224	31.610	30.654
M36 × 4	6h	0.000	36.000	35.525	33.402	33.178	0.224	31.670	30.714
M36 × 4	4g6g	0.060	35.940	35.465	33.342	33.202	0.140	31.610	30.738
M36 × 2	6g	0.038	35.962	35.682	34.663	34.493	0.170	33.797	33.261
M36 × 2	6h	0.000	36.000	35.720	34.701	34.531	0.170	33.835	33.299
M36 × 2	4g6g	0.038	35.962	35.682	34.663	34.557	0.106	33.797	33.325
M39 × 2	6g	0.038	38.962	38.682	37.663	37.493	0.170	36.797	36.261
M39 × 2	6h	0.000	39.000	38.720	37.701	37.531	0.170	36.835	36.299
M39 × 2	4g6g	0.038	38.962	38.682	37.663	37.557	0.106	36.797	36.325
M40 × 1.5	6g	0.032	39.968	39.732	38.994	38.844	0.150	38.344	37.920
M40 × 1.5	6h	0.000	40.000	39.764	39.026	38.876	0.150	38.376	37.952

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Table 14 External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2) and (3)]			Max. Minor Diameter (Flat Form), d_1 [Note (2)]	Min. Minor Diameter (Rounded Form), d_3 [Note (4)] (For Reference)
			Max.	Min.	Max.	Min.	Tol.		
M40 × 1.5	4g6g	0.032	39.968	39.732	38.994	38.899	0.095	38.344	37.975
M42 × 4.5	6g	0.063	41.937	41.437	39.014	38.778	0.236	37.065	36.006
M42 × 4.5	6h	0.000	42.000	41.500	39.077	38.841	0.236	37.128	36.069
M42 × 4.5	4g6g	0.063	41.937	41.437	39.014	38.864	0.150	37.065	36.092
M42 × 2	6g	0.038	41.962	41.682	40.663	40.493	0.170	39.797	39.261
M42 × 2	6h	0.000	42.000	41.720	40.701	40.531	0.170	39.835	39.299
M42 × 2	4g6g	0.038	41.962	41.682	40.663	40.557	0.106	39.797	39.325
M45 × 1.5	6g	0.032	44.968	44.732	43.994	43.844	0.150	43.344	42.920
M45 × 1.5	6h	0.000	45.000	44.764	44.026	43.876	0.150	43.376	42.952
M45 × 1.5	4g6g	0.032	44.968	44.732	43.994	43.899	0.095	43.344	42.975
M48 × 5	6g	0.071	47.929	47.399	44.681	44.431	0.250	42.516	41.351
M48 × 5	6h	0.000	48.000	47.470	44.752	44.502	0.250	42.587	41.422
M48 × 5	4g6g	0.071	47.929	47.399	44.681	44.521	0.160	42.516	41.441
M48 × 2	6g	0.038	47.962	47.682	46.663	46.483	0.180	45.797	45.251
M48 × 2	6h	0.000	48.000	47.720	46.701	46.521	0.180	45.835	45.289
M48 × 2	4g6g	0.038	47.962	47.682	46.663	46.551	0.112	45.797	45.319
M50 × 1.5	6g	0.032	49.968	49.732	48.994	48.834	0.160	48.344	47.910
M50 × 1.5	6h	0.000	50.000	49.764	49.026	48.866	0.160	48.376	47.942
M50 × 1.5	4g6g	0.032	49.968	49.732	48.994	48.894	0.100	48.344	47.970
M55 × 1.5	6g	0.032	54.968	54.732	53.994	53.834	0.160	53.344	52.910
M55 × 1.5	6h	0.000	55.000	54.764	54.026	53.866	0.160	53.376	52.942
M55 × 1.5	4g6g	0.032	54.968	54.732	53.994	53.894	0.100	53.344	52.970
M56 × 5.5	6g	0.075	55.925	55.365	52.353	52.088	0.265	49.971	48.700
M56 × 5.5	6h	0.000	56.000	55.440	52.428	52.163	0.265	50.046	48.775
M56 × 5.5	4g6g	0.075	55.925	55.365	52.353	52.183	0.170	49.971	48.795
M56 × 2	6g	0.038	55.962	55.682	54.663	54.483	0.180	53.797	53.251
M56 × 2	6h	0.000	56.000	55.720	54.701	54.521	0.180	53.835	53.289
M56 × 2	4g6g	0.038	55.962	55.682	54.663	54.551	0.112	53.797	53.319
M60 × 1.5	6g	0.032	59.968	59.732	58.994	58.834	0.160	58.344	57.910
M60 × 1.5	6h	0.000	60.000	59.764	59.026	58.866	0.160	58.376	57.942
M60 × 1.5	4g6g	0.032	59.968	59.732	58.994	58.894	0.100	58.344	57.970

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Table 14 External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2) and (3)]			Max. Minor Diameter (Flat Form), d_1 [Note (2)]	Min. Minor Diameter (Rounded Form), d_3 [Note (4)] (For Reference)
			Max.	Min.	Max.	Min.	Tol.		
M64 × 6	6g	0.080	63.920	63.320	60.023	59.743	0.280	57.425	56.047
M64 × 6	6h	0.000	64.000	63.400	60.103	59.823	0.280	57.505	56.127
M64 × 6	4g6g	0.080	63.920	63.320	60.023	59.843	0.180	57.425	56.147
M64 × 2	6g	0.038	63.962	63.682	62.663	62.483	0.180	61.797	61.251
M64 × 2	6h	0.000	64.000	63.720	62.701	62.521	0.180	61.835	61.289
M64 × 2	4g6g	0.038	63.962	63.682	62.663	62.551	0.112	61.797	61.319
M65 × 1.5	6g	0.032	64.968	64.732	63.994	63.834	0.160	63.344	62.910
M65 × 1.5	6h	0.000	65.000	64.764	64.026	63.866	0.160	63.376	62.942
M65 × 1.5	4g6g	0.032	64.968	64.732	63.994	63.894	0.100	63.344	62.970
M70 × 1.5	6g	0.032	69.968	69.732	68.994	68.834	0.160	68.344	67.910
M70 × 1.5	6h	0.000	70.000	69.764	69.026	68.866	0.160	68.376	67.942
M70 × 1.5	4g6g	0.032	69.968	69.732	68.994	68.894	0.100	68.344	67.970
M72 × 6	6g	0.080	71.920	71.320	68.023	67.743	0.280	65.425	64.047
M72 × 6	6h	0.000	72.000	71.400	68.103	67.823	0.280	65.505	64.127
M72 × 6	4g6g	0.080	71.920	71.320	68.023	67.843	0.180	65.425	64.147
M72 × 2	6g	0.038	71.962	71.682	70.663	70.483	0.180	69.797	69.251
M72 × 2	6h	0.000	72.000	71.720	70.701	70.521	0.180	69.835	69.289
M72 × 2	4g6g	0.038	71.962	71.682	70.663	70.551	0.112	69.797	69.319
M75 × 1.5	6g	0.032	74.968	74.732	73.994	73.834	0.160	73.344	72.910
M75 × 1.5	6h	0.000	75.000	74.764	74.026	73.866	0.160	73.376	72.942
M75 × 1.5	4g6g	0.032	74.968	74.732	73.994	73.894	0.100	73.344	72.970
M80 × 6	6g	0.080	79.920	79.320	76.023	75.743	0.280	73.425	72.047
M80 × 6	6h	0.000	80.000	79.400	76.103	75.823	0.280	73.505	72.127
M80 × 6	4g6g	0.080	79.920	79.320	76.023	75.843	0.180	73.425	72.147
M80 × 2	6g	0.038	79.962	79.682	78.663	78.483	0.180	77.797	77.251
M80 × 2	6h	0.000	80.000	79.720	78.701	78.521	0.180	77.835	77.289
M80 × 2	4g6g	0.038	79.962	79.682	78.663	78.551	0.112	77.797	77.319
M80 × 1.5	6g	0.032	79.968	79.732	78.994	78.834	0.160	78.344	77.910
M80 × 1.5	6h	0.000	80.000	79.764	79.026	78.866	0.160	78.376	77.942
M80 × 1.5	4g6g	0.032	79.968	79.732	78.994	78.894	0.100	78.344	77.970
M85 × 2	6g	0.038	84.962	84.682	83.663	83.483	0.180	82.797	82.251
M85 × 2	6h	0.000	85.000	84.720	83.701	83.521	0.180	82.835	82.289

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Table 14 External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2) and (3)]			Max. Minor Diameter (Flat Form), d_1 [Note (2)]	Min. Minor Diameter (Rounded Form), d_3 [Note (4)] (For Reference)
			Max.	Min.	Max.	Min.	Tol.		
M85 × 2	4g6g	0.038	84.962	84.682	83.663	83.551	0.112	82.797	82.319
M90 × 6	6g	0.080	89.920	89.320	86.023	85.743	0.280	83.425	82.047
M90 × 6	6h	0.000	90.000	89.400	86.103	85.823	0.280	83.505	82.127
M90 × 6	4g6g	0.080	89.920	89.320	86.023	85.843	0.180	83.425	82.147
M90 × 2	6g	0.038	89.962	89.682	88.663	88.483	0.180	87.797	87.251
M90 × 2	6h	0.000	90.000	89.720	88.701	88.521	0.180	87.835	87.289
M90 × 2	4g6g	0.038	89.962	89.682	88.663	88.551	0.112	87.797	87.319
M95 × 2	6g	0.038	94.962	94.682	93.663	93.473	0.190	92.797	92.241
M95 × 2	6h	0.000	95.000	94.720	93.701	93.511	0.190	92.835	92.279
M95 × 2	4g6g	0.038	94.962	94.682	93.663	93.545	0.118	92.797	92.313
M100 × 6	6g	0.080	99.920	99.320	96.023	95.723	0.300	93.425	92.027
M100 × 6	6h	0.000	100.000	99.400	96.103	95.803	0.300	93.505	92.107
M100 × 6	4g6g	0.080	99.920	99.320	96.023	95.833	0.190	93.425	92.137
M100 × 2	6g	0.038	99.962	99.682	98.663	98.473	0.190	97.797	97.241
M100 × 2	6h	0.000	100.000	99.720	98.701	98.511	0.190	97.835	97.279
M100 × 2	4g6g	0.038	99.962	99.682	98.663	98.545	0.118	97.797	97.313
M105 × 2	6g	0.038	104.962	104.682	103.663	103.473	0.190	102.797	102.241
M105 × 2	6h	0.000	105.000	104.720	103.701	103.511	0.190	102.835	102.279
M105 × 2	4g6g	0.038	104.962	104.682	103.663	103.545	0.118	102.797	102.313
M110 × 2	6g	0.038	109.962	109.682	108.663	108.473	0.190	107.797	107.241
M110 × 2	6h	0.000	110.000	109.720	108.701	108.511	0.190	107.835	107.279
M110 × 2	4g6g	0.038	109.962	109.682	108.663	108.545	0.118	107.797	107.313
M120 × 2	6g	0.038	119.962	119.682	118.663	118.473	0.190	117.797	117.241
M120 × 2	6h	0.000	120.000	119.720	118.701	118.511	0.190	117.835	117.279
M120 × 2	4g6g	0.038	119.962	119.682	118.663	118.545	0.118	117.797	117.313
M130 × 2	6g	0.038	129.962	129.682	128.663	128.473	0.190	127.797	127.241
M130 × 2	6h	0.000	130.000	129.720	128.701	128.511	0.190	127.835	127.279
M130 × 2	4g6g	0.038	129.962	129.682	128.663	128.545	0.118	127.797	127.313
M140 × 2	6g	0.038	139.962	139.682	138.663	138.473	0.190	137.797	137.241
M140 × 2	6h	0.000	140.000	139.720	138.701	138.511	0.190	137.835	137.279
M140 × 2	4g6g	0.038	139.962	139.682	138.663	138.545	0.118	137.797	137.313

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Table 14 External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2) and (3)]			Max Minor Diameter (Flat Form) d_1 [Note (2)]	Min. Minor Diameter (Rounded Form), d_3 [Note (4)] (For Reference)
			Max.	Min.	Max.	Min.	Tol.		
M150 × 2	6g	0.038	149.962	149.682	148.663	148.473	0.190	147.797	147.241
M150 × 2	6h	0.000	150.000	149.720	148.701	148.511	0.190	147.835	147.279
M150 × 2	4g6g	0.038	149.962	149.682	148.663	148.545	0.118	147.797	147.313
M160 × 3	6g	0.048	159.952	159.577	158.003	157.779	0.224	156.704	155.931
M160 × 3	6h	0.000	160.000	159.625	158.051	157.827	0.224	156.752	155.979
M160 × 3	4g6g	0.048	159.952	159.577	158.003	157.863	0.140	156.704	156.015
M170 × 3	6g	0.048	169.952	169.577	168.003	167.779	0.224	166.704	165.931
M170 × 3	6h	0.000	170.000	169.625	168.051	167.827	0.224	166.752	165.979
M170 × 3	4g6g	0.048	169.952	169.577	168.003	167.863	0.140	166.704	166.015
M180 × 3	6g	0.048	179.952	179.577	178.003	177.779	0.224	176.704	175.931
M180 × 3	6h	0.000	180.000	179.625	178.051	177.827	0.224	176.752	175.979
M180 × 3	4g6g	0.048	179.952	179.577	178.003	177.863	0.140	176.704	176.015
M190 × 3	6g	0.048	189.952	189.577	188.003	187.753	0.250	186.704	185.905
M190 × 3	6h	0.000	190.000	189.625	188.051	187.801	0.250	186.752	185.953
M190 × 3	4g6g	0.048	189.952	189.577	188.003	187.843	0.160	186.704	185.995
M200 × 3	6g	0.048	199.952	199.577	198.003	197.753	0.250	196.704	195.905
M200 × 3	6h	0.000	200.000	199.625	198.051	197.801	0.250	196.752	195.953
M200 × 3	4g6g	0.048	199.952	199.577	198.003	197.843	0.160	196.704	195.995

GENERAL NOTE: All dimensions are in millimeters.

NOTES:

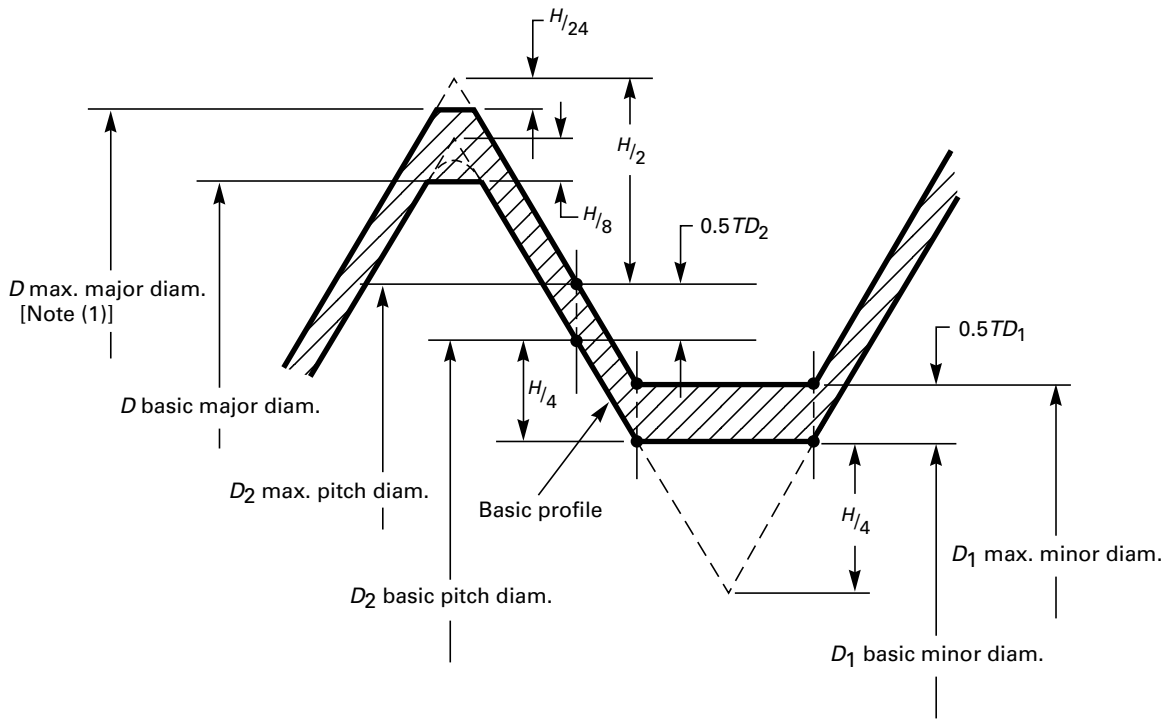
(1) *es* is absolute value.

