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**SIMPLE, COMPOUND, DIFFERENTIAL, AND BLOCK INDEXING**

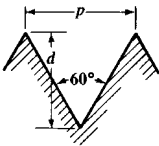
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## SCREW THREAD SYSTEMS

## Screw Thread Forms

Of the various screw thread forms which have been developed, the most used are those having symmetrical sides inclined at equal angles with a vertical center line through the thread apex. Present-day examples of such threads would include the Unified, the Whitworth and the Acme forms. One of the early forms was the Sharp V which is now used only occasionally. Symmetrical threads are relatively easy to manufacture and inspect and hence are widely used on mass-produced general-purpose threaded fasteners of all types. In addition to general-purpose fastener applications, certain threads are used to repeatedly move or translate machine parts against heavy loads. For these so-called translation threads a stronger form is required. The most widely used translation thread forms are the square, the Acme, and the buttress. Of these, the square thread is the most efficient, but it is also the most difficult to cut owing to its parallel sides and it cannot be adjusted to compensate for wear. Although less efficient, the Acme form of thread has none of the disadvantages of the square form and has the advantage of being somewhat stronger. The buttress form is used for translation of loads in one direction only because of its non-symmetrical form and combines the high efficiency and strength of the square thread with the ease of cutting and adjustment of the Acme thread.

**V-Thread, Sharp V-thread.**—The sides of the thread form an angle of 60 degrees with each other. The top and bottom or root of this thread form are theoretically sharp, but in actual practice the thread is made with a slight flat, owing to the difficulty of producing a perfectly sharp edge and because of the tendency of such an edge to wear away or become battered. This flat is usually equal to about one twenty-fifth of the pitch, although there is no generally recognized standard.



Owing to the difficulties connected with the V-thread, the tap manufacturers agreed in 1909 to discontinue the making of sharp V-thread taps, except when ordered. One advantage of the V-thread is that the same cutting tool may be used for all pitches, whereas, with the American Standard form, the width of the point or the flat varies according to the pitch.

The V-thread is regarded as a good form where a steam-tight joint is necessary, and many of the taps used on locomotive work have this form of thread. Some modified V-threads, for locomotive boiler taps particularly, have a depth of  $0.8 \times$  pitch.

The American Standard screw thread is used largely in preference to the sharp V-thread because it has several advantages; see *American Standard for Unified Screw Threads*. If  $p$  = pitch of thread, and  $d$  depth of thread, then

$$d = p \times \cos 30 \text{ deg.} = 0.866 \times p = \frac{0.866}{\text{No. of threads per inch}}$$

**United States Standard Screw Thread.**—William Sellers of Philadelphia, in a paper read before the Franklin Institute in 1864, originally proposed the screw thread system that later became known as the U. S. Standard system for screw threads. A report was made to the United States Navy in May, 1868, in which the Sellers system was recommended as a standard for the Navy Department, which accounts for the name of U. S. Standard. The American Standard Screw Thread system is a further development of the United States Standard. The thread form which is known as the American (National) form is the same as the United States Standard form. See *American Standard for Unified Screw Threads*.

**American National and Unified Screw Thread Forms.**—The American National form (formerly known as the United States Standard) was used for many years for most screws, bolts, and miscellaneous threaded products produced in the United States. The American

National Standard for Unified Screw Threads now in use includes certain modifications of the former standard as is explained below and on page 1732. The basic profile is shown in Fig. 1 and is identical for both UN and UNR screw threads. In this figure  $H$  is the height of a sharp V-thread,  $P$  is the pitch,  $D$  and  $d$  are the basic major diameters,  $D_2$  and  $d_2$  are the basic pitch diameters, and  $D_1$  and  $d_1$  are the basic minor diameters. Capital letters are used to designate the internal thread dimensions ( $D$ ,  $D_2$ ,  $D_1$ ), and lowercase letters to designate the external thread dimensions ( $d$ ,  $d_2$ ,  $d_1$ ). Definitions of *Basic Size* and *Basic Profile of Thread* are given on page 1727.

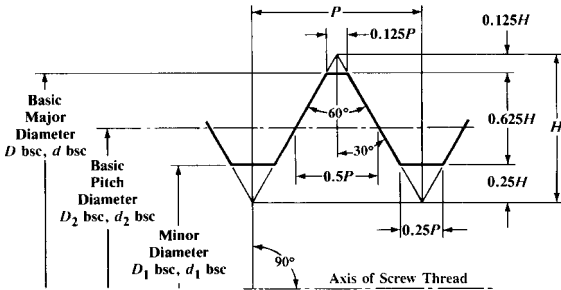


Fig. 1. Basic Profile of UN and UNF Screw Threads

In the past, other symbols were used for some of the thread dimensions illustrated above. These symbols were changed to conform with current practice in nomenclature as defined in ANSI/ASME B1.7M, "Nomenclature, Definitions, and Letter Symbols for Screw Threads." The symbols used above are also in accordance with terminology and symbols used for threads of the ISO metric thread system.

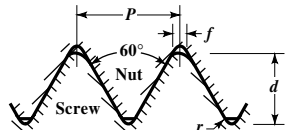
**International Metric Thread System.**—The *Système Internationale* (S.I.) Thread was adopted at the International Congress for the standardization of screw threads held in Zurich in 1898. The thread form is similar to the American standard (formerly U.S. Standard), excepting the depth which is greater. There is a clearance between the root and mating crest fixed at a maximum of  $\frac{1}{16}$  the height of the fundamental triangle or  $0.054 \times$  pitch. A rounded root profile is recommended. The angle in the plane of the axis is 60 degrees and the crest has a flat like the American standard equal to  $0.125 \times$  pitch. This system formed the basis of the normal metric series (ISO threads) of many European countries, Japan, and many other countries, including metric thread standards of the United States.

Depth  $d = 0.7035 P$  max.;  $0.6855 P$  min.

Flat  $f = 0.125 P$

Radius  $r = 0.0633 P$  max.;  $0.054 P$  min.

Tap drill dia = major dia. – pitch



**International Metric Fine Thread:** The International Metric Fine Thread form of thread is the same as the International system but the pitch for a given diameter is smaller.

**German Metric Thread Form:** The German metric thread form is like the International Standard but the thread depth =  $0.6945 P$ . The root radius is the same as the maximum for the International Standard or  $0.0633 P$ .

**ISO Metric Thread System.**—ISO refers to the International Organization for Standardization, a worldwide federation of national standards bodies (for example, the American National Standards Institute is the ISO national body representing the United States) that develops standards on a very wide variety of subjects.

The basic profile of ISO metric threads is specified in ISO 68 and shown in Fig. 2. The basic profile of this thread is very similar to that of the Unified thread, and as previously discussed,  $H$  is the height of a sharp V-thread,  $P$  is the pitch,  $D$  and  $d$  are the basic major diameters,  $D_2$  and  $d_2$  are the basic pitch diameters, and  $D_1$  and  $d_1$  are the basic minor diameters. Here also, capital letters designate the internal thread dimensions ( $D$ ,  $D_2$ ,  $D_1$ ), and lowercase letters designate the external thread dimensions ( $d$ ,  $d_2$ ,  $d_1$ ). This metric thread is discussed in detail in the section *METRIC SCREW THREADS* starting on page 1783.

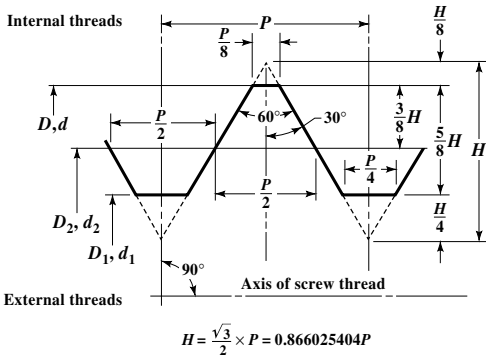


Fig. 2. ISO 68 Basic Profile

### Definitions of Screw Threads

The following definitions are based on American National Standard ANSI/ASME B1.7M-1984 (R2001) "Nomenclature, Definitions, and Letter Symbols for Screw Threads," and refer to both straight and taper threads.

**Actual Size:** An actual size is a measured size.

**Allowance:** An allowance is 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*.

**Axis of Thread:** Thread axis is coincident with the axis of its pitch cylinder or cone.

**Basic Profile of Thread:** The basic profile of a thread is the cyclical 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.

**Basic Size:** The basic size is that size from which the limits of size are derived by the application of allowances and tolerances.

**Bilateral Tolerance:** This is a tolerance in which variation is permitted in both directions from the specified dimension.

**Black Crest Thread:** This is a thread whose crest displays an unfinished cast, rolled, or forged surface.

**Blunt Start Thread:** "Blunt start" designates the removal of the incomplete thread at the starting end of the thread. This is a feature of threaded parts that are repeatedly assembled

by hand, such as hose couplings and thread plug gages, to prevent cutting of hands and crossing of threads. It was formerly known as a Higbee cut.

*Chamfer:* This is a conical surface at the starting end of a thread.

*Class of Thread:* The class of a thread is an alphanumeric designation to indicate the standard grade of tolerance and allowance specified for a thread.

*Clearance Fit:* This is a fit having limits of size so prescribed that a clearance always results when mating parts are assembled at their maximum material condition.

*Complete Thread:* The complete thread is that thread whose profile lies within the size limits. (See also *Effective Thread* and *Length of Complete Thread*.) *Note:* Formerly in pipe thread terminology this was referred to as "the perfect thread" but that term is no longer considered desirable.

*Crest:* This is that surface of a thread which joins the flanks of the thread and is farthest from the cylinder or cone from which the thread projects.

*Crest Truncation:* This is the radial distance between the sharp crest (crest apex) and the cylinder or cone that would bound the crest.

*Depth of Thread Engagement:* The depth (or height) of thread engagement between two coaxially assembled mating threads is the radial distance by which their thread forms overlap each other.

*Design Size:* This is the basic size with allowance applied, from which the limits of size are derived by the application of a tolerance. If there is no allowance, the design size is the same as the basic size.

*Deviation:* Deviation is a variation from an established dimension, position, standard, or value. In ISO usage, it is the algebraic difference between a size (actual, maximum, or minimum) and the corresponding basic size. The term deviation does not necessarily indicate an error. (See also *Error*.)

*Deviation, Fundamental (ISO term):* For standard threads, the fundamental deviation is the upper or lower deviation 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 also *Allowance* and *Tolerance Position*.)

*Deviation, Lower (ISO term):* The algebraic difference between the minimum limit of size and the basic size. It is designated  $EI$  for internal and  $ei$  for external thread diameters.

*Deviation, Upper (ISO term):* The algebraic difference between the maximum limit of size and the basic size. It is designated  $ES$  for internal and  $es$  for external thread diameters.

*Dimension:* A numerical value expressed in appropriate units of measure and indicated on drawings along with lines, symbols, and notes to define the geometrical characteristic of an object.

*Effective Size:* See *Pitch Diameter, Functional Diameter*.

*Effective Thread:* The effective (or useful) thread includes the complete thread, and those portions of the incomplete thread which are fully formed at the root but not at the crest (in taper pipe threads it includes the so-called black crest threads); thus excluding the vanish thread.

*Error:* The algebraic difference between an observed or measured value beyond tolerance limits, and the specified value.

*External Thread:* A thread on a cylindrical or conical external surface.

*Fit:* Fit is the relationship resulting from the designed difference, before assembly, between the sizes of two mating parts which are to be assembled.

*Flank:* The flank of a thread is either surface connecting the crest with the root. The flank surface intersection with an axial plane is theoretically a straight line.

*Flank Angle:* The flank angles are the angles between the individual flanks and the perpendicular to the axis of the thread, measured in an axial plane. A flank angle of a symmetrical thread is commonly termed the half-angle of thread.

*Flank Diametral Displacement:* In a boundary profile defined system, flank diametral displacement is twice the radial distance between the straight thread flank segments of the



maximum and minimum boundary profiles. The value of flank diametral displacement is equal to pitch diameter tolerance in a pitch line reference thread system.

*Height of Thread:* The height (or depth) of thread is the distance, measured radially, between the major and minor cylinders or cones, respectively.

*Helix Angle:* On a straight thread, the helix angle is the angle made by the helix of the thread and its relation to the thread axis. On a taper thread, the helix angle at a given axial position is the angle made by the conical spiral of the thread with the axis of the thread. The helix angle is the complement of the lead angle. (See also page 1966 for diagram.)

*Higbee Cut:* See *Blunt Start Thread*.

*Imperfect Thread:* See *Incomplete Thread*.

*Included Angle:* This is the angle between the flanks of the thread measured in an axial plane.

*Incomplete Thread:* A threaded profile having either crests or roots or both, not fully formed, resulting from their intersection with the cylindrical or end surface of the work or the vanish cone. It may occur at either end of the thread.

*Interference Fit:* A fit having limits of size so prescribed that an interference always results when mating parts are assembled.

*Internal Thread:* A thread on a cylindrical or conical internal surface.

*Lead:* Lead is the axial distance between two consecutive points of intersection of a helix by a line parallel to the axis of the cylinder on which it lies, i.e., the axial movement of a threaded part rotated one turn in its mating thread.

*Lead Angle:* On a straight thread, the lead angle is the angle made by the helix of the thread at the pitch line with a plane perpendicular to the axis. On a taper thread, the lead angle at a given axial position is the angle made by the conical spiral of the thread with the perpendicular to the axis at the pitch line.

*Lead Thread:* That portion of the incomplete thread that is fully formed at the root but not fully formed at the crest that occurs at the entering end of either an external or internal thread.

*Left-hand Thread:* A thread is a left-hand thread if, when viewed axially, it winds in a counterclockwise and receding direction. Left-hand threads are designated LH.

*Length of Complete Thread:* The axial length of a thread section having full form at both crest and root but also including a maximum of two pitches at the start of the thread which may have a chamfer or incomplete crests.

*Length of Thread Engagement:* The length of thread engagement of two mating threads is the axial distance over which the two threads, each having full form at both crest and root, are designed to contact. (See also *Length of Complete Thread*.)

*Limits of Size:* The applicable maximum and minimum sizes.

*Major Clearance:* The radial distance between the root of the internal thread and the crest of the external thread of the coaxially assembled designed forms of mating threads.

*Major Cone:* The imaginary cone that would bound the crests of an external taper thread or the roots of an internal taper thread.

*Major Cylinder:* The imaginary cylinder that would bound the crests of an external straight thread or the roots of an internal straight thread.

*Major Diameter:* On a straight thread the major diameter is that of the major cylinder. On a taper thread the major diameter at a given position on the thread axis is that of the major cone at that position. (See also *Major Cylinder* and *Major Cone*.)

*Maximum Material Condition: (MMC):* The condition where a feature of size contains the maximum amount of material within the stated limits of size. For example, minimum internal thread size or maximum external thread size.

*Minimum Material Condition: (Least Material Condition (LMC)):* The condition where a feature of size contains the least amount of material within the stated limits of size. For example, maximum internal thread size or minimum external thread size.

*Minor Clearance:* The radial distance between the crest of the internal thread and the root of the external thread of the coaxially assembled design forms of mating threads.

*Minor Cone:* The imaginary cone that would bound the roots of an external taper thread or the crests of an internal taper thread.

*Minor Cylinder:* The imaginary cylinder that would bound the roots of an external straight thread or the crests of an internal straight thread.

*Minor Diameter:* On a straight thread the minor diameter is that of the minor cylinder. On a taper thread the minor diameter at a given position on the thread axis is that of the minor cone at that position. (See also *Minor Cylinder* and *Minor Cone*.)

*Multiple-Start Thread:* A thread in which the lead is an integral multiple, other than one, of the pitch.

*Nominal Size:* Designation used for general identification.

*Parallel Thread:* See *Screw Thread*.

*Partial Thread:* See *Vanish Thread*.

*Pitch:* The pitch of a thread having uniform spacing is the distance measured parallel with its axis between corresponding points on adjacent thread forms in the same axial plane and on the same side of the axis. Pitch is equal to the lead divided by the number of thread starts.

*Pitch Cone:* The pitch cone is an imaginary cone of such apex angle and location of its vertex and axis that its surface would pass through a taper thread in such a manner as to make the widths of the thread ridge and the thread groove equal. It is, therefore, located equidistantly between the sharp major and minor cones of a given thread form. On a theoretically perfect taper thread, these widths are equal to one-half the basic pitch. (See also *Axis of Thread* and *Pitch Diameter*.)

*Pitch Cylinder:* The pitch cylinder is an imaginary cylinder of such diameter and location of its axis that its surface would pass through a straight thread in such a manner as to make the widths of the thread ridge and groove equal. It is, therefore, located equidistantly between the sharp major and minor cylinders of a given thread form. On a theoretically perfect thread these widths are equal to one-half the basic pitch. (See also *Axis of Thread* and *Pitch Diameter*.)

*Pitch Diameter:* On a straight thread the pitch diameter is the diameter of the pitch cylinder. On a taper thread the pitch diameter at a given position on the thread axis is the diameter of the pitch cone at that position. *Note:* When the crest of a thread is truncated beyond the pitch line, the pitch diameter and pitch cylinder or pitch cone would be based on a theoretical extension of the thread flanks.

*Pitch Diameter, Functional Diameter:* The functional diameter is the pitch diameter of an enveloping thread with perfect pitch, lead, and flank angles and having a specified length of engagement. It includes the cumulative effect of variations in lead (pitch), flank angle, taper, straightness, and roundness. Variations at the thread crest and root are excluded. Other, nonpreferred terms are *virtual diameter*, *effective size*, *virtual effective diameter*, and *thread assembly diameter*.

*Pitch Line:* The generator of the cylinder or cone specified in *Pitch Cylinder* and *Pitch Cone*.

*Right-hand Thread:* A thread is a right-hand thread if, when viewed axially, it winds in a clockwise and receding direction. A thread is considered to be right-hand unless specifically indicated otherwise.

*Root:* That surface of the thread which joins the flanks of adjacent thread forms and is immediately adjacent to the cylinder or cone from which the thread projects.

*Root Truncation:* The radial distance between the sharp root (root apex) and the cylinder or cone that would bound the root. See also *Sharp Root (Root Apex)*.

*Runout:* As applied to screw threads, unless otherwise specified, runout refers to circular runout of major and minor cylinders with respect to the pitch cylinder. Circular runout, in accordance with ANSI Y14.5M, controls cumulative variations of circularity and coaxiality. Runout includes variations due to eccentricity and out-of-roundness. The amount of runout is usually expressed in terms of full indicator movement (FIM).

*Screw Thread:* A screw thread is a continuous and projecting helical ridge usually of uniform section on a cylindrical or conical surface.

*Sharp Crest (Crest Apex):* The apex formed by the intersection of the flanks of a thread when extended, if necessary, beyond the crest.

*Sharp Root (Root Apex):* The apex formed by the intersection of the adjacent flanks of adjacent threads when extended, if necessary, beyond the root.

*Standoff:* The axial distance between specified reference points on external and internal taper thread members or gages, when assembled with a specified torque or under other specified conditions.

*Straight Thread:* A straight thread is a screw thread projecting from a cylindrical surface.

*Taper Thread:* A taper thread is a screw thread projecting from a conical surface.

*Tensile Stress Area:* The tensile stress area is an arbitrarily selected area for computing the tensile strength of an externally threaded fastener so that the fastener strength is consistent with the basic material strength of the fastener. It is typically defined as a function of pitch diameter and/or minor diameter to calculate a circular cross section of the fastener correcting for the notch and helix effects of the threads.

*Thread:* A thread is a portion of a screw thread encompassed by one pitch. On a single-start thread it is equal to one turn. (See also *Threads per Inch* and *Turns per Inch*.)

*Thread Angle:* See *Included Angle*.

*Thread Runout:* See *Vanish Thread*.

*Thread Series:* Thread Series are groups of diameter/pitch combinations distinguished from each other by the number of threads per inch applied to specific diameters.

*Thread Shear Area:* The thread shear area is the total ridge cross-sectional area intersected by a specified cylinder with diameter and length equal to the mating thread engagement. Usually the cylinder diameter for external thread shearing is the minor diameter of the internal thread and for internal thread shearing it is the major diameter of the external thread.

*Threads per Inch:* The number of threads per inch is the reciprocal of the axial pitch in inches.

*Tolerance:* The total amount by which a specific dimension is permitted to vary. The tolerance is the difference between the maximum and minimum limits.

*Tolerance Class: (metric):* The tolerance class (metric) is the combination of a tolerance position with a tolerance grade. It specifies the allowance (fundamental deviation), pitch diameter tolerance (flank diametral displacement), and the crest diameter tolerance.

*Tolerance Grade: (metric):* The tolerance grade (metric) is a numerical symbol that designates the tolerances of crest diameters and pitch diameters applied to the design profiles.

*Tolerance Limit:* The variation, positive or negative, by which a size is permitted to depart from the design size.

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

*Total Thread:* Includes the complete and all the incomplete thread, thus including the vanish thread and the lead thread.

*Transition Fit:* A fit having limits of size so prescribed that either a clearance or an interference may result when mating parts are assembled.

*Turns per Inch:* The number of turns per inch is the reciprocal of the lead in inches.

*Unilateral Tolerance:* A tolerance in which variation is permitted in one direction from the specified dimension.

*Vanish Thread: (Partial Thread, Washout Thread, or Thread Runout):* That portion of the incomplete thread which is not fully formed at the root or at crest and root. It is produced by the chamfer at the starting end of the thread forming tool.

*Virtual Diameter:* See *Pitch Diameter, Functional Diameter*.

*Washout Thread:* See *Vanish Thread*.

## UNIFIED SCREW THREADS

## American Standard for Unified Screw Threads

American Standard B1.1-1949 was the first American standard to cover those Unified Thread Series agreed upon by the United Kingdom, Canada, and the United States to obtain screw thread interchangeability among these three nations. These Unified threads are now the basic American standard for fastening types of screw threads. In relation to previous American practice, Unified threads have substantially the same thread form and are mechanically interchangeable with the former American National threads of the same diameter and pitch.

The principal differences between the two systems lie in: 1) application of allowances; 2) variation of tolerances with size; 3) difference in amount of pitch diameter tolerance on external and internal threads; and 4) differences in thread designation.

In the Unified system an allowance is provided on both the Classes 1A and 2A external threads whereas in the American National system only the Class I external thread has an allowance. Also, in the Unified system, the pitch diameter tolerance of an internal thread is 30 per cent greater than that of the external thread, whereas they are equal in the American National system.

**Revised Standard.**—The revised screw thread standard ANSI/ASME B1.1-1989 (R2001) is much the same as that of ANSI B1.1-1982. The latest symbols in accordance with ANSI/ASME B1.7M-1984 (R2001) Nomenclature, are used. Acceptability criteria are described in ANSI/ASME B1.3M-1992 (R2001), Screw Thread Gaging Systems for Dimensional Acceptability, Inch or Metric Screw Threads (UN, UNR, UNJ, M, and MJ).

Where the letters U, A or B do not appear in the thread designations, the threads conform to the outdated American National screw threads.

**Advantages of Unified Threads.**—The Unified standard is designed to correct certain production difficulties resulting from the former standard. Often, under the old system, the tolerances of the product were practically absorbed by the combined tool and gage tolerances, leaving little for a working tolerance in manufacture. Somewhat greater tolerances are now provided for nut threads. As contrasted with the old “classes of fit” 1, 2, and 3, for each of which the pitch diameter tolerance on the external and internal threads were equal, the Classes 1B, 2B, and 3B (internal) threads in the new standard have, respectively, a 30 per cent larger pitch diameter tolerance than the 1A, 2A, and 3A (external) threads. Relatively more tolerance is provided for fine threads than for coarse threads of the same pitch. Where previous tolerances were more liberal than required, they were reduced.

**Thread Form.**—The Design Profiles for Unified screw threads, shown on page 1733, define the maximum material condition for external and internal threads with no allowance and are derived from the Basic Profile, shown on page 1726.