(2) For coated threads with tolerance classes 6g or 4g6g, see para. 8.2.

(3) See para. 5.4(b).

(4) Dimension used in the design of tools, etc. In dimensioning external threads it is not normally specified. Generally, minor diameter acceptance is based on maximum material condition gaging.

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GENERAL NOTE: Section-lined portions identify tolerance zone.

NOTE:

(1) Dimension is used in the design of tools, etc. In dimensioning internal threads it is not normally specified. Generally major diameter acceptance is based upon a maximum material condition gaging.

Fig. 8 Internal Thread — Limiting M Profile, Tolerance Position *H*

(e) Maximum flat form minor diameter = maximum pitch diameter − 0.4330127P (Table 2)

(f) Maximum rounded form minor diameter =

$$\text{max. pitch diam.} - \left\{ 0.5H + 2r \text{ min.} \left\{ 1 - \cos \left[60 \text{ deg} - \arccos \left(1 - \frac{Td_2}{4r \text{ min.}} \right) \right] \right\} \right\}$$

(for 0.125P min. root radius)

(g) Minimum rounded form minor diameter = minimum pitch diameter − 0.6160254P (Table 2)

$$r \text{ min.} = 0.125P \text{ (Table 3)}$$

9.4 Examples of Calculations of Size Limits

Tables 16A through 16D show examples that are based upon the practices for calculating and rounding screw thread dimensions as specified in ASME B1.30. Dimensions are expressed in millimeters.

9.4.1 External Screw Thread, Standard Size. The example in Table 16A shows how tabulated values for allowances and tolerances (in accordance with ISO 965-1) are used for the calculation of size limits in ASME B1.13M tables for standard external thread sizes listed in ISO 261. See para. 9.4.3 for an example with a size not listed in ISO 261.

9.4.2 Internal Metric Screw Thread, Standard Size. The example in Table 16B shows how tabulated values for allowances and tolerances (in accordance with ISO 965-1) are used for the calculation of size limits in ASME B1.13M tables for standard internal thread sizes listed in ISO 261. See para. 9.4.4 for an example with a size not listed in ISO 261.

9.4.3 Metric External Screw Thread, Non-Standard Size. The example in Table 16C shows how size limit calculations are made by use of formulas for sizes not listed in ISO 261. For an example of how tabulated values for allowances and tolerances (in accordance with ISO 965-1) are used for the calculation of size limits in ASME B1.13M tables for standard external thread sizes listed in ISO 261, see para. 9.4.1.

9.4.4 Internal Metric Screw Thread, Non-Standard Size. The example in Table 16D shows how size limit calculations are made by use of formulas for sizes not listed in ISO 261. For an example of how tabulated values for allowances and tolerances (in accordance with ISO 965-1) are used for the calculation of size limits in

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Table 15 Internal Thread — Limiting Dimensions M Profile

Basic Thread Designation	Tolerance Class	Minor Diam., D_1		Pitch Diam., D_2 and Functional Diam. [Note (1)]			Major Diam., D	
		Min.	Max.	Min.	Max.	Tol.	Min.	Max. [Note (2)] (For Reference)
M1.6 × 0.35	6H	1.221	1.321	1.373	1.458	0.085	1.600	1.736
M2 × 0.4	6H	1.567	1.679	1.740	1.830	0.090	2.000	2.148
M2.5 × 0.45	6H	2.013	2.138	2.208	2.303	0.095	2.500	2.660
M3 × 0.5	6H	2.459	2.599	2.675	2.775	0.100	3.000	3.172
M3.5 × 0.6	6H	2.850	3.010	3.110	3.222	0.112	3.500	3.698
M4 × 0.7	6H	3.242	3.422	3.545	3.663	0.118	4.000	4.219
M5 × 0.8	6H	4.134	4.334	4.480	4.605	0.125	5.000	5.240
M6 × 1	6H	4.917	5.153	5.350	5.500	0.150	6.000	6.294
M8 × 1.25	6H	6.647	6.912	7.188	7.348	0.160	8.000	8.340
M8 × 1	6H	6.917	7.153	7.350	7.500	0.150	8.000	8.294
M10 × 1.5	6H	8.376	8.676	9.026	9.206	0.180	10.000	10.397
M10 × 1.25	6H	8.647	8.912	9.188	9.348	0.160	10.000	10.340
M10 × 1	6H	8.917	9.153	9.350	9.500	0.150	10.000	10.294
M10 × 0.75	6H	9.188	9.378	9.513	9.645	0.132	10.000	10.240
M12 × 1.75	6H	10.106	10.441	10.863	11.063	0.200	12.000	12.452
M12 × 1.5	6H	10.376	10.676	11.026	11.216	0.190	12.000	12.407
M12 × 1.25	6H	10.647	10.912	11.188	11.368	0.180	12.000	12.360
M12 × 1	6H	10.917	11.153	11.350	11.510	0.160	12.000	12.304
M14 × 2	6H	11.835	12.210	12.701	12.913	0.212	14.000	14.501
M14 × 1.5	6H	12.376	12.676	13.026	13.216	0.190	14.000	14.407
M15 × 1	6H	13.917	14.153	14.350	14.510	0.160	15.000	15.304
M16 × 2	6H	13.835	14.210	14.701	14.913	0.212	16.000	16.501
M16 × 1.5	6H	14.376	14.676	15.026	15.216	0.190	16.000	16.407
M17 × 1	6H	15.917	16.153	16.350	16.510	0.160	17.000	17.304
M18 × 1.5	6H	16.376	16.676	17.026	17.216	0.190	18.000	18.407
M20 × 2.5	6H	17.294	17.744	18.376	18.600	0.224	20.000	20.585
M20 × 1.5	6H	18.376	18.676	19.026	19.216	0.190	20.000	20.407
M20 × 1	6H	18.917	19.153	19.350	19.510	0.160	20.000	20.304
M22 × 2.5	6H	19.294	19.744	20.376	20.600	0.224	22.000	22.585
M22 × 1.5	6H	20.376	20.676	21.026	21.216	0.190	22.000	22.407
M24 × 3	6H	20.752	21.252	22.051	22.316	0.265	24.000	24.698
M24 × 2	6H	21.835	22.210	22.701	22.925	0.224	24.000	24.513
M25 × 1.5	6H	23.376	23.676	24.026	24.226	0.200	25.000	25.417
M27 × 3	6H	23.752	24.252	25.051	25.316	0.265	27.000	27.698
M27 × 2	6H	24.835	25.210	25.701	25.925	0.224	27.000	27.513
M30 × 3.5	6H	26.211	26.771	27.727	28.007	0.280	30.000	30.786
M30 × 2	6H	27.835	28.210	28.701	28.925	0.224	30.000	30.513
M30 × 1.5	6H	28.376	28.676	29.026	29.226	0.200	30.000	30.417
M33 × 2	6H	30.835	31.210	31.701	31.925	0.224	33.000	33.513
M35 × 1.5	6H	33.376	33.676	34.026	34.226	0.200	35.000	35.417
M36 × 4	6H	31.670	32.270	33.402	33.702	0.300	36.000	36.877
M36 × 2	6H	33.835	34.210	34.701	34.925	0.224	36.000	36.513
M39 × 2	6H	36.835	37.210	37.701	37.925	0.224	39.000	39.513
M40 × 1.5	6H	38.376	38.676	39.026	39.226	0.200	40.000	40.417
M42 × 4.5	6H	37.129	37.799	39.077	39.392	0.315	42.000	42.964

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Table 15 Internal Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Minor Diam., D_1		Pitch Diam., D_2 and Functional Diam. [Note (1)]			Major Diam., D	
		Min.	Max.	Min.	Max.	Tol.	Min.	Max. [Note (2)] (For Reference)
M42 × 2	6H	39.835	40.210	40.701	40.925	0.224	42.000	42.513
M45 × 1.5	6H	43.376	43.676	44.026	44.226	0.200	45.000	45.417
M48 × 5	6H	42.587	43.297	44.752	45.087	0.335	48.000	49.056
M48 × 2	6H	45.835	46.210	46.701	46.937	0.236	48.000	48.525
M50 × 1.5	6H	48.376	48.676	49.026	49.238	0.212	50.000	50.429
M55 × 1.5	6H	53.376	53.676	54.026	54.238	0.212	55.000	55.429
M56 × 5.5	6H	50.046	50.796	52.428	52.783	0.355	56.000	57.149
M56 × 2	6H	53.835	54.210	54.701	54.937	0.236	56.000	56.525
M60 × 1.5	6H	58.376	58.676	59.026	59.238	0.212	60.000	60.429
M64 × 6	6H	57.505	58.305	60.103	60.478	0.375	64.000	65.241
M64 × 2	6H	61.835	62.210	62.701	62.937	0.236	64.000	64.525
M65 × 1.5	6H	63.376	63.676	64.026	64.238	0.212	65.000	65.429
M70 × 1.5	6H	68.376	68.676	69.026	69.238	0.212	70.000	70.429
M72 × 6	6H	65.505	66.305	68.103	68.478	0.375	72.000	73.241
M72 × 2	6H	69.835	70.210	70.701	70.937	0.236	72.000	72.525
M75 × 1.5	6H	73.376	73.676	74.026	74.238	0.212	75.000	75.429
M80 × 6	6H	73.505	74.305	76.103	76.478	0.375	80.000	81.241
M80 × 2	6H	77.835	78.210	78.701	78.937	0.236	80.000	80.525
M80 × 1.5	6H	78.376	78.676	79.026	79.238	0.212	80.000	80.429
M85 × 2	6H	82.835	83.210	83.701	83.937	0.236	85.000	85.525
M90 × 6	6H	83.505	84.305	86.103	86.478	0.375	90.000	91.241
M90 × 2	6H	87.835	88.210	88.701	88.937	0.236	90.000	90.525
M95 × 2	6H	92.835	93.210	93.701	93.951	0.250	95.000	95.539
M100 × 6	6H	93.505	94.305	96.103	96.503	0.400	100.000	101.266
M100 × 2	6H	97.835	98.210	98.701	98.951	0.250	100.000	100.539
M105 × 2	6H	102.835	103.210	103.701	103.951	0.250	105.000	105.539
M110 × 2	6H	107.835	108.210	108.701	108.951	0.250	110.000	110.539
M120 × 2	6H	117.835	118.210	118.701	118.951	0.250	120.000	120.539
M130 × 2	6H	127.835	128.210	128.701	128.951	0.250	130.000	130.539
M140 × 2	6H	137.835	138.210	138.701	138.951	0.250	140.000	140.539
M150 × 2	6H	147.835	148.210	148.701	148.951	0.250	150.000	150.539
M160 × 3	6H	156.752	157.252	158.051	158.351	0.300	160.000	160.733
M170 × 3	6H	166.752	167.252	168.051	168.351	0.300	170.000	170.733
M180 × 3	6H	176.752	177.252	178.051	178.351	0.300	180.000	180.733
M190 × 3	6H	186.752	187.252	188.051	188.386	0.335	190.000	190.768
M200 × 3	6H	196.752	197.252	198.051	198.386	0.335	200.000	200.768

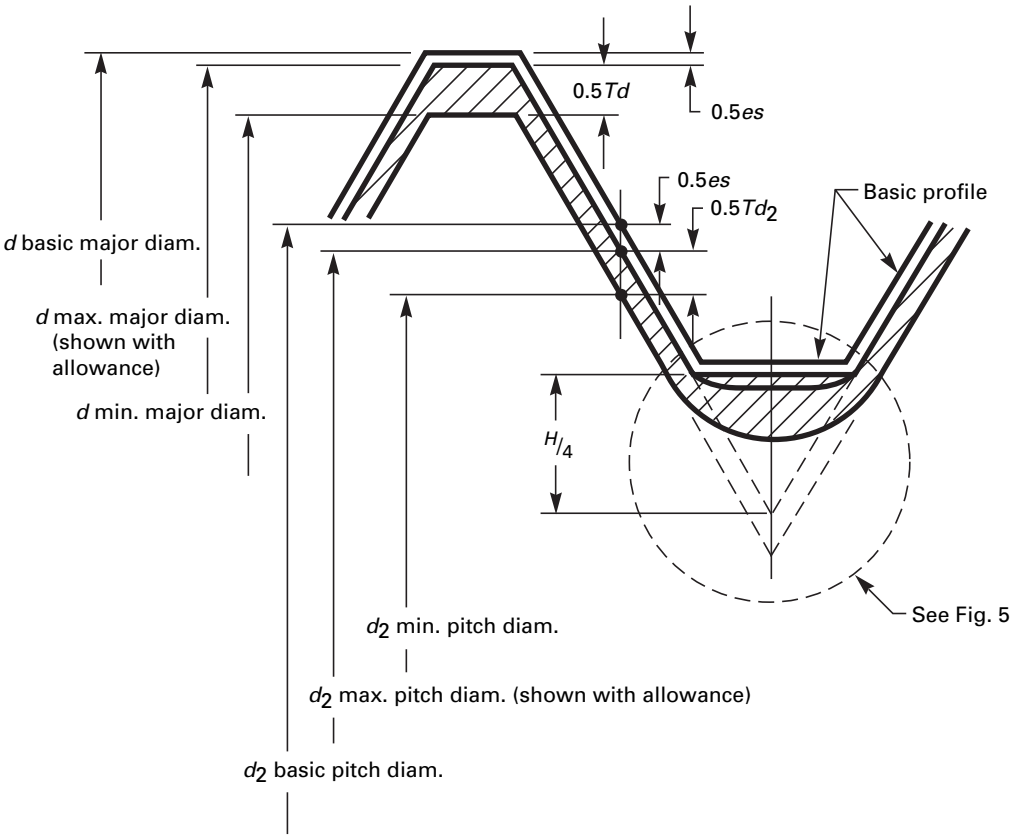
GENERAL NOTE: All dimensions are in millimeters.

NOTES:

(1) See para. 5.4(b).

(2) Dimension is used in the design of tools, etc. In dimensioning internal threads it is not normally specified. Generally, major diameter acceptance is based on maximum material condition gaging.

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GENERAL NOTES:
(a) Section-lined portions identify tolerance zone and unshaded portions identify allowance (fundamental deviation).
(b) Tolerance position *g* is shown. For position *h*, allowance *es* is zero.

Fig. 9 External Thread — Limiting M Thread Profile

ASME B1.13M tables for standard internal thread sizes listed in ISO 261, see para. 9.4.2.

10 LEAD AND FLANK ANGLE TOLERANCES

10.1 Lead and Flank Angle Acceptance

Acceptance of lead and flank angles of product screw threads shall be in accordance with paras. 10.1.1 through 10.1.6. These factors also contribute to visual identification of gross defects in thread profile.

10.1.1 When Thread Gaging System 21 of ASME B1.3 is specified, product thread lead (including helix) and flank angle variations are not considered.

10.1.2 When Thread Gaging System 22 of ASME B1.3 is specified, with the pitch diameter or thread groove diameter inspection required, the product thread lead (including helix) and flank angles shall be considered acceptable when the minimum material characteristic (pitch diameter or thread groove diameter in Tables 1 and 2, Cols. C and D of ASME B1.3) and the maximum material characteristic (GO in Tables 1 and 2, Col. A of ASME B1.3) are accepted by the gages specified for System 22, over the standard GO thread gage length.

When Thread Gaging System 22 is specified with NOT-GO (LO) functional diameter combined with control of lead and flank option, agreements must be reached between the purchaser and the supplier on lead and flank angle limits and method of evaluation.

10.1.3 When Thread Gaging System 23 of ASME B1.3 is specified, product thread lead and flank angles shall be acceptable if within the allowable variations as specified in Tables 17 and 18. Also, the minimum material characteristic (pitch diameter or thread groove diameter in Tables 1 and 2, Cols. C and D of ASME B1.3) and the maximum material characteristic (GO in Tables 1 and 2, Col. A of ASME B1.3) must be accepted by the gages specified for System 23, over the standard GO thread gage length.

Allowable variations in lead and flank angles are maximum values. Maximum variation in these and pitch

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diameter tolerance cannot be taken simultaneously. See paras. 10.1.5 and 10.1.6.

10.1.4 When individual inspections of lead (including helix) and flank angle variations are required, in addition to Thread Gaging System 21 or 22 of ASME B1.3, the allowable variations for these characteristics shall be specified.

10.1.5 For sizes not included in Tables 17 and 18, the allowable lead variation is equal to 0.57735 times one-half the pitch diameter tolerance. This is the lead variation that causes a change in functional diameter equal to one-half the pitch diameter tolerance. The allowable flank half-angle variation in minutes of arc is equal to 125 divided by the square root of pitch for pitch diameter tolerance grade 6 and 80 divided by the square root of pitch for pitch diameter tolerance grade 4. For other standard tolerance grades, multiply allowable angle variations for tolerance grade 6 by the multipliers in para. 6.6.1.1. Round calculated angle variations to the nearest 5 min.

10.1.6 For requirements of paras. 10.1.4 and 10.1.5, lead variation values tabulated or calculated are the maximum variations from specified lead between any two points not farther apart than the length of the standard GO thread gage. (See ASME B47.1.) Flank angle variation values are maximum variations from the basic 30 deg angle between thread flanks and perpendiculars to the thread axis.

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Table 16A Example of External Screw Thread, Standard Size

Thread Size = M12 x 1.75–4g6g		
Characteristic Description	**Example of Size Calculation**	**Additional Information**
(1) Maximum external major diameter ($d$max.) = Basic major diameter ($d$bsc) – allowance (es)	$d$max. = $d$bsc – $\lvert es \rvert$; $\lvert es \rvert$ is absolute value $d$bsc = 12.000 $\lvert es_g \rvert$ = 0.034 $d$max. = 12.000 – 0.034 = 11.966	. . . From thread size. From Allowance in Table 13. Final value is rounded to three decimal places so no further rounding is necessary.
(2) Minimum external major diameter ($d$min.) = Maximum external major diameter ($d$max.) – major diameter tolerance (Td)	$d$min. = $d$max. – Td $d$max. = 11.966 Td = 0.265 $d$min. = 11.966 – 0.265 = 11.701	. . . [See Table 16A, (1).] From Major Diameter Tolerance in Table 10. Final value is rounded to three decimal places so no further rounding is necessary.
(3) Maximum external pitch diameter ($d_2$max.) = Basic major diameter ($d$bsc) – allowance (es) – 0.6495191P or maximum external major diameter ($d$max.) – 0.6495191P	$d_2$max. = $d$max. – 0.6495191P $d$max. = 11.966 0.6495191P = (0.6495191)(1.75) 0.6495191P = 1.1366584 0.6495191P = 1.13666 $d_2$max. = 11.966 – 1.13666 $d_2$max. = 10.82934 $d_2$max. = 10.829, when rounded	. . . [See Table 16A, (1).] . . . This figure is rounded to five decimal places which is two places beyond the three decimal place final value of $d_2$max. This value may also be found in Thread Data in Table 2. . . . This figure is rounded to three decimal places to obtain the final value of $d_2$max. . . .
(4) Minimum external pitch diameter ($d_2$min.) = Maximum external pitch diameter ($d_2$max.) – external pitch diameter tolerance (Td_2)	$d_2$min. = $d_2$max. – Td_2 $d_2$max. = 10.829 Td_2 = 0.095 $d_2$min. = 10.829 – 0.095 = 10.734	. . . [See Table 16A, (3).] From Pitch Diameter Tolerance in Table 11. Final value is rounded to three decimal places so no further rounding is necessary.

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Table 16A Example of External Screw Thread, Standard Size (Cont'd)

Thread Size = M12 x 1.75–4g6g		
Characteristic Description	**Example of Size Calculation**	**Additional Information**
(5) Maximum external minor diameter ($d_1$max.) (flat form) = Maximum external pitch diameter ($d_2$max.) – 0.4330127P	$d_1$max. = $d_2$max. – 0.4330127P	. . .
	$d_2$max. = 10.829	[See Table 16A, (3).]
	0.4330127P = (0.4330127)(1.75)	. . .
	0.4330127P = 0.7577722	This figure is rounded to five decimal places which is two places beyond the three decimal place final value of $d_1$max.
	0.4330127P = 0.75777	This value may also be found in Thread Data in Table 2.
	$d_1$max. = 10.829 – 0.75777	. . .
	$d_1$max. = 10.07123	This figure is rounded to three decimal places to obtain the final value of $d_1$max.
	$d_1$max. = 10.071, when rounded	. . .
(6) For Reference: Minimum external minor diameter ($d_3$min.) (round form) = Minimum external pitch diameter ($d_2$min.) – 0.6160254P	$d_3$min. = $d_2$min. – 0.6160254P	. . .
	$d_2$min. = 10.734	[See Table 16A, (4).]
	0.6160254P = (0.6160254)(1.75)	. . .
	0.6160254P = 1.0780445	This figure is rounded to five decimal places which is two places beyond the three decimal place final value of $d_3$min.
	0.6160254P = 1.07804	This value may also be found in Thread Data in Table 2.
	$d_3$min. = 10.734 – 1.07804 = 9.65596	This figure is rounded to three decimal places to obtain the final value of $d_3$min.
	$d_3$min. = 9.656, when rounded	. . .

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Table 16B Example of Internal Metric Screw Thread, Standard Size

Thread Size = M12 x 1.75–6H		
Characteristic Description	**Example of Size Calculation**	**Additional Information**
(1) Minimum internal major diameter (Dmin.) = Basic internal major diameter (Dbsc) + allowance (EI)	Dmin. = Dbsc + $\lvert EI \rvert$; $\lvert EI \rvert$ is absolute value	. . .
	Dbsc = $d$bsc = 12.000	From thread size.
	$\lvert EI_H \rvert$ = 0	From Allowance in Table 13.
	Dmin. = 12.000 + 0.000 = 12.000	Final value is rounded to three decimal places so no further rounding is necessary.
(2) Minimum internal pitch diameter (D_2min.) = Basic internal major diameter (Dbsc) – 0.6495191P + allowance (EI) or minimum internal major diameter (Dmin.) – 0.6495191P	D_2min. = Dmin. – 0.6495191P	. . .
	Dmin. = 12.000	[See Table 16B, (1).]
	0.6495191P = 0.6495191 (1.75)	. . .
	0.6495191P = 1.1366584	This figure is rounded to five decimal places which is two places beyond the three decimal place final value of D_2min.
	0.6495191P = 1.13666	This value may also be found in Thread Data in Table 2.
	D_2min. = 12.000 – 1.13666	. . .
	D_2min. = 10.86334	This figure is rounded to obtain the final value of minimum pitch diameter.
	D_2min. = 10.863, when rounded	. . .
(3) Maximum internal pitch diameter (D_2max.) = Minimum internal pitch diameter (D_2min.) + internal pitch diameter tolerance (TD_2)	D_2max. = D_2min. + TD_2	. . .
	D_2min. = 10.863	[See Table 16B, (2).]
	TD_2 (6) = 0.200	From Pitch Diameter Tolerance in Table 12.
	D_2max. = 10.863 + 0.200 = 11.063	Final value is rounded to three decimal places so no further rounding is necessary.
(4) Minimum internal minor diameter (D_1min.) = Minimum internal major diameter (Dmin.) – 1.0825318P	D_1min. = Dmin. – 1.0825318P	. . .
	Dmin. = 12.000	[See Table 16B, (1).]
	1.0825318P = (1.0825318)(1.75)	. . .
	1.0825318P = 1.8944306	This figure is rounded to five decimal places which is two places beyond the three decimal place final value D_1min.
	1.0825318P = 1.89443	This value may also be found in Thread Data in Table 2.
	D_1min. = 12.000 – 1.89443	. . .
	D_1min. = 10.10557	This figure is rounded to three decimal places to obtain the final value of minimum pitch diameter.
	D_1min. = 10.106, when rounded	. . .

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Table 16B Example of Internal Metric Screw Thread, Standard Size (Cont'd)

Thread Size = M12 x 1.75–6H		
Characteristic Description	**Example of Size Calculation**	**Additional Information**
(5) Maximum internal minor diameter (D_1max.) = Minimum internal minor diameter (D_1min.) + internal minor diameter tolerance (TD_1)	D_1max. = D_1min. + TD_1	. . .
	D_1min. = 10.106	[See Table 16B, (4).]
	TD_1 (6) = 0.335	From Minor Diameter Tolerance in Table 9.
	D_1max. = 10.106 + 0.335 = 10.441	Final value is rounded to three decimal places so no further rounding is necessary.
(6) For Reference: Maximum internal major diameter (Dmax.) = Maximum internal pitch diameter (D_2max.) + 0.7938566P	Dmax. = D_2max. + 0.7938566P	. . .
	D_2max. = 11.063	[See Table 16B, (3).]
	0.7938566P = (0.7938566) 1.75	. . .
	0.7938566P = 1.3892490	This figure is rounded to five decimal places which is two places beyond the three decimal place final value of Dmax.
	0.7938566P = 1.38925	This value may also be found in Thread Data in Table 2.
	Dmax. = 11.063 + 1.38925	. . .
	Dmax. = 12.45225	This figure is rounded to three decimal places to obtain the final value of maximum major diameter.
	Dmax. = 12.452, when rounded	. . .

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Table 16C Example of External Metric Screw Thread, Non-Standard Size

Thread Size = M13 x 0.9–4g6g		
Characteristic Description	**Example of Size Calculation**	**Additional Information**
(1) Maximum external major diameter ($d$max.) = Basic major diameter ($d$bsc) – allowance (es)	$d\text{max.} = d\text{bsc} - \lvert es \rvert$; $\lvert es \rvert$ is absolute value	. . .
	$d\text{bsc} = 13.000$	This is the final value of the basic major diameter and is therefore expressed with three decimal places.
	$\lvert es_g \rvert = 0.015 + 0.011P$	es for tolerance position g is not tabulated for $P = 0.9$ so it must be calculated.
	$\lvert es_g \rvert = 0.015 + 0.011(0.9)$	. . .
	$\lvert es_g \rvert = 0.0249$	This figure is rounded to three decimal places to obtain the final absolute value of allowance for tolerance position g.
	$\lvert es_g \rvert = 0.025$, when rounded	. . .
	$d\text{max.} = 13.000 - 0.025 = 12.975$	Final value is rounded to three decimal places so no further rounding is necessary.
(2) Minimum external major diameter ($d$min.) = Maximum external major diameter ($d$max.) – tolerance (Td)	$d\text{min.} = d\text{max.} - Td$	. . .
	$d\text{max.} = 12.975$	[See Table 16C, (1).]
	$Td\ (6) = 0.18\sqrt[3]{P^2} - \dfrac{0.00315}{\sqrt{P}}$	Td for tolerance grade 6 is not tabulated for $P = 0.9$ so it must be calculated.
	$Td\ (6) = 0.18\sqrt[3]{0.9^2} - \dfrac{0.00315}{\sqrt{0.9}}$	. . .
	$Td\ (6) = 0.18\sqrt[3]{0.81000} - \dfrac{0.00315}{0.94868}$	. . .
	$Td\ (6) = 0.18\ (0.93217) - \dfrac{0.00315}{0.94868}$	. . .
	$Td\ (6) = 0.16779–0.00332$	. . .
	$Td\ (6) = 0.16447$	This figure is rounded to three decimal places to obtain the final value of major diameter tolerance for tolerance grade 6.
	$Td\ (6) = 0.164$, when rounded	. . .
	$d\text{min.} = 12.975 - 0.164 = 12.811$	Final value is rounded to three decimal places so no further rounding is necessary.
(3) Maximum external pitch diameter ($d_2$max.) = [Basic major diameter ($d$bsc) – allowance (es)] – 06495191P or maximum external major diameter ($d$max.) – 06495191P	$d_2\text{max.} = d\text{max.} - 0.6495191P$	. . .
	$d\text{max.} = 12.975$	[See Table 16C, (1).]
	$0.6495191P = 0.6495191(0.9)$	. . .
	$0.6495191P = 0.5845672$	This figure is rounded to five decimal places to obtain the final value.
	$0.6495191P = 0.58457$	. . .
	$d_2\text{max.} = 12.975 - 0.58457$	. . .
	$d_2\text{max.} = 12.39043$	This figure is rounded to obtain the final value of $d_2$max.
	$d_2\text{max.} = 12.390$, when rounded	. . .

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Table 16C Example of External Metric Screw Thread, Non-Standard Size (Cont'd)

Thread Size = M13 x 0.9–4g6g		
Characteristic Description	**Example of Size Calculation**	**Additional Information**
(4) Minimum external pitch diameter ($d_2$min.) = Maximum external pitch diameter ($d_2$max.) – external pitch diameter tolerance (Td_2)	$d_2$min. = $d_2$max. – Td_2	. . .
	$d_2$max. = 12.390	[See Table 16C, (3).]
	Td_2 (4) = 0.63Td_2 (6)	Td_2 for tolerance grade 4 is not tabulated for P = 0.9 so it must be calculated.
	Td_2 (4) = 0.63 [0.09$P^{0.4}d^{0.1}$]	. . .
	Td_2 (4) = 0.63 [0.09 $(0.9)^{0.4}(13)^{0.1}$]	. . .
	Td_2 (4) = 0.63 [0.09 (0.95873) (1.29239)]	. . .
	Td_2 (4) = 0.63 [(0.09)(1.23905)]	. . .
	Td_2 (4) = (0.63)(0.11151)	. . .
	Td_2 (4) = 0.07025	This figure is rounded to three decimal places to obtain the final value of pitch diameter tolerance for tolerance grade 4.
	Td_2 (4) = 0.070, when rounded	. . .
	$d_2$min. = 12.390 – 0.070 = 12.320	Final value is rounded to three decimal places so no further rounding is necessary.
(5) Maximum external minor diameter ($d_1$max.) (flat form) = Maximum external pitch diameter ($d_2$max.) – 0.4330127P	$d_1$max. = $d_2$max. – 0.4330127P	. . .
	$d_2$max. = 12.390	[See Table 16C, (3).]
	0.4330127P = 0.4330127 (0.9)	. . .
	0.4330127P = 0.3897114	This figure is rounded to five decimal places, which is two decimal places beyond the three decimal place value of $d_1$max.
	0.4330127P = 0.38971	. . .
	$d_1$max. = 12.390 – 0.38971	. . .
	$d_1$max. = 12.00029	This figure is rounded to three decimal places to obtain the final value of maximum minor diameter
	$d_1$max. = 12.000, when rounded	. . .
(6) For Reference: Minimum external minor diameter ($d_3$min.)(round form) = Minimum external pitch diameter ($d_2$min.) – 0.6160254P	$d_3$min. = $d_2$min. – 0.6160254P	. . .
	$d_2$min. = 12.320	[See Table 16C, (4).]
	0.6160254P = 0.6160254 (0.9)	. . .
	0.6160254P = 0.5544229	This figure is rounded to five decimal places, which is two decimal places beyond the three decimal place final value of $d_3$min.
	0.6160254P = 0.55442	. . .
	$d_3$min. = 12.320 – 0.55442	. . .
	$d_3$min. = 11.76558	This figure is rounded to obtain the final value of minimum minor diameter.
	$d_3$min. = 11.766, when rounded	. . .

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Table 16D Example of Internal Metric Screw Thread, Non-Standard Size

Thread Size = M13 x 0.9–6H		
Characteristic Description	**Example of Size Calculation**	**Additional Information**
(1) Minimum internal major diameter (Dmin.) = Basic internal major diameter (Dbsc) + allowance (EI)	Dmin. = Dbsc + $\|EI\|$; $\|EI\|$ is absolute value	. . .
	Dbsc = $d$bsc = 13.000	[See Table 16C, (1)]
	EI_H = 0	From Allowance for tolerance position H in Table 13.
	Dmin. = 13.000 + 0.000 = 13.000	Final value is rounded to three decimal places so no further rounding is necessary.
(2) Minimum internal pitch diameter (D_2min.) = Basic internal major diameter (Dmin.) – 0.6495191P + allowance (EI); or minimum internal major diameter (Dmin.) – 0.6495191P	D_2min. = Dmin. – 0.6495191P	. . .
	Dmin. = 13.000	[See Table 16D, (1).]
	0.6495191P = 0.6495191 (0.9)	. . .
	0.6495191P = 0.5845672	This figure is rounded to five decimal places, which is two places beyond the three decimal place final value of D_2min.
	0.6495191P = 0.58457	. . .
	D_2min. = 13.000 – 0.58457	. . .
	D_2min. = 12.41543	This figure is rounded to obtain the final value of minimum pitch diameter.
	D_2min. = 12.415, when rounded	. . .
(3) Maximum internal pitch diameter (D_2max.) = Minimum internal pitch diameter (D_2min.) + internal pitch diameter tolerance (TD_2)	D_2max. = D_2min. + TD_2	. . .
	D_2min. = 12.415	[See Table 16D, (2).]
	TD_2 (6) = 1.32Td_2 (6)	TD_2 (or Td_2) for tolerance grade 6 is not tabulated for P = 0.9 so it must be calculated.
	TD_2 (6) = 1.32 [0.09$P^{0.4}d^{0.1}$]	. . .
	TD_2 (6) = 1.32 [0.09 $(0.9)^{0.4}(13)^{0.1}$]	. . .
	TD_2 (6) = 1.32 [0.09 (0.95873)(1.29239)]	. . .
	TD_2 (6) = 0.14720	This figure is rounded to three decimal places to obtain the final value of pitch diameter tolerance for tolerance grade 6.
	TD_2 (6) = 0.147, when rounded	. . .
	D_2max. = 12.415 + 0.147 = 12.562	Final value is rounded to three decimal places so no further rounding is necessary.
(4) Minimum internal minor diameter (D_1min.) = Minimum internal major diameter (Dmin.) – 1.0825318P	D_1min. = Dmin. – 1.0825318P	. . .
	Dmin. = 13.000	[See Table 16D, (1).]
	1.0825318P = 1.0825318 (0.9)	. . .
	1.0825318P = 0.9742786	This figure is rounded to five decimal places, which is two places beyond the three decimal place final value of D_1min.
	1.0825318P = 0.97428	. . .
	D_1min. = 13.000 – 0.97428	. . .
	D_1min. = 12.02572	This figure is rounded to three decimal places to obtain the final value of minimum pitch diameter
	D_1min. = 12.026, when rounded	. . .