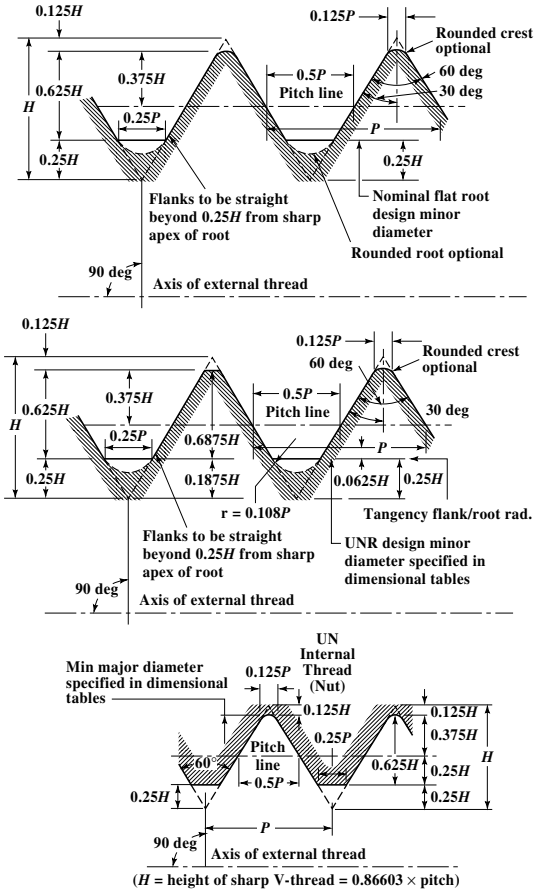
*UN External Screw Threads:* A flat root contour is specified, but it is necessary to provide for some threading tool crest wear, hence a rounded root contour cleared beyond the  $0.25P$  flat width of the Basic Profile is optional.

*UNR External Screw Threads:* To reduce the rate of threading tool crest wear and to improve fatigue strength of a flat root thread, the Design Profile of the UNR thread has a smooth, continuous, non-reversing contour with a radius of curvature not less than  $0.108P$  at any point and blends tangentially into the flanks and any straight segment. At the maximum material condition, the point of tangency is specified to be at a distance not less than  $0.625H$  (where  $H$  is the height of a sharp V-thread) below the basic major diameter.

*UN and UNR External Screw Threads:* The Design Profiles of both UN and UNR external screw threads have flat crests. However, in practice, product threads are produced with partially or completely rounded crests. A rounded crest tangent at  $0.125P$  flat is shown as an option on page 1733.

**UN Internal Screw Thread:** In practice it is necessary to provide for some threading tool crest wear, therefore the root of the Design Profile is rounded and cleared beyond the  $0.125P$  flat width of the Basic Profile. There is no internal UNR screw thread.

**American National Standard Unified Internal and External Screw Thread Design Profiles (Maximum Material Condition).—**



**Thread Series.**—Thread series are groups of diameter-pitch combinations distinguished from each other by the numbers of threads per inch applied to a specific diameter. The various diameter-pitch combinations of eleven standard series are shown in [Table 2](#). The limits of size of threads in the eleven standard series together with certain selected combinations of diameter and pitch, as well as the symbols for designating the various threads, are given in [Table 3](#). (Text continues on page 1763)

Table 1. American Standard Unified Inch Screw Thread Form Data

Threads per Inch <i>n</i>	Pitch <i>P</i>	Depth of Sharp V-Thread 0.86603 <i>P</i>	Depth of Int. Thd. and UN Ext. Thd. <sup>a</sup> 0.54127 <i>P</i>	Depth of UNR Ext. Thd. 0.59539 <i>P</i>	Truncation of Ext. Thd. Root 0.21651 <i>P</i>	Truncation of UNR Ext. Thd. Root <sup>b</sup> 0.16238 <i>P</i>	Truncation of Ext. Thd. Crest 0.10825 <i>P</i>	Truncation of Int. Thd. Root 0.10825 <i>P</i>	Truncation of Int. Thd. Crest 0.2165 <i>P</i>	Flat at Ext. Thd. Crest and Int. Thd. Root 0.125 <i>P</i>	Basic Flat at Int. Thd. Crest <sup>c</sup> 0.25 <i>P</i>	Maximum Ext. Thd. Root Radius 0.14434 <i>P</i>	Addendum of Ext. Thd. 0.32476 <i>P</i>
80	0.01250	0.01083	0.00677	0.00744	0.00271	0.00203	0.00135	0.00135	0.00271	0.00156	0.00312	0.00180	0.00406
72	0.01389	0.01203	0.00752	0.00827	0.00301	0.00226	0.00150	0.00150	0.00301	0.00174	0.00347	0.00200	0.00451
64	0.01563	0.01353	0.00846	0.00930	0.00338	0.00254	0.00169	0.00169	0.00338	0.00195	0.00391	0.00226	0.00507
56	0.01786	0.01546	0.00967	0.01063	0.00387	0.00290	0.00193	0.00193	0.00387	0.00223	0.00446	0.00258	0.00580
48	0.02083	0.01804	0.01128	0.01240	0.00451	0.00338	0.00226	0.00226	0.00451	0.00260	0.00521	0.00301	0.00677
44	0.02273	0.01968	0.01230	0.01353	0.00492	0.00369	0.00246	0.00246	0.00492	0.00284	0.00568	0.00328	0.00738
40	0.02500	0.02165	0.01353	0.01488	0.00541	0.00406	0.00271	0.00271	0.00541	0.00312	0.00625	0.00361	0.00812
36	0.02778	0.02406	0.01504	0.01654	0.00601	0.00451	0.00301	0.00301	0.00601	0.00347	0.00694	0.00401	0.00902
32	0.03125	0.02706	0.01691	0.01861	0.00677	0.00507	0.00338	0.00338	0.00677	0.00391	0.00781	0.00451	0.01015
28	0.03571	0.03093	0.01933	0.02126	0.00773	0.00580	0.00387	0.00387	0.00773	0.00446	0.00893	0.00515	0.01160
27	0.03704	0.03208	0.02005	0.02205	0.00802	0.00601	0.00401	0.00401	0.00802	0.00463	0.00926	0.00535	0.01203
24	0.04167	0.03608	0.02255	0.02481	0.00902	0.00677	0.00451	0.00451	0.00902	0.00521	0.01042	0.00601	0.01353
20	0.05000	0.04330	0.02706	0.02977	0.01083	0.00812	0.00541	0.00541	0.01083	0.00625	0.01250	0.00722	0.01624
18	0.05556	0.04811	0.03007	0.03308	0.01203	0.00902	0.00601	0.00601	0.01203	0.00694	0.01389	0.00802	0.01804
16	0.06250	0.05413	0.03383	0.03721	0.01353	0.01015	0.00677	0.00677	0.01353	0.00781	0.01562	0.00902	0.02030
14	0.07143	0.06186	0.03866	0.04253	0.01546	0.01160	0.00773	0.00773	0.01546	0.00893	0.01786	0.01031	0.02320
13	0.07692	0.06662	0.04164	0.04580	0.01655	0.01249	0.00833	0.00833	0.01655	0.00962	0.01923	0.01110	0.02498
12	0.08333	0.07217	0.04511	0.04962	0.01804	0.01353	0.00902	0.00902	0.01804	0.01042	0.02083	0.01203	0.02706
11½	0.08696	0.07531	0.04707	0.05177	0.01883	0.01412	0.00941	0.00941	0.01883	0.01042	0.02174	0.01255	0.02824
11	0.09091	0.07873	0.04921	0.05413	0.01968	0.01476	0.00984	0.00984	0.01968	0.01136	0.02273	0.01312	0.02952
10	0.10000	0.08660	0.05413	0.05954	0.02165	0.01624	0.01083	0.01083	0.02165	0.01250	0.02500	0.01443	0.03248
9	0.11111	0.09623	0.06014	0.06615	0.02406	0.01804	0.01203	0.01203	0.02406	0.01389	0.02778	0.01604	0.03608
8	0.12500	0.10825	0.06766	0.07442	0.02706	0.02030	0.01353	0.01353	0.02706	0.01562	0.03125	0.01804	0.04059
7	0.14286	0.12372	0.07732	0.08506	0.03093	0.02320	0.01546	0.01546	0.03093	0.01786	0.03571	0.02062	0.04639
6	0.16667	0.14434	0.09021	0.09923	0.03608	0.02706	0.01804	0.01804	0.03608	0.02083	0.04167	0.02406	0.05413
5	0.20000	0.17321	0.10825	0.11908	0.04330	0.03248	0.02165	0.02165	0.04330	0.02500	0.05000	0.02887	0.06495
4½	0.22222	0.19245	0.12028	0.13231	0.04811	0.03608	0.02406	0.02406	0.04811	0.02780	0.05556	0.03208	0.07217
4	0.25000	0.21651	0.13532	0.14885	0.05413	0.04059	0.02706	0.02706	0.05413	0.03125	0.06250	0.03608	0.08119

<sup>a</sup> Also depth of thread engagement.<sup>b</sup> Design profile.<sup>c</sup> Also basic flat at external UN thread root.

All dimensions are in inches.

**Table 2. Diameter-Pitch Combinations for Standard Series of Threads (UN/UNR)**

Sizes <sup>a</sup> No. or Inches	Basic Major Dia. Inches	Threads per Inch										
		Series with Graded Pitches			Series with Uniform (Constant) Pitches							
		Coarse UNC	Fine <sup>b</sup> UNF	Extra fine <sup>c</sup> UNEF	4-UN	6-UN	8-UN	12-UN	16-UN	20-UN	28-UN	32-UN
0	0.0600	...	80	Series designation shown indicates the UN thread form; however, the UNR thread form may be specified by substituting UNR in place of UN in all designations for external threads.								
(1)	0.0730	64	72									
2	0.0860	56	64									
(3)	0.0990	48	56									
4	0.1120	40	48									
5	0.1250	40	44									
6	0.1380	32	40									
8	0.1640	32	36									
10	0.1900	24	32									
(12)	0.2160	24	28									
1/4	0.2500	20	28	32	...	...	...	...	UNC	UNC	UNC	
5/16	0.3125	18	24	32	...	...	...	...	20	28	UNC	
3/8	0.3750	16	24	32	...	...	...	...	UNC	20	28	
7/16	0.4375	14	20	28	...	...	...	...	16	UNC	32	
1/2	0.5000	13	20	28	...	...	...	...	16	UNC	32	
9/16	0.5625	12	18	24	...	...	...	UNC	16	20	28	
5/8	0.6250	11	18	24	...	...	...	12	16	20	28	
(1 1/16)	0.6875	...	...	24	...	...	...	12	16	20	28	
3/4	0.7500	10	16	20	...	...	...	12	UNC	UNC	32	
(1 3/16)	0.8125	...	...	20	...	...	...	12	16	UNC	32	
7/8	0.8750	9	14	20	...	...	...	12	16	UNC	32	
(1 5/16)	0.9375	...	...	20	...	...	...	12	16	UNC	32	
1	1.0000	8	12	20	...	...	UNC	UNC	16	UNC	32	
(1 1/8)	1.0625	...	...	18	...	...	8	12	16	20	...	
1 1/8	1.1250	7	12	18	...	...	8	UNC	16	20	...	
(1 3/8)	1.1875	...	...	18	...	...	8	12	16	20	...	
1 1/4	1.2500	7	12	18	...	...	8	UNC	16	20	...	
1 5/16	1.3125	...	...	18	...	...	8	12	16	20	...	
1 3/8	1.3750	6	12	18	...	UNC	8	UNC	16	20	...	
(1 7/16)	1.4375	...	...	18	...	...	6	8	12	16	...	
1 1/2	1.5000	6	12	18	...	UNC	8	UNC	16	20	...	
(1 9/16)	1.5625	...	...	18	...	...	6	8	12	16	...	
1 5/8	1.6250	...	...	18	...	...	6	8	12	16	...	
(1 11/16)	1.6875	...	...	18	...	...	6	8	12	16	...	
1 3/4	1.7500	5	...	...	...	...	6	8	12	16	...	
(1 13/16)	1.8125	...	...	...	...	...	6	8	12	16	...	
1 7/8	1.8750	...	...	...	...	...	6	8	12	16	...	
(1 15/16)	1.9375	...	...	...	...	...	6	8	12	16	...	
2	2.0000	4 1/2	...	...	...	...	6	8	12	16	...	
(2 1/8)	2.1250	...	...	...	...	...	6	8	12	16	...	
2 1/4	2.2500	4 1/2	...	...	...	...	6	8	12	16	...	
(2 3/8)	2.3750	...	...	...	...	...	6	8	12	16	...	
2 1/2	2.5000	4	...	...	...	UNC	6	8	12	16	...	
(2 5/8)	2.6250	...	...	...	...	4	6	8	12	16	...	
2 3/4	2.7500	4	...	...	...	UNC	6	8	12	16	...	
(2 7/8)	2.8750	...	...	...	...	4	6	8	12	16	...	
3	3.0000	4	...	...	...	UNC	6	8	12	16	...	
(3 1/8)	3.1250	...	...	...	...	4	6	8	12	16	...	
3 1/4	3.2500	4	...	...	...	UNC	6	8	12	16	...	
(3 3/8)	3.3750	...	...	...	...	4	6	8	12	16	...	
3 1/2	3.5000	4	...	...	...	UNC	6	8	12	16	...	
(3 5/8)	3.6250	...	...	...	...	4	6	8	12	16	...	
3 3/4	3.7500	4	...	...	...	UNC	6	8	12	16	...	
(3 7/8)	3.8750	...	...	...	...	4	6	8	12	16	...	
4	4.0000	4	...	...	...	UNC	6	8	12	16	...	

<sup>a</sup> Sizes shown in parentheses are secondary sizes. Primary sizes of 4 1/4, 4 1/2, 4 3/4, 5, 5 1/4, 5 1/2, 5 3/4 and 6 inches also are in the 4, 6, 8, 12, and 16 thread series; secondary sizes of 4 1/8, 4 3/8, 4 7/8, 5 1/8, 5 3/8, 5 7/8, and 5 7/16 also are in the 4, 6, 8, 12, and 16 thread series.

<sup>b</sup> For diameters over 1 1/2 inches, use 12-thread series.

<sup>c</sup> For diameters over 1 11/16 inches, use 16-thread series.

For UNR thread form substitute UNR for UN for external threads only.

Table 3. Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>								Internal <sup>b</sup>					
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
0–80 UNF	2A	0.0005	0.0595	0.0563	—	0.0514	0.0496	0.0446	2B	0.0465	0.0514	0.0519	0.0542	0.0600
	3A	0.0000	0.0600	0.0568	—	0.0519	0.0506	0.0451	3B	0.0465	0.0514	0.0519	0.0536	0.0600
1–64 UNC	2A	0.0006	0.0724	0.0686	—	0.0623	0.0603	0.0538	2B	0.0561	0.0623	0.0629	0.0655	0.0730
	3A	0.0000	0.0730	0.0692	—	0.0629	0.0614	0.0544	3B	0.0561	0.0623	0.0629	0.0648	0.0730
1–72 UNF	2A	0.0006	0.0724	0.0689	—	0.0634	0.0615	0.0559	2B	0.0580	0.0635	0.0640	0.0665	0.0730
	3A	0.0000	0.0730	0.0695	—	0.0640	0.0626	0.0565	3B	0.0580	0.0635	0.0640	0.0659	0.0730
2–56 UNC	2A	0.0006	0.0854	0.0813	—	0.0738	0.0717	0.0642	2B	0.0667	0.0737	0.0744	0.0772	0.0860
	3A	0.0000	0.0860	0.0819	—	0.0744	0.0728	0.0648	3B	0.0667	0.0737	0.0744	0.0765	0.0860
2–64 UNF	2A	0.0006	0.0854	0.0816	—	0.0753	0.0733	0.0668	2B	0.0691	0.0753	0.0759	0.0786	0.0860
	3A	0.0000	0.0860	0.0822	—	0.0759	0.0744	0.0674	3B	0.0691	0.0753	0.0759	0.0779	0.0860
3–48 UNC	2A	0.0007	0.0983	0.0938	—	0.0848	0.0825	0.0734	2B	0.0764	0.0845	0.0855	0.0885	0.0990
	3A	0.0000	0.0990	0.0945	—	0.0855	0.0838	0.0741	3B	0.0764	0.0845	0.0855	0.0877	0.0990
3–56 UNF	2A	0.0007	0.0983	0.0942	—	0.0867	0.0845	0.0771	2B	0.0797	0.0865	0.0874	0.0902	0.0990
	3A	0.0000	0.0990	0.0949	—	0.0874	0.0858	0.0778	3B	0.0797	0.0865	0.0874	0.0895	0.0990
4–40 UNC	2A	0.0008	0.1112	0.1061	—	0.0950	0.0925	0.0814	2B	0.0849	0.0939	0.0958	0.0991	0.1120
	3A	0.0000	0.1120	0.1069	—	0.0958	0.0939	0.0822	3B	0.0849	0.0939	0.0958	0.0982	0.1120
4–48 UNF	2A	0.0007	0.1113	0.1068	—	0.0978	0.0954	0.0864	2B	0.0894	0.0968	0.0985	0.1016	0.1120
	3A	0.0000	0.1120	0.1075	—	0.0985	0.0967	0.0871	3B	0.0894	0.0968	0.0985	0.1008	0.1120
5–40 UNC	2A	0.0008	0.1242	0.1191	—	0.1080	0.1054	0.0944	2B	0.0979	0.1062	0.1088	0.1121	0.1250
	3A	0.0000	0.1250	0.1199	—	0.1088	0.1069	0.0952	3B	0.0979	0.1062	0.1088	0.1113	0.1250
5–44 UNF	2A	0.0007	0.1243	0.1195	—	0.1095	0.1070	0.0972	2B	0.1004	0.1079	0.1102	0.1134	0.1250
	3A	0.0000	0.1250	0.1202	—	0.1102	0.1083	0.0979	3B	0.1004	0.1079	0.1102	0.1126	0.1250
6–32 UNC	2A	0.0008	0.1372	0.1312	—	0.1169	0.1141	0.1000	2B	0.104	0.114	0.1177	0.1214	0.1380
	3A	0.0000	0.1380	0.1320	—	0.1177	0.1156	0.1008	3B	0.1040	0.1140	0.1177	0.1204	0.1380
6–40 UNF	2A	0.0008	0.1372	0.1321	—	0.1210	0.1184	0.1074	2B	0.111	0.119	0.1218	0.1252	0.1380
	3A	0.0000	0.1380	0.1329	—	0.1218	0.1198	0.1082	3B	0.1110	0.1186	0.1218	0.1243	0.1380
8–32 UNC	2A	0.0009	0.1631	0.1571	—	0.1428	0.1399	0.1259	2B	0.130	0.139	0.1437	0.1475	0.1640
	3A	0.0000	0.1640	0.1580	—	0.1437	0.1415	0.1268	3B	0.1300	0.1389	0.1437	0.1465	0.1640
8–36 UNF	2A	0.0008	0.1632	0.1577	—	0.1452	0.1424	0.1301	2B	0.134	0.142	0.1460	0.1496	0.1640
	3A	0.0000	0.1640	0.1585	—	0.1460	0.1439	0.1309	3B	0.1340	0.1416	0.1460	0.1487	0.1640



Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>						Internal <sup>b</sup>							
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia. <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
10–24 UNC	2A	0.0010	0.1890	0.1818	—	0.1619	0.1586	0.1394	2B	0.145	0.156	0.1629	0.1672	0.1900
	3A	0.0000	0.1900	0.1828	—	0.1629	0.1604	0.1404	3B	0.1450	0.1555	0.1629	0.1661	0.1900
10–28 UNS	2A	0.0010	0.1890	0.1825	—	0.1658	0.1625	0.1464	2B	0.151	0.160	0.1668	0.1711	0.1900
10–32 UNF	2A	0.0009	0.1891	0.1831	—	0.1688	0.1658	0.1519	2B	0.156	0.164	0.1697	0.1736	0.1900
	3A	0.0000	0.1900	0.1840	—	0.1697	0.1674	0.1528	3B	0.1560	0.1641	0.1697	0.1726	0.1900
10–36 UNS	2A	0.0009	0.1891	0.1836	—	0.1711	0.1681	0.1560	2B	0.160	0.166	0.1720	0.1759	0.1900
10–40 UNS	2A	0.0009	0.1891	0.1840	—	0.1729	0.1700	0.1592	2B	0.163	0.169	0.1738	0.1775	0.1900
10–48 UNS	2A	0.0008	0.1892	0.1847	—	0.1757	0.1731	0.1644	2B	0.167	0.172	0.1765	0.1799	0.1900
10–56 UNS	2A	0.0007	0.1893	0.1852	—	0.1777	0.1752	0.1681	2B	0.171	0.175	0.1784	0.1816	0.1900
12–24 UNC	2A	0.0010	0.2150	0.2078	—	0.1879	0.1845	0.1654	2B	0.171	0.181	0.1889	0.1933	0.2160
	3A	0.0000	0.2160	0.2088	—	0.1889	0.1863	0.1664	3B	0.1710	0.1807	0.1889	0.1922	0.2160
12–28 UNF	2A	0.0010	0.2150	0.2085	—	0.1918	0.1886	0.1724	2B	0.177	0.186	0.1928	0.1970	0.2160
	3A	0.0000	0.2160	0.2095	—	0.1928	0.1904	0.1734	3B	0.1770	0.1857	0.1928	0.1959	0.2160
12–32 UNEF	2A	0.0009	0.2151	0.2091	—	0.1948	0.1917	0.1779	2B	0.182	0.190	0.1957	0.1998	0.2160
	3A	0.0000	0.2160	0.2100	—	0.1957	0.1933	0.1788	3B	0.1820	0.1895	0.1957	0.1988	0.2160
12–36 UNS	2A	0.0009	0.2151	0.2096	—	0.1971	0.1941	0.1821	2B	0.186	0.192	0.1980	0.2019	0.2160
12–40 UNS	2A	0.0009	0.2151	0.2100	—	0.1989	0.1960	0.1835	2B	0.189	0.195	0.1998	0.2035	0.2160
12–48 UNS	2A	0.0008	0.2152	0.2107	—	0.2017	0.1991	0.1904	2B	0.193	0.198	0.2025	0.2059	0.2160
12–56 UNS	2A	0.0007	0.2153	0.2112	—	0.2037	0.2012	0.1941	2B	0.197	0.201	0.2044	0.2076	0.2160
1/4–20 UNC	1A	0.0011	0.2489	0.2367	—	0.2164	0.2108	0.1894	1B	0.196	0.207	0.2175	0.2248	0.2500
	2A	0.0011	0.2489	0.2408	0.2367	0.2164	0.2127	0.1894	2B	0.196	0.207	0.2175	0.2224	0.2500
	3A	0.0000	0.2500	0.2419	—	0.2175	0.2147	0.1905	3B	0.1960	0.2067	0.2175	0.2211	0.2500
1/4–24 UNS	2A	0.0011	0.2489	0.2417	—	0.2218	0.2181	0.1993	2B	0.205	0.215	0.2229	0.2277	0.2500
1/4–27 UNS	2A	0.0010	0.2490	0.2423	—	0.2249	0.2214	0.2049	2B	0.210	0.219	0.2259	0.2304	0.2500
1/4–28 UNF	1A	0.0010	0.2490	0.2392	—	0.2258	0.2208	0.2064	1B	0.211	0.220	0.2268	0.2333	0.2500
	2A	0.0010	0.2490	0.2425	—	0.2258	0.2225	0.2064	2B	0.211	0.220	0.2268	0.2311	0.2500
	3A	0.0000	0.2500	0.2435	—	0.2268	0.2243	0.2074	3B	0.2110	0.2190	0.2268	0.2300	0.2500
1/4–32 UNEF	2A	0.0010	0.2490	0.2430	—	0.2287	0.2255	0.2118	2B	0.216	0.224	0.2297	0.2339	0.2500
	3A	0.0000	0.2500	0.2440	—	0.2297	0.2273	0.2128	3B	0.2160	0.2229	0.2297	0.2328	0.2500

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>							Internal <sup>b</sup>						
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
$\frac{1}{4}$ -36 UNS	2A	0.0009	0.2491	0.2436	—	0.2311	0.2280	0.2161	2B	0.220	0.226	0.2320	0.2360	0.2500
$\frac{1}{4}$ -40 UNS	2A	0.0009	0.2491	0.2440	—	0.2329	0.2300	0.2193	2B	0.223	0.229	0.2338	0.2376	0.2500
$\frac{1}{4}$ -48 UNS	2A	0.0008	0.2492	0.2447	—	0.2357	0.2330	0.2243	2B	0.227	0.232	0.2365	0.2401	0.2500
$\frac{1}{4}$ -56 UNS	2A	0.0008	0.2492	0.2451	—	0.2376	0.2350	0.2280	2B	0.231	0.235	0.2384	0.2417	0.2500
$\frac{5}{16}$ -18 UNC	1A	0.0012	0.3113	0.2982	—	0.2752	0.2691	0.2452	1B	0.252	0.265	0.2764	0.2843	0.3125
	2A	0.0012	0.3113	0.3026	0.2982	0.2752	0.2712	0.2452	2B	0.252	0.265	0.2764	0.2817	0.3125
	3A	0.0000	0.3125	0.3038	—	0.2764	0.2734	0.2464	3B	0.2520	0.2630	0.2764	0.2803	0.3125
$\frac{5}{16}$ -20 UN	2A	0.0012	0.3113	0.3032	—	0.2788	0.2748	0.2518	2B	0.258	0.270	0.2800	0.2852	0.3125
	3A	0.0000	0.3125	0.3044	—	0.2800	0.2770	0.2530	3B	0.2580	0.2680	0.2800	0.2839	0.3125
$\frac{5}{16}$ -24 UNF	1A	0.0011	0.3114	0.3006	—	0.2843	0.2788	0.2618	1B	0.267	0.277	0.2854	0.2925	0.3125
	2A	0.0011	0.3114	0.3042	—	0.2843	0.2806	0.2618	2B	0.267	0.277	0.2854	0.2902	0.3125
	3A	0.0000	0.3125	0.3053	—	0.2854	0.2827	0.2629	3B	0.2670	0.2754	0.2854	0.2890	0.3125
$\frac{5}{16}$ -27 UNS	2A	0.0010	0.3115	0.3048	—	0.2874	0.2839	0.2674	2B	0.272	0.281	0.2884	0.2929	0.3125
$\frac{5}{16}$ -28 UN	2A	0.0010	0.3115	0.3050	—	0.2883	0.2849	0.2689	2B	0.274	0.282	0.2893	0.2937	0.3125
	3A	0.0000	0.3125	0.3060	—	0.2893	0.2867	0.2699	3B	0.2740	0.2807	0.2893	0.2926	0.3125
$\frac{5}{16}$ -32 UNEF	2A	0.0010	0.3115	0.3055	—	0.2912	0.2880	0.2743	2B	0.279	0.286	0.2922	0.2964	0.3125
	3A	0.0000	0.3125	0.3065	—	0.2922	0.2898	0.2753	3B	0.2790	0.2847	0.2922	0.2953	0.3125
$\frac{5}{16}$ -36 UNS	2A	0.0009	0.3116	0.3061	—	0.2936	0.2905	0.2785	2B	0.282	0.289	0.2945	0.2985	0.3125
$\frac{5}{16}$ -40 UNS	2A	0.0009	0.3116	0.3065	—	0.2954	0.2925	0.2818	2B	0.285	0.291	0.2963	0.3001	0.3125
$\frac{5}{16}$ -48 UNS	2A	0.0008	0.3117	0.3072	—	0.2982	0.2955	0.2869	2B	0.290	0.295	0.2990	0.3026	0.3125
$\frac{3}{8}$ -16 UNC	1A	0.0013	0.3737	0.3595	—	0.3331	0.3266	0.2992	1B	0.307	0.321	0.3344	0.3429	0.3750
	2A	0.0013	0.3737	0.3643	0.3595	0.3331	0.3287	0.2992	2B	0.307	0.321	0.3344	0.3401	0.3750
	3A	0.0000	0.3750	0.3656	—	0.3344	0.3311	0.3005	3B	0.3070	0.3182	0.3344	0.3387	0.3750
$\frac{3}{8}$ -18 UNS	2A	0.0013	0.3737	0.3650	—	0.3376	0.3333	0.3076	2B	0.315	0.328	0.3389	0.3445	0.3750
$\frac{3}{8}$ -20 UN	2A	0.0012	0.3738	0.3657	—	0.3413	0.3372	0.3143	2B	0.321	0.332	0.3425	0.3479	0.3750
	3A	0.0000	0.3750	0.3669	—	0.3425	0.3394	0.3155	3B	0.3210	0.3297	0.3425	0.3465	0.3750

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>							Internal <sup>b</sup>						
	Class	Allowance	Major Diameter			Pitch Diameter		UNR Minor Dia. <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
$\frac{3}{8}$ -24 UNF	1A	0.0011	0.3739	0.3631	—	0.3468	0.3411	0.3243	1B	0.330	0.340	0.3479	0.3553	0.3750
	2A	0.0011	0.3739	0.3667	—	0.3468	0.3430	0.3243	2B	0.330	0.340	0.3479	0.3528	0.3750
$\frac{3}{8}$ -24 UNF	3A	0.0000	0.3750	0.3678	—	0.3479	0.3450	0.3254	3B	0.3300	0.3372	0.3479	0.3516	0.3750
	2A	0.0011	0.3739	0.3672	—	0.3498	0.3462	0.3298	2B	0.335	0.344	0.3509	0.3556	0.3750
$\frac{3}{8}$ -27 UNS	2A	0.0011	0.3739	0.3674	—	0.3507	0.3471	0.3313	2B	0.336	0.345	0.3518	0.3564	0.3750
	3A	0.0000	0.3750	0.3685	—	0.3518	0.3491	0.3324	3B	0.3360	0.3426	0.3518	0.3553	0.3750
$\frac{3}{8}$ -32 UNEF	2A	0.0010	0.3740	0.3680	—	0.3537	0.3503	0.3368	2B	0.341	0.349	0.3547	0.3591	0.3750
	3A	0.0000	0.3750	0.3690	—	0.3547	0.3522	0.3378	3B	0.3410	0.3469	0.3547	0.3580	0.3750
$\frac{3}{8}$ -36 UNS	2A	0.0010	0.3740	0.3685	—	0.3560	0.3528	0.3409	2B	0.345	0.352	0.3570	0.3612	0.3750
	2A	0.0009	0.3741	0.3690	—	0.3579	0.3548	0.3443	2B	0.348	0.354	0.3588	0.3628	0.3750
0.390-27 UNS	2A	0.0011	0.3889	0.3822	—	0.3648	0.3612	0.3448	2B	0.350	0.359	0.3659	0.3706	0.3900
	1A	0.0014	0.4361	0.4206	—	0.3897	0.3826	0.3511	1B	0.360	0.376	0.3911	0.4003	0.4375
$\frac{7}{16}$ -14 UNC	2A	0.0014	0.4361	0.4258	0.4206	0.3897	0.3850	0.3511	2B	0.360	0.376	0.3911	0.3972	0.4375
	3A	0.0000	0.4375	0.4272	—	0.3911	0.3876	0.3525	3B	0.3600	0.3717	0.3911	0.3957	0.4375
$\frac{7}{16}$ -16 UN	2A	0.0014	0.4361	0.4267	—	0.3955	0.3909	0.3616	2B	0.370	0.384	0.3969	0.4028	0.4375
	3A	0.0000	0.4375	0.4281	—	0.3969	0.3935	0.3630	3B	0.3700	0.3800	0.3969	0.4014	0.4375
$\frac{7}{16}$ -18 UNS	2A	0.0013	0.4362	0.4275	—	0.4001	0.3958	0.3701	2B	0.377	0.390	0.4014	0.4070	0.4375
	1A	0.0013	0.4362	0.4240	—	0.4037	0.3975	0.3767	1B	0.383	0.395	0.4050	0.4131	0.4375
$\frac{7}{16}$ -20 UNF	2A	0.0013	0.4362	0.4281	—	0.4037	0.3995	0.3767	2B	0.383	0.395	0.4050	0.4104	0.4375
	3A	0.0000	0.4375	0.4294	—	0.4050	0.4019	0.3780	3B	0.3830	0.3916	0.4050	0.4091	0.4375
$\frac{7}{16}$ -24 UNS	2A	0.0011	0.4364	0.4292	—	0.4093	0.4055	0.3868	2B	0.392	0.402	0.4104	0.4153	0.4375
	2A	0.0011	0.4364	0.4297	—	0.4123	0.4087	0.3923	2B	0.397	0.406	0.4134	0.4181	0.4375
$\frac{7}{16}$ -28 UNEF	2A	0.0011	0.4364	0.4299	—	0.4132	0.4096	0.3938	2B	0.399	0.407	0.4143	0.4189	0.4375
	3A	0.0000	0.4375	0.4310	—	0.4143	0.4116	0.3949	3B	0.3990	0.4051	0.4143	0.4178	0.4375
$\frac{7}{16}$ -32 UN	2A	0.0010	0.4365	0.4305	—	0.4162	0.4128	0.3993	2B	0.404	0.411	0.4172	0.4216	0.4375
	3A	0.0000	0.4375	0.4315	—	0.4172	0.4147	0.4003	3B	0.4040	0.4094	0.4172	0.4205	0.4375

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>							Internal <sup>b</sup>						
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia. <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
$\frac{1}{2}$ -12 UNS	2A	0.0016	0.4984	0.4870	—	0.4443	0.4389	0.3992	2B	0.410	0.428	0.4459	0.4529	0.5000
	3A	0.0000	0.5000	0.4886	—	0.4459	0.4419	0.4008	3B	0.4100	0.4223	0.4459	0.4511	0.5000
$\frac{1}{2}$ -13 UNC	1A	0.0015	0.4985	0.4822	—	0.4485	0.4411	0.4069	1B	0.417	0.434	0.4500	0.4597	0.5000
	2A	0.0015	0.4985	0.4876	0.4822	0.4485	0.4435	0.4069	2B	0.417	0.434	0.4500	0.4565	0.5000
$\frac{1}{2}$ -14 UNS	3A	0.0000	0.5000	0.4891	—	0.4500	0.4463	0.4084	3B	0.4170	0.4284	0.4500	0.4548	0.5000
	2A	0.0015	0.4985	0.4882	—	0.4521	0.4471	0.4135	2B	0.423	0.438	0.4536	0.4601	0.5000
$\frac{1}{2}$ -16 UN	2A	0.0014	0.4986	0.4892	—	0.4580	0.4533	0.4241	2B	0.432	0.446	0.4594	0.4655	0.5000
	3A	0.0000	0.5000	0.4906	—	0.4594	0.4559	0.4255	3B	0.4320	0.4419	0.4594	0.4640	0.5000
$\frac{1}{2}$ -18 UNS	2A	0.0013	0.4987	0.4900	—	0.4626	0.4582	0.4326	2B	0.440	0.453	0.4639	0.4697	0.5000
	1A	0.0013	0.4987	0.4865	—	0.4662	0.4598	0.4392	1B	0.446	0.457	0.4675	0.4759	0.5000
$\frac{1}{2}$ -20 UNF	2A	0.0013	0.4987	0.4906	—	0.4662	0.4619	0.4392	2B	0.446	0.457	0.4675	0.4731	0.5000
	3A	0.0000	0.5000	0.4919	—	0.4675	0.4643	0.4405	3B	0.4460	0.4537	0.4675	0.4717	0.5000
$\frac{1}{2}$ -24 UNS	2A	0.0012	0.4988	0.4916	—	0.4717	0.4678	0.4492	2B	0.455	0.465	0.4729	0.4780	0.5000
	2A	0.0011	0.4989	0.4922	—	0.4748	0.4711	0.4548	2B	0.460	0.469	0.4759	0.4807	0.5000
$\frac{1}{2}$ -27 UNS	2A	0.0011	0.4989	0.4924	—	0.4757	0.4720	0.4563	2B	0.461	0.470	0.4768	0.4816	0.5000
	3A	0.0000	0.5000	0.4935	—	0.4768	0.4740	0.4574	3B	0.4610	0.4676	0.4768	0.4804	0.5000
$\frac{1}{2}$ -28 UNEF	2A	0.0010	0.4990	0.4930	—	0.4787	0.4752	0.4618	2B	0.466	0.474	0.4797	0.4842	0.5000
	3A	0.0000	0.5000	0.4940	—	0.4797	0.4771	0.4628	3B	0.4660	0.4719	0.4797	0.4831	0.5000
$\frac{3}{16}$ -12 UNC	1A	0.0016	0.5609	0.5437	—	0.5068	0.4990	0.4617	1B	0.472	0.490	0.5084	0.5186	0.5625
	2A	0.0016	0.5609	0.5495	0.5437	0.5068	0.5016	0.4617	2B	0.472	0.490	0.5084	0.5152	0.5625
$\frac{3}{16}$ -14 UNS	3A	0.0000	0.5625	0.5511	—	0.5084	0.5045	0.4633	3B	0.4720	0.4843	0.5084	0.5135	0.5625
	2A	0.0015	0.5610	0.5507	—	0.5146	0.5096	0.4760	2B	0.485	0.501	0.5161	0.5226	0.5625
$\frac{3}{16}$ -16 UN	2A	0.0014	0.5611	0.5517	—	0.5205	0.5158	0.4866	2B	0.495	0.509	0.5219	0.5280	0.5625
	3A	0.0000	0.5625	0.5531	—	0.5219	0.5184	0.4880	3B	0.4950	0.5040	0.5219	0.5265	0.5625
$\frac{3}{16}$ -18 UNF	1A	0.0014	0.5611	0.5480	—	0.5250	0.5182	0.4950	1B	0.502	0.515	0.5264	0.5353	0.5625
	2A	0.0014	0.5611	0.5524	—	0.5250	0.5205	0.4950	2B	0.502	0.515	0.5264	0.5323	0.5625
	3A	0.0000	0.5625	0.5538	—	0.5264	0.5230	0.4964	3B	0.5020	0.5106	0.5264	0.5308	0.5625

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>								Internal <sup>b</sup>					
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	Min
$\frac{1}{16}$ -20 UN	2A	0.0013	0.5612	0.5531	—	0.5287	0.5245	0.5017	2B	0.508	0.520	0.5300	0.5355	0.5625
	3A	0.0000	0.5625	0.5544	—	0.5300	0.5268	0.5030	3B	0.5080	0.5162	0.5300	0.5341	0.5625
$\frac{1}{16}$ -24 UNEF	2A	0.0012	0.5613	0.5541	—	0.5342	0.5303	0.5117	2B	0.517	0.527	0.5354	0.5405	0.5625
	3A	0.0000	0.5625	0.5553	—	0.5354	0.5325	0.5129	3B	0.5170	0.5244	0.5354	0.5392	0.5625
$\frac{1}{16}$ -27 UNS	2A	0.0011	0.5614	0.5547	—	0.5373	0.5336	0.5173	2B	0.522	0.531	0.5384	0.5432	0.5625
$\frac{1}{16}$ -28 UN	2A	0.0011	0.5614	0.5549	—	0.5382	0.5345	0.5188	2B	0.524	0.532	0.5393	0.5441	0.5625
	3A	0.0000	0.5625	0.5560	—	0.5393	0.5365	0.5199	3B	0.5240	0.5301	0.5393	0.5429	0.5625
$\frac{1}{16}$ -32 UN	2A	0.0010	0.5615	0.5555	—	0.5412	0.5377	0.5243	2B	0.529	0.536	0.5422	0.5467	0.5625
	3A	0.0000	0.5625	0.5565	—	0.5422	0.5396	0.5253	3B	0.5290	0.5344	0.5422	0.5456	0.5625
$\frac{5}{8}$ -11 UNC	1A	0.0016	0.6234	0.6052	—	0.5644	0.5561	0.5152	1B	0.527	0.546	0.5660	0.5767	0.6250
	2A	0.0016	0.6234	0.6113	0.6052	0.5644	0.5589	0.5152	2B	0.527	0.546	0.5660	0.5732	0.6250
	3A	0.0000	0.6250	0.6129	—	0.5660	0.5619	0.5168	3B	0.5270	0.5391	0.5660	0.5714	0.6250
$\frac{5}{8}$ -12 UN	2A	0.0016	0.6234	0.6120	—	0.5693	0.5639	0.5242	2B	0.535	0.553	0.5709	0.5780	0.6250
	3A	0.0000	0.6250	0.6136	—	0.5709	0.5668	0.5258	3B	0.5350	0.5463	0.5709	0.5762	0.6250
$\frac{5}{8}$ -14 UNS	2A	0.0015	0.6235	0.6132	—	0.5771	0.5720	0.5385	2B	0.548	0.564	0.5786	0.5852	0.6250
	2A	0.0014	0.6236	0.6142	—	0.5830	0.5782	0.5491	2B	0.557	0.571	0.5844	0.5906	0.6250
$\frac{5}{8}$ -16 UN	3A	0.0000	0.6250	0.6156	—	0.5844	0.5808	0.5505	3B	0.5570	0.5662	0.5844	0.5890	0.6250
	1A	0.0014	0.6236	0.6105	—	0.5875	0.5805	0.5575	1B	0.565	0.578	0.5889	0.5980	0.6250
$\frac{5}{8}$ -18 UNF	2A	0.0014	0.6236	0.6149	—	0.5875	0.5828	0.5575	2B	0.565	0.578	0.5889	0.5949	0.6250
	3A	0.0000	0.6250	0.6163	—	0.5889	0.5854	0.5589	3B	0.5650	0.5730	0.5889	0.5934	0.6250
$\frac{5}{8}$ -20 UN	2A	0.0013	0.6237	0.6156	—	0.5912	0.5869	0.5642	2B	0.571	0.582	0.5925	0.5981	0.6250
	3A	0.0000	0.6250	0.6169	—	0.5925	0.5893	0.5655	3B	0.5710	0.5787	0.5925	0.5967	0.6250
$\frac{5}{8}$ -24 UNEF	2A	0.0012	0.6238	0.6166	—	0.5967	0.5927	0.5742	2B	0.580	0.590	0.5979	0.6031	0.6250
	3A	0.0000	0.6250	0.6178	—	0.5979	0.5949	0.5754	3B	0.5800	0.5869	0.5979	0.6018	0.6250
$\frac{5}{8}$ -27 UNS	2A	0.0011	0.6239	0.6172	—	0.5998	0.5960	0.5798	2B	0.585	0.594	0.6009	0.6059	0.6250
$\frac{5}{8}$ -28 UN	2A	0.0011	0.6239	0.6174	—	0.6007	0.5969	0.5813	2B	0.586	0.595	0.6018	0.6067	0.6250
	3A	0.0000	0.6250	0.6185	—	0.6018	0.5990	0.5824	3B	0.5860	0.5926	0.6018	0.6055	0.6250

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>							Internal <sup>b</sup>						
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	Min
$\frac{5}{8}$ -32 UN	2A	0.0011	0.6239	0.6179	—	0.6036	0.6000	0.5867	2B	0.591	0.599	0.6047	0.6093	0.6250
	3A	0.0000	0.6250	0.6190	—	0.6047	0.6020	0.5878	3B	0.5910	0.5969	0.6047	0.6082	0.6250
$\frac{1}{2}$ -12 UN	2A	0.0016	0.6859	0.6745	—	0.6318	0.6264	0.5867	2B	0.597	0.615	0.6334	0.6405	0.6875
	3A	0.0000	0.6875	0.6761	—	0.6334	0.6293	0.5883	3B	0.5970	0.6085	0.6334	0.6387	0.6875
$\frac{1}{2}$ -16 UN	2A	0.0014	0.6861	0.6767	—	0.6455	0.6407	0.6116	2B	0.620	0.634	0.6469	0.6531	0.6875
	3A	0.0000	0.6875	0.6781	—	0.6469	0.6433	0.6130	3B	0.6200	0.6284	0.6469	0.6515	0.6875
$\frac{1}{2}$ -20 UN	2A	0.0013	0.6862	0.6781	—	0.6537	0.6494	0.6267	2B	0.633	0.645	0.6550	0.6606	0.6875
	3A	0.0000	0.6875	0.6794	—	0.6550	0.6518	0.6280	3B	0.6330	0.6412	0.6550	0.6592	0.6875
$\frac{1}{2}$ -24 UNEF	2A	0.0012	0.6863	0.6791	—	0.6592	0.6552	0.6367	2B	0.642	0.652	0.6604	0.6656	0.6875
	3A	0.0000	0.6875	0.6803	—	0.6604	0.6574	0.6379	3B	0.6420	0.6494	0.6604	0.6643	0.6875
$\frac{1}{2}$ -28 UN	2A	0.0011	0.6864	0.6799	—	0.6632	0.6594	0.6438	2B	0.649	0.657	0.6643	0.6692	0.6875
	3A	0.0000	0.6875	0.6810	—	0.6643	0.6615	0.6449	3B	0.6490	0.6551	0.6643	0.6680	0.6875
$\frac{1}{2}$ -32 UN	2A	0.0011	0.6864	0.6804	—	0.6661	0.6625	0.6492	2B	0.654	0.661	0.6672	0.6718	0.6875
	3A	0.0000	0.6875	0.6815	—	0.6672	0.6645	0.6503	3B	0.6540	0.6594	0.6672	0.6707	0.6875
$\frac{3}{4}$ -10 UNC	1A	0.0018	0.7482	0.7288	—	0.6832	0.6744	0.6291	1B	0.642	0.663	0.6850	0.6965	0.7500
	2A	0.0018	0.7482	0.7353	0.7288	0.6832	0.6773	0.6291	2B	0.642	0.663	0.6850	0.6927	0.7500
$\frac{3}{4}$ -12 UN	3A	0.0000	0.7500	0.7371	—	0.6850	0.6806	0.6309	3B	0.6420	0.6545	0.6850	0.6907	0.7500
	2A	0.0017	0.7483	0.7369	—	0.6942	0.6887	0.6491	2B	0.660	0.678	0.6959	0.7031	0.7500
$\frac{3}{4}$ -14 UNS	3A	0.0000	0.7500	0.7386	—	0.6959	0.6918	0.6508	3B	0.6600	0.6707	0.6959	0.7013	0.7500
	2A	0.0015	0.7485	0.7382	—	0.7021	0.6970	0.6635	2B	0.673	0.688	0.7036	0.7103	0.7500
$\frac{3}{4}$ -16 UNF	1A	0.0015	0.7485	0.7343	—	0.7079	0.7004	0.6740	1B	0.682	0.696	0.7094	0.7192	0.7500
	2A	0.0015	0.7485	0.7391	—	0.7079	0.7029	0.6740	2B	0.682	0.696	0.7094	0.7159	0.7500
$\frac{3}{4}$ -18 UNS	3A	0.0000	0.7500	0.7406	—	0.7094	0.7056	0.6755	3B	0.6820	0.6908	0.7094	0.7143	0.7500
	2A	0.0014	0.7486	0.7399	—	0.7125	0.7079	0.6825	2B	0.690	0.703	0.7139	0.7199	0.7500
$\frac{3}{4}$ -20 UNEF	2A	0.0013	0.7487	0.7406	—	0.7162	0.7118	0.6892	2B	0.696	0.707	0.7175	0.7232	0.7500
	3A	0.0000	0.7500	0.7419	—	0.7175	0.7142	0.6905	3B	0.6960	0.7037	0.7175	0.7218	0.7500
$\frac{3}{4}$ -24 UNS	2A	0.0012	0.7488	0.7416	—	0.7217	0.7176	0.6992	2B	0.705	0.715	0.7229	0.7282	0.7500
	2A	0.0012	0.7488	0.7421	—	0.7247	0.7208	0.7047	2B	0.710	0.719	0.7259	0.7310	0.7500