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Table 16D Example of Internal Metric Screw Thread, Non-Standard Size (Cont'd)

Thread Size = M13 x 0.9–6H		
Characteristic Description	**Example of Size Calculation**	**Additional Information**
(5) Maximum internal minor diameter (D_1max.) = Minimum internal minor diameter (D_1min.) + tolerance (TD_1)	D_1max. = D_1min. + TD_1	. . .
	D_1min. = 12.026	[See Table 16D, (4).]
	TD_1 (6) = 0.218	P = 0.9 is not tabulated nor is there any ISO formula applicable to this pitch. Therefore, a tolerance midway between the tabulated values for P = 0.8 and P = 1.0 has been selected. This value is TD_1 (6) = 0.218.
	D_1max. = 12.026 + 0.218 = 12.244	Final value is rounded to three decimal places so no further rounding is necessary.
(6) For Reference: Maximum internal major diameter (Dmax.) = Maximum internal pitch diameter (D_2max.) + 0.7938566P	Dmax. = D_2max. + 0.7938566P	. . .
	D_2max. = 12.562	[See Table 16D, (3).]
	0.7938566P = 0.7938566 (0.9)	. . .
	0.7938566P = 0.7144709	This figure is rounded to five decimal places, which is two places beyond the three decimal place value of Dmax.
	0.7938566P = 0.71447	. . .
	Dmax. = 12.562 + 0.71447	. . .
	Dmax. = 13.27647	This figure is rounded to three decimal places to obtain the final value of maximum major diameter.
	Dmax. = 13.276, when rounded	. . .

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Table 17 Allowable Variations in Lead and Equivalent Change in Functional Diameter

(See paras. 10.1.3 through 10.1.6 for applicability.)

	External Threads			Internal Threads		
Basic Thread Designation	Tolerance Class	Allowable Variation in Lead (±)	Equivalent Change in Functional Diameter (+)	Tolerance Class	Allowable Variation in Lead (±)	Equivalent Change in Functional Diameter (–)
M1.6 × 0.35	6g	0.018	0.032	6H	0.025	0.042
	4g6g	0.012	0.020	...	...	...
M2 × 0.4	6g	0.019	0.034	6H	0.026	0.045
	4g6g	0.012	0.021	...	...	...
M2.5 × 0.45	6g	0.020	0.036	6H	0.027	0.048
	4g6g	0.013	0.022	...	...	...
M3 × 0.5	6g	0.022	0.038	6H	0.029	0.050
	4g6g	0.014	0.024	...	...	...
M3.5 × 0.6	6g	0.025	0.042	6H	0.032	0.056
	4g6g	0.015	0.026	...	...	...
M4 × 0.7	6g	0.026	0.045	6H	0.034	0.059
	4g6g	0.016	0.028	...	...	...
M5 × 0.8	6g	0.027	0.048	6H	0.036	0.062
	4g6g	0.017	0.030	...	...	...
M6 × 1	6g	0.032	0.056	6H	0.043	0.075
	4g6g	0.020	0.036	...	...	...
M8 × 1.25	6g	0.034	0.059	6H	0.046	0.080
	4g6g	0.022	0.038	...	...	...
M8 × 1	6g	0.032	0.056	6H	0.043	0.075
	4g6g	0.020	0.036	...	...	...
M10 × 1.5	6g	0.038	0.066	6H	0.052	0.090
	4g6g	0.025	0.042	...	...	...
M10 × 1.25	6g	0.034	0.059	6H	0.046	0.080
	4g6g	0.022	0.038	...	...	...
M10 × 1	6g	0.032	0.056	6H	0.043	0.075
	4g6g	0.020	0.036	...	...	...
M10 × 0.75	6g	0.029	0.050	6H	0.038	0.066
	4g6g	0.019	0.032	...	...	...
M12 × 1.75	6g	0.043	0.075	6H	0.058	0.100
	4g6g	0.027	0.048	...	...	...
M12 × 1.5	6g	0.040	0.070	6H	0.055	0.095
	4g6g	0.026	0.045	...	...	...
M12 × 1.25	6g	0.038	0.066	6H	0.052	0.090
	4g6g	0.025	0.042	...	...	...
M12 × 1	6g	0.034	0.059	6H	0.055	0.080
	4g6g	0.022	0.038	...	...	...
M14 × 2	6g	0.046	0.080	6H	0.061	0.106
	4g6g	0.029	0.050	...	...	...
M14 × 1.5	6g	0.040	0.070	6H	0.055	0.095
	4g6g	0.026	0.045	...	...	...
M15 × 1	6g	0.034	0.059	6H	0.055	0.080
	4g6g	0.022	0.038	...	...	...
M16 × 2	6g	0.046	0.080	6H	0.061	0.106
	4g6g	0.029	0.050	...	...	...
M16 × 1.5	6g	0.040	0.070	6H	0.055	0.095
	4g6g	0.026	0.045	...	...	...
M17 × 1	6g	0.034	0.059	6H	0.046	0.080
	4g6g	0.022	0.038	...	...	...

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Table 17 Allowable Variations in Lead and Equivalent Change in Functional Diameter (Cont'd)

(See paras. 10.1.3 through 10.1.6 for applicability.)

	External Threads			Internal Threads		
Basic Thread Designation	Tolerance Class	Allowable Variation in Lead (±)	Equivalent Change in Functional Diameter (+)	Tolerance Class	Allowable Variation in Lead (±)	Equivalent Change in Functional Diameter (–)
M18 × 1.5	6g	0.040	0.070	6H	0.055	0.095
	4g6g	0.026	0.045	...	...	...
M20 × 2.5	6g	0.049	0.085	6H	0.065	0.112
	4g6g	0.031	0.053	...	...	...
M20 × 1.5	6g	0.040	0.070	6H	0.055	0.095
	4g6g	0.026	0.045	...	...	...
M20 × 1	6g	0.034	0.059	6H	0.046	0.080
	4g6g	0.022	0.038	...	...	...
M22 × 2.5	6g	0.049	0.085	6H	0.065	0.112
M22 × 1.5	6g	0.040	0.070	6H	0.055	0.095
	4g6g	0.026	0.045	...	...	...
M24 × 3	6g	0.058	0.100	6H	0.076	0.132
	4g6g	0.036	0.062	...	...	...
M24 × 2	6g	0.049	0.085	6H	0.065	0.112
	4g6g	0.031	0.053	...	...	...
M25 × 1.5	6g	0.043	0.075	6H	0.058	0.100
	4g6g	0.025	0.042	...	...	...
M27 × 3	6g	0.058	0.100	6H	0.076	0.132
M27 × 2	6g	0.049	0.085	6H	0.065	0.112
	4g6g	0.031	0.053	...	...	...
M30 × 3.5	6g	0.061	0.106	6H	0.081	0.140
	4g6g	0.038	0.066	...	...	...
M30 × 2	6g	0.049	0.085	6H	0.065	0.112
	4g6g	0.031	0.053	...	...	...
M30 × 1.5	6g	0.043	0.075	6H	0.058	0.100
	4g6g	0.025	0.042	...	...	...
M33 × 2	6g	0.049	0.085	6H	0.065	0.112
	4g6g	0.031	0.053	...	...	...
M35 × 1.5	6g	0.043	0.075	6H	0.058	0.100
M36 × 4	6g	0.065	0.112	6H	0.087	0.150
	4g6g	0.040	0.070	...	...	...
M36 × 2	6g	0.049	0.085	6H	0.065	0.112
	4g6g	0.031	0.053	...	...	...
M39 × 2	6g	0.049	0.085	6H	0.065	0.112
	4g6g	0.031	0.053	...	...	...
M40 × 1.5	6g	0.043	0.075	6H	0.058	0.100
	4g6g	0.025	0.042	...	...	...
M42 × 4.5	6g	0.068	0.118	6H	0.091	0.158
	4g6g	0.043	0.075	...	...	...
M42 × 2	6g	0.049	0.085	6H	0.065	0.112
	4g6g	0.031	0.053	...	...	...
M45 × 1.5	6g	0.043	0.075	6H	0.058	0.100
	4g6g	0.025	0.042	...	...	...
M48 × 5	6g	0.072	0.125	6H	0.097	0.168
	4g6g	0.046	0.080	...	...	...
M48 × 2	6g	0.052	0.090	6H	0.068	0.118
	4g6g	0.032	0.056	...	...	...
M50 × 1.5	6g	0.046	0.080	6H	0.061	0.106
	4g6g	0.029	0.050	...	...	...

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Table 17 Allowable Variations in Lead and Equivalent Change in Functional Diameter (Cont'd)

(See paras. 10.1.3 through 10.1.6 for applicability.)

	External Threads			Internal Threads		
Basic Thread Designation	Tolerance Class	Allowable Variation in Lead (±)	Equivalent Change in Functional Diameter (+)	Tolerance Class	Allowable Variation in Lead (±)	Equivalent Change in Functional Diameter (–)
M55 × 1.5	6g	0.046	0.080	6H	0.061	0.106
	4g6g	0.029	0.050	...	...	...
M56 × 5.5	6g	0.076	0.132	6H	0.102	0.178
	4g6g	0.049	0.085	...	...	...
M56 × 2	6g	0.052	0.090	6H	0.068	0.118
	4g6g	0.032	0.056	...	...	...
M60 × 1.5	6g	0.046	0.080	6H	0.061	0.106
	4g6g	0.029	0.050	...	...	...
M64 × 6	6g	0.081	0.140	6H	0.108	0.188
	4g6g	0.052	0.090	...	...	...
M64 × 2	6g	0.052	0.090	6H	0.068	0.118
	4g6g	0.032	0.056	...	...	...
M65 × 1.5	6g	0.046	0.080	6H	0.061	0.106
	4g6g	0.029	0.050	...	...	...
M70 × 1.5	6g	0.046	0.080	6H	0.061	0.106
	4g6g	0.029	0.050	...	...	...
M72 × 6	6g	0.081	0.140	6H	0.108	0.188
	4g6g	0.052	0.090	...	...	...
M72 × 2	6g	0.052	0.090	6H	0.068	0.118
	4g6g	0.032	0.056	...	...	...
M75 × 1.5	6g	0.046	0.080	6H	0.061	0.106
	4g6g	0.029	0.050	...	...	...
M80 × 6	6g	0.081	0.140	6H	0.108	0.188
	4g6g	0.052	0.090	...	...	...
M80 × 2	6g	0.052	0.090	6H	0.068	0.118
	4g6g	0.032	0.056	...	...	...
M80 × 1.5	6g	0.046	0.080	6H	0.061	0.106
	4g6g	0.029	0.050	...	...	...
M85 × 2	6g	0.052	0.090	6H	0.068	0.118
	4g6g	0.032	0.056	...	...	...
M90 × 6	6g	0.081	0.140	6H	0.108	0.188
	4g6g	0.052	0.090	...	...	...
M90 × 2	6g	0.052	0.090	6H	0.068	0.118
	4g6g	0.032	0.056	...	...	...
M95 × 2	6g	0.055	0.095	6H	0.072	0.125
	4g6g	0.034	0.059	...	...	...
M100 × 6	6g	0.087	0.150	6H	0.115	0.200
	4g6g	0.055	0.095	...	...	...
M100 × 2	6g	0.055	0.095	6H	0.072	0.125
	4g6g	0.034	0.059	...	...	...
M105 × 2	6g	0.055	0.095	6H	0.072	0.125
	4g6g	0.034	0.059	...	...	...
M110 × 2	6g	0.055	0.095	6H	0.072	0.125
	4g6g	0.034	0.059	...	...	...
M120 × 2	6g	0.055	0.095	6H	0.072	0.125
	4g6g	0.034	0.059	...	...	...
M130 × 2	6g	0.055	0.095	6H	0.072	0.125
	4g6g	0.034	0.059	...	...	...

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Table 17 Allowable Variations in Lead and Equivalent Change in Functional Diameter (Cont'd)

(See paras. 10.1.3 through 10.1.6 for applicability.)

	External Threads			Internal Threads		
Basic Thread Designation	Tolerance Class	Allowable Variation in Lead (±)	Equivalent Change in Functional Diameter (+)	Tolerance Class	Allowable Variation in Lead (±)	Equivalent Change in Functional Diameter (–)
M140 × 2	6g	0.055	0.095	6H	0.072	0.125
	4g6g	0.034	0.059	...	...	...
M150 × 2	6g	0.055	0.095	6H	0.072	0.125
	4g6g	0.034	0.059	...	...	...
M160 × 3	6g	0.065	0.112	6H	0.087	0.150
	4g6g	0.040	0.070	...	...	...
M170 × 3	6g	0.065	0.112	6H	0.087	0.150
	4g6g	0.040	0.070	...	...	...
M180 × 3	6g	0.065	0.112	6H	0.087	0.150
	4g6g	0.040	0.070	...	...	...
M190 × 3	6g	0.072	0.125	6H	0.097	0.168
	4g6g	0.046	0.080	...	...	...
M200 × 3	6g	0.072	0.125	6H	0.097	0.168
	4g6g	0.046	0.080	...	...	...

GENERAL NOTE: All dimensions are in millimeters.

Table 18 Allowable Variations in 30 deg Basic Half-Angle of Screw Threads

External and Internal Threads				
	Allowable Variation in Half-Angle			
	Pitch Diam. Tol. Grade 6		Pitch Diam. Tol. Grade 4	
Pitch	± deg	Min.	± deg	Min.
0.35	3	30	2	15
0.4	3	20	2	05
0.45	3	05	2	00
0.5	2	55	1	55
0.6	2	40	1	45
0.7	2	30	1	35
0.75	2	25	1	30
0.8	2	20	1	30
1	2	05	1	20
1.25	1	50	1	10
1.5	1	40	1	05
1.75	1	35	1	00
2	1	30	0	55
2.5	1	20	0	50
3	1	10	0	45
3.5	1	05	0	45
4	1	05	0	40
4.5	1	00	0	40
5	0	55	0	35
5.5	0	55	0	35
6	0	50	0	35
8	0	45	0	30

GENERAL NOTE: See paras. 10.1.3 through 10.1.6 for applicability.

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NONMANDATORY APPENDIX A
STANDARD RULES FOR ROUNDING

See ASME B1.30 for rounding rules and examples.

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NONMANDATORY APPENDIX B
THREAD STRENGTH DESIGN FORMULAS

B-1 THREAD TENSILE STRESS AREA

The following tensile stress area formula is used for the purpose of product acceptance computations per ISO 898-1. This formula is based upon the area at a section midway between the basic pitch diameter and the basic rounded form minor diameter with radius of 0.144*P*.

Tensile stress Area, mm^2

$$As = 0.7854\,(d\text{bsc} - 0.9382P)^2$$

B-2 THREAD SHEAR AREA

The following formulas for thread shear areas are geometric minimum values. Shear (Thread Stripping) strength of screw threads under load are dependent, in addition, on mating component relative material strengths, nut geometry, and coefficient of friction between thread bearing surfaces. Effective shear areas are therefore somewhat less than the geometric values.

Thread Geometric Shear Areas:

$$AS_n = \frac{3.1416}{P}\,LE\,d\text{ min.}\left[\frac{P}{2} + 0.57735\,(d\text{ min.} - D_2\text{ max.})\right]$$

$$AS_s = \frac{3.1416}{P}\,LE\,D_1\text{ max.}\left[\frac{P}{2} + 0.57735\,(d_2\text{ min.} - D_1\text{ max.})\right]$$

where

AS_n = minimum thread shear area for internal threads, mm^2
AS_s = minimum thread shear area for external threads, mm^2
LE = length of engagement

B-3 LENGTH OF THREAD ENGAGEMENT

In general the length of engagement of mating threads is selected to utilize full tensile strength of a bolt prior to shearing of nut threads. Other applications may require internal thread shear prior to failure of the externally threaded part. For noncritical design, the following formulas are often used for approximation:

Tensile strength of externally threaded part, kN

$$= \frac{S_t A_s}{1\,000}$$

Shear strength of threads, kN

$$= S_t\,(AS_n \text{ or } AS_s)/2\,000$$

where

S_t = Ultimate tensile strength of material, MPa

An internationally accepted study on the subject has been published in the 1977 Transactions of the Society of Automotive Engineers as Paper number 770420, *Analysis and Design of Threaded Assemblies* by E. M. Alexander.

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NONMANDATORY APPENDIX C
LIMITING DIMENSIONS M PROFILE SCREW THREADS — INCH TRANSLATION

This Appendix (see Tables C-1 and C-2) presents an inch translation of limiting dimensions for M profile screw threads appearing in Tables 14 and 15. Data appearing here are for reference only. Dimensions have been calculated by dividing millimeter values in Tables 14 and 15, respectively, by 25.400 and rounding to 5 decimal places in accordance with ASME B1.30.

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Table C-1 Inch Translation for External Thread — Limiting Dimensions M Profile

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2), (3), and (4)]			Max. Minor Diameter (Flat Form), d_1 [Note (2)]	Min. Minor Diam., (Rounded Form), d_3 [Note (5)] (For Reference)	Nominal Pitch, *P*
			Max.	Min.	Max.	Min.	Tol.			
M1.6 × 0.35	6g	0.00075	0.06224	0.05890	0.05331	0.05083	0.00248	0.04732	0.04232	0.01378
M1.6 × 0.35	6h	0.00000	0.06299	0.05965	0.05406	0.05157	0.00248	0.04807	0.04307	0.01378
M1.6 × 0.35	4g6g	0.00075	0.06224	0.05890	0.05331	0.05173	0.00158	0.04732	0.04323	0.01378
M2 × 0.4	6g	0.00075	0.07799	0.07425	0.06776	0.06512	0.00264	0.06094	0.05543	0.01575
M2 × 0.4	6h	0.00000	0.07874	0.07500	0.06850	0.06587	0.00264	0.06169	0.05618	0.01575
M2 × 0.4	4g6g	0.00075	0.07799	0.07425	0.06776	0.06610	0.00166	0.06094	0.05642	0.01575
M2.5 × 0.45	6g	0.00079	0.09764	0.09370	0.08614	0.08335	0.00280	0.07846	0.07244	0.01772
M2.5 × 0.45	6h	0.00000	0.09843	0.09449	0.08693	0.08413	0.00280	0.07925	0.07323	0.01772
M2.5 × 0.45	4g6g	0.00079	0.09764	0.09370	0.08614	0.08437	0.00177	0.07846	0.07346	0.01772
M3 × 0.5	6g	0.00079	0.11732	0.11315	0.10453	0.10157	0.00295	0.09598	0.08945	0.01969
M3 × 0.5	6h	0.00000	0.11811	0.11394	0.10531	0.10236	0.00295	0.09677	0.09024	0.01969
M3 × 0.5	4g6g	0.00079	0.11732	0.11315	0.10453	0.10264	0.00189	0.09598	0.09051	0.01969
M3.5 × 0.6	6g	0.00083	0.13697	0.13205	0.12161	0.11827	0.00335	0.11138	0.10370	0.02362
M3.5 × 0.6	6h	0.00000	0.13780	0.13287	0.12244	0.11909	0.00335	0.11220	0.10453	0.02362
M3.5 × 0.6	4g6g	0.00083	0.13697	0.13205	0.12161	0.11953	0.00208	0.11138	0.10496	0.02362
M4 × 0.7	6g	0.00087	0.15661	0.15110	0.13870	0.13516	0.00354	0.12677	0.11819	0.02756
M4 × 0.7	6h	0.00000	0.15748	0.15197	0.13957	0.13602	0.00354	0.12764	0.11906	0.02756
M4 × 0.7	4g6g	0.00087	0.15661	0.15110	0.13870	0.13650	0.00220	0.12677	0.11953	0.02756
M5 × 0.8	6g	0.00094	0.19591	0.19000	0.17543	0.17169	0.00374	0.16181	0.15228	0.03150
M5 × 0.8	6h	0.00000	0.19685	0.19094	0.17638	0.17264	0.00374	0.16276	0.15323	0.03150
M5 × 0.8	4g6g	0.00094	0.19591	0.19000	0.17543	0.17307	0.00236	0.16181	0.15366	0.03150
M6 × 1	6g	0.00102	0.23520	0.22811	0.20961	0.20520	0.00441	0.19256	0.18094	0.03937
M6 × 1	6h	0.00000	0.23622	0.22913	0.21063	0.20622	0.00441	0.19358	0.18197	0.03937
M6 × 1	4g6g	0.00102	0.23520	0.22811	0.20961	0.20681	0.00280	0.19256	0.18256	0.03937
M8 × 1.25	6g	0.00110	0.31386	0.30551	0.28189	0.27724	0.00465	0.26059	0.24693	0.04921
M8 × 1.25	6h	0.00000	0.31496	0.30661	0.28299	0.27835	0.00465	0.26169	0.24803	0.04921
M8 × 1.25	4g6g	0.00110	0.31386	0.30551	0.28189	0.27894	0.00295	0.26059	0.24862	0.04921
M8 × 1	6g	0.00102	0.31394	0.30685	0.28835	0.28394	0.00441	0.27130	0.25969	0.03937
M8 × 1	6h	0.00000	0.31496	0.30787	0.28937	0.28496	0.00441	0.27232	0.26071	0.03937
M8 × 1	4g6g	0.00102	0.31394	0.30685	0.28835	0.28555	0.00280	0.27130	0.26130	0.03937
M10 × 1.5	6g	0.00126	0.39244	0.38315	0.35409	0.34890	0.00520	0.32850	0.31252	0.05906
M10 × 1.5	6h	0.00000	0.39370	0.38441	0.35535	0.35016	0.00520	0.32976	0.31378	0.05906

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Table C-1 Inch Translation for External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2), (3), and (4)]			Max. Minor Diameter (Flat Form), d_1 [Note (2)]	Min. Minor Diam. (Rounded Form), d_3 [Note (5)] (For Reference)	Nominal Pitch, *P*
			Max.	Min.	Max.	Min.	Tol.			
M10 × 1.5	4g6g	0.00126	0.39244	0.38315	0.35409	0.35075	0.00334	0.32850	0.31437	0.05906
M10 × 1.25	6g	0.00110	0.39260	0.38425	0.36063	0.35598	0.00465	0.33933	0.32567	0.04921
M10 × 1.25	6h	0.00000	0.39370	0.38535	0.36173	0.35709	0.00465	0.34043	0.32677	0.04921
M10 × 1.25	4g6g	0.00110	0.39260	0.38425	0.36063	0.35768	0.00295	0.33933	0.32736	0.04921
M10 × 1	6g	0.00102	0.39268	0.38559	0.36709	0.36268	0.00441	0.35004	0.33843	0.03937
M10 × 1	6h	0.00000	0.39370	0.38661	0.36811	0.36370	0.00441	0.35106	0.33945	0.03937
M10 × 1	4g6g	0.00102	0.39268	0.38559	0.36709	0.36429	0.00280	0.35004	0.34004	0.03937
M10 × 0.75	6g	0.00087	0.39283	0.38732	0.37366	0.36972	0.00394	0.36087	0.35154	0.02953
M10 × 0.75	6h	0.00000	0.39370	0.38819	0.37453	0.37059	0.00394	0.36173	0.35240	0.02953
M10 × 0.75	4g6g	0.00087	0.39283	0.38732	0.37366	0.37118	0.00248	0.36087	0.35299	0.02953
M12 × 1.75	6g	0.00134	0.47110	0.46067	0.42634	0.42023	0.00591	0.39650	0.37799	0.06890
M12 × 1.75	6h	0.00000	0.47244	0.46201	0.42768	0.42177	0.00591	0.39783	0.37933	0.06890
M12 × 1.75	4g6g	0.00134	0.47110	0.46067	0.42634	0.42260	0.00374	0.39650	0.38016	0.06890
M12 × 1.5	6g	0.00126	0.47118	0.46189	0.43283	0.42732	0.00551	0.40724	0.39094	0.05906
M12 × 1.5	6h	0.00000	0.47244	0.46315	0.43409	0.42858	0.00551	0.40850	0.39220	0.05906
M12 × 1.5	4g6g	0.00126	0.47118	0.46189	0.43283	0.42929	0.00354	0.40724	0.39291	0.05906
M12 × 1.25	6g	0.00110	0.47134	0.46299	0.43937	0.43417	0.00520	0.41807	0.40386	0.04921
M12 × 1.25	6h	0.00000	0.47244	0.46409	0.44047	0.43528	0.00520	0.41917	0.40496	0.04921
M12 × 1.25	4g6g	0.00110	0.47134	0.46299	0.43937	0.43602	0.00335	0.41807	0.40571	0.04921
M12 × 1	6g	0.00102	0.47142	0.46433	0.44583	0.44118	0.00465	0.42878	0.41693	0.03937
M12 × 1	6h	0.00000	0.47244	0.46535	0.44685	0.44220	0.00465	0.42980	0.41795	0.03937
M12 × 1	4g6g	0.00102	0.47142	0.46433	0.44583	0.44287	0.00296	0.42878	0.41862	0.03937
M14 × 2	6g	0.00150	0.54969	0.53866	0.49854	0.49224	0.00630	0.46445	0.44374	0.07874
M14 × 2	6h	0.00000	0.55118	0.54016	0.50004	0.49374	0.00630	0.46594	0.44524	0.07874
M14 × 2	4g6g	0.00150	0.54969	0.53866	0.49854	0.49461	0.00393	0.46445	0.44610	0.07874
M14 × 1.5	6g	0.00126	0.54992	0.54063	0.51157	0.50606	0.00551	0.48598	0.46969	0.05906
M14 × 1.5	6h	0.00000	0.55118	0.54189	0.51283	0.50732	0.00551	0.48724	0.47094	0.05906
M14 × 1.5	4g6g	0.00126	0.54992	0.54063	0.51157	0.50803	0.00354	0.48598	0.47165	0.05906
M15 × 1	6g	0.00102	0.58953	0.58244	0.56394	0.55929	0.00465	0.54689	0.53504	0.03937
M15 × 1	6h	0.00000	0.59055	0.58346	0.56496	0.56031	0.00465	0.54791	0.53606	0.03937
M15 × 1	4g6g	0.00102	0.58953	0.58244	0.56394	0.56098	0.00296	0.54689	0.53673	0.03937
M16 × 2	6g	0.00150	0.62843	0.61740	0.57728	0.57098	0.00630	0.54319	0.52248	0.07874
M16 × 2	6h	0.00000	0.62992	0.61890	0.57878	0.57248	0.00630	0.54469	0.52398	0.07874
M16 × 2	4g6g	0.00150	0.62843	0.61740	0.57728	0.57335	0.00393	0.54319	0.52484	0.07874

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Table C-1 Inch Translation for External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2), (3), and (4)]			Max. Minor Diameter (Flat Form), d_1 [Note (2)]	Min. Minor Diam. (Rounded Form), d_3 [Note (5)] (For Reference)	Nominal Pitch, *P*
			Max.	Min.	Max.	Min.	Tol.			
M16 × 1.5	6g	0.00126	0.62866	0.61937	0.59031	0.58480	0.00551	0.56472	0.54843	0.05906
M16 × 1.5	6h	0.00000	0.62992	0.62063	0.59157	0.58606	0.00551	0.56598	0.54969	0.05906
M16 × 1.5	4g6g	0.00126	0.62866	0.61937	0.59031	0.58677	0.00354	0.56472	0.55039	0.05906
M17 × 1	6g	0.00102	0.66827	0.66118	0.64268	0.63803	0.00465	0.62563	0.61378	0.03937
M17 × 1	6h	0.00000	0.66929	0.66220	0.64370	0.63906	0.00465	0.62665	0.61480	0.03937
M17 × 1	4g6g	0.00102	0.66827	0.66118	0.64268	0.63972	0.00296	0.62563	0.61547	0.03937
M18 × 1.5	6g	0.00126	0.70740	0.69811	0.66906	0.66354	0.00551	0.64346	0.62717	0.05906
M18 × 1.5	6h	0.00000	0.70866	0.69937	0.67031	0.66480	0.00551	0.64472	0.62843	0.05906
M18 × 1.5	4g6g	0.00126	0.70740	0.69811	0.66906	0.66551	0.00355	0.64346	0.62913	0.05906
M20 × 2.5	6g	0.00165	0.78575	0.77256	0.72181	0.71512	0.00669	0.67917	0.65449	0.09843
M20 × 2.5	6h	0.00000	0.78740	0.77421	0.72346	0.71677	0.00669	0.68083	0.65614	0.09843
M20 × 2.5	4g6g	0.00165	0.78575	0.77256	0.72181	0.71764	0.00417	0.67917	0.65701	0.09843
M20 × 1.5	6g	0.00126	0.78614	0.77685	0.74780	0.74228	0.00551	0.72220	0.70591	0.05906
M20 × 1.5	6h	0.00000	0.78740	0.77811	0.74906	0.74354	0.00551	0.72346	0.70717	0.05906
M20 × 1.5	4g6g	0.00126	0.78614	0.77685	0.74780	0.74425	0.00355	0.72220	0.70787	0.05906
M20 × 1	6g	0.00102	0.78638	0.77929	0.76079	0.75614	0.00465	0.74374	0.73189	0.03937
M20 × 1	6h	0.00000	0.78740	0.78031	0.76181	0.75717	0.00465	0.74476	0.73291	0.03937
M20 × 1	4g6g	0.00102	0.78638	0.77929	0.76079	0.75783	0.00296	0.74374	0.73358	0.03937
M22 × 2.5	6g	0.00165	0.86449	0.85130	0.80055	0.79386	0.00669	0.75791	0.73323	0.09843
M22 × 2.5	6h	0.00000	0.86614	0.85295	0.80220	0.79551	0.00669	0.75957	0.73488	0.09843
M22 × 1.5	6g	0.00126	0.86488	0.85559	0.82654	0.82102	0.00551	0.80094	0.78465	0.05906
M22 × 1.5	6h	0.00000	0.86614	0.85685	0.82780	0.82228	0.00551	0.80220	0.78591	0.05906
M22 × 1.5	4g6g	0.00126	0.86488	0.85559	0.82654	0.82299	0.00355	0.80094	0.78661	0.05906
M24 × 3	6g	0.00189	0.94299	0.92823	0.86626	0.85839	0.00787	0.81512	0.78563	0.11811
M24 × 3	6h	0.00000	0.94488	0.93012	0.86815	0.86028	0.00787	0.81701	0.78752	0.11811
M24 × 3	4g6g	0.00189	0.94299	0.92823	0.86626	0.86134	0.00492	0.81512	0.78858	0.11811
M24 × 2	6g	0.00150	0.94339	0.93236	0.89224	0.88555	0.00669	0.85815	0.83705	0.07874
M24 × 2	6h	0.00000	0.94488	0.93386	0.89374	0.88705	0.00669	0.85965	0.83854	0.07874
M24 × 2	4g6g	0.00150	0.94339	0.93236	0.89224	0.88807	0.00417	0.85815	0.83957	0.07874
M25 × 1.5	6g	0.00126	0.98299	0.97370	0.94465	0.93874	0.00591	0.91906	0.90236	0.05906
M25 × 1.5	6h	0.00000	0.98425	0.97496	0.94591	0.94000	0.00591	0.92031	0.90362	0.05906
M25 ×1.5	4g6g	0.00126	0.98299	0.97370	0.94465	0.94091	0.00374	0.91906	0.90453	0.05906