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>							Internal <sup>b</sup>						
	Class	Allowance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	Min
$\frac{3}{8}$ -28 UN	2A	0.0012	0.7488	0.7423	—	0.7256	0.7218	0.7062	2B	0.711	0.720	0.7268	0.7318	0.7500
	3A	0.0000	0.7500	0.7435	—	0.7268	0.7239	0.7074	3B	0.7110	0.7176	0.7268	0.7305	0.7500
$\frac{3}{8}$ -32 UN	2A	0.0011	0.7489	0.7429	—	0.7286	0.7250	0.7117	2B	0.716	0.724	0.7297	0.7344	0.7500
	3A	0.0000	0.7500	0.7440	—	0.7297	0.7270	0.7128	3B	0.7160	0.7219	0.7297	0.7333	0.7500
$\frac{1}{2}$ -12 UN	2A	0.0017	0.8108	0.7994	—	0.7567	0.7512	0.7116	2B	0.722	0.740	0.7584	0.7656	0.8125
	3A	0.0000	0.8125	0.8011	—	0.7584	0.7543	0.7133	3B	0.7220	0.7329	0.7584	0.7638	0.8125
$\frac{1}{2}$ -16 UN	2A	0.0015	0.8110	0.8016	—	0.7704	0.7655	0.7365	2B	0.745	0.759	0.7719	0.7782	0.8125
	3A	0.0000	0.8125	0.8031	—	0.7719	0.7683	0.7380	3B	0.7450	0.7533	0.7719	0.7766	0.8125
$\frac{1}{2}$ -20 UNEF	2A	0.0013	0.8112	0.8031	—	0.7787	0.7743	0.7517	2B	0.758	0.770	0.7800	0.7857	0.8125
	3A	0.0000	0.8125	0.8044	—	0.7800	0.7767	0.7530	3B	0.7580	0.7662	0.7800	0.7843	0.8125
$\frac{1}{2}$ -28 UN	2A	0.0012	0.8113	0.8048	—	0.7881	0.7843	0.7687	2B	0.774	0.782	0.7893	0.7943	0.8125
	3A	0.0000	0.8125	0.8060	—	0.7893	0.7864	0.7699	3B	0.7740	0.7801	0.7893	0.7930	0.8125
$\frac{1}{2}$ -32 UN	2A	0.0011	0.8114	0.8054	—	0.7911	0.7875	0.7742	2B	0.779	0.786	0.7922	0.7969	0.8125
	3A	0.0000	0.8125	0.8065	—	0.7922	0.7895	0.7753	3B	0.7790	0.7844	0.7922	0.7958	0.8125
$\frac{7}{8}$ -9 UNC	1A	0.0019	0.8731	0.8523	—	0.8009	0.7914	0.7408	1B	0.755	0.778	0.8028	0.8151	0.8750
	2A	0.0019	0.8731	0.8592	0.8523	0.8009	0.7946	0.7408	2B	0.755	0.778	0.8028	0.8110	0.8750
$\frac{7}{8}$ -10 UNS	3A	0.0000	0.8750	0.8611	—	0.8028	0.7981	0.7427	3B	0.7550	0.7681	0.8028	0.8089	0.8750
	2A	0.0018	0.8732	0.8603	—	0.8082	0.8022	0.7542	2B	0.767	0.788	0.8100	0.8178	0.8750
$\frac{7}{8}$ -12 UN	2A	0.0017	0.8733	0.8619	—	0.8192	0.8137	0.7741	2B	0.785	0.803	0.8209	0.8281	0.8750
	3A	0.0000	0.8750	0.8636	—	0.8209	0.8168	0.7758	3B	0.7850	0.7948	0.8209	0.8263	0.8750
$\frac{7}{8}$ -14 UNF	1A	0.0016	0.8734	0.8579	—	0.8270	0.8189	0.7884	1B	0.798	0.814	0.8286	0.8392	0.8750
	2A	0.0016	0.8734	0.8631	—	0.8270	0.8216	0.7884	2B	0.798	0.814	0.8286	0.8356	0.8750
$\frac{7}{8}$ -16 UN	3A	0.0000	0.8750	0.8647	—	0.8286	0.8245	0.7900	3B	0.7980	0.8068	0.8286	0.8339	0.8750
	2A	0.0015	0.8735	0.8641	—	0.8329	0.8280	0.7900	2B	0.807	0.821	0.8344	0.8407	0.8750
$\frac{7}{8}$ -18 UNS	3A	0.0000	0.8750	0.8656	—	0.8344	0.8308	0.8005	3B	0.8070	0.8158	0.8344	0.8391	0.8750
	2A	0.0014	0.8736	0.8649	—	0.8375	0.8329	0.8075	2B	0.815	0.828	0.8389	0.8449	0.8750
$\frac{7}{8}$ -20 UNEF	2A	0.0013	0.8737	0.8656	—	0.8412	0.8368	0.8142	2B	0.821	0.832	0.8425	0.8482	0.8750
	3A	0.0000	0.8750	0.8669	—	0.8425	0.8392	0.8155	3B	0.8210	0.8287	0.8425	0.8468	0.8750

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>							Internal <sup>b</sup>						
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia. <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
$\frac{7}{8}$ -24 UNS	2A	0.0012	0.8738	0.8666	—	0.8467	0.8426	0.8242	2B	0.830	0.840	0.8479	0.8532	0.8750
$\frac{7}{8}$ -27 UNS	2A	0.0012	0.8738	0.8671	—	0.8497	0.8458	0.8297	2B	0.835	0.844	0.8509	0.8560	0.8750
$\frac{7}{8}$ -28 UN	2A	0.0012	0.8738	0.8673	—	0.8506	0.8468	0.8312	2B	0.836	0.845	0.8518	0.8568	0.8750
	3A	0.0000	0.8750	0.8685	—	0.8518	0.8489	0.8324	3B	0.8360	0.8426	0.8518	0.8555	0.8750
$\frac{7}{8}$ -32 UN	2A	0.0011	0.8739	0.8679	—	0.8536	0.8500	0.8367	2B	0.841	0.849	0.8547	0.8594	0.8750
	3A	0.0000	0.8750	0.8690	—	0.8547	0.8520	0.8378	3B	0.8410	0.8469	0.8547	0.8583	0.8750
$\frac{15}{16}$ -12 UN	2A	0.0017	0.9358	0.9244	—	0.8817	0.8760	0.8366	2B	0.847	0.865	0.8834	0.8908	0.9375
	3A	0.0000	0.9375	0.9261	—	0.8834	0.8793	0.8383	3B	0.8470	0.8575	0.8834	0.8889	0.9375
$\frac{15}{16}$ -16 UN	2A	0.0015	0.9360	0.9266	—	0.8954	0.8904	0.8615	2B	0.870	0.884	0.8969	0.9034	0.9375
	3A	0.0000	0.9375	0.9281	—	0.8969	0.8932	0.8630	3B	0.8700	0.8783	0.8969	0.9018	0.9375
$\frac{15}{16}$ -20 UNEF	2A	0.0014	0.9361	0.9280	—	0.9036	0.8991	0.8766	2B	0.883	0.895	0.9050	0.9109	0.9375
	3A	0.0000	0.9375	0.9294	—	0.9050	0.9016	0.8780	3B	0.8830	0.8912	0.9050	0.9094	0.9375
$\frac{15}{16}$ -28 UN	2A	0.0012	0.9363	0.9298	—	0.9131	0.9091	0.8937	2B	0.899	0.907	0.9143	0.9195	0.9375
	3A	0.0000	0.9375	0.9310	—	0.9143	0.9113	0.8949	3B	0.8990	0.9051	0.9143	0.9182	0.9375
$\frac{15}{16}$ -32 UN	2A	0.0011	0.9364	0.9304	—	0.9161	0.9123	0.8992	2B	0.904	0.911	0.9172	0.9221	0.9375
	3A	0.0000	0.9375	0.9315	—	0.9172	0.9144	0.9003	3B	0.9040	0.9094	0.9172	0.9209	0.9375
1-8 UNC	1A	0.0020	0.9980	0.9755	—	0.9168	0.9067	0.8492	1B	0.865	0.890	0.9188	0.9320	1.0000
	2A	0.0020	0.9980	0.9830	0.9755	0.9168	0.9100	0.8492	2B	0.865	0.890	0.9188	0.9276	1.0000
	3A	0.0000	1.0000	0.9850	—	0.9188	0.9137	0.8512	3B	0.8650	0.8797	0.9188	0.9254	1.0000
1-10 UNS	2A	0.0018	0.9982	0.9853	—	0.9332	0.9270	0.8792	2B	0.892	0.913	0.9350	0.9430	1.0000
1-12 UNF	1A	0.0018	0.9982	0.9810	—	0.9441	0.9353	0.8990	1B	0.910	0.928	0.9459	0.9573	1.0000
	2A	0.0018	0.9982	0.9868	—	0.9441	0.9382	0.8990	2B	0.910	0.928	0.9459	0.9535	1.0000
	3A	0.0000	1.0000	0.9886	—	0.9459	0.9415	0.9008	3B	0.9100	0.9198	0.9459	0.9516	1.0000
1-14 UNS <sup>f</sup>	1A	0.0017	0.9983	0.9828	—	0.9519	0.9435	0.9132	1B	0.923	0.938	0.9536	0.9645	1.0000
	2A	0.0017	0.9983	0.9880	—	0.9519	0.9463	0.9132	2B	0.923	0.938	0.9536	0.9609	1.0000
	3A	0.0000	1.0000	0.9897	—	0.9536	0.9494	0.9149	3B	0.9230	0.9315	0.9536	0.9590	1.0000
1-16 UN	2A	0.0015	0.9985	0.9891	—	0.9579	0.9529	0.9240	2B	0.932	0.946	0.9594	0.9659	1.0000
	3A	0.0000	1.0000	0.9906	—	0.9594	0.9557	0.9255	3B	0.9320	0.9408	0.9594	0.9643	1.0000
1-18 UNS	2A	0.0014	0.9986	0.9899	—	0.9625	0.9578	0.9325	2B	0.940	0.953	0.9639	0.9701	1.0000



Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>						Internal <sup>b</sup>							
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	Min
1-20 UNEF	2A	0.0014	0.9986	0.9905	—	0.9661	0.9616	0.9391	2B	0.946	0.957	0.9675	0.9734	1.0000
	3A	0.0000	1.0000	0.9919	—	0.9675	0.9641	0.9405	3B	0.9460	0.9537	0.9675	0.9719	1.0000
1-24 UNS	2A	0.0013	0.9987	0.9915	—	0.9716	0.9674	0.9491	2B	0.955	0.965	0.9729	0.9784	1.0000
1-27 UNS	2A	0.0012	0.9988	0.9921	—	0.9747	0.9707	0.9547	2B	0.960	0.969	0.9759	0.9811	1.0000
1-28 UN	2A	0.0012	0.9988	0.9923	—	0.9756	0.9716	0.9562	2B	0.961	0.970	0.9768	0.9820	1.0000
	3A	0.0000	1.0000	0.9935	—	0.9768	0.9738	0.9574	3B	0.9610	0.9676	0.9768	0.9807	1.0000
1-32 UN	2A	0.0011	0.9989	0.9929	—	0.9786	0.9748	0.9617	2B	0.966	0.974	0.9797	0.9846	1.0000
	3A	0.0000	1.0000	0.9940	—	0.9797	0.9769	0.9628	3B	0.9660	0.9719	0.9797	0.9834	1.0000
1 $\frac{1}{16}$ -8 UN	2A	0.0020	1.0605	1.0455	—	0.9793	0.9725	0.9117	2B	0.927	0.952	0.9813	0.9902	1.0625
	3A	0.0000	1.0625	1.0475	—	0.9813	0.9762	0.9137	3B	0.9270	0.9422	0.9813	0.9880	1.0625
1 $\frac{1}{16}$ -12 UN	2A	0.0017	1.0608	1.0494	—	1.0067	1.0010	0.9616	2B	0.972	0.990	1.0084	1.0158	1.0625
	3A	0.0000	1.0625	1.0511	—	1.0084	1.0042	0.9633	3B	0.9720	0.9823	1.0084	1.0139	1.0625
1 $\frac{1}{16}$ -16 UN	2A	0.0015	1.0610	1.0516	—	1.0204	1.0154	0.9865	2B	0.995	1.009	1.0219	1.0284	1.0625
	3A	0.0000	1.0625	1.0531	—	1.0219	1.0182	0.9880	3B	0.9950	1.0033	1.0219	1.0268	1.0625
1 $\frac{1}{16}$ -18 UNEF	2A	0.0014	1.0611	1.0524	—	1.0250	1.0203	0.9950	2B	1.002	1.015	1.0264	1.0326	1.0625
	3A	0.0000	1.0625	1.0538	—	1.0264	1.0228	0.9964	3B	1.0020	1.0105	1.0264	1.0310	1.0625
1 $\frac{1}{16}$ -20 UN	2A	0.0014	1.0611	1.0530	—	1.0286	1.0241	1.0016	2B	1.008	1.020	1.0300	1.0359	1.0625
	3A	0.0000	1.0625	1.0544	—	1.0300	1.0266	1.0030	3B	1.0080	1.0162	1.0300	1.0344	1.0625
1 $\frac{1}{16}$ -28 UN	2A	0.0012	1.0613	1.0548	—	1.0381	1.0341	1.0187	2B	1.024	1.032	1.0393	1.0445	1.0625
	3A	0.0000	1.0625	1.0560	—	1.0393	1.0363	1.0199	3B	1.0240	1.0301	1.0393	1.0432	1.0625
1 $\frac{1}{8}$ -7 UNC	1A	0.0022	1.1228	1.0982	—	1.0300	1.0191	0.9527	1B	0.970	0.998	1.0322	1.0463	1.1250
	2A	0.0022	1.1228	1.1064	1.0982	1.0300	1.0228	0.9527	2B	0.970	0.998	1.0322	1.0416	1.1250
1 $\frac{1}{8}$ -8 UN	3A	0.0000	1.1250	1.1086	—	1.0322	1.0268	0.9549	3B	0.9700	0.9875	1.0322	1.0393	1.1250
	2A	0.0021	1.1229	1.1079	1.1004	1.0417	1.0348	0.9741	2B	0.990	1.015	1.0438	1.0528	1.1250
1 $\frac{1}{8}$ -10 UNS	3A	0.0000	1.1250	1.1100	—	1.0438	1.0386	0.9762	3B	0.9900	1.0047	1.0438	1.0505	1.1250
	2A	0.0018	1.1232	1.1103	—	1.0582	1.0520	1.0042	2B	1.017	1.038	1.0600	1.0680	1.1250
1 $\frac{1}{8}$ -12 UNF	1A	0.0018	1.1232	1.1060	—	1.0691	1.0601	1.0240	1B	1.035	1.053	1.0709	1.0826	1.1250
	2A	0.0018	1.1232	1.1118	—	1.0691	1.0631	1.0240	2B	1.035	1.053	1.0709	1.0787	1.1250
3A	0.0000	1.1250	1.1136	—	1.0709	1.0664	1.0258	3B	1.0350	1.0448	1.0709	1.0768	1.1250	

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>							Internal <sup>b</sup>						
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia. <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	Min
1 $\frac{1}{8}$ -14 UNS	2A	0.0016	1.1234	1.1131	—	1.0770	1.0717	1.0384	2B	1.048	1.064	1.0786	1.0855	1.1250
1 $\frac{1}{8}$ -16 UN	2A	0.0015	1.1235	1.1141	—	1.0829	1.0779	1.0490	2B	1.057	1.071	1.0844	1.0909	1.1250
	3A	0.0000	1.1250	1.1156	—	1.0844	1.0807	1.0505	3B	1.0570	1.0658	1.0844	1.0893	1.1250
	2A	0.0014	1.1236	1.1149	—	1.0875	1.0828	1.0575	2B	1.065	1.078	1.0889	1.0951	1.1250
1 $\frac{1}{8}$ -18 UNEF	3A	0.0000	1.1250	1.1163	—	1.0889	1.0853	1.0589	3B	1.0650	1.0730	1.0889	1.0935	1.1250
	2A	0.0014	1.1236	1.1155	—	1.0911	1.0866	1.0641	2B	1.071	1.082	1.0925	1.0984	1.1250
	3A	0.0000	1.1250	1.1169	—	1.0925	1.0891	1.0655	3B	1.0710	1.0787	1.0925	1.0969	1.1250
1 $\frac{1}{8}$ -20 UN	2A	0.0013	1.1237	1.1165	—	1.0966	1.0924	1.0742	2B	1.080	1.090	1.0979	1.1034	1.1250
1 $\frac{1}{8}$ -24 UNS	3A	0.0000	1.1250	1.1173	—	1.1006	1.0966	1.0812	2B	1.086	1.095	1.1018	1.1070	1.1250
	2A	0.0012	1.1238	1.1173	—	1.1006	1.0966	1.0812	2B	1.086	1.095	1.1018	1.1070	1.1250
	3A	0.0000	1.1250	1.1185	—	1.1018	1.0988	1.0824	3B	1.0860	1.0926	1.1018	1.1057	1.1250
1 $\frac{3}{16}$ -8 UN	2A	0.0021	1.1854	1.1704	—	1.1042	1.0972	1.0366	2B	1.052	1.077	1.1063	1.1154	1.1875
	3A	0.0000	1.1875	1.1725	—	1.1063	1.1011	1.0387	3B	1.0520	1.0672	1.1063	1.1131	1.1875
	2A	0.0017	1.1858	1.1744	—	1.1317	1.1259	1.0866	2B	1.097	1.115	1.1334	1.1409	1.1875
1 $\frac{3}{16}$ -12 UN	3A	0.0000	1.1875	1.1761	—	1.1334	1.1291	1.0883	3B	1.0970	1.1073	1.1334	1.1390	1.1875
	2A	0.0015	1.1860	1.1766	—	1.1454	1.1403	1.1115	2B	1.120	1.134	1.1469	1.1535	1.1875
	3A	0.0000	1.1875	1.1781	—	1.1469	1.1431	1.1130	3B	1.1200	1.1283	1.1469	1.1519	1.1875
1 $\frac{3}{16}$ -16 UN	2A	0.0015	1.1860	1.1773	—	1.1499	1.1450	1.1199	2B	1.127	1.140	1.1514	1.1577	1.1875
	3A	0.0000	1.1875	1.1788	—	1.1514	1.1478	1.1214	3B	1.1270	1.1355	1.1514	1.1561	1.1875
	2A	0.0014	1.1861	1.1780	—	1.1536	1.1489	1.1266	2B	1.133	1.145	1.1550	1.1611	1.1875
1 $\frac{3}{16}$ -20 UN	3A	0.0000	1.1875	1.1794	—	1.1550	1.1515	1.1280	3B	1.1330	1.1412	1.1550	1.1595	1.1875
	2A	0.0012	1.1863	1.1798	—	1.1631	1.1590	1.1437	2B	1.149	1.157	1.1643	1.1696	1.1875
	3A	0.0000	1.1875	1.1810	—	1.1643	1.1612	1.1449	3B	1.1490	1.1551	1.1643	1.1683	1.1875
1 $\frac{1}{4}$ -7 UNC	1A	0.0022	1.2478	1.2332	—	1.1550	1.1439	1.0777	1B	1.095	1.123	1.1572	1.1716	1.2500
	2A	0.0022	1.2478	1.2314	1.2232	1.1550	1.1476	1.0777	2B	1.095	1.123	1.1572	1.1668	1.2500
	3A	0.0000	1.2500	1.2336	—	1.1572	1.1517	1.0799	3B	1.0950	1.1125	1.1572	1.1644	1.2500
1 $\frac{1}{4}$ -8 UN	2A	0.0021	1.2479	1.2329	1.2254	1.1667	1.1597	1.0991	2B	1.115	1.140	1.1688	1.1780	1.2500
	3A	0.0000	1.2500	1.2350	—	1.1688	1.1635	1.1012	3B	1.1150	1.1297	1.1688	1.1757	1.2500
	2A	0.0019	1.2481	1.2352	—	1.1831	1.1768	1.1291	2B	1.142	1.163	1.1850	1.1932	1.2500

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>						Internal <sup>b</sup>							
	Class	Allowance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	Min
1¼-12 UNF	1A	0.0018	1.2482	1.2310	—	1.1941	1.1849	1.1490	1B	1.160	1.178	1.1959	1.2079	1.2500
	2A	0.0018	1.2482	1.2368	—	1.1941	1.1879	1.1490	2B	1.160	1.178	1.1959	1.2039	1.2500
	3A	0.0000	1.2500	1.2386	—	1.1959	1.1913	1.1508	3B	1.1600	1.1698	1.1959	1.2019	1.2500
1¼-14 UNS	2A	0.0016	1.2484	1.2381	—	1.2020	1.1966	1.1634	2B	1.173	1.188	1.2036	1.2106	1.2500
	1¼-16 UN	2A	0.0015	1.2485	1.2391	—	1.2079	1.2028	1.1740	2B	1.182	1.196	1.2094	1.2160
1¼-18 UNEF	3A	0.0000	1.2500	1.2406	—	1.2094	1.2056	1.1755	3B	1.1820	1.1908	1.2094	1.2144	1.2500
	2A	0.0015	1.2485	1.2398	—	1.2124	1.2075	1.1824	2B	1.190	1.203	1.2139	1.2202	1.2500
	3A	0.0000	1.2500	1.2413	—	1.2139	1.2103	1.1839	3B	1.1900	1.1980	1.2139	1.2186	1.2500
1½-20 UN	2A	0.0014	1.2486	1.2405	—	1.2161	1.2114	1.1891	2B	1.196	1.207	1.2175	1.2236	1.2500
	3A	0.0000	1.2500	1.2419	—	1.2175	1.2140	1.1905	3B	1.1960	1.2037	1.2175	1.2220	1.2500
	1½-24 UNS	2A	0.0013	1.2487	1.2415	—	1.2216	1.2173	1.1991	2B	1.205	1.215	1.2229	1.2285
1½-28 UN	2A	0.0012	1.2488	1.2423	—	1.2256	1.2215	1.2062	2B	1.211	1.220	1.2268	1.2321	1.2500
	3A	0.0000	1.2500	1.2435	—	1.2268	1.2237	1.2074	3B	1.2110	1.2176	1.2268	1.2308	1.2500
1⅝-8 UN	2A	0.0021	1.3104	1.2954	—	1.2292	1.2221	1.1616	2B	1.177	1.202	1.2313	1.2405	1.3125
	3A	0.0000	1.3125	1.2975	—	1.2313	1.2260	1.1637	3B	1.1770	1.1922	1.2313	1.2382	1.3125
	1⅝-12 UN	2A	0.0017	1.3108	1.2994	—	1.2567	1.2509	1.2116	2B	1.222	1.240	1.2584	1.2659
1⅝-16 UN	3A	0.0000	1.3125	1.3011	—	1.2584	1.2541	1.2133	3B	1.2220	1.2323	1.2584	1.2640	1.3125
	2A	0.0015	1.3110	1.3016	—	1.2704	1.2653	1.2365	2B	1.245	1.259	1.2719	1.2785	1.3125
	3A	0.0000	1.3125	1.3031	—	1.2719	1.2681	1.2380	3B	1.2450	1.2533	1.2719	1.2769	1.3125
1⅝-18 UNEF	2A	0.0015	1.3110	1.3023	—	1.2749	1.2700	1.2449	2B	1.252	1.265	1.2764	1.2827	1.3125
	3A	0.0000	1.3125	1.3038	—	1.2764	1.2728	1.2464	3B	1.2520	1.2605	1.2764	1.2811	1.3125
	1⅝-20 UN	2A	0.0014	1.3111	1.3030	—	1.2786	1.2739	1.2516	2B	1.258	1.270	1.2800	1.2861
1⅝-24 UNS	3A	0.0000	1.3125	1.3044	—	1.2800	1.2765	1.2530	3B	1.2580	1.2662	1.2800	1.2845	1.3125
	2A	0.0012	1.3113	1.3048	—	1.2881	1.2840	1.2687	2B	1.274	1.282	1.2893	1.2946	1.3125
	3A	0.0000	1.3125	1.3060	—	1.2893	1.2862	1.2699	3B	1.2740	1.2801	1.2893	1.2933	1.3125
1⅝-6 UNC	1A	0.0024	1.3726	1.3453	—	1.2643	1.2523	1.1742	1B	1.195	1.225	1.2667	1.2822	1.3750
	2A	0.0024	1.3726	1.3544	1.3453	1.2643	1.2563	1.1742	2B	1.195	1.225	1.2667	1.2771	1.3750
	3A	0.0000	1.3750	1.3568	—	1.2667	1.2607	1.1766	3B	1.1950	1.2146	1.2667	1.2745	1.3750