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Table C-1 Inch Translation for External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2), (3), and (4)]			Max. Minor Diameter (Flat Form), d_1 [Note (2)]	Min. Minor Diam. (Rounded Form), d_3 [Note (5)] (For Reference)	Nominal Pitch, *P*
			Max.	Min.	Max.	Min.	Tol.			
M27 × 3	6g	0.00189	1.06110	1.04634	0.98437	0.97650	0.00787	0.93323	0.90374	0.11811
M27 × 3	6h	0.00000	1.06299	1.04823	0.98626	0.97839	0.00787	0.93512	0.90563	0.11811
M27 × 2	6g	0.00150	1.06150	1.05047	1.01035	1.00366	0.00669	0.97626	0.95516	0.07874
M27 × 2	6h	0.00000	1.06299	1.05197	1.01185	1.00516	0.00669	0.97776	0.95665	0.07874
M27 × 2	4g6g	0.00150	1.06150	1.05047	1.01035	1.00618	0.00417	0.97626	0.95768	0.07874
M30 × 3.5	6g	0.00209	1.17902	1.16228	1.08953	1.08118	0.00835	1.02984	0.99630	0.13780
M30 × 3.5	6h	0.00000	1.18110	1.16437	1.09161	1.08327	0.00835	1.03193	0.99839	0.13780
M30 × 3.5	4g6g	0.00209	1.17902	1.16228	1.08953	1.08433	0.00520	1.02984	0.99945	0.13780
M30 × 2	6g	0.00150	1.17961	1.16858	1.12846	1.12177	0.00669	1.09437	1.07327	0.07874
M30 × 2	6h	0.00000	1.18110	1.17008	1.12996	1.12327	0.00669	1.09587	1.07476	0.07874
M30 × 2	4g6g	0.00150	1.17961	1.16858	1.12846	1.12429	0.00417	1.09437	1.07579	0.07874
M30 × 1.5	6g	0.00126	1.17984	1.17055	1.14150	1.13559	0.00591	1.11591	1.09921	0.05906
M30 × 1.5	6h	0.00000	1.18110	1.17181	1.14276	1.13685	0.00591	1.11717	1.10047	0.05906
M30 × 1.5	4g6g	0.00126	1.17984	1.17055	1.14150	1.13776	0.00374	1.11591	1.10138	0.05906
M33 × 2	6g	0.00150	1.29772	1.28669	1.24657	1.23988	0.00669	1.21248	1.19138	0.07874
M33 × 2	6h	0.00000	1.29921	1.28819	1.24807	1.24138	0.00669	1.21398	1.19287	0.07874
M33 × 2	4g6g	0.00150	1.29772	1.28669	1.24657	1.24240	0.00417	1.21248	1.19390	0.07874
M35 × 1.5	6g	0.00126	1.37669	1.36740	1.33835	1.33244	0.00591	1.31276	1.29606	0.05906
M35 × 1.5	6h	0.00000	1.37795	1.36866	1.33961	1.33370	0.00591	1.31402	1.29732	0.05906
M36 × 4	6g	0.00236	1.41496	1.39626	1.31268	1.30386	0.00882	1.24449	1.20685	0.15748
M36 × 4	6h	0.00000	1.41732	1.39862	1.31504	1.30622	0.00882	1.24685	1.20921	0.15748
M36 × 4	4g6g	0.00236	1.41496	1.39626	1.31268	1.30717	0.00551	1.24449	1.21016	0.15748
M36 × 2	6g	0.00150	1.41583	1.40480	1.36469	1.35799	0.00669	1.33059	1.30949	0.07874
M36 × 2	6h	0.00000	1.41732	1.40630	1.36618	1.35949	0.00669	1.33209	1.31098	0.07874
M36 × 2	4g6g	0.00150	1.41583	1.40480	1.36469	1.36051	0.00418	1.33059	1.31201	0.07874
M39 × 2	6g	0.00150	1.53394	1.52291	1.48280	1.47610	0.00669	1.44870	1.42760	0.07874
M39 × 2	6h	0.00000	1.53543	1.52441	1.48429	1.47760	0.00669	1.45020	1.42909	0.07874
M39 × 2	4g6g	0.00150	1.53394	1.52291	1.48280	1.47862	0.00418	1.44870	1.43012	0.07874
M40 × 1.5	6g	0.00126	1.57354	1.56425	1.53520	1.52929	0.00591	1.50961	1.49291	0.05906
M40 × 1.5	6h	0.00000	1.57480	1.56551	1.53646	1.53055	0.00591	1.51087	1.49417	0.05906
M40 × 1.5	4g6g	0.00126	1.57354	1.56425	1.53520	1.53146	0.00374	1.50961	1.49508	0.05906
M42 × 4.5	6g	0.00248	1.65106	1.63138	1.53598	1.52669	0.00929	1.45925	1.41756	0.17717
M42 × 4.5	6h	0.00000	1.65354	1.63386	1.53846	1.52917	0.00929	1.46173	1.42004	0.17717

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Table C-1 Inch Translation for External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2), (3), and (4)]			Max. Minor Diameter (Flat Form), d_1 [Note (2)]	Min. Minor Diam. (Rounded Form), d_3 [Note (5)] (For Reference)	Nominal Pitch, *P*
			Max.	Min.	Max.	Min.	Tol.			
M42 × 4.5	4g6g	0.00248	1.65106	1.63138	1.53598	1.53008	0.00590	1.45925	1.42094	0.17717
M42 × 2	6g	0.00150	1.65205	1.64102	1.60091	1.59421	0.00669	1.56681	1.54571	0.07874
M42 × 2	6h	0.00000	1.65354	1.64252	1.60240	1.59571	0.00669	1.56831	1.54720	0.07874
M42 × 2	4g6g	0.00150	1.65205	1.64102	1.60091	1.59673	0.00418	1.56681	1.54823	0.07874
M45 × 1.5	6g	0.00126	1.77039	1.76110	1.73205	1.72614	0.00591	1.70646	1.68976	0.05906
M45 × 1.5	6h	0.00000	1.77165	1.76236	1.73331	1.72740	0.00591	1.70772	1.69102	0.05906
M45 × 1.5	4g6g	0.00126	1.77039	1.76110	1.73205	1.72831	0.00374	1.70646	1.69193	0.05906
M48 × 5	6g	0.00280	1.88697	1.86610	1.75909	1.74925	0.00984	1.67386	1.62799	0.19685
M48 × 5	6h	0.00000	1.88976	1.86890	1.76189	1.75205	0.00984	1.67665	1.63079	0.19685
M48 × 5	4g6g	0.00280	1.88697	1.86610	1.75909	1.75280	0.00629	1.67386	1.63154	0.19685
M48 × 2	6g	0.00150	1.88827	1.87724	1.83713	1.83004	0.00709	1.80303	1.78154	0.07874
M48 × 2	6h	0.00000	1.88976	1.87874	1.83862	1.83154	0.00709	1.80453	1.78303	0.07874
M48 × 2	4g6g	0.00150	1.88827	1.87724	1.83713	1.83272	0.00441	1.80303	1.78421	0.07874
M50 × 1.5	6g	0.00126	1.96724	1.95795	1.92890	1.92260	0.00630	1.90331	1.88622	0.05906
M50 × 1.5	6h	0.00000	1.96850	1.95921	1.93016	1.92386	0.00630	1.90457	1.88748	0.05906
M50 × 1.5	4g6g	0.00126	1.96724	1.95795	1.92890	1.92496	0.00394	1.90331	1.88858	0.05906
M55 × 1.5	6g	0.00126	2.16409	2.15480	2.12575	2.11945	0.00630	2.10016	2.08307	0.05906
M55 × 1.5	6h	0.00000	2.16535	2.15606	2.12701	2.12071	0.00630	2.10142	2.08433	0.05906
M55 × 1.5	4g6g	0.00126	2.16409	2.15480	2.12575	2.12181	0.00394	2.10016	2.08543	0.05906
M56 × 5.5	6g	0.00295	2.20177	2.17972	2.06114	2.05071	0.01043	1.96736	1.91732	0.21654
M56 × 5.5	6h	0.00000	2.20472	2.18268	2.06409	2.05366	0.01043	1.97031	1.92028	0.21654
M56 × 5.5	4g6g	0.00295	2.20177	2.17972	2.06114	2.05445	0.00669	1.96736	1.92106	0.21654
M56 × 2	6g	0.00150	2.20323	2.19220	2.15209	2.14500	0.00709	2.11799	2.09650	0.07874
M56 × 2	6h	0.00000	2.20472	2.19370	2.15358	2.14650	0.00709	2.11949	2.09799	0.07874
M56 × 2	4g6g	0.00150	2.20323	2.19220	2.15209	2.14768	0.00441	2.11799	2.09917	0.07874
M60 × 1.5	6g	0.00126	2.36094	2.35165	2.32260	2.31630	0.00630	2.29701	2.27992	0.05906
M60 × 1.5	6h	0.00000	2.36220	2.35291	2.32386	2.31756	0.00630	2.29827	2.28118	0.05906
M60 × 1.5	4g6g	0.00126	2.36094	2.35165	2.32260	2.31866	0.00394	2.29701	2.28228	0.05906
M64 × 6	6g	0.00315	2.51654	2.49291	2.36311	2.35209	0.01102	2.26083	2.20657	0.23622
M64 × 6	6h	0.00000	2.51969	2.49606	2.36626	2.35524	0.01102	2.26398	2.20972	0.23622
M64 × 6	4g6g	0.00315	2.51654	2.49291	2.36311	2.35602	0.00709	2.26083	2.21051	0.23622

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Table C-1 Inch Translation for External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diam., d_2 and Functional Diameter [Notes (2), (3), and (4)]			Max. Minor Diameter (Flat Form), d_1 [Note (2)]	Min. Minor Diam. (Rounded Form), d_3 [Note (5)], (For Reference)	Nominal Pitch, *P*
			Max.	Min.	Max.	Min.	Tol.			
M64 × 2	6g	0.00150	2.51819	2.50717	2.46705	2.45996	0.00709	2.43295	2.41146	0.07874
M64 × 2	6h	0.00000	2.51969	2.50866	2.46854	2.46146	0.00709	2.43445	2.41295	0.07874
M64 × 2	4g6g	0.00150	2.51819	2.50717	2.46705	2.46264	0.00441	2.43295	2.41413	0.07874
M65 × 1.5	6g	0.00126	2.55780	2.54850	2.51945	2.51315	0.00630	2.49386	2.47677	0.05906
M65 × 1.5	6h	0.00000	2.55906	2.54976	2.52071	2.51441	0.00630	2.49512	2.47803	0.05906
M65 × 1.5	4g6g	0.00126	2.55780	2.54850	2.51945	2.51551	0.00394	2.49386	2.47913	0.05906
M70 ×1.5	6g	0.00126	2.75465	2.74535	2.71630	2.71000	0.00630	2.69071	2.67362	0.05906
M70 × 1.5	6h	0.00000	2.75591	2.74661	2.71756	2.71126	0.00630	2.69197	2.67488	0.05906
M70 ×1.5	4g6g	0.00126	2.75465	2.74535	2.71630	2.71236	0.00394	2.69071	2.67598	0.05906
M72 × 6	6g	0.00315	2.83150	2.80787	2.67807	2.66705	0.01102	2.57579	2.52154	0.23622
M72 × 6	6h	0.00000	2.83465	2.81102	2.68122	2.67020	0.01102	2.57894	2.52469	0.23622
M72 × 6	4g6g	0.00315	2.83150	2.80787	2.67807	2.67098	0.00709	2.57579	2.52547	0.23622
M72 × 2	6g	0.00150	2.83315	2.82213	2.78201	2.77492	0.00709	2.74791	2.72642	0.07874
M72 × 2	6h	0.00000	2.83465	2.82362	2.78350	2.77642	0.00709	2.74941	2.72791	0.07874
M72 × 2	4g6g	0.00150	2.83315	2.82213	2.78201	2.77760	0.00441	2.74791	2.72909	0.07874
M75 × 1.5	6g	0.00126	2.95150	2.94220	2.91315	2.90685	0.00630	2.88756	2.87047	0.05906
M75 × 1.5	6h	0.00000	2.95276	2.94346	2.91441	2.90811	0.00630	2.88882	2.87173	0.05906
M75 × 1.5	4g6g	0.00126	2.95150	2.94220	2.91315	2.90921	0.00394	2.88756	2.87283	0.05906
M80 × 6	6g	0.00315	3.14646	3.12283	2.99303	2.98201	0.01102	2.89075	2.83650	0.23622
M80 × 6	6h	0.00000	3.14961	3.12598	2.99618	2.98516	0.01102	2.89390	2.83965	0.23622
M80 × 6	4g6g	0.00315	3.14646	3.12283	2.99303	2.98594	0.00709	2.89075	2.84043	0.23622
M80 × 2	6g	0.00150	3.14811	3.13709	3.09697	3.08988	0.00709	3.06287	3.04138	0.07874
M80 × 2	6h	0.00000	3.14961	3.13858	3.09846	3.09138	0.00709	3.06437	3.04287	0.07874
M80 × 2	4g6g	0.00150	3.14811	3.13709	3.09697	3.09256	0.00441	3.06287	3.04406	0.07874
M80 × 1.5	6g	0.00126	3.14835	3.13906	3.11000	3.10370	0.00630	3.08441	3.06732	0.05906
M80 × 1.5	6h	0.00000	3.14961	3.14031	3.11126	3.10496	0.00630	3.08567	3.06858	0.05906
M80 × 1.5	4g6g	0.00126	3.14835	3.13906	3.11000	3.10606	0.00394	3.08441	3.06969	0.05906
M85 × 2	6g	0.00150	3.34496	3.33394	3.29382	3.28673	0.00709	3.25972	3.23823	0.07874
M85 × 2	6h	0.00000	3.34646	3.33543	3.29531	3.28823	0.00709	3.26122	3.23972	0.07874
M85 × 2	4g6g	0.00150	3.34496	3.33394	3.29382	3.28941	0.00441	3.25972	3.24091	0.07874
M90 × 6	6g	0.00315	3.54016	3.51654	3.38673	3.37571	0.01102	3.28445	3.23020	0.23622
M90 × 6	6h	0.00000	3.54331	3.51969	3.38988	3.37886	0.01102	3.28760	3.23335	0.23622

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Table C-1 Inch Translation for External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2), (3), and (4)]			Max. Minor Diameter (Flat Form), d_1 [Note (2)]	Min. Minor Diam. (Rounded Form), d_3 [Note (5)] (For Reference)	Nominal Pitch, *P*
			Max.	Min.	Max.	Min.	Tol.			
M90 × 6	4g6g	0.00315	3.54016	3.51654	3.38673	3.37965	0.00708	3.28445	3.23413	0.23622
M90 × 2	6g	0.00150	3.54181	3.53079	3.49067	3.48358	0.00709	3.45657	3.43508	0.07874
M90 × 2	6h	0.00000	3.54331	3.53228	3.49217	3.48508	0.00709	3.45807	3.43657	0.07874
M90 × 2	4g6g	0.00150	3.54181	3.53079	3.49067	3.48626	0.00441	3.45657	3.43776	0.07874
M95 × 2	6g	0.00150	3.73866	3.72764	3.68752	3.68004	0.00748	3.65343	3.63154	0.07874
M95 × 2	6h	0.00000	3.74016	3.72913	3.68902	3.68154	0.00748	3.65492	3.63303	0.07874
M95 × 2	4g6g	0.00150	3.73866	3.72764	3.68752	3.68287	0.00465	3.65343	3.63437	0.07874
M100 × 6	6g	0.00315	3.93386	3.91024	3.78043	3.76862	0.01181	3.67815	3.62311	0.23622
M100 × 6	6h	0.00000	3.93701	3.91339	3.78358	3.77177	0.01181	3.68130	3.62626	0.23622
M100 × 6	4g6g	0.00315	3.93386	3.91024	3.78043	3.77295	0.00748	3.67815	3.62744	0.23622
M100 × 2	6g	0.00150	3.93551	3.92449	3.88437	3.87689	0.00748	3.85028	3.82839	0.07874
M100 × 2	6h	0.00000	3.93701	3.92598	3.88587	3.87839	0.00748	3.85177	3.82988	0.07874
M100 × 2	4g6g	0.00150	3.93551	3.92449	3.88437	3.87972	0.00465	3.85028	3.83122	0.07874
M105 × 2	6g	0.00150	4.13236	4.12134	4.08122	4.07374	0.00748	4.04713	4.02524	0.07874
M105 × 2	6h	0.00000	4.13386	4.12283	4.08272	4.07524	0.00748	4.04862	4.02673	0.07874
M105 × 2	4g6g	0.00150	4.13236	4.12134	4.08122	4.07657	0.00465	4.04713	4.02807	0.07874
M110 × 2	6g	0.00150	4.32921	4.31819	4.27807	4.27059	0.00748	4.24398	4.22209	0.07874
M110 × 2	6h	0.00000	4.33071	4.31969	4.27957	4.27209	0.00748	4.24547	4.22358	0.07874
M110 × 2	4g6g	0.00150	4.32921	4.31819	4.27807	4.27343	0.00464	4.24398	4.22492	0.07874
M120 × 2	6g	0.00150	4.72291	4.71189	4.67177	4.66429	0.00748	4.63768	4.61579	0.07874
M120 × 2	6h	0.00000	4.72441	4.71339	4.67327	4.66579	0.00748	4.63917	4.61728	0.07874
M120 × 2	4g6g	0.00150	4.72291	4.71189	4.67177	4.66713	0.00464	4.63768	4.61862	0.07874
M130 × 2	6g	0.00150	5.11661	5.10559	5.06547	5.05799	0.00748	5.03138	5.00949	0.07874
M130 × 2	6h	0.00000	5.11811	5.10709	5.06697	5.05949	0.00748	5.03287	5.01098	0.07874
M130 × 2	4g6g	0.00150	5.11661	5.10559	5.06547	5.06083	0.00464	5.03138	5.01232	0.07874
M140 × 2	6g	0.00150	5.51031	5.49929	5.45917	5.45169	0.00748	5.42508	5.40319	0.07874
M140 × 2	6h	0.00000	5.51181	5.50079	5.46067	5.45319	0.00748	5.42657	5.40469	0.07874
M140 × 2	4g6g	0.00150	5.51031	5.49929	5.45917	5.45453	0.00464	5.42508	5.40602	0.07874
M150 × 2	6g	0.00150	5.90402	5.89299	5.85287	5.84539	0.00748	5.81878	5.79689	0.07874
M150 × 2	6h	0.00000	5.90551	5.89449	5.85437	5.84689	0.00748	5.82028	5.79839	0.07874
M150 × 2	4g6g	0.00150	5.90402	5.89299	5.85287	5.84823	0.00464	5.81878	5.79972	0.07874

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Table C-1 Inch Translation for External Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Allowance, *es* [Note (1)]	Major Diameter, *d* [Note (2)]		Pitch Diameter, d_2 and Functional Diameter [Notes (2), (3), and (4)]			Max. Minor Diameter (Flat Form), d_1 [Note (2)]	Min. Minor Diam. (Rounded Form), d_3 [Note (5)] (For Reference)	Nominal Pitch, *P*
			Max.	Min.	Max.	Min.	Tol.			
M160 × 3	6g	0.00189	6.29732	6.28256	6.22059	6.21177	0.00882	6.16945	6.13902	0.11811
M160 × 3	6h	0.00000	6.29921	6.28445	6.22248	6.21366	0.00882	6.17134	6.14091	0.11811
M160 × 3	4g6g	0.00189	6.29732	6.28256	6.22059	6.21508	0.00551	6.16945	6.14232	0.11811
M170 × 3	6g	0.00189	6.69102	6.67626	6.61429	6.60547	0.00882	6.56315	6.53272	0.11811
M170 × 3	6h	0.00000	6.69291	6.67815	6.61618	6.60736	0.00882	6.56504	6.53461	0.11811
M170 × 3	4g6g	0.00189	6.69102	6.67626	6.61429	6.60878	0.00551	6.56315	6.53602	0.11811
M180 × 3	6g	0.00189	7.08472	7.06996	7.00799	6.99917	0.00882	6.95685	6.92642	0.11811
M180 × 3	6h	0.00000	7.08661	7.07185	7.00988	7.00106	0.00882	6.95874	6.92831	0.11811
M180 × 3	4g6g	0.00189	7.08472	7.06996	7.00799	7.00248	0.00551	6.95685	6.92972	0.11811
M190 × 3	6g	0.00189	7.47843	7.46366	7.40169	7.39185	0.00984	7.35055	7.31909	0.11811
M190 × 3	6h	0.00000	7.48031	7.46555	7.40358	7.39374	0.00984	7.35244	7.32098	0.11811
M190 × 3	4g6g	0.00189	7.47843	7.46366	7.40169	7.39539	0.00630	7.35055	7.32264	0.11811
M200 × 3	6g	0.00189	7.87213	7.85736	7.79539	7.78555	0.00984	7.74425	7.71280	0.11811
M200 × 3	6h	0.00000	7.87402	7.85925	7.79728	7.78744	0.00984	7.74614	7.71469	0.11811
M200 × 3	4g6g	0.00189	7.87213	7.85736	7.79539	7.78909	0.00630	7.74425	7.71634	0.11811

GENERAL NOTE: All dimensions are in inches.

NOTES:

(1) *es* is absolute value.

(2) For coated threads with tolerance classes 6g or 4g6g, see para. 8.2.

(3) See para. 5.4(b).

(4) Since these tabulated tolerance values have been converted and then rounded, they may differ slightly from the difference between tabulated maximum and minimum values.

(5) Dimension used in the design of tools, etc. In dimensioning external threads it is not normally specified. Generally, minor diameter acceptance is based on maximum material condition gaging.

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Table C-2 Inch Translation for Internal Thread — Limiting Dimensions M Profile

Basic Thread Designation	Tolerance Class	Minor Diam., D_1		Pitch Diam., D_2 and Functional Diam. [Notes (1) and (2)]			Major Diam., D		Nominal Pitch, P
		Min.	Max.	Min.	Max.	Tol.	Min.	Max. [Note (3)] (Reference)	
M1.6 × 0.35	6H	0.04807	0.05201	0.05406	0.05740	0.00335	0.06299	0.06835	0.01378
M2 × 0.4	6H	0.06169	0.06610	0.06850	0.07205	0.00354	0.07874	0.08457	0.01575
M2.5 × 0.45	6H	0.07925	0.08417	0.08693	0.09067	0.00374	0.09843	0.10472	0.01772
M3 × 0.5	6H	0.09681	0.10232	0.10531	0.10925	0.00394	0.11811	0.12488	0.01969
M3.5 × 0.6	6H	0.11220	0.11850	0.12244	0.12685	0.00441	0.13780	0.14559	0.02362
M4 × 0.7	6H	0.12764	0.13472	0.13957	0.14421	0.00465	0.15748	0.16610	0.02756
M5 × 0.8	6H	0.16276	0.17063	0.17638	0.18130	0.00492	0.19685	0.20630	0.03150
M6 × 1	6H	0.19358	0.20287	0.21063	0.21654	0.00591	0.23622	0.24780	0.03937
M8 × 1.25	6H	0.26169	0.27213	0.28299	0.28929	0.00630	0.31496	0.32835	0.04921
M8 × 1	6H	0.27232	0.28161	0.28937	0.29528	0.00591	0.31496	0.32654	0.03937
M10 × 1.5	6H	0.32976	0.34157	0.35535	0.36244	0.00709	0.39370	0.40933	0.05906
M10 × 1.25	6H	0.34043	0.35087	0.36173	0.36803	0.00630	0.39370	0.40709	0.04921
M10 × 1	6H	0.35106	0.36035	0.36811	0.37402	0.00591	0.39370	0.40528	0.03937
M10 × 0.75	6H	0.36173	0.36921	0.37453	0.37972	0.00520	0.39370	0.40315	0.02953
M12 × 1.75	6H	0.39787	0.41106	0.42768	0.43555	0.00787	0.47244	0.49024	0.06890
M12 × 1.5	6H	0.40850	0.42031	0.43409	0.44157	0.00748	0.47244	0.48846	0.05906
M12 × 1.25	6H	0.41917	0.42961	0.44047	0.44756	0.00709	0.47244	0.48661	0.04921
M12 × 1	6H	0.42980	0.43909	0.44685	0.45315	0.00630	0.47244	0.48441	0.03937
M14 × 2	6H	0.46594	0.48071	0.50004	0.50839	0.00835	0.55118	0.57091	0.07874
M14 × 1.5	6H	0.48724	0.49906	0.51283	0.52031	0.00748	0.55118	0.56720	0.05906
M15 × 1	6H	0.54791	0.55720	0.56496	0.57126	0.00630	0.59055	0.60252	0.03937
M16 × 2	6H	0.54469	0.55945	0.57878	0.58713	0.00835	0.62992	0.64965	0.07874
M16 × 1.5	6H	0.56598	0.57780	0.59157	0.59906	0.00748	0.62992	0.64594	0.05906
M17 × 1	6H	0.62665	0.63594	0.64370	0.65000	0.00630	0.66929	0.68126	0.03937
M18 × 1.5	6H	0.64472	0.65654	0.67031	0.67780	0.00748	0.70866	0.72469	0.05906
M20 × 2.5	6H	0.68087	0.69858	0.72346	0.73228	0.00882	0.78740	0.81043	0.09843
M20 × 1.5	6H	0.72346	0.73528	0.74906	0.75654	0.00748	0.78740	0.80343	0.05906
M20 × 1	6H	0.74476	0.75406	0.76181	0.76811	0.00630	0.78740	0.79937	0.03937
M22 × 2.5	6H	0.75961	0.77732	0.80220	0.81102	0.00882	0.86614	0.88917	0.09843
M22 × 1.5	6H	0.80220	0.81402	0.82780	0.83528	0.00748	0.86614	0.88217	0.05906
M24 × 3	6H	0.81701	0.83669	0.86815	0.87858	0.01043	0.94488	0.97236	0.11811
M24 × 2	6H	0.85965	0.87441	0.89374	0.90256	0.00882	0.94488	0.96508	0.07874
M25 × 1.5	6H	0.92031	0.93213	0.94591	0.95378	0.00787	0.98425	1.00067	0.05906
M27 × 3	6H	0.93512	0.95480	0.98626	0.99669	0.01043	1.06299	1.09047	0.11811
M27 × 2	6H	0.97776	0.99252	1.01185	1.02067	0.00882	1.06299	1.08319	0.07874
M30 × 3.5	6H	1.03193	1.05398	1.09161	1.10264	0.01102	1.18110	1.21205	0.13780
M30 × 2	6H	1.09587	1.11063	1.12996	1.13878	0.00882	1.18110	1.20130	0.07874
M30 × 1.5	6H	1.11717	1.12898	1.14276	1.15063	0.00787	1.18110	1.19752	0.05906
M33 × 2	6H	1.21398	1.22874	1.24807	1.25689	0.00882	1.29921	1.31941	0.07874
M35 × 1.5	6H	1.31402	1.32583	1.33961	1.34748	0.00787	1.37795	1.39437	0.05906
M36 × 4	6H	1.24685	1.27047	1.31504	1.32685	0.01181	1.41732	1.45185	0.15748
M36 × 2	6H	1.33209	1.34685	1.36618	1.37500	0.00882	1.41732	1.43752	0.07874
M39 × 2	6H	1.45020	1.46496	1.48429	1.49311	0.00882	1.53543	1.55563	0.07874
M40 × 1.5	6H	1.51087	1.52268	1.53646	1.54433	0.00787	1.57480	1.59122	0.05906
M42 × 4.5	6H	1.46177	1.48815	1.53846	1.55087	0.01240	1.65354	1.69150	0.17717

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Table C-2 Inch Translation for Internal Thread — Limiting Dimensions M Profile (Cont'd)

Basic Thread Designation	Tolerance Class	Minor Diam., D_1		Pitch Diam., D_2 and Functional Diam. [Notes (1) and (2)]			Major Diam., D		Nominal Pitch, P
		Min.	Max.	Min.	Max.	Tol.	Min.	Max. [Note (3)] (Reference)	
M42 × 2	6H	1.56831	1.58307	1.60240	1.61122	0.00882	1.65354	1.67374	0.07874
M45 × 1.5	6H	1.70772	1.71953	1.73331	1.74118	0.00787	1.77165	1.78807	0.05906
M48 × 5	6H	1.67665	1.70461	1.76189	1.77508	0.01319	1.88976	1.93134	0.19685
M48 × 2	6H	1.80453	1.81929	1.83862	1.84791	0.00929	1.88976	1.91043	0.07874
M50 × 1.5	6H	1.90457	1.91638	1.93016	1.93850	0.00835	1.96850	1.98539	0.05906
M55 × 1.5	6H	2.10142	2.11323	2.12701	2.13535	0.00835	2.16535	2.18224	0.05906
M56 × 5.5	6H	1.97031	1.99984	2.06409	2.07807	0.01398	2.20472	2.24996	0.21654
M56 × 2	6H	2.11949	2.13425	2.15358	2.16287	0.00929	2.20472	2.22539	0.07874
M60 × 1.5	6H	2.29827	2.31008	2.32386	2.33220	0.00835	2.36220	2.37909	0.05906
M64 × 6	6H	2.26398	2.29547	2.36626	2.38102	0.01476	2.51969	2.56854	0.23622
M64 × 2	6H	2.43445	2.44921	2.46854	2.47783	0.00929	2.51969	2.54035	0.07874
M65 × 1.5	6H	2.49512	2.50693	2.52071	2.52906	0.00835	2.55906	2.57594	0.05906
M70 × 1.5	6H	2.69197	2.70378	2.71756	2.72591	0.00835	2.75591	2.77280	0.05906
M72 × 6	6H	2.57894	2.61043	2.68122	2.69598	0.01476	2.83465	2.88350	0.23622
M72 × 2	6H	2.74941	2.76417	2.78350	2.79280	0.00929	2.83465	2.85531	0.07874
M75 × 1.5	6H	2.88882	2.90063	2.91441	2.92276	0.00835	2.95276	2.96965	0.05906
M80 × 6	6H	2.89390	2.92539	2.99618	3.01094	0.01476	3.14961	3.19846	0.23622
M80 × 2	6H	3.06437	3.07913	3.09846	3.10776	0.00929	3.14961	3.17028	0.07874
M80 × 1.5	6H	3.08567	3.09748	3.11126	3.11961	0.00835	3.14961	3.16650	0.05906
M85 × 2	6H	3.26122	3.27598	3.29531	3.30461	0.00929	3.34646	3.36713	0.07874
M90 × 6	6H	3.28760	3.31909	3.38988	3.40465	0.01476	3.54331	3.59217	0.23622
M90 × 2	6H	3.45807	3.47283	3.49217	3.50146	0.00929	3.54331	3.56398	0.07874
M95 × 2	6H	3.65492	3.66969	3.68902	3.69886	0.00984	3.74016	3.76138	0.07874
M100 × 6	6H	3.68130	3.71280	3.78358	3.79933	0.01575	3.93701	3.98685	0.23622
M100 × 2	6H	3.85177	3.86654	3.88587	3.89571	0.00984	3.93701	3.95823	0.07874
M105 × 2	6H	4.04862	4.06339	4.08272	4.09256	0.00984	4.13386	4.15508	0.07874
M110 × 2	6H	4.24547	4.26024	4.27957	4.28941	0.00984	4.33071	4.35193	0.07874
M120 × 2	6H	4.63917	4.65394	4.67327	4.68311	0.00984	4.72441	4.74563	0.07874
M130 × 2	6H	5.03287	5.04764	5.06697	5.07681	0.00984	5.11811	5.13933	0.07874
M140 × 2	6H	5.42657	5.44134	5.46067	5.47051	0.00984	5.51181	5.53303	0.07874
M150 × 2	6H	5.82028	5.83504	5.85437	5.86421	0.00984	5.90551	5.92673	0.07874
M160 × 3	6H	6.17134	6.19102	6.22248	6.23429	0.01181	6.29921	6.32807	0.11811
M170 × 3	6H	6.56504	6.58472	6.61618	6.62799	0.01181	6.69291	6.72177	0.11811
M180 × 3	6H	6.95874	6.97843	7.00988	7.02169	0.01181	7.08661	7.11547	0.11811
M190 × 3	6H	7.35244	7.37213	7.40358	7.41677	0.01319	7.48031	7.51055	0.11811
M200 × 3	6H	7.74614	7.76583	7.79728	7.81047	0.01319	7.87402	7.90425	0.11811

GENERAL NOTE: All dimensions are in inches.

NOTES:

(1) See para. 5.4.2.

(2) Since these tablulated tolerance values have been converted and then rounded, they may differ slightly from the difference between tabulated maximum and minimum values.

(3) Dimension is used in the design of tools, etc. In dimensioning internal threads it is not normally specified. Generally, major diameter acceptance is based on maximum material condition gaging.