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>							Internal <sup>b</sup>						
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	Min
1 $\frac{3}{8}$ -8 UN	2A	0.0022	1.3728	1.3578	1.3503	1.2916	1.2844	1.2240	2B	1.240	1.265	1.2938	1.3031	1.3750
	3A	0.0000	1.3750	1.3600	—	1.2938	1.2884	1.2262	3B	1.2400	1.2547	1.2938	1.3008	1.3750
1 $\frac{3}{8}$ -10 UNS	2A	0.0019	1.3731	1.3602	—	1.3081	1.3018	1.2541	2B	1.267	1.288	1.3100	1.3182	1.3750
1 $\frac{3}{8}$ -12 UNF	1A	0.0019	1.3731	1.3559	—	1.3190	1.3096	1.2739	1B	1.285	1.303	1.3209	1.3332	1.3750
	2A	0.0019	1.3731	1.3617	—	1.3190	1.3127	1.2739	2B	1.285	1.303	1.3209	1.3291	1.3750
	3A	0.0000	1.3750	1.3636	—	1.3209	1.3162	1.2758	3B	1.2850	1.2948	1.3209	1.3270	1.3750
1 $\frac{3}{8}$ -14 UNS	2A	0.0016	1.3734	1.3631	—	1.3270	1.3216	1.2884	2B	1.298	1.314	1.3286	1.3356	1.3750
	2A	0.0015	1.3735	1.3641	—	1.3329	1.3278	1.2990	2B	1.307	1.321	1.3344	1.3410	1.3750
1 $\frac{3}{8}$ -16 UN	3A	0.0000	1.3750	1.3656	—	1.3344	1.3306	1.3005	3B	1.3070	1.3158	1.3344	1.3394	1.3750
	2A	0.0015	1.3735	1.3648	—	1.3374	1.3325	1.3074	2B	1.315	1.328	1.3389	1.3452	1.3750
1 $\frac{3}{8}$ -18 UNEF	3A	0.0000	1.3750	1.3663	—	1.3389	1.3353	1.3089	3B	1.3150	1.3230	1.3389	1.3436	1.3750
	2A	0.0014	1.3736	1.3655	—	1.3411	1.3364	1.3141	2B	1.321	1.332	1.3425	1.3486	1.3750
1 $\frac{3}{8}$ -20 UN	3A	0.0000	1.3750	1.3669	—	1.3425	1.3390	1.3155	3B	1.3210	1.3287	1.3425	1.3470	1.3750
	2A	0.0013	1.3737	1.3665	—	1.3466	1.3423	1.3241	2B	1.330	1.340	1.3479	1.3535	1.3750
1 $\frac{3}{8}$ -28 UN	2A	0.0012	1.3738	1.3673	—	1.3506	1.3465	1.3312	2B	1.336	1.345	1.3518	1.3571	1.3750
	3A	0.0000	1.3750	1.3685	—	1.3518	1.3487	1.3324	3B	1.3360	1.3426	1.3518	1.3558	1.3750
1 $\frac{7}{16}$ -6 UN	2A	0.0024	1.4351	1.4169	—	1.3268	1.3188	1.2367	2B	1.257	1.288	1.3292	1.3396	1.4375
	3A	0.0000	1.4375	1.4193	—	1.3292	1.3232	1.2391	3B	1.2570	1.2771	1.3292	1.3370	1.4375
1 $\frac{7}{16}$ -8 UN	2A	0.0022	1.4353	1.4203	—	1.3541	1.3469	1.2865	2B	1.302	1.327	1.3563	1.3657	1.4375
	3A	0.0000	1.4375	1.4225	—	1.3563	1.3509	1.2887	3B	1.3020	1.3172	1.3563	1.3634	1.4375
1 $\frac{7}{16}$ -12 UN	2A	0.0018	1.4357	1.4243	—	1.3816	1.3757	1.3365	2B	1.347	1.365	1.3834	1.3910	1.4375
	3A	0.0000	1.4375	1.4261	—	1.3834	1.3790	1.3383	3B	1.3470	1.3573	1.3834	1.3891	1.4375
	2A	0.0016	1.4359	1.4265	—	1.3953	1.3901	1.3614	2B	1.370	1.384	1.3969	1.4037	1.4375
1 $\frac{7}{16}$ -16 UN	3A	0.0000	1.4375	1.4281	—	1.3969	1.3930	1.3630	3B	1.3700	1.3783	1.3969	1.4020	1.4375
	2A	0.0015	1.4360	1.4273	—	1.3999	1.3949	1.3699	2B	1.377	1.390	1.4014	1.4079	1.4375
1 $\frac{7}{16}$ -18 UNEF	3A	0.0000	1.4375	1.4288	—	1.4014	1.3977	1.3714	3B	1.3770	1.3855	1.4014	1.4062	1.4375
	2A	0.0014	1.4361	1.4280	—	1.4036	1.3988	1.3766	2B	1.383	1.395	1.4050	1.4112	1.4375
1 $\frac{7}{16}$ -20 UN	3A	0.0000	1.4375	1.4294	—	1.4050	1.4014	1.3780	3B	1.3830	1.3912	1.4050	1.4096	1.4375

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>						Internal <sup>b</sup>							
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia. <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	Min
1 $\frac{1}{16}$ -28 UN	2A	0.0013	1.4362	1.4297	—	1.4130	1.4088	1.3936	2B	1.399	1.407	1.4143	1.4198	1.4375
	3A	0.0000	1.4375	1.4310	—	1.4143	1.4112	1.3949	3B	1.3990	1.4051	1.4143	1.4184	1.4375
1 $\frac{1}{2}$ -6	1A	0.0024	1.4976	1.4703	—	1.3893	1.3772	1.2992	1B	1.320	1.350	1.3917	1.4075	1.5000
	2A	0.0024	1.4976	1.4794	1.4703	1.3893	1.3812	1.2992	2B	1.320	1.350	1.3917	1.4022	1.5000
1 $\frac{1}{2}$ -8 UN	3A	0.0000	1.5000	1.4818	—	1.3917	1.3856	1.3016	3B	1.3200	1.3396	1.3917	1.3996	1.5000
	2A	0.0022	1.4978	1.4828	1.4753	1.4166	1.4093	1.3490	2B	1.365	1.390	1.4188	1.4283	1.5000
1 $\frac{1}{2}$ -10 UNS	3A	0.0000	1.5000	1.4850	—	1.4188	1.4133	1.3512	3B	1.3650	1.3797	1.4188	1.4259	1.5000
	2A	0.0019	1.4981	1.4852	—	1.4331	1.4267	1.3791	2B	1.392	1.413	1.4350	1.4433	1.5000
1 $\frac{1}{2}$ -12 UNF	1A	0.0019	1.4981	1.4809	—	1.4440	1.4344	1.3989	1B	1.410	1.428	1.4459	1.4584	1.5000
	2A	0.0019	1.4981	1.4867	—	1.4440	1.4376	1.3989	2B	1.410	1.428	1.4459	1.4542	1.5000
1 $\frac{1}{2}$ -14 UNS	3A	0.0000	1.5000	1.4886	—	1.4459	1.4411	1.4008	3B	1.4100	1.4198	1.4459	1.4522	1.5000
	2A	0.0017	1.4983	1.4880	—	1.4519	1.4464	1.4133	2B	1.423	1.438	1.4536	1.4608	1.5000
1 $\frac{1}{2}$ -16 UN	2A	0.0016	1.4984	1.4890	—	1.4578	1.4526	1.4239	2B	1.432	1.446	1.4594	1.4662	1.5000
	3A	0.0000	1.5000	1.4906	—	1.4594	1.4555	1.4255	3B	1.4320	1.4408	1.4594	1.4645	1.5000
1 $\frac{1}{2}$ -18 UNEF	2A	0.0015	1.4985	1.4898	—	1.4624	1.4574	1.4324	2B	1.440	1.452	1.4639	1.4704	1.5000
	3A	0.0000	1.5000	1.4913	—	1.4639	1.4602	1.4339	3B	1.4400	1.4480	1.4639	1.4687	1.5000
1 $\frac{1}{2}$ -20 UN	2A	0.0014	1.4986	1.4905	—	1.4661	1.4613	1.4391	2B	1.446	1.457	1.4675	1.4737	1.5000
	3A	0.0000	1.5000	1.4919	—	1.4675	1.4639	1.4405	3B	1.4460	1.4537	1.4675	1.4721	1.5000
1 $\frac{1}{2}$ -24 UNS	2A	0.0013	1.4987	1.4915	—	1.4716	1.4672	1.4491	2B	1.455	1.465	1.4729	1.4787	1.5000
	2A	0.0013	1.4987	1.4922	—	1.4755	1.4713	1.4561	2B	1.461	1.470	1.4768	1.4823	1.5000
1 $\frac{1}{16}$ -6 UN	3A	0.0000	1.5000	1.4935	—	1.4768	1.4737	1.4574	3B	1.4610	1.4676	1.4768	1.4809	1.5000
	2A	0.0024	1.5601	1.5419	—	1.4518	1.4436	1.3617	2B	1.382	1.413	1.4542	1.4648	1.5625
1 $\frac{1}{16}$ -8 UN	3A	0.0000	1.5625	1.5443	—	1.4542	1.4481	1.3641	3B	1.3820	1.4021	1.4542	1.4622	1.5625
	2A	0.0022	1.5603	1.5453	—	1.4791	1.4717	1.4115	2B	1.427	1.452	1.4813	1.4909	1.5625
1 $\frac{1}{16}$ -12 UN	3A	0.0000	1.5625	1.5475	—	1.4813	1.4758	1.4137	3B	1.4270	1.4422	1.4813	1.4885	1.5625
	2A	0.0018	1.5607	1.5493	—	1.5066	1.5007	1.4615	2B	1.472	1.490	1.5084	1.5160	1.5625
	3A	0.0000	1.5625	1.5511	—	1.5084	1.5040	1.4633	3B	1.4720	1.4823	1.5084	1.5141	1.5625

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>							Internal <sup>b</sup>						
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	Min
1 $\frac{1}{16}$ -16 UN	2A	0.0016	1.5609	1.5515	—	1.5203	1.5151	1.4864	2B	1.495	1.509	1.5219	1.5287	1.5625
	3A	0.0000	1.5625	1.5531	—	1.5219	1.5180	1.4880	3B	1.4950	1.5033	1.5219	1.5270	1.5625
1 $\frac{1}{16}$ -18 UNEF	2A	0.0015	1.5610	1.5523	—	1.5249	1.5199	1.4949	2B	1.502	1.515	1.5264	1.5329	1.5625
	3A	0.0000	1.5625	1.5538	—	1.5264	1.5227	1.4964	3B	1.5020	1.5105	1.5264	1.5312	1.5625
1 $\frac{1}{16}$ -20 UN	2A	0.0014	1.5611	1.5530	—	1.5286	1.5238	1.5016	2B	1.508	1.520	1.5300	1.5362	1.5625
	3A	0.0000	1.5625	1.5544	—	1.5300	1.5264	1.5030	3B	1.5080	1.5162	1.5300	1.5346	1.5625
1 $\frac{1}{8}$ -6 UN	2A	0.0025	1.6225	1.6043	—	1.5142	1.5060	1.4246	2B	1.445	1.475	1.5167	1.5274	1.6250
	3A	0.0000	1.6250	1.6068	—	1.5167	1.5105	1.4271	3B	1.4450	1.4646	1.5167	1.5247	1.6250
1 $\frac{1}{8}$ -8 UN	2A	0.0022	1.6228	1.6078	1.6003	1.5416	1.5342	1.4784	2B	1.490	1.515	1.5438	1.5535	1.6250
	3A	0.0000	1.6250	1.6100	—	1.5438	1.5382	1.4806	3B	1.4900	1.5047	1.5438	1.5510	1.6250
1 $\frac{1}{8}$ -10 UNS	2A	0.0019	1.6231	1.6102	—	1.5581	1.5517	1.5041	2B	1.517	1.538	1.5600	1.5683	1.6250
	2A	0.0018	1.6232	1.6118	—	1.5691	1.5632	1.5240	2B	1.535	1.553	1.5709	1.5785	1.6250
1 $\frac{1}{8}$ -12 UN	3A	0.0000	1.6250	1.6136	—	1.5709	1.5665	1.5258	3B	1.5350	1.5448	1.5709	1.5766	1.6250
	2A	0.0017	1.6233	1.6130	—	1.5769	1.5714	1.5383	2B	1.548	1.564	1.5786	1.5858	1.6250
1 $\frac{1}{8}$ -16 UN	2A	0.0016	1.6234	1.6140	—	1.5828	1.5776	1.5489	2B	1.557	1.571	1.5844	1.5912	1.6250
	3A	0.0000	1.6250	1.6156	—	1.5844	1.5805	1.5505	3B	1.5570	1.5658	1.5844	1.5895	1.6250
1 $\frac{1}{8}$ -18 UNEF	2A	0.0015	1.6235	1.6148	—	1.5874	1.5824	1.5574	2B	1.565	1.578	1.5889	1.5954	1.6250
	3A	0.0000	1.6250	1.6163	—	1.5889	1.5852	1.5589	3B	1.5650	1.5730	1.5889	1.5937	1.6250
1 $\frac{1}{8}$ -20 UN	2A	0.0014	1.6236	1.6155	—	1.5911	1.5863	1.5641	2B	1.571	1.582	1.5925	1.5987	1.6250
	3A	0.0000	1.6250	1.6169	—	1.5925	1.5889	1.5655	3B	1.5710	1.5787	1.5925	1.5971	1.6250
1 $\frac{1}{8}$ -24 UNS	2A	0.0013	1.6237	1.6165	—	1.5966	1.5922	1.5741	2B	1.580	1.590	1.5979	1.6037	1.6250
	1 $\frac{1}{16}$ -6 UN	2A	0.0025	1.6850	1.6668	—	1.5767	1.5684	1.4866	2B	1.507	1.538	1.5792	1.5900
3A		0.0000	1.6875	1.6693	—	1.5792	1.5730	1.4891	3B	1.5070	1.5271	1.5792	1.5873	1.6875
1 $\frac{1}{16}$ -8 UN	2A	0.0022	1.6853	1.6703	—	1.6041	1.5966	1.5365	2B	1.552	1.577	1.6063	1.6160	1.6875
	3A	0.0000	1.6875	1.6725	—	1.6063	1.6007	1.5387	3B	1.5520	1.5672	1.6063	1.6136	1.6875
1 $\frac{1}{16}$ -12 UN	2A	0.0018	1.6857	1.6743	—	1.6316	1.6256	1.5865	2B	1.597	1.615	1.6334	1.6412	1.6875
	3A	0.0000	1.6875	1.6761	—	1.6334	1.6289	1.5883	3B	1.5970	1.6073	1.6334	1.6392	1.6875

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>							Internal <sup>b</sup>						
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia. <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter	Major Diameter	
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
1 <sup>1</sup> / <sub>16</sub> -16 UN	2A	0.0016	1.6859	1.6765	—	1.6453	1.6400	1.6114	2B	1.620	1.634	1.6469	1.6538	1.6875
	3A	0.0000	1.6875	1.6781	—	1.6469	1.6429	1.6130	3B	1.6200	1.6283	1.6469	1.6521	1.6875
	2A	0.0015	1.6860	1.6773	—	1.6499	1.6448	1.6199	2B	1.627	1.640	1.6514	1.6580	1.6875
1 <sup>1</sup> / <sub>16</sub> -18 UNEF	3A	0.0000	1.6875	1.6788	—	1.6514	1.6476	1.6214	3B	1.6270	1.6355	1.6514	1.6563	1.6875
	2A	0.0015	1.6860	1.6779	—	1.6535	1.6487	1.6265	2B	1.633	1.645	1.6550	1.6613	1.6875
	3A	0.0000	1.6875	1.6794	—	1.6550	1.6514	1.6280	3B	1.6330	1.6412	1.6550	1.6597	1.6875
1 <sup>3</sup> / <sub>4</sub> -5 UNC	1A	0.0027	1.7473	1.7165	—	1.6174	1.6040	1.5092	1B	1.534	1.568	1.6201	1.6375	1.7500
	2A	0.0027	1.7473	1.7268	1.7165	1.6174	1.6085	1.5092	2B	1.534	1.568	1.6201	1.6317	1.7500
	3A	0.0000	1.7500	1.7295	—	1.6201	1.6134	1.5119	3B	1.5340	1.5575	1.6201	1.6288	1.7500
1 <sup>3</sup> / <sub>4</sub> -6 UN	2A	0.0025	1.7475	1.7293	—	1.6392	1.6309	1.5491	2B	1.570	1.600	1.6417	1.6525	1.7500
	3A	0.0000	1.7500	1.7318	—	1.6417	1.6354	1.5516	3B	1.5700	1.5896	1.6417	1.6498	1.7500
	2A	0.0023	1.7477	1.7327	1.7252	1.6665	1.6590	1.5989	2B	1.615	1.640	1.6688	1.6786	1.7500
1 <sup>3</sup> / <sub>4</sub> -8 UN	3A	0.0000	1.7500	1.7350	—	1.6688	1.6632	1.6012	3B	1.6150	1.6297	1.6688	1.6762	1.7500
	2A	0.0019	1.7481	1.7352	—	1.6831	1.6766	1.6291	2B	1.642	1.663	1.6850	1.6934	1.7500
	3A	0.0000	1.7500	1.7386	—	1.6941	1.6881	1.6490	2B	1.660	1.678	1.6959	1.7037	1.7500
1 <sup>3</sup> / <sub>4</sub> -10 UNS	2A	0.0019	1.7481	1.7386	—	1.6959	1.6914	1.6508	3B	1.6600	1.6698	1.6959	1.7017	1.7500
1 <sup>3</sup> / <sub>4</sub> -12 UN	2A	0.0018	1.7482	1.7368	—	1.7019	1.6963	1.6632	2B	1.673	1.688	1.7036	1.7109	1.7500
1 <sup>3</sup> / <sub>4</sub> -14 UNS	3A	0.0000	1.7500	1.7386	—	1.7019	1.6963	1.6632	2B	1.673	1.688	1.7036	1.7109	1.7500
	2A	0.0017	1.7483	1.7380	—	1.7019	1.6963	1.6632	2B	1.673	1.688	1.7036	1.7109	1.7500
	3A	0.0000	1.7500	1.7386	—	1.7019	1.6963	1.6632	2B	1.673	1.688	1.7036	1.7109	1.7500
1 <sup>3</sup> / <sub>4</sub> -16 UN	2A	0.0016	1.7484	1.7390	—	1.7078	1.7025	1.6739	2B	1.682	1.696	1.7094	1.7163	1.7500
1 <sup>3</sup> / <sub>4</sub> -18 UNS	3A	0.0000	1.7500	1.7406	—	1.7094	1.7054	1.6755	3B	1.6820	1.6908	1.7094	1.7146	1.7500
	2A	0.0015	1.7485	1.7398	—	1.7124	1.7073	1.6824	2B	1.690	1.703	1.7139	1.7205	1.7500
	3A	0.0000	1.7500	1.7419	—	1.7175	1.7139	1.6905	3B	1.6960	1.7037	1.7175	1.7222	1.7500
1 <sup>3</sup> / <sub>4</sub> -20 UN	2A	0.0015	1.7485	1.7404	—	1.7160	1.7112	1.6890	2B	1.696	1.707	1.7175	1.7238	1.7500
1 <sup>13</sup> / <sub>16</sub> -6 UN	3A	0.0000	1.8125	1.7943	—	1.7042	1.6979	1.6141	3B	1.6320	1.6521	1.7042	1.7124	1.8125
	2A	0.0025	1.8100	1.7918	—	1.7017	1.6933	1.6116	2B	1.632	1.663	1.7042	1.7151	1.8125
	3A	0.0000	1.8125	1.7943	—	1.7042	1.6979	1.6141	3B	1.6320	1.6521	1.7042	1.7124	1.8125
1 <sup>13</sup> / <sub>16</sub> -8 UN	2A	0.0023	1.8102	1.7952	—	1.7290	1.7214	1.6614	2B	1.677	1.702	1.7313	1.7412	1.8125
	3A	0.0000	1.8125	1.7975	—	1.7313	1.7256	1.6637	3B	1.6770	1.6922	1.7313	1.7387	1.8125
	2A	0.0018	1.8107	1.7993	—	1.7566	1.7506	1.7115	2B	1.722	1.740	1.7584	1.7662	1.8125
1 <sup>13</sup> / <sub>16</sub> -12 UN	3A	0.0000	1.8125	1.8011	—	1.7584	1.7539	1.7133	3B	1.7220	1.7323	1.7584	1.7642	1.8125