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NONMANDATORY APPENDIX D
BASIC DIMENSIONS FOR ISO SERIES METRIC SCREW THREADS FROM ISO 724

Table D-1

Nom. Diam. = Major Diam., D, d	Pitch, P	Pitch Diameter, D_2, d_2	Minor Diameter, D_1, d_1
1.6	0.35	1.373	1.221
	0.2	1.470	1.383
1.8	0.35	1.573	1.421
	0.2	1.670	1.583
2	0.4	1.740	1.567
	0.25	1.838	1.729
2.2	0.45	1.908	1.713
	0.25	2.038	1.929
2.5	0.45	2.208	2.013
	0.35	2.273	2.121
3	0.5	2.675	2.459
	0.35	2.773	2.621
3.5	0.6	3.110	2.850
	0.35	3.273	3.121
4	0.7	3.545	3.242
	0.5	3.675	3.459
4.5	0.75	4.013	3.688
	0.5	4.175	3.959
5	0.8	4.480	4.134
	0.5	4.675	4.459
5.5	0.5	5.175	4.959
6	1	5.350	4.917
	0.75	5.513	5.188
7	1	6.350	5.917
	0.75	6.513	6.188
8	1.25	7.188	6.647
	1	7.350	6.917
	0.75	7.513	7.188
9	1.25	8.188	7.647
	1	8.350	7.917
	0.75	8.513	8.188
10	1.5	9.026	8.376
	1.25	9.188	8.647
	1	9.350	8.917
	0.75	9.513	9.188
11	1.5	10.026	9.376
	1	10.350	9.917
	0.75	10.513	10.188

Table D-1 (Cont'd)

Nom. Diam. = Major Diam., D, d	Pitch, P	Pitch Diameter, D_2, d_2	Minor Diameter, D_1, d_1
12	1.75	10.863	10.106
	1.5	11.026	10.376
	1.25	11.188	10.647
	1	11.350	10.917
14	2	12.701	11.835
	1.5	13.026	12.376
	1.25	13.188	12.647
	1	13.350	12.917
15	1.5	14.026	13.376
	1	14.350	13.917
16	2	14.701	13.835
	1.5	15.026	14.376
	1	15.350	14.917
17	1.5	16.026	15.376
	1	16.350	15.917
18	2.5	16.376	15.294
	2	16.701	15.835
	1.5	17.026	16.376
	1	17.350	16.917
20	2.5	18.376	17.294
	2	18.701	17.835
	1.5	19.026	18.376
	1	19.350	18.917
22	2.5	20.376	19.294
	2	20.701	19.835
	1.5	21.026	20.376
	1	21.350	20.917
24	3	22.051	20.752
	2	22.701	21.835
	1.5	23.026	22.376
	1	23.350	22.917
25	2	23.701	22.835
	1.5	24.026	23.376
	1	24.350	23.917
26	1.5	25.026	24.376
27	3	25.051	23.752
	2	25.701	24.835
	1.5	26.026	25.376
	1	26.350	25.917
28	2	26.701	25.835
	1.5	27.026	26.376
	1	27.350	26.917

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Table D-1 (Cont'd)

Nom. Diam. = Major Diam., D, d	Pitch, P	Pitch Diameter, D_2, d_2	Minor Diameter, D_1, d_1
30	3.5	27.727	26.211
	3	28.051	26.752
	2	28.701	27.835
	1.5	29.026	28.376
	1	29.350	28.917
32	2	30.701	29.835
	1.5	31.026	30.376
33	3.5	30.727	29.211
	3	31.051	29.752
	2	31.701	30.835
	1.5	32.026	31.376
35	1.5	34.026	33.376
36	4	33.402	31.670
	3	34.051	32.752
	2	34.701	33.835
	1.5	35.026	34.376
38	1.5	37.026	36.376
39	4	36.402	34.670
	3	37.051	35.752
	2	37.701	36.835
	1.5	38.026	37.376
40	3	38.051	36.752
	2	38.701	37.835
	1.5	39.026	38.376
42	4.5	39.077	37.129
	4	39.402	37.670
	3	40.051	38.752
	2	40.701	39.835
	1.5	41.026	40.376
45	4.5	42.077	40.129
	4	42.402	40.670
	3	43.051	41.752
	2	43.701	42.835
	1.5	44.026	43.376
48	5	44.752	42.587
	4	45.402	43.670
	3	46.051	44.752
	2	46.701	45.835
	1.5	47.026	46.376
50	3	48.051	46.752
	2	48.701	47.835
	1.5	49.026	48.376
52	5	48.752	46.587
	4	49.402	47.670
	3	50.051	48.752
	2	50.701	49.835
	1.5	51.026	50.376
55	4	52.402	50.670
	3	53.051	51.752
	2	53.701	52.835
	1.5	54.026	53.376

Table D-1 (Cont'd)

Nom. Diam. = Major Diam., D, d	Pitch, P	Pitch Diameter, D_2, d_2	Minor Diameter, D_1, d_1
56	5.5	52.428	50.046
	4	53.402	51.670
	3	54.051	52.752
	2	54.701	53.835
	1.5	55.026	54.376
58	4	55.402	53.670
	3	56.051	54.752
	2	56.701	55.835
	1.5	57.026	56.376
60	5.5	56.428	54.046
	4	57.402	55.670
	3	58.051	56.752
	2	58.701	57.835
	1.5	59.026	58.376
62	4	59.402	57.670
	3	60.051	58.752
	2	60.701	59.835
	1.5	61.026	60.376
64	6	60.103	57.505
	4	61.402	59.670
	3	62.051	60.752
	2	62.701	61.835
	1.5	63.026	62.376
65	4	62.402	60.670
	3	63.051	61.752
	2	63.701	62.835
	1.5	64.026	63.376
68	6	64.103	61.505
	4	65.402	63.670
	3	66.051	64.752
	2	66.701	65.835
	1.5	67.026	66.376
70	6	66.103	63.505
	4	67.402	65.670
	3	68.051	66.752
	2	68.701	67.835
	1.5	69.026	68.376
72	6	68.103	65.505
	4	69.402	67.670
	3	70.051	68.752
	2	70.701	69.835
	1.5	71.026	70.376
75	4	72.402	70.670
	3	73.051	71.752
	2	73.701	72.835
	1.5	74.026	73.376
76	6	72.103	69.505
	4	73.402	71.670
	3	74.051	72.752
	2	74.701	73.835
	1.5	75.026	74.376
78	2	76.700	75.835

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Table D-1 (Cont'd)

Nom. Diam. = Major Diam., D, d	Pitch, P	Pitch Diameter, D_2, d_2	Minor Diameter, D_1, d_1
80	6	76.103	73.505
	4	77.402	75.670
	3	78.051	76.752
	2	78.701	77.835
	1.5	79.026	78.376
82	2	80.701	79.835
85	6	81.103	78.505
	4	82.402	80.670
	3	83.051	81.752
	2	83.701	82.835
90	6	86.103	83.505
	4	87.402	85.670
	3	88.051	86.752
	2	88.701	87.835
95	6	91.103	88.505
	4	92.402	90.670
	3	93.051	91.752
	2	93.701	92.835
100	6	96.103	93.505
	4	97.402	95.670
	3	98.051	96.752
	2	98.701	97.835
105	6	101.103	98.505
	4	102.402	100.670
	3	103.051	101.752
	2	103.701	102.835
110	6	106.103	103.505
	4	107.402	105.670
	3	108.051	106.752
	2	108.701	107.835
115	6	111.103	108.505
	4	112.402	110.670
	3	113.051	111.752
	2	113.701	112.835
120	6	116.103	113.505
	4	117.402	115.670
	3	118.051	116.752
	2	118.701	117.835
125	8 [Note(1)]	119.804	116.340
	6	121.103	118.505
	4	122.402	120.670
	3	123.051	121.752
	2	123.701	122.835
130	8 [Note(1)]	124.804	121.340
	6	126.103	123.505
	4	127.402	125.670
	3	128.051	126.752
	2	128.701	127.835
135	6	131.103	128.505
	4	132.402	130.670
	3	133.051	131.752
	2	133.701	132.835

Table D-1 (Cont'd)

Nom. Diam. = Major Diam., D, d	Pitch, P	Pitch Diameter, D_2, d_2	Minor Diameter, D_1, d_1
140	8 [Note (1)]	134.804	131.340
	6	136.103	133.505
	4	137.402	135.670
	3	138.051	136.752
	2	138.701	137.835
145	6	141.103	138.505
	4	142.402	140.670
	3	143.051	141.752
	2	143.701	142.835
150	8	144.804	141.340
	6	146.103	143.505
	4	147.402	145.670
	3	148.051	146.752
	2	148.701	147.835
155	6	151.103	148.505
	4	152.402	150.670
	3	153.051	151.752
160	8	154.804	151.340
	6	156.103	153.505
	4	157.402	155.670
	3	158.051	156.752
165	6	161.103	158.505
	4	162.402	160.670
	3	163.051	161.752
170	8	164.804	161.340
	6	166.103	163.505
	4	167.402	165.670
	3	168.051	166.752
175	6	171.103	168.505
	4	172.402	170.670
	3	173.051	171.752
180	8	174.804	171.340
	6	176.103	173.505
	4	177.402	175.670
	3	178.051	176.752
185	6	181.103	178.505
	4	182.402	180.670
	3	183.051	181.752
190	8	184.804	181.340
	6	186.103	183.505
	4	187.402	185.670
	3	188.051	186.752
195	6	191.103	188.505
	4	192.402	190.670
	3	193.051	191.752
200	8	194.804	191.340
	6	196.103	193.505
	4	197.402	195.670
	3	198.051	196.752
205	6	201.103	198.505
	4	202.402	200.670
	3	203.051	201.752

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Table D-1 (Cont'd)

Nom. Diam. = Major Diam., *D*, *d*	Pitch, *P*	Pitch Diameter, D_2, d_2	Minor Diameter, D_1, d_1
210	8	204.804	201.340
	6	206.103	203.505
	4	207.402	205.670
	3	208.051	206.752
215	6	211.103	208.505
	4	212.402	210.670
	3	213.051	211.752
220	8	214.804	211.340
	6	216.103	213.505
	4	217.402	215.670
	3	218.051	216.752
225	6	221.103	218.505
	4	222.402	220.670
	3	223.051	221.752
230	8	224.804	221.340
	6	226.103	223.505
	4	227.402	225.670
	3	228.051	226.752
235	6	231.103	228.505
	4	232.402	230.670
	3	233.051	231.752
240	8	234.804	231.340
	6	236.103	233.505
	4	237.402	235.670
	3	238.051	236.752
245	6	241.103	238.505
	4	242.402	240.670
	3	243.051	241.752
250	8	244.804	241.340
	6	246.103	243.505
	4	247.402	245.670
	3	248.051	246.752

Table D-1 (Cont'd)

Nom. Diam. = Major Diam., *D*, *d*	Pitch, *P*	Pitch Diameter, D_2, d_2	Minor Diameter, D_1, d_1
255	6	251.103	248.505
	4	252.402	250.670
260	8	254.804	251.340
	6	256.103	253.505
	4	257.402	255.670
265	6	261.103	258.505
	4	262.402	260.670
270	8	264.804	261.340
	6	266.103	263.505
	4	267.402	265.670
275	6	271.103	268.505
	4	272.402	270.670
280	8	274.804	271.340
	6	276.103	273.505
	4	277.402	275.670
285	6	281.103	278.505
	4	282.402	280.670
290	8	284.804	281.340
	6	286.103	283.505
	4	287.402	285.670
295	6	291.103	288.505
	4	292.402	290.670
300	8	294.804	291.340
	6	296.103	293.505
	4	297.402	295.670

GENERAL NOTE: All dimensions are in millimeters.

NOTE:

(1) Not yet incorporated in ISO 724.

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NONMANDATORY APPENDIX E
OVERTAPPED NUT THREAD CLASS 6AX

This Appendix (see Tables E-1 and E-2) contains information on internal threads of tolerance class 6AX, which follow current USA practice of overtapping to accommodate as-coated hot-dip galvanized external threads of tolerance class 6g prior to coating. It incorporates thread size limits from ISO 965-5 and is consistent with average galvanizing practice as stated in ASTM A153.

Table E-1 Allowance (Fundamental Deviation), Tolerance Position AX (ISO 965-5)

Pitch, *P*	Allowance (Fundamental Deviation), *EI* [Note (1)]
1.25 [Note (2)]	+0.255
1.5	+0.310
1.75	+0.365
2	+0.420
2.5	+0.530
3	+0.640
3.5	+0.750
4	+0.860
4.5	+0.970
5	+1.080
5.5	+1.190
6	+1.300

GENERAL NOTE: All dimensions are in millimeters.

NOTES:

(1) Allowance = + (0.220*P* − 0.020).

(2) 1.25 pitch is not included in ISO 965-5.

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Table E-2 Internal Thread — Limiting Dimensions, Tolerance Class 6AX for Normal Length of Engagement (ISO 965-5)

Size	Minor Diameter [Note (1)]		Pitch Diameter [Note (2)]			Min. Major Diameter [Note (2)]
	Min.	Max.	Min.	Max.	Tol.	
M8 × 1.25 [Note (3)]	6.902	7.167	7.443	7.603	0.160	8.255
M10 × 1.5	8.686	8.986	9.336	9.516	0.180	10.310
M12 × 1.75	10.471	10.806	11.228	11.428	0.200	12.365
M14 × 2	12.255	12.630	13.121	13.333	0.212	14.420
M16 × 2	14.255	14.630	15.121	15.333	0.212	16.420
M20 × 2.5	17.824	18.274	18.906	19.130	0.224	20.530
M22 × 2.5	19.824	20.274	20.906	21.130	0.224	22.530
M24 × 3	21.392	21.892	22.691	22.956	0.265	24.640
M27 × 3	24.392	24.892	25.691	25.956	0.265	27.640
M30 × 3.5	26.961	27.521	28.477	28.757	0.280	30.750
M36 × 4	32.530	33.130	34.262	34.562	0.300	36.860
M42 × 4.5	38.099	38.769	40.047	40.362	0.315	42.970
M48 × 5	43.667	44.377	45.832	46.167	0.335	49.080
M56 × 5.5	51.236	51.986	53.618	53.973	0.355	57.190
M64 × 6	58.805	59.605	61.403	61.778	0.375	65.300

GENERAL NOTE: All dimensions are in millimeters.

NOTES:

(1) Dimensions apply before galvanizing or after removal of zinc fragments.

(2) Dimensions apply after galvanizing and tapping oversize.

(3) M8 × 1.25 – 6AX is not included in ISO 965-5.

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NONMANDATORY APPENDIX F
INTERNAL THREAD ALLOWANCE (FUNDAMENTAL DEVIATION) TOLERANCE POSITION *E*

This Appendix (see Table F-1) contains information on internal threads of tolerance position *E* for use in special applications where *G* does not provide sufficient allowance. It uses the numerical values of external thread tolerance position *e* applied in the opposite direction.

Table F-1 Allowance (Fundamental Deviation), Tolerance Position *E*

Pitch, *P*	Allowance (Fundamental Deviation), *EI* [Note (1)]	Pitch, *P*	Allowance (Fundamental Deviation), *EI* [Note (1)]
0.5	+0.050	2	+0.071
0.6	+0.053	2.5	+0.080
0.7	+0.056	3	+0.085
0.75	+0.056	3.5	+0.090
0.8	+0.060	4	+0.095
1	+0.060	4.5	+0.100
1.25	+0.063	5	+0.106
1.5	+0.067	5.5	+0.112
1.75	+0.071	6	+0.118
		8	+0.140

GENERAL NOTE: All dimensions are in millimeters (mm).

NOTE:

(1) Allowance = $+(0.05 + 0.011P)$.

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B1 OTHER STANDARDS FOR SCREW THREADS

Unified Inch Screw Threads (UN and UNR Thread Form) B1.1-2003
Gages and Gaging for Unified Inch Screw Threads B1.2-1983 (R2001)
Screw Thread Gaging Systems for Dimensional Acceptability —
Inch and Metric Screw Threads (UN, UNR, UNJ, M, and MJ) B1.3M-1992 (R2001)
Acme Screw Threads B1.5-1997 (R2004)
Nomenclature, Definitions, and Letter Symbols for Screw Threads B1.7M-1984 (R2001)
Stub Acme Screw Threads B1.8-1988 (R2001)
Buttress Inch Screw Threads 7°/45° Form With 0.6 Pitch Basic Height of Thread Engagement B1.9-1973 (R2001)
Unified Miniature Screw Threads B1.10M-2004
Microscope Objective Thread B1.11-1958 (R2001)
Class 5 Interference-Fit Thread B1.12-1987 (R2003)
Metric Screw Threads: M Profile B1.13M-2005
Unified Inch Screw Threads (UNJ Thread Form) B1.15-1995
Gages and Gaging for Metric M Screw Threads B1.16M-1984 (R2001)
Pipe Threads, General Purpose (Inch) B1.20.1-1983 (R2001)
Dryseal Pipe Threads (Inch) B1.20.3-1976 (R2003)
Gaging for Dryseal Pipe Threads (Inch) B1.20.5-1991 (R2004)
Hose Coupling Screw Threads (Inch) B1.20.7-1991 (R2003)
Metric Screw Threads: MJ Profile B1.21M-1997 (R2003)
Gages and Gaging for MJ Series Metric Screw Threads B1.22M-1985 (R2001)
Screw Threads: Standard Practice for Calculating and Rounding Dimensions B1.30-2002

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