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>						Internal <sup>b</sup>							
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia. <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
1 <sup>3</sup> / <sub>16</sub> -16 UN	2A	0.0016	1.8109	1.8015	—	1.7703	1.7650	1.7364	2B	1.745	1.759	1.7719	1.7788	1.8125
	3A	0.0000	1.8125	1.8031	—	1.7719	1.7679	1.7380	3B	1.7450	1.7533	1.7719	1.7771	1.8125
1 <sup>3</sup> / <sub>16</sub> -20 UN	2A	0.0015	1.8110	1.8029	—	1.7785	1.7737	1.7515	2B	1.758	1.770	1.7800	1.7863	1.8125
	3A	0.0000	1.8125	1.8044	—	1.7800	1.7764	1.7530	3B	1.7580	1.7662	1.7800	1.7847	1.8125
1 <sup>7</sup> / <sub>8</sub> -6 UN	2A	0.0025	1.8725	1.8543	—	1.7642	1.7558	1.6741	2B	1.695	1.725	1.7667	1.7777	1.8750
	3A	0.0000	1.8750	1.8568	—	1.7667	1.7604	1.6766	3B	1.6950	1.7146	1.7667	1.7749	1.8750
1 <sup>7</sup> / <sub>8</sub> -8 UN	2A	0.0023	1.8727	1.8577	1.8502	1.7915	1.7838	1.7239	2B	1.740	1.765	1.7938	1.8038	1.8750
	3A	0.0000	1.8750	1.8600	—	1.7938	1.7881	1.7262	3B	1.7400	1.7547	1.7938	1.8013	1.8750
1 <sup>7</sup> / <sub>8</sub> -10 UNS	2A	0.0019	1.8731	1.8602	—	1.8081	1.8016	1.7541	2B	1.767	1.788	1.8100	1.8184	1.8750
	3A	0.0000	1.8732	1.8618	—	1.8191	1.8131	1.7740	2B	1.785	1.803	1.8209	1.8287	1.8750
1 <sup>7</sup> / <sub>8</sub> -12 UN	2A	0.0018	1.8732	1.8618	—	1.8191	1.8131	1.7740	2B	1.785	1.803	1.8209	1.8287	1.8750
	3A	0.0000	1.8750	1.8636	—	1.8209	1.8164	1.7758	3B	1.7850	1.7948	1.8209	1.8267	1.8750
1 <sup>7</sup> / <sub>8</sub> -14 UNS	2A	0.0017	1.8733	1.8630	—	1.8269	1.8213	1.7883	2B	1.798	1.814	1.8286	1.8359	1.8750
	3A	0.0000	1.8734	1.8640	—	1.8328	1.8275	1.7989	2B	1.807	1.821	1.8344	1.8413	1.8750
1 <sup>7</sup> / <sub>8</sub> -16 UN	2A	0.0016	1.8734	1.8640	—	1.8328	1.8275	1.7989	2B	1.807	1.821	1.8344	1.8413	1.8750
	3A	0.0000	1.8750	1.8656	—	1.8344	1.8304	1.8005	3B	1.8070	1.8158	1.8344	1.8396	1.8750
1 <sup>7</sup> / <sub>8</sub> -18 UNS	2A	0.0015	1.8735	1.8648	—	1.8374	1.8323	1.8074	2B	1.815	1.828	1.8389	1.8455	1.8750
	3A	0.0000	1.8735	1.8654	—	1.8410	1.8362	1.8140	2B	1.821	1.832	1.8425	1.8488	1.8750
1 <sup>7</sup> / <sub>8</sub> -20 UN	2A	0.0015	1.8735	1.8654	—	1.8410	1.8362	1.8140	2B	1.821	1.832	1.8425	1.8488	1.8750
	3A	0.0000	1.8750	1.8669	—	1.8425	1.8389	1.8155	3B	1.8210	1.8287	1.8425	1.8472	1.8750
1 <sup>5</sup> / <sub>16</sub> -6 UN	2A	0.0026	1.9349	1.9167	—	1.8266	1.8181	1.7365	2B	1.757	1.788	1.8292	1.8403	1.9375
	3A	0.0000	1.9375	1.9193	—	1.8292	1.8228	1.7391	3B	1.7570	1.7771	1.8292	1.8375	1.9375
1 <sup>5</sup> / <sub>16</sub> -8 UN	2A	0.0023	1.9352	1.9202	—	1.8540	1.8463	1.7864	2B	1.802	1.827	1.8563	1.8663	1.9375
	3A	0.0000	1.9375	1.9225	—	1.8563	1.8505	1.7887	3B	1.8020	1.8172	1.8563	1.8638	1.9375
1 <sup>5</sup> / <sub>16</sub> -12 UN	2A	0.0018	1.9357	1.9243	—	1.8816	1.8755	1.8365	2B	1.847	1.865	1.8834	1.8913	1.9375
	3A	0.0000	1.9375	1.9261	—	1.8834	1.8789	1.8383	3B	1.8470	1.8573	1.8834	1.8893	1.9375
1 <sup>5</sup> / <sub>16</sub> -16 UN	2A	0.0016	1.9359	1.9265	—	1.8953	1.8899	1.8614	2B	1.870	1.884	1.8969	1.9039	1.9375
	3A	0.0000	1.9375	1.9281	—	1.8969	1.8929	1.8630	3B	1.8700	1.8783	1.8969	1.9021	1.9375
1 <sup>5</sup> / <sub>16</sub> -20 UN	2A	0.0015	1.9360	1.9279	—	1.9035	1.8986	1.8765	2B	1.883	1.895	1.9050	1.9114	1.9375
	3A	0.0000	1.9375	1.9294	—	1.9050	1.9013	1.8780	3B	1.8830	1.8912	1.9050	1.9098	1.9375



Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>						Internal <sup>b</sup>							
	Class	Allowance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
2-4½ UNC	1A	0.0029	1.9971	1.9641	—	1.8528	1.8385	1.7324	1B	1.759	1.795	1.8557	1.8743	2.0000
	2A	0.0029	1.9971	1.9751	1.9641	1.8528	1.8433	1.7324	2B	1.759	1.795	1.8557	1.8681	2.0000
	3A	0.0000	2.0000	1.9780	—	1.8557	1.8486	1.7353	3B	1.7590	1.7861	1.8557	1.8650	2.0000
2-6 UN	2A	0.0026	1.9974	1.9792	—	1.8891	1.8805	1.7990	2B	1.820	1.850	1.8917	1.9028	2.0000
	3A	0.0000	2.0000	1.9818	—	1.8917	1.8853	1.8016	3B	1.8200	1.8396	1.8917	1.9000	2.0000
2-8 UN	2A	0.0023	1.9977	1.9827	1.9752	1.9165	1.9087	1.8489	2B	1.865	1.890	1.9188	1.9289	2.0000
	3A	0.0000	2.0000	1.9850	—	1.9188	1.9130	1.8512	3B	1.8650	1.8797	1.9188	1.9264	2.0000
2-10 UNS	2A	0.0020	1.9980	1.9851	—	1.9330	1.9265	1.8790	2B	1.892	1.913	1.9350	1.9435	2.0000
2-12 UN	2A	0.0018	1.9982	1.9868	—	1.9441	1.9380	1.8990	2B	1.910	1.928	1.9459	1.9538	2.0000
	3A	0.0000	2.0000	1.9886	—	1.9459	1.9414	1.9008	3B	1.9100	1.9198	1.9459	1.9518	2.0000
2-14 UNS	2A	0.0017	1.9983	1.9880	—	1.9519	1.9462	1.9133	2B	1.923	1.938	1.9536	1.9610	2.0000
2-16 UN	2A	0.0016	1.9984	1.9890	—	1.9578	1.9524	1.9239	2B	1.932	1.946	1.9594	1.9664	2.0000
	3A	0.0000	2.0000	1.9906	—	1.9594	1.9554	1.9255	3B	1.9320	1.9408	1.9594	1.9646	2.0000
2-18 UNS	2A	0.0015	1.9985	1.9898	—	1.9624	1.9573	1.9324	2B	1.940	1.953	1.9639	1.9706	2.0000
2-20 UN	2A	0.0015	1.9985	1.9904	—	1.9660	1.9611	1.9390	2B	1.946	1.957	1.9675	1.9739	2.0000
	3A	0.0000	2.0000	1.9919	—	1.9675	1.9638	1.9405	3B	1.9460	1.9537	1.9675	1.9723	2.0000
2½/16-16 UNS	2A	0.0016	2.0609	2.0515	—	2.0203	2.0149	1.9864	2B	1.995	2.009	2.0219	2.0289	2.0625
	3A	0.0000	2.0625	2.0531	—	2.0219	2.0179	1.9880	3B	1.9950	2.0033	2.0219	2.0271	2.0625
	2A	0.0026	2.1224	2.1042	—	2.0141	2.0054	1.9240	2B	1.945	1.975	2.0167	2.0280	2.1250
2½/8-6 UN	3A	0.0000	2.1250	2.1068	—	2.0167	2.0102	1.9266	3B	1.9450	1.9646	2.0167	2.0251	2.1250
	2A	0.0024	2.1226	2.1076	2.1001	2.0414	2.0335	1.9738	2B	1.990	2.015	2.0438	2.0540	2.1250
2½/8-8 UN	3A	0.0000	2.1250	2.1100	—	2.0438	2.0379	1.9762	3B	1.9900	2.0047	2.0438	2.0515	2.1250
	2A	0.0018	2.1232	2.1118	—	2.0691	2.0630	2.0240	2B	2.035	2.053	2.0709	2.0788	2.1250
2½/8-12 UN	3A	0.0000	2.1250	2.1136	—	2.0709	2.0664	2.0258	3B	2.0350	2.0448	2.0709	2.0768	2.1250
	2A	0.0016	2.1234	2.1140	—	2.0828	2.0774	2.0489	2B	2.057	2.071	2.0844	2.0914	2.1250
2½/8-16 UN	3A	0.0000	2.1250	2.1156	—	2.0844	2.0803	2.0505	3B	2.0570	2.0658	2.0844	2.0896	2.1250
	2A	0.0015	2.1235	2.1154	—	2.0910	2.0861	2.0640	2B	2.071	2.082	2.0925	2.0989	2.1250
2½/8-20 UN	3A	0.0000	2.1250	2.1169	—	2.0925	2.0888	2.0655	3B	2.0710	2.0787	2.0925	2.0973	2.1250

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>						Internal <sup>b</sup>							
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
2 $\frac{3}{16}$ -16 UNS	2A	0.0016	2.1859	2.1765	—	2.1453	2.1399	2.1114	2B	2.120	2.134	2.1469	2.1539	2.1875
	3A	0.0000	2.1875	2.1781	—	2.1469	2.1428	2.1130	3B	2.1200	2.1283	2.1469	2.1521	2.1875
2 $\frac{1}{4}$ -4 $\frac{1}{2}$ UNC	1A	0.0029	2.2471	2.2141	—	2.1028	2.0882	1.9824	1B	2.009	2.045	2.1057	2.1247	2.2500
	2A	0.0029	2.2471	2.2251	2.2141	2.1028	2.0931	1.9824	2B	2.009	2.045	2.1057	2.1183	2.2500
	3A	0.0000	2.2500	2.2280	—	2.1057	2.0984	1.9853	3B	2.0090	2.0361	2.1057	2.1152	2.2500
2 $\frac{1}{4}$ -6 UN	2A	0.0026	2.2474	2.2292	—	2.1391	2.1303	2.0490	2B	2.070	2.100	2.1417	2.1531	2.2500
	3A	0.0000	2.2500	2.2318	—	2.1417	2.1351	2.0516	3B	2.0700	2.0896	2.1417	2.1502	2.2500
2 $\frac{1}{4}$ -8 UN	2A	0.0024	2.2476	2.2326	2.2251	2.1664	2.1584	2.0988	2B	2.115	2.140	2.1688	2.1792	2.2500
	3A	0.0000	2.2500	2.2350	—	2.1688	2.1628	2.1012	3B	2.1150	2.1297	2.1688	2.1766	2.2500
2 $\frac{1}{4}$ -10 UNS	2A	0.0020	2.2480	2.2351	—	2.1830	2.1765	2.1290	2B	2.142	2.163	2.1850	2.1935	2.2500
	3A	0.0018	2.2482	2.2368	—	2.1941	2.1880	2.1490	2B	2.160	2.178	2.1959	2.2038	2.2500
2 $\frac{1}{4}$ -12 UN	2A	0.0000	2.2500	2.2386	—	2.1959	2.1914	2.1508	3B	2.1600	2.1698	2.1959	2.2018	2.2500
	2A	0.0017	2.2483	2.2380	—	2.2019	2.1962	2.1633	2B	2.173	2.188	2.2036	2.2110	2.2500
2 $\frac{1}{4}$ -16 UN	2A	0.0016	2.2484	2.2390	—	2.2078	2.2024	2.1739	2B	2.182	2.196	2.2094	2.2164	2.2500
	3A	0.0000	2.2500	2.2406	—	2.2094	2.2053	2.1755	3B	2.1820	2.1908	2.2094	2.2146	2.2500
2 $\frac{1}{4}$ -18 UNS	2A	0.0015	2.2485	2.2398	—	2.2124	2.2073	2.1824	2B	2.190	2.203	2.2139	2.2206	2.2500
	2A	0.0015	2.2485	2.2404	—	2.2160	2.2111	2.1890	2B	2.196	2.207	2.2175	2.2239	2.2500
2 $\frac{1}{4}$ -20 UN	3A	0.0000	2.2500	2.2419	—	2.2175	2.2137	2.1905	3B	2.1960	2.2037	2.2175	2.2223	2.2500
	2A	0.0017	2.3108	2.3014	—	2.2702	2.2647	2.2363	2B	2.245	2.259	2.2719	2.2791	2.3125
	3A	0.0000	2.3125	2.3031	—	2.2719	2.2678	2.2380	3B	2.2450	2.2533	2.2719	2.2773	2.3125
2 $\frac{3}{8}$ -6 UN	2A	0.0027	2.3723	2.3541	—	2.2640	2.2551	2.1739	2B	2.195	2.226	2.2667	2.2782	2.3750
	3A	0.0000	2.3750	2.3568	—	2.2667	2.2601	2.1766	3B	2.1950	2.2146	2.2667	2.2753	2.3750
2 $\frac{3}{8}$ -8 UN	2A	0.0024	2.3726	2.3576	—	2.2914	2.2833	2.2238	2B	2.240	2.265	2.2938	2.3043	2.3750
	3A	0.0000	2.3750	2.3600	—	2.2938	2.2878	2.2262	3B	2.2400	2.2547	2.2938	2.3017	2.3750
2 $\frac{3}{8}$ -12 UN	2A	0.0019	2.3731	2.3617	—	2.3190	2.3128	2.2739	2B	2.285	2.303	2.3209	2.3290	2.3750
	3A	0.0000	2.3750	2.3636	—	2.3209	2.3163	2.2758	3B	2.2850	2.2948	2.3209	2.3269	2.3750
2 $\frac{3}{8}$ -16 UN	2A	0.0017	2.3733	2.3639	—	2.3327	2.3272	2.2988	2B	2.307	2.321	2.3344	2.3416	2.3750
	3A	0.0000	2.3750	2.3656	—	2.3344	2.3303	2.3005	3B	2.3070	2.3158	2.3344	2.3398	2.3750

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>						Internal <sup>b</sup>							
	Class	Allowance	Major Diameter			Pitch Diameter		UNR Minor Dia. <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
2 $\frac{3}{8}$ -20 UN	2A	0.0015	2.3735	2.3654	—	2.3410	2.3359	2.3140	2B	2.321	2.332	2.3425	2.3491	2.3750
	3A	0.0000	2.3750	2.3669	—	2.3425	2.3387	2.3155	3B	2.3210	2.3287	2.3425	2.3475	2.3750
2 $\frac{7}{16}$ -16 UNS	2A	0.0017	2.4358	2.4264	—	2.3952	2.3897	2.3613	2B	2.370	2.384	2.3969	2.4041	2.4375
	3A	0.0000	2.4375	2.4281	—	2.3969	2.3928	2.3630	3B	2.3700	2.3783	2.3969	2.4023	2.4375
2 $\frac{1}{2}$ -4 UNC	1A	0.0031	2.4969	2.4612	—	2.3345	2.3190	2.1992	1B	2.229	2.267	2.3376	2.3578	2.5000
	2A	0.0031	2.4969	2.4731	2.4612	2.3345	2.3241	2.1992	2B	2.229	2.267	2.3376	2.3511	2.5000
2 $\frac{1}{2}$ -6 UN	3A	0.0000	2.5000	2.4762	—	2.3376	2.3298	2.2023	3B	2.2290	2.2594	2.3376	2.3477	2.5000
	2A	0.0027	2.4973	2.4791	—	2.3890	2.3800	2.2989	2B	2.320	2.350	2.3917	2.4033	2.5000
2 $\frac{1}{2}$ -8 UN	3A	0.0000	2.5000	2.4818	—	2.3917	2.3850	2.3016	3B	2.3200	2.3396	2.3917	2.4004	2.5000
	2A	0.0024	2.4976	2.4826	2.4751	2.4164	2.4082	2.3488	2B	2.365	2.390	2.4188	2.4294	2.5000
2 $\frac{1}{2}$ -10 UNS	3A	0.0000	2.5000	2.4850	—	2.4188	2.4127	2.3512	3B	2.3650	2.3797	2.4188	2.4268	2.5000
	2A	0.0020	2.4980	2.4851	—	2.4330	2.4263	2.3790	2B	2.392	2.413	2.4350	2.4437	2.5000
2 $\frac{1}{2}$ -12 UN	2A	0.0019	2.4981	2.4867	—	2.4440	2.4378	2.3989	2B	2.410	2.428	2.4459	2.4540	2.5000
	3A	0.0000	2.5000	2.4886	—	2.4459	2.4413	2.4008	3B	2.4100	2.4198	2.4459	2.4519	2.5000
2 $\frac{1}{2}$ -14 UNS	2A	0.0017	2.4983	2.4880	—	2.4519	2.4461	2.4133	2B	2.423	2.438	2.4536	2.4612	2.5000
	2A	0.0017	2.4983	2.4889	—	2.4577	2.4522	2.4238	2B	2.432	2.446	2.4594	2.4666	2.5000
2 $\frac{1}{2}$ -16 UN	3A	0.0000	2.5000	2.4906	—	2.4594	2.4553	2.4255	3B	2.4320	2.4408	2.4594	2.4648	2.5000
	2A	0.0016	2.4984	2.4897	—	2.4623	2.4570	2.4323	2B	2.440	2.453	2.4639	2.4708	2.5000
2 $\frac{1}{2}$ -20 UN	2A	0.0015	2.4985	2.4904	—	2.4660	2.4609	2.4390	2B	2.446	2.457	2.4675	2.4741	2.5000
	3A	0.0000	2.5000	2.4919	—	2.4675	2.4637	2.4405	3B	2.4460	2.4537	2.4675	2.4725	2.5000
2 $\frac{5}{8}$ -6 UN	2A	0.0027	2.6223	2.6041	—	2.5140	2.5050	2.4239	2B	2.445	2.475	2.5167	2.5285	2.6250
	3A	0.0000	2.6250	2.6068	—	2.5167	2.5099	2.4266	3B	2.4450	2.4646	2.5167	2.5255	2.6250
2 $\frac{5}{8}$ -8 UN	2A	0.0025	2.6225	2.6075	—	2.5413	2.5331	2.4737	2B	2.490	2.515	2.5438	2.5545	2.6250
	3A	0.0000	2.6250	2.6100	—	2.5438	2.5376	2.4762	3B	2.4900	2.5047	2.5438	2.5518	2.6250
2 $\frac{5}{8}$ -12 UN	2A	0.0019	2.6231	2.6117	—	2.5690	2.5628	2.5239	2B	2.535	2.553	2.5709	2.5790	2.6250
	3A	0.0000	2.6250	2.6136	—	2.5709	2.5663	2.5258	3B	2.5350	2.5448	2.5709	2.5769	2.6250
2 $\frac{5}{8}$ -16 UN	2A	0.0017	2.6233	2.6139	—	2.5827	2.5772	2.5488	2B	2.557	2.571	2.5844	2.5916	2.6250
	3A	0.0000	2.6250	2.6156	—	2.5844	2.5803	2.5505	3B	2.5570	2.5658	2.5844	2.5898	2.6250

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>						Internal <sup>b</sup>							
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
2 $\frac{3}{8}$ -20 UN	2A	0.0015	2.6235	2.6154	—	2.5910	2.5859	2.5640	2B	2.571	2.582	2.5925	2.5991	2.6250
	3A	0.0000	2.6250	2.6169	—	2.5925	2.5887	2.5655	3B	2.5710	2.5787	2.5925	2.5975	2.6250
2 $\frac{3}{4}$ -4 UNC	1A	0.0032	2.7468	2.7111	—	2.5844	2.5686	2.4491	1B	2.479	2.517	2.5876	2.6082	2.7500
	2A	0.0032	2.7468	2.7230	2.7111	2.5844	2.5739	2.4491	2B	2.479	2.517	2.5876	2.6013	2.7500
	3A	0.0000	2.7500	2.7262	—	2.5876	2.5797	2.4523	3B	2.4790	2.5094	2.5876	2.5979	2.7500
2 $\frac{3}{4}$ -6 UN	2A	0.0027	2.7473	2.7291	—	2.6390	2.6299	2.5489	2B	2.570	2.600	2.6417	2.6536	2.7500
	3A	0.0000	2.7500	2.7318	—	2.6417	2.6349	2.5516	3B	2.5700	2.5896	2.6417	2.6506	2.7500
2 $\frac{3}{4}$ -8 UN	2A	0.0025	2.7475	2.7325	2.7250	2.6663	2.6580	2.5987	2B	2.615	2.640	2.6688	2.6796	2.7500
	3A	0.0000	2.7500	2.7350	—	2.6688	2.6625	2.6012	3B	2.6150	2.6297	2.6688	2.6769	2.7500
2 $\frac{3}{4}$ -10 UNS	2A	0.0020	2.7480	2.7351	—	2.6830	2.6763	2.6290	2B	2.642	2.663	2.6850	2.6937	2.7500
	2A	0.0019	2.7481	2.7367	—	2.6940	2.6878	2.6489	2B	2.660	2.678	2.6959	2.7040	2.7500
2 $\frac{3}{4}$ -14 UNS	3A	0.0000	2.7500	2.7386	—	2.6959	2.6913	2.6508	3B	2.6600	2.6698	2.6959	2.7019	2.7500
	2A	0.0017	2.7483	2.7380	—	2.7019	2.6961	2.6633	2B	2.673	2.688	2.7036	2.7112	2.7500
2 $\frac{3}{4}$ -16 UN	2A	0.0017	2.7483	2.7389	—	2.7077	2.7022	2.6738	2B	2.682	2.696	2.7094	2.7166	2.7500
	3A	0.0000	2.7500	2.7406	—	2.7094	2.7053	2.6755	3B	2.6820	2.6908	2.7094	2.7148	2.7500
2 $\frac{3}{4}$ -18 UNS	2A	0.0016	2.7484	2.7397	—	2.7123	2.7070	2.6823	2B	2.690	2.703	2.7139	2.7208	2.7500
	2A	0.0015	2.7485	2.7404	—	2.7160	2.7109	2.6890	2B	2.696	2.707	2.7175	2.7241	2.7500
2 $\frac{3}{4}$ -6 UN	3A	0.0000	2.7500	2.7419	—	2.7175	2.7137	2.6905	3B	2.6960	2.7037	2.7175	2.7225	2.7500
	2A	0.0028	2.8722	2.8540	—	2.7639	2.7547	2.6738	2B	2.695	2.725	2.7667	2.7787	2.8750
2 $\frac{3}{4}$ -8 UN	3A	0.0000	2.8750	2.8568	—	2.7667	2.7598	2.6766	3B	2.6950	2.7146	2.7667	2.7757	2.8750
	2A	0.0025	2.8725	2.8575	—	2.7913	2.7829	2.7237	2B	2.740	2.765	2.7938	2.8048	2.8750
2 $\frac{3}{4}$ -12 UN	3A	0.0000	2.8750	2.8600	—	2.7938	2.7875	2.7262	3B	2.7400	2.7547	2.7938	2.8020	2.8750
	2A	0.0019	2.8731	2.8617	—	2.8190	2.8127	2.7739	2B	2.785	2.803	2.8209	2.8291	2.8750
2 $\frac{7}{8}$ -16 UN	3A	0.0000	2.8750	2.8636	—	2.8209	2.8162	2.7758	3B	2.7850	2.7948	2.8209	2.8271	2.8750
	2A	0.0017	2.8733	2.8639	—	2.8327	2.8271	2.7988	2B	2.807	2.821	2.8344	2.8417	2.8750
2 $\frac{7}{8}$ -20 UN	3A	0.0000	2.8750	2.8656	—	2.8344	2.8302	2.8005	3B	2.8070	2.8158	2.8344	2.8399	2.8750
	2A	0.0016	2.8734	2.8653	—	2.8409	2.8357	2.8139	2B	2.821	2.832	2.8425	2.8493	2.8750
	3A	0.0000	2.8750	2.8669	—	2.8425	2.8386	2.8155	3B	2.8210	2.8287	2.8425	2.8476	2.8750

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>							Internal <sup>b</sup>						
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	Min
3-4 UNC	1A	0.0032	2.9968	2.9611	—	2.8344	2.8183	2.6991	1B	2.729	2.767	2.8376	2.8585	3.0000
	2A	0.0032	2.9968	2.9730	2.9611	2.8344	2.8237	2.6991	2B	2.729	2.767	2.8376	2.8515	3.0000
	3A	0.0000	3.0000	2.9762	—	2.8376	2.8296	2.7023	3B	2.7290	2.7594	2.8376	2.8480	3.0000
3-6 UN	2A	0.0028	2.9972	2.9790	—	2.8889	2.8796	2.7988	2B	2.820	2.850	2.8917	2.9038	3.0000
	3A	0.0000	3.0000	2.9818	—	2.8917	2.8847	2.8016	3B	2.8200	2.8396	2.8917	2.9008	3.0000
3-8 UN	2A	0.0026	2.9974	2.9824	2.9749	2.9162	2.9077	2.8486	2B	2.865	2.890	2.9188	2.9299	3.0000
	3A	0.0000	3.0000	2.9850	—	2.9188	2.9124	2.8512	3B	2.8650	2.8797	2.9188	2.9271	3.0000
3-10 UNS	2A	0.0020	2.9980	2.9851	—	2.9330	2.9262	2.8790	2B	2.892	2.913	2.9350	2.9439	3.0000
3-12 UN	2A	0.0019	2.9981	2.9867	—	2.9440	2.9377	2.8989	2B	2.910	2.928	2.9459	2.9541	3.0000
	3A	0.0000	3.0000	2.9886	—	2.9459	2.9412	2.9008	3B	2.9100	2.9198	2.9459	2.9521	3.0000
3-14 UNS	2A	0.0018	2.9982	2.9879	—	2.9518	2.9459	2.9132	2B	2.923	2.938	2.9536	2.9613	3.0000
3-16 UN	2A	0.0017	2.9983	2.9889	—	2.9577	2.9521	2.9238	2B	2.932	2.946	2.9594	2.9667	3.0000
	3A	0.0000	3.0000	2.9906	—	2.9594	2.9552	2.9255	3B	2.9320	2.9408	2.9594	2.9649	3.0000
3-18 UNS	2A	0.0016	2.9984	2.9897	—	2.9623	2.9569	2.9323	2B	2.940	2.953	2.9639	2.9709	3.0000
3-20 UN	2A	0.0016	2.9984	2.9903	—	2.9659	2.9607	2.9389	2B	2.946	2.957	2.9675	2.9743	3.0000
	3A	0.0000	3.0000	2.9919	—	2.9675	2.9636	2.9405	3B	2.9460	2.9537	2.9675	2.9726	3.0000
3½-6 UN	2A	0.0028	3.1222	3.1040	—	3.0139	3.0045	2.9238	2B	2.945	2.975	3.0167	3.0289	3.1250
	3A	0.0000	3.1250	3.1068	—	3.0167	3.0097	2.9266	3B	2.9450	2.9646	3.0167	3.0259	3.1250
3½-8 UN	2A	0.0026	3.1224	3.1074	—	3.0412	3.0326	2.9736	2B	2.990	3.015	3.0438	3.0550	3.1250
	3A	0.0000	3.1250	3.1100	—	3.0438	3.0374	2.9762	3B	2.9900	3.0047	3.0438	3.0522	3.1250
3½-12 UN	2A	0.0019	3.1231	3.1117	—	3.0690	3.0627	3.0239	2B	3.035	3.053	3.0709	3.0791	3.1250
	3A	0.0000	3.1250	3.1136	—	3.0709	3.0662	3.0258	3B	3.0350	3.0448	3.0709	3.0771	3.1250
3½-16 UN	2A	0.0017	3.1233	3.1139	—	3.0827	3.0771	3.0488	2B	3.057	3.071	3.0844	3.0917	3.1250
	3A	0.0000	3.1250	3.1156	—	3.0844	3.0802	3.0505	3B	3.0570	3.0658	3.0844	3.0899	3.1250
¾-4 UNC	1A	0.0033	3.2467	3.2110	—	3.0843	3.0680	2.9490	1B	2.979	3.017	3.0876	3.1088	3.2500
	2A	0.0033	3.2467	3.2229	3.2110	3.0843	3.0734	2.9490	2B	2.979	3.017	3.0876	3.1017	3.2500
	3A	0.0000	3.2500	3.2262	—	3.0876	3.0794	2.9523	3B	2.9790	3.0094	3.0876	3.0982	3.2500
¾-6 UN	2A	0.0028	3.2472	3.2290	—	3.1389	3.1294	3.0488	2B	3.070	3.100	3.1417	3.1540	3.2500
	3A	0.0000	3.2500	3.2318	—	3.1417	3.1346	3.0516	3B	3.0700	3.0896	3.1417	3.1509	3.2500

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>						Internal <sup>b</sup>							
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia. <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	Min
3/4-8 UN	2A	0.0026	3.2474	3.2324	3.2249	3.1662	3.1575	3.0986	2B	3.115	3.140	3.1688	3.1801	3.2500
	3A	0.0000	3.2500	3.2350	—	3.1688	3.1623	3.1012	3B	3.1150	3.1297	3.1688	3.1773	3.2500
3/4-10 UNS	2A	0.0020	3.2480	3.2351	—	3.1830	3.1762	3.1290	2B	3.142	3.163	3.1850	3.1939	3.2500
	2A	0.0019	3.2481	3.2367	—	3.1940	3.1877	3.1489	2B	3.160	3.178	3.1959	3.2041	3.2500
3/4-12 UN	3A	0.0000	3.2500	3.2386	—	3.1959	3.1912	3.1508	3B	3.1600	3.1698	3.1959	3.2041	3.2500
	2A	0.0018	3.2482	3.2379	—	3.2018	3.1959	3.1632	2B	3.173	3.188	3.2036	3.2113	3.2500
3/4-16 UN	2A	0.0017	3.2483	3.2389	—	3.2077	3.2021	3.1738	2B	3.182	3.196	3.2094	3.2167	3.2500
	3A	0.0000	3.2500	3.2406	—	3.2094	3.2052	3.1755	3B	3.1820	3.1908	3.2094	3.2149	3.2500
3/4-18 UNS	2A	0.0016	3.2484	3.2397	—	3.2123	3.2069	3.1823	2B	3.190	3.203	3.2139	3.2209	3.2500
	3/8-6 UN	2A	0.0029	3.3721	3.3539	—	3.2638	3.2543	3.1737	2B	3.195	3.225	3.2667	3.2791
3A		0.0000	3.3750	3.3568	—	3.2667	3.2595	3.1766	3B	3.1950	3.2146	3.2667	3.2760	3.3750
3/8-8 UN	2A	0.0026	3.3724	3.3574	—	3.2912	3.2824	3.2236	2B	3.240	3.265	3.2938	3.3052	3.3750
	3A	0.0000	3.3750	3.3600	—	3.2938	3.2872	3.2262	3B	3.2400	3.2547	3.2938	3.3023	3.3750
3/8-12 UN	2A	0.0019	3.3731	3.3617	—	3.3190	3.3126	3.2739	2B	3.285	3.303	3.3209	3.3293	3.3750
	3A	0.0000	3.3750	3.3636	—	3.3209	3.3161	3.2758	3B	3.2850	3.2948	3.3209	3.3272	3.3750
3/8-16 UN	2A	0.0017	3.3733	3.3639	—	3.3327	3.3269	3.2988	2B	3.307	3.321	3.3344	3.3419	3.3750
	3A	0.0000	3.3750	3.3656	—	3.3344	3.3301	3.3005	3B	3.3070	3.3158	3.3344	3.3400	3.3750
3/2-4 UNC	1A	0.0033	3.4967	3.4610	—	3.3343	3.3177	3.1990	1B	3.229	3.267	3.3376	3.3591	3.5000
	2A	0.0033	3.4967	3.4729	3.4610	3.3343	3.3233	3.1990	2B	3.229	3.267	3.3376	3.3519	3.5000
3/2-6 UN	3A	0.0000	3.5000	3.4762	—	3.3376	3.3293	3.2023	3B	3.2290	3.2594	3.3376	3.3484	3.5000
	2A	0.0029	3.4971	3.4789	—	3.3888	3.3792	3.2987	2B	3.320	3.350	3.3917	3.4042	3.5000
3/2-8 UN	3A	0.0000	3.5000	3.4818	—	3.3917	3.3845	3.3016	3B	3.3200	3.3396	3.3917	3.4011	3.5000
	2A	0.0026	3.4974	3.4824	3.4749	3.4162	3.4074	3.3486	2B	3.365	3.390	3.4188	3.4303	3.5000
3/2-10 UNS	3A	0.0000	3.5000	3.4850	—	3.4188	3.4122	3.3512	3B	3.3650	3.3797	3.4188	3.4274	3.5000
	2A	0.0021	3.4979	3.4850	—	3.4329	3.4260	3.3789	2B	3.392	3.413	3.4350	3.4440	3.5000
3/2-12 UN	2A	0.0019	3.4981	3.4867	—	3.4440	3.4376	3.3989	2B	3.410	3.428	3.4459	3.4543	3.5000
	3A	0.0000	3.5000	3.4886	—	3.4459	3.4411	3.4008	3B	3.4100	3.4198	3.4459	3.4522	3.5000

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>						Internal <sup>b</sup>							
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia. <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	Min
3½-14 UNS	2A	0.0018	3.4982	3.4879	—	3.4518	3.4457	3.4132	2B	3.423	3.438	3.4536	3.4615	3.5000
3½-16 UN	2A	0.0017	3.4983	3.4889	—	3.4577	3.4519	3.4238	2B	3.432	3.446	3.4594	3.4669	3.5000
	3A	0.0000	3.5000	3.4906	—	3.4594	3.4551	3.4255	3B	3.4320	3.4408	3.4594	3.4650	3.5000
	2A	0.0017	3.4983	3.4896	—	3.4622	3.4567	3.4322	2B	3.440	3.453	3.4639	3.4711	3.5000
3½-18 UNS	2A	0.0029	3.6221	3.6039	—	3.5138	3.5041	3.4237	2B	3.445	3.475	3.5167	3.5293	3.6250
	3A	0.0000	3.6250	3.6068	—	3.5167	3.5094	3.4266	3B	3.4450	3.4646	3.5167	3.5262	3.6250
	2A	0.0027	3.6223	3.6073	—	3.5411	3.5322	3.4735	2B	3.490	3.515	3.5438	3.5554	3.6250
3½-8 UN	3A	0.0000	3.6250	3.6100	—	3.5438	3.5371	3.4762	3B	3.4900	3.5047	3.5438	3.5525	3.6250
	2A	0.0019	3.6231	3.6117	—	3.5690	3.5626	3.5239	2B	3.535	3.553	3.5709	3.5793	3.6250
	3A	0.0000	3.6250	3.6136	—	3.5709	3.5661	3.5258	3B	3.5350	3.5448	3.5709	3.5772	3.6250
3½-16 UN	2A	0.0017	3.6233	3.6139	—	3.5827	3.5769	3.5488	2B	3.557	3.571	3.5844	3.5919	3.6250
	3A	0.0000	3.6250	3.6156	—	3.5844	3.5801	3.5505	3B	3.5570	3.5658	3.5844	3.5900	3.6250
	1A	0.0034	3.7466	3.7109	—	3.5842	3.5674	3.4489	1B	3.479	3.517	3.5876	3.6094	3.7500
3¾-4 UNC	2A	0.0034	3.7466	3.7228	3.7109	3.5842	3.5730	3.4489	2B	3.479	3.517	3.5876	3.6021	3.7500
	3A	0.0000	3.7500	3.7262	—	3.5876	3.5792	3.4523	3B	3.4790	3.5094	3.5876	3.5985	3.7500
	2A	0.0029	3.7471	3.7289	—	3.6388	3.6290	3.5487	2B	3.570	3.600	3.6417	3.6544	3.7500
3¾-6 UN	3A	0.0000	3.7500	3.7318	—	3.6417	3.6344	3.5516	3B	3.5700	3.5896	3.6417	3.6512	3.7500
	2A	0.0027	3.7473	3.7323	3.7248	3.6661	3.6571	3.5985	2B	3.615	3.640	3.6688	3.6805	3.7500
	3A	0.0000	3.7500	3.7350	—	3.6688	3.6621	3.6012	3B	3.6150	3.6297	3.6688	3.6776	3.7500
3¾-10 UNS	2A	0.0021	3.7479	3.7350	—	3.6829	3.6760	3.6289	2B	3.642	3.663	3.6850	3.6940	3.7500
	2A	0.0019	3.7481	3.7367	—	3.6940	3.6876	3.6489	2B	3.660	3.678	3.6959	3.7043	3.7500
	3A	0.0000	3.7500	3.7386	—	3.6959	3.6911	3.6508	3B	3.6600	3.6698	3.6959	3.7022	3.7500
3¾-14 UNS	2A	0.0018	3.7482	3.7379	—	3.7018	3.6957	3.6632	2B	3.673	3.688	3.7036	3.7115	3.7500
	2A	0.0017	3.7483	3.7389	—	3.7077	3.7019	3.6738	2B	3.682	3.696	3.7094	3.7169	3.7500
	3A	0.0000	3.7500	3.7406	—	3.7094	3.7051	3.6755	3B	3.6820	3.6908	3.7094	3.7150	3.7500
3¾-18 UNS	2A	0.0017	3.7483	3.7396	—	3.7122	3.7067	3.6822	2B	3.690	3.703	3.7139	3.7211	3.7500

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>							Internal <sup>b</sup>						
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia. <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter	Major Diameter	
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
3/8-6 UN	2A	0.0030	3.8720	3.8538	—	3.7637	3.7538	3.6736	2B	3.695	3.725	3.7667	3.7795	3.8750
	3A	0.0000	3.8750	3.8568	—	3.7667	3.7593	3.6766	3B	3.6950	3.7146	3.7667	3.7763	3.8750
3/8-8 UN	2A	0.0027	3.8723	3.8573	—	3.7911	3.7820	3.7235	2B	3.740	3.765	3.7938	3.8056	3.8750
	3A	0.0000	3.8750	3.8600	—	3.7938	3.7870	3.7262	3B	3.7400	3.7547	3.7938	3.8026	3.8750
3/8-12 UN	2A	0.0020	3.8730	3.8616	—	3.8189	3.8124	3.7738	2B	3.785	3.803	3.8209	3.8294	3.8750
	3A	0.0000	3.8750	3.8636	—	3.8209	3.8160	3.7758	3B	3.7850	3.7948	3.8209	3.8273	3.8750
3/8-16 UN	2A	0.0018	3.8732	3.8638	—	3.8326	3.8267	3.7987	2B	3.807	3.821	3.8344	3.8420	3.8750
	3A	0.0000	3.8750	3.8656	—	3.8344	3.8300	3.8005	3B	3.8070	3.8158	3.8344	3.8401	3.8750
4-4 UNC	1A	0.0034	3.9966	3.9609	—	3.8342	3.8172	3.6989	1B	3.729	3.767	3.8376	3.8597	4.0000
	2A	0.0034	3.9966	3.9728	3.9609	3.8342	3.8229	3.6989	2B	3.729	3.767	3.8376	3.8523	4.0000
4-6 UN	3A	0.0000	4.0000	3.9762	—	3.8376	3.8291	3.7023	3B	3.7290	3.7594	3.8376	3.8487	4.0000
	2A	0.0030	3.9970	3.9788	—	3.8887	3.8788	3.7986	2B	3.820	3.850	3.8917	3.9046	4.0000
4-8 UN	3A	0.0000	4.0000	3.9818	—	3.8917	3.8843	3.8016	3B	3.8200	3.8396	3.8917	3.9014	4.0000
	2A	0.0027	3.9973	3.9823	3.9748	3.9161	3.9070	3.8485	2B	3.865	3.890	3.9188	3.9307	4.0000
4-10 UNS	3A	0.0000	4.0000	3.9850	—	3.9188	3.9120	3.8512	3B	3.8650	3.8797	3.9188	3.9277	4.0000
	2A	0.0021	3.9979	3.9850	—	3.9329	3.9259	3.8768	2B	3.892	3.913	3.9350	3.9441	4.0000
4-12 UN	2A	0.0020	3.9980	3.9866	—	3.9439	3.9374	3.8988	2B	3.910	3.928	3.9459	3.9544	4.0000
	3A	0.0000	4.0000	3.9886	—	3.9459	3.9410	3.9008	3B	3.9100	3.9198	3.9459	3.9523	4.0000
4-14 UNS	2A	0.0018	3.9982	3.9879	—	3.9518	3.9456	3.9132	2B	3.923	3.938	3.9536	3.9616	4.0000
	2A	0.0018	3.9982	3.9888	—	3.9576	3.9517	3.9237	2B	3.932	3.946	3.9594	3.9670	4.0000
4-16 UN	3A	0.0000	4.0000	3.9906	—	3.9594	3.9550	3.9255	3B	3.9320	3.9408	3.9594	3.9651	4.0000
	2A	0.0021	4.2479	4.2350	—	4.1829	4.1759	4.1289	2B	4.142	4.163	4.1850	4.1941	4.2500
4 1/4-10 UNS	2A	0.0018	4.2482	4.2379	—	4.2018	4.1956	4.1632	2B	4.173	4.188	4.2036	4.2116	4.2500
	2A	0.0020	4.2480	4.2366	—	4.1939	4.1874	4.1488	2B	4.160	4.178	4.1959	4.2044	4.2500
4 1/4-12 UN	3A	0.0000	4.2500	4.2386	—	4.1959	4.1910	4.1508	3B	4.1600	4.1698	4.1959	4.2023	4.2500
	2A	0.0018	4.2482	4.2388	—	4.2076	4.2017	4.1737	2B	4.182	4.196	4.2094	4.2170	4.2500
4 1/4-16 UN	3A	0.0000	4.2500	4.2406	—	4.2094	4.2050	4.1755	3B	4.1820	4.1900	4.2094	4.2151	4.2500
	2A	0.0021	4.4979	4.4850	—	4.4329	4.4259	4.3789	2B	4.392	4.413	4.4350	4.4441	4.5000
4 1/2-10 UNS	2A	0.0018	4.4982	4.4879	—	4.4518	4.4456	4.4132	2B	4.423	4.438	4.4536	4.4616	4.5000



Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>							Internal <sup>b</sup>						
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	Min
4½-12 UN	2A	0.0020	4.4980	4.4866	—	4.4439	4.4374	4.3988	2B	4.410	4.428	4.4459	4.4544	4.5000
	3A	0.0000	4.5000	4.4886	—	4.4459	4.4410	4.4008	3B	4.4100	4.4198	4.4459	4.4523	4.5000
4½-16 UN	2A	0.0018	4.4982	4.4888	—	4.4576	4.4517	4.4237	2B	4.432	4.446	4.4594	4.4670	4.5000
	3A	0.0000	4.5000	4.4906	—	4.4594	4.4550	4.4255	3B	4.4320	4.4408	4.4594	4.4651	4.5000
4¾-10 UNS	2A	0.0022	4.7478	4.7349	—	4.6828	4.6756	4.6288	2B	4.642	4.663	4.6850	4.6944	4.7500
4¾-14 UNS	2A	0.0019	4.7481	4.7378	—	4.7017	4.6953	4.6631	2B	4.673	4.688	4.7036	4.7119	4.7500
4¾-12 UN	2A	0.0020	4.7480	4.7366	—	4.6939	4.6872	4.6488	2B	4.660	4.678	4.6959	4.7046	4.7500
	3A	0.0000	4.7500	4.7386	—	4.6959	4.6909	4.6508	3B	4.6600	4.6698	4.6959	4.7025	4.7500
	2A	0.0018	4.7482	4.7388	—	4.7076	4.7015	4.6737	2B	4.682	4.696	4.7094	4.7173	4.7500
4¾-16 UN	3A	0.0000	4.7500	4.7406	—	4.7094	4.7049	4.6755	3B	4.6820	4.6908	4.7094	4.7153	4.7500
	2A	0.0022	4.9978	4.9849	—	4.9328	4.9256	4.8788	2B	4.892	4.913	4.9350	4.9444	5.0000
5.00-10 UNS	2A	0.0019	4.9981	4.9878	—	4.9517	4.9453	4.9131	2B	4.923	4.938	4.9536	4.9619	5.0000
5.00-14 UNS	2A	0.0020	4.9980	4.9866	—	4.9439	4.9372	4.8988	2B	4.910	4.928	4.9459	4.9546	5.0000
	3A	0.0000	5.0000	4.9886	—	4.9459	4.9409	4.9008	3B	4.9100	4.9198	4.9459	4.9525	5.0000
5.00-16 UN	2A	0.0018	4.9982	4.9888	—	4.9576	4.9515	4.9237	2B	4.932	4.946	4.9594	4.9673	5.0000
	3A	0.0000	5.0000	4.9906	—	4.9594	4.9549	4.9255	3B	4.9320	4.9408	4.9594	4.9653	5.0000
5¼-10 UNS	2A	0.0022	5.2478	5.2349	—	5.1829	5.1756	5.1288	2B	5.142	5.163	5.1850	5.1944	5.2500
5¼-14 UNS	2A	0.0019	5.2481	5.2378	—	5.2017	5.1953	5.1631	2B	5.173	5.188	5.2036	5.2119	5.2500
	2A	0.0020	5.2480	5.2366	—	5.1939	5.1872	5.1488	2B	5.160	5.178	5.1959	5.2046	5.2500
5¼-12 UN	3A	0.0000	5.2500	5.2386	—	5.1959	5.1909	5.1508	3B	5.1600	5.1698	5.1959	5.2025	5.2500
	2A	0.0018	5.2482	5.2388	—	5.2076	5.2015	5.1737	2B	5.182	5.196	5.2094	5.2173	5.2500
5¼-16 UN	3A	0.0000	5.2500	5.2406	—	5.2094	5.2049	5.1755	3B	5.1820	5.1908	5.2094	5.2153	5.2500
	2A	0.0022	5.4978	5.4849	—	5.4328	5.4256	5.3788	2B	5.392	5.413	5.4350	5.4444	5.5000
5½-14 UNS	2A	0.0019	5.4981	5.4878	—	5.4517	5.4453	5.4131	2B	5.423	5.438	5.4536	5.4619	5.5000
	2A	0.0020	5.4980	5.4866	—	5.4439	5.4372	5.3988	2B	5.410	5.428	5.4459	5.4546	5.5000
5½-12 UN	3A	0.0000	5.5000	5.4886	—	5.4459	5.4409	5.4008	3B	5.4100	5.4198	5.4459	5.4525	5.5000
	2A	0.0018	5.4982	5.4888	—	5.4576	5.4515	5.4237	2B	5.432	5.446	5.4594	5.4673	5.5000
5½-16 UN	3A	0.0000	5.5000	5.4906	—	5.4594	5.4549	5.4255	3B	5.4320	5.4408	5.4594	5.4653	5.5000

Table 3. (Continued) Standard Series and Selected Combinations — Unified Screw Threads

Nominal Size, Threads per Inch, and Series Designation <sup>a</sup>	External <sup>b</sup>								Internal <sup>b</sup>					
	Class	Allow- ance	Major Diameter			Pitch Diameter		UNR Minor Dia., <sup>c</sup> Max (Ref.)	Class	Minor Diameter		Pitch Diameter		Major Diameter
			Max <sup>d</sup>	Min	Min <sup>e</sup>	Max <sup>d</sup>	Min			Min	Max	Min	Max	
5 $\frac{3}{4}$ -10 UNS	2A	0.0022	5.7478	5.7349	—	5.6828	5.6754	5.6288	2B	5.642	5.663	5.6850	5.6946	5.7500
5 $\frac{3}{4}$ -14 UNS	2A	0.0020	5.7480	5.7377	—	5.7016	5.6951	5.6630	2B	5.673	5.688	5.7036	5.7121	5.7500
5 $\frac{3}{4}$ -12 UN	2A	0.0021	5.7479	5.7365	—	5.6938	5.6869	5.6487	2B	5.660	5.678	5.6959	5.7049	5.7500
	3A	0.0000	5.7500	5.7386	—	5.6959	5.6907	5.6508	3B	5.6600	5.6698	5.6959	5.7026	5.7500
5 $\frac{3}{4}$ -16 UN	2A	0.0019	5.7481	5.7387	—	5.7075	5.7013	5.6736	2B	5.682	5.696	5.7094	5.7175	5.7500
	3A	0.0000	5.7500	5.7406	—	5.7094	5.7047	5.6755	3B	5.6820	5.6908	5.7094	5.7155	5.7500
6-10 UNS	2A	0.0022	5.9978	5.9849	—	5.9328	5.9254	5.8788	2B	5.892	5.913	5.9350	5.9446	6.0000
6-14 UNS	2A	0.0020	5.9980	5.9877	—	5.9516	5.9451	5.9130	2B	5.923	5.938	5.9536	5.9621	6.0000
6-12 UN	2A	0.0021	5.9979	5.9865	—	5.9438	5.9369	5.8987	2B	5.910	5.928	5.9459	5.9549	6.0000
	3A	0.0000	6.0000	5.9886	—	5.9459	5.9407	5.9008	3B	5.9100	5.9198	5.9459	5.9526	6.0000
6-16 UN	2A	0.0019	5.9981	5.9887	—	5.9575	5.9513	5.9236	2B	5.932	5.946	5.9594	5.9675	6.0000
	3A	0.0000	6.0000	5.9906	—	5.9594	5.9547	5.9255	3B	5.9320	5.9408	5.9594	5.9655	6.0000

<sup>a</sup> Use UNR designation instead of UN wherever UNR thread form is desired for external use.

<sup>b</sup> Regarding combinations of thread classes, see text on page 1773.

<sup>c</sup> UN series external thread maximum minor diameter is basic for Class 3A and basic minus allowance for Classes 1A and 2A.

<sup>d</sup> For Class 2A threads having an additive finish the maximum is increased, by the allowance, to the basic size, the value being the same as for Class 3A.

<sup>e</sup> For unfinished hot-rolled material not including standard fasteners with rolled threads.

<sup>f</sup> Formerly NF, tolerances and allowances are based on one diameter length of engagement.

All dimensions in inches.

Use UNS threads only if Standard Series do not meet requirements (see pages 1733, 1765, and 1776). For additional sizes above 4 inches see ASME/ANSI B1.1-1989 (R2001).

*Coarse-Thread Series:* This series, UNC/UNRC, is the one most commonly used in the bulk production of bolts, screws, nuts and other general engineering applications. It is also used for threading into lower tensile strength materials such as cast iron, mild steel and softer materials (bronze, brass, aluminum, magnesium and plastics) to obtain the optimum resistance to stripping of the internal thread. It is applicable for rapid assembly or disassembly, or if corrosion or slight damage is possible.

**Table 4a. Coarse-Thread Series, UNC and UNRC — Basic Dimensions**

Sizes No. or Inches	Basic Major Dia., <i>D</i> Inches	Thds. per Inch, <i>n</i>	Basic Pitch Dia., <sup>a</sup> <i>D</i> <sub>2</sub> Inches	Minor Diameter		Lead Angle $\lambda$ at Basic P.D.		Area of Minor Dia. at <i>D</i> -2 <i>h</i> <sub>b</sub> Sq. In.	Tensile Stress Area <sup>b</sup> Sq. In.
				Ext. Thds., <sup>c</sup> <i>d</i> <sub>3</sub> (Ref.) Inches	Int. Thds., <sup>d</sup> <i>D</i> <sub>1</sub> Inches	Deg.	Min		
1 (0.073) <sup>e</sup>	0.0730	64	0.0629	0.0544	0.0561	4	31	0.00218	0.00263
2 (0.086)	0.0860	56	0.0744	0.0648	0.0667	4	22	0.00310	0.00370
3 (0.099) <sup>e</sup>	0.0990	48	0.0855	0.0741	0.0764	4	26	0.00406	0.00487
4 (0.112)	0.1120	40	0.0958	0.0822	0.0849	4	45	0.00496	0.00604
5 (0.125)	0.1250	40	0.1088	0.0952	0.0979	4	11	0.00672	0.00796
6 (0.138)	0.1380	32	0.1177	0.1008	0.1042	4	50	0.00745	0.00909
8 (0.164)	0.1640	32	0.1437	0.1268	0.1302	3	58	0.01196	0.0140
10 (0.190)	0.1900	24	0.1629	0.1404	0.1449	4	39	0.01450	0.0175
12 (0.216) <sup>e</sup>	0.2160	24	0.1889	0.1664	0.1709	4	1	0.0206	0.0242
1/4	0.2500	20	0.2175	0.1905	0.1959	4	11	0.0269	0.0318
5/16	0.3125	18	0.2764	0.2464	0.2524	3	40	0.0454	0.0524
3/8	0.3750	16	0.3344	0.3005	0.3073	3	24	0.0678	0.0775
7/16	0.4375	14	0.3911	0.3525	0.3602	3	20	0.0933	0.1063
1/2	0.5000	13	0.4500	0.4084	0.4167	3	7	0.1257	0.1419
9/16	0.5625	12	0.5084	0.4633	0.4723	2	59	0.162	0.182
5/8	0.6250	11	0.5660	0.5168	0.5266	2	56	0.202	0.226
3/4	0.7500	10	0.6850	0.6309	0.6417	2	40	0.302	0.334
7/8	0.8750	9	0.8028	0.7427	0.7547	2	31	0.419	0.462
1	1.0000	8	0.9188	0.8512	0.8647	2	29	0.551	0.606
1 1/8	1.1250	7	1.0322	0.9549	0.9704	2	31	0.693	0.763
1 1/4	1.2500	7	1.1572	1.0799	1.0954	2	15	0.890	0.969
1 3/8	1.3750	6	1.2667	1.1766	1.1946	2	24	1.054	1.155
1 1/2	1.5000	6	1.3917	1.3016	1.3196	2	11	1.294	1.405
1 3/4	1.7500	5	1.6201	1.5119	1.5335	2	15	1.74	1.90
2	2.0000	4 1/2	1.8557	1.7353	1.7594	2	11	2.30	2.50
2 1/4	2.2500	4 1/2	2.1057	1.9853	2.0094	1	55	3.02	3.25
2 1/2	2.5000	4	2.3376	2.2023	2.2294	1	57	3.72	4.00
2 3/4	2.7500	4	2.5876	2.4523	2.4794	1	46	4.62	4.93
3	3.0000	4	2.8376	2.7023	2.7294	1	36	5.62	5.97
3 1/4	3.2500	4	3.0876	2.9523	2.9794	1	29	6.72	7.10
3 1/2	3.5000	4	3.3376	3.2023	3.2294	1	22	7.92	8.33
3 3/4	3.7500	4	3.5876	3.4523	3.4794	1	16	9.21	9.66
4	4.0000	4	3.8376	3.7023	3.7294	1	11	10.61	11.08

<sup>a</sup> British: Effective Diameter.

<sup>b</sup> See formula, pages 1502 and 1510.

<sup>c</sup> Design form for UNR threads. (See figure on page 1733.)

<sup>d</sup> Basic minor diameter.

<sup>e</sup> Secondary sizes.

*Fine-Thread Series:* This series, UNF/UNRF, is suitable for the production of bolts, screws, and nuts and for other applications where the Coarse series is not applicable. External threads of this series have greater tensile stress area than comparable sizes of the Coarse series. The Fine series is suitable when the resistance to stripping of both external

and mating internal threads equals or exceeds the tensile load carrying capacity of the externally threaded member (see page 1510). It is also used where the length of engagement is short, where a smaller lead angle is desired, where the wall thickness demands a fine pitch, or where finer adjustment is needed.

**Table 4b. Fine-Thread Series, UNF and UNRF — Basic Dimensions**

Sizes No. or Inches	Basic Major Dia., <i>D</i> Inches	Thds. per Inch, <i>n</i>	Basic Pitch Dia., <sup>a</sup> <i>D</i> <sub>2</sub> Inches	Minor Diameter		Lead Angle $\lambda$ at Basic P.D.		Area of Minor Dia. at <i>D-2h<sub>b</sub></i> Sq. In.	Tensile Stress Area <sup>b</sup> Sq. In.
				Ext. Thds., <sup>c</sup> <i>d</i> <sub>3</sub> (Ref.) Inches	Int. Thds., <sup>d</sup> <i>D</i> <sub>1</sub> Inches	Deg.	Min		
0 (0.060)	0.0600	80	0.0519	0.0451	0.0465	4	23	0.00151	0.00180
1 (0.073) <sup>e</sup>	0.0730	72	0.0640	0.0565	0.0580	3	57	0.00237	0.00278
2 (0.086)	0.0860	64	0.0759	0.0674	0.0691	3	45	0.00339	0.00394
3 (0.099) <sup>e</sup>	0.0990	56	0.0874	0.0778	0.0797	3	43	0.00451	0.00523
4 (0.112)	0.1120	48	0.0985	0.0871	0.0894	3	51	0.00566	0.00661
5 (0.125)	0.1250	44	0.1102	0.0979	0.1004	3	45	0.00716	0.00830
6 (0.138)	0.1380	40	0.1218	0.1082	0.1109	3	44	0.00874	0.01015
8 (0.164)	0.1640	36	0.1460	0.1309	0.1339	3	28	0.01285	0.01474
10 (0.190)	0.1900	32	0.1697	0.1528	0.1562	3	21	0.0175	0.0200
12 (0.216) <sup>e</sup>	0.2160	28	0.1928	0.1734	0.1773	3	22	0.0226	0.258
1/4	0.2500	28	0.2268	0.2074	0.2113	2	52	0.0326	0.0364
5/16	0.3125	24	0.2854	0.2629	0.2674	2	40	0.0524	0.0580
3/8	0.3750	24	0.3479	0.3254	0.3299	2	11	0.0809	0.0878
7/16	0.4375	20	0.4050	0.3780	0.3834	2	15	0.1090	0.1187
1/2	0.5000	20	0.4675	0.4405	0.4459	1	57	0.1486	0.1599
9/16	0.5625	18	0.5264	0.4964	0.5024	1	55	0.189	0.203
5/8	0.6250	18	0.5889	0.5589	0.5649	1	43	0.240	0.256
3/4	0.7500	16	0.7094	0.6763	0.6823	1	36	0.351	0.373
7/8	0.8750	14	0.8286	0.7900	0.7977	1	34	0.480	0.509
1	1.0000	12	0.9459	0.9001	0.9098	1	36	0.625	0.663
1 1/8	1.1250	12	1.0709	1.0258	1.0348	1	25	0.812	0.856
1 1/4	1.2500	12	1.1959	1.1508	1.1598	1	16	1.024	1.073
1 3/8	1.3750	12	1.3209	1.2758	1.2848	1	9	1.260	1.315
1 1/2	1.5000	12	1.4459	1.4008	1.4098	1	3	1.521	1.581

<sup>a</sup> British: Effective Diameter.

<sup>b</sup> See formula, pages 1502 and 1510.

<sup>c</sup> Design form for UNR threads. (See figure on page 1733.)

<sup>d</sup> Basic minor diameter.

<sup>e</sup> Secondary sizes.

*Extra-Fine-Thread Series:* This series, UNEF/UNREF, is applicable where even finer pitches of threads are desirable, as for short lengths of engagement and for thin-walled tubes, nuts, ferrules, or couplings. It is also generally applicable under the conditions stated above for the fine threads. See Table 4c.

*Fine Threads for Thin-Wall Tubing:* Dimensions for a 27-thread series, ranging from 1/4- to 1-inch nominal size, also are included in Table 3. These threads are recommended for general use on thin-wall tubing. The minimum length of complete thread is one-third of the basic major diameter plus 5 threads (+ 0.185 in.).

*Selected Combinations:* Thread data are tabulated in Table 3 for certain additional selected special combinations of diameter and pitch, with pitch diameter tolerances based on a length of thread engagement of 9 times the pitch. The pitch diameter limits are applicable to a length of engagement of from 5 to 15 times the pitch. (This provision should not be confused with the lengths of thread on mating parts, as they may exceed the length of engagement by a considerable amount.) Thread symbols are UNS and UNRS.

**Table 4c. Extra-Fine-Thread Series, UNEF and UNREF — Basic Dimensions**

Sizes No. or Inches	Basic Major Dia., <i>D</i>	Thds. per Inch, <i>n</i>	Basic Pitch Dia., <sup>a</sup> <i>D</i> <sub>2</sub>	Minor Diameter		Lead Angle $\lambda$ at Basic P.D.	Area of Minor Dia. at $D - 2h_b$	Tensile Stress Area <sup>b</sup>
				Ext. Thds., <sup>c</sup> <i>d</i> <sub>3</sub> (Ref.)	Int. Thds., <sup>d</sup> <i>D</i> <sub>1</sub>			
				Inches	Inches			
<b>12 (0.216)<sup>e</sup></b>	<b>0.2160</b>	<b>32</b>	<b>0.1957</b>	<b>0.1788</b>	<b>0.1822</b>	<b>2 55</b>	0.0242	0.0270
$\frac{1}{4}$	<b>0.2500</b>	<b>32</b>	<b>0.2297</b>	<b>0.2128</b>	<b>0.2162</b>	<b>2 29</b>	0.0344	0.0379
$\frac{5}{16}$	<b>0.3125</b>	<b>32</b>	<b>0.2922</b>	<b>0.2753</b>	<b>0.2787</b>	<b>1 57</b>	0.0581	0.0625
$\frac{3}{8}$	<b>0.3750</b>	<b>32</b>	<b>0.3547</b>	<b>0.3378</b>	<b>0.3412</b>	<b>1 36</b>	0.0878	0.0932
$\frac{7}{16}$	<b>0.4375</b>	<b>28</b>	<b>0.4143</b>	<b>0.3949</b>	<b>0.3988</b>	<b>1 34</b>	0.1201	0.1274
$\frac{1}{2}$	<b>0.5000</b>	<b>28</b>	<b>0.4768</b>	<b>0.4574</b>	<b>0.4613</b>	<b>1 22</b>	0.162	0.170
$\frac{9}{16}$	<b>0.5625</b>	<b>24</b>	<b>0.5354</b>	<b>0.5129</b>	<b>0.5174</b>	<b>1 25</b>	0.203	0.214
$\frac{5}{8}$	<b>0.6250</b>	<b>24</b>	<b>0.5979</b>	<b>0.5754</b>	<b>0.5799</b>	<b>1 16</b>	0.256	0.268
$\frac{11}{16}$ <sup>e</sup>	<b>0.6875</b>	<b>24</b>	<b>0.6604</b>	<b>0.6379</b>	<b>0.6424</b>	<b>1 9</b>	0.315	0.329
$\frac{3}{4}$	<b>0.7500</b>	<b>20</b>	<b>0.7175</b>	<b>0.6905</b>	<b>0.6959</b>	<b>1 16</b>	0.369	0.386
$\frac{13}{16}$ <sup>e</sup>	<b>0.8125</b>	<b>20</b>	<b>0.7800</b>	<b>0.7530</b>	<b>0.7584</b>	<b>1 10</b>	0.439	0.458
$\frac{7}{8}$	<b>0.8750</b>	<b>20</b>	<b>0.8425</b>	<b>0.8155</b>	<b>0.8209</b>	<b>1 5</b>	0.515	0.536
$\frac{15}{16}$ <sup>e</sup>	<b>0.9375</b>	<b>20</b>	<b>0.9050</b>	<b>0.8780</b>	<b>0.8834</b>	<b>1 0</b>	0.598	0.620
<b>1</b>	<b>1.0000</b>	<b>20</b>	<b>0.9675</b>	<b>0.9405</b>	<b>0.9459</b>	<b>0 57</b>	0.687	0.711
$\frac{1}{16}$ <sup>e</sup>	<b>1.0625</b>	<b>18</b>	<b>1.0264</b>	<b>0.9964</b>	<b>1.0024</b>	<b>0 59</b>	0.770	0.799
$\frac{1}{8}$	<b>1.1250</b>	<b>18</b>	<b>1.0889</b>	<b>1.0589</b>	<b>1.0649</b>	<b>0 56</b>	0.871	0.901
$\frac{3}{16}$ <sup>e</sup>	<b>1.1875</b>	<b>18</b>	<b>1.1514</b>	<b>1.1214</b>	<b>1.1274</b>	<b>0 53</b>	0.977	1.009
$\frac{1}{4}$	<b>1.2500</b>	<b>18</b>	<b>1.2139</b>	<b>1.1839</b>	<b>1.1899</b>	<b>0 50</b>	1.090	1.123
$\frac{5}{16}$ <sup>e</sup>	<b>1.3125</b>	<b>18</b>	<b>1.2764</b>	<b>1.2464</b>	<b>1.2524</b>	<b>0 48</b>	1.208	1.244
$\frac{3}{8}$	<b>1.3750</b>	<b>18</b>	<b>1.3389</b>	<b>1.3089</b>	<b>1.3149</b>	<b>0 45</b>	1.333	1.370
$\frac{7}{16}$ <sup>e</sup>	<b>1.4375</b>	<b>18</b>	<b>1.4014</b>	<b>1.3714</b>	<b>1.3774</b>	<b>0 43</b>	1.464	1.503
$\frac{1}{2}$	<b>1.5000</b>	<b>18</b>	<b>1.4639</b>	<b>1.4339</b>	<b>1.4399</b>	<b>0 42</b>	1.60	1.64
$\frac{9}{16}$ <sup>e</sup>	<b>1.5625</b>	<b>18</b>	<b>1.5264</b>	<b>1.4964</b>	<b>1.5024</b>	<b>0 40</b>	1.74	1.79
$\frac{5}{8}$	<b>1.6250</b>	<b>18</b>	<b>1.5889</b>	<b>1.5589</b>	<b>1.5649</b>	<b>0 38</b>	1.89	1.94
$\frac{11}{16}$ <sup>e</sup>	<b>1.6875</b>	<b>18</b>	<b>1.6514</b>	<b>1.6214</b>	<b>1.6274</b>	<b>0 37</b>	2.05	2.10

<sup>a</sup> British: Effective Diameter.<sup>b</sup> See formula, pages 1502 and 1510.<sup>c</sup> Design form for UNR threads. (See figure on page 1733.)<sup>d</sup> Basic minor diameter.<sup>e</sup> Secondary sizes.

*Other Threads of Special Diameters, Pitches, and Lengths of Engagement:* Thread data for special combinations of diameter, pitch, and length of engagement not included in selected combinations are also given in the Standard but are not given here. Also, when design considerations require non-standard pitches or extreme conditions of engagement not covered by the tables, the allowance and tolerances should be derived from the formulas in the Standard. The thread symbol for such special threads is UNS.

**Constant Pitch Series.**—The various constant-pitch series, UN, with 4, 6, 8, 12, 16, 20, 28 and 32 threads per inch, given in Table 3, offer a comprehensive range of diameter-pitch combinations for those purposes where the threads in the Coarse, Fine, and Extra-Fine series do not meet the particular requirements of the design.

When selecting threads from these constant-pitch series, preference should be given wherever possible to those tabulated in the 8-, 12-, or 16-thread series.

*8-Thread Series:* The 8-thread series (8-UN) is a uniform-pitch series for large diameters. Although originally intended for high-pressure-joint bolts and nuts, it is now widely used as a substitute for the Coarse-Thread Series for diameters larger than 1 inch.

**12-Thread Series:** The 12-thread series (12-UN) is a uniform pitch series for large diameters requiring threads of medium-fine pitch. Although originally intended for boiler practice, it is now used as a continuation of the Fine-Thread Series for diameters larger than  $1\frac{1}{2}$  inches.

**16-Thread Series:** The 16-thread series (16-UN) is a uniform pitch series for large diameters requiring fine-pitch threads. It is suitable for adjusting collars and retaining nuts, and also serves as a continuation of the Extra-fine Thread Series for diameters larger than  $1\frac{11}{16}$  inches.

**4-, 6-, 20-, 28-, and 32-Thread Series:** These thread series have been used more or less widely in industry for various applications where the Standard Coarse, Fine or Extra-fine Series were not as applicable. They are now recognized as Standard Unified Thread Series in a specified selection of diameters for each pitch (see Table 2).

Whenever a thread in a constant-pitch series also appears in the UNC, UNF, or UNEF series, the symbols and tolerances for limits of size of UNC, UNF, or UNEF series are applicable, as will be seen in Tables 2 and 3.

**Table 5a. 4-Thread Series, 4-UN and 4-UNR — Basic Dimensions**

Sizes		Basic Major Dia., $D$	Basic Pitch Dia., <sup>a</sup> $D_2$	Minor Diameter		Lead Angle $\lambda$ at Basic P.D.		Area of Minor Dia. at $D - 2h_b$	Tensile Stress Area <sup>b</sup>
Primary	Secondary			Ext. Thds., <sup>c</sup> $d_{3s}$ (Ref.)	Int. Thds., <sup>d</sup> $D_1$	Deg.	Min.		
Inches	Inches	Inches	Inches	Inches	Inches	Deg.	Min.	Sq. In.	Sq. In.
$2\frac{1}{2}$		2.5000	2.3376	2.2023	2.2294	1	57	3.72	4.00
	$2\frac{5}{8}$	2.6250	2.4626	2.3273	2.3544	1	51	4.16	4.45
$2\frac{3}{4}$		2.7500	2.5876	2.4523	2.4794	1	46	4.62	4.93
	$2\frac{7}{8}$	2.8750	2.7126	2.5773	2.6044	1	41	5.11	5.44
3 <sup>c</sup>		3.0000	2.8376	2.7023	2.7294	1	36	5.62	5.97
	$3\frac{1}{8}$	3.1250	2.9626	2.8273	2.8544	1	32	6.16	6.52
$3\frac{1}{4}$		3.2500	3.0876	2.9523	2.9794	1	29	6.72	7.10
	$3\frac{3}{8}$	3.3750	3.2126	3.0773	3.1044	1	25	7.31	7.70
$3\frac{1}{2}$		3.5000	3.3376	3.2023	3.2294	1	22	7.92	8.33
	$3\frac{5}{8}$	3.6250	3.4626	3.3273	3.3544	1	19	8.55	9.00
$3\frac{3}{4}$		3.7500	3.5876	3.4523	3.4794	1	16	9.21	9.66
	$3\frac{7}{8}$	3.8750	3.7126	3.5773	3.6044	1	14	9.90	10.36
4 <sup>c</sup>		4.0000	3.8376	3.7023	3.7294	1	11	10.61	11.08
	$4\frac{1}{8}$	4.1250	3.9626	3.8273	3.8544	1	9	11.34	11.83
$4\frac{1}{4}$		4.2500	4.0876	3.9523	3.9794	1	7	12.10	12.61
	$4\frac{3}{8}$	4.3750	4.2126	4.0773	4.1044	1	5	12.88	13.41
$4\frac{1}{2}$		4.5000	4.3376	4.2023	4.2294	1	3	13.69	14.23
	$4\frac{5}{8}$	4.6250	4.4626	4.3273	4.3544	1	1	14.52	15.1
$4\frac{3}{4}$		4.7500	4.5876	4.4523	4.4794	1	0	15.4	15.9
	$4\frac{7}{8}$	4.8750	4.7126	4.5773	4.6044	0	58	16.3	16.8
5		5.0000	4.8376	4.7023	4.7294	0	57	17.2	17.8
	$5\frac{1}{8}$	5.1250	4.9626	4.8273	4.8544	0	55	18.1	18.7
$5\frac{1}{4}$		5.2500	5.0876	4.9523	4.9794	0	54	19.1	19.7
	$5\frac{3}{8}$	5.3750	5.2126	5.0773	5.1044	0	52	20.0	20.7
$5\frac{1}{2}$		5.5000	5.3376	5.2023	5.2294	0	51	21.0	21.7
	$5\frac{5}{8}$	5.6250	5.4626	5.3273	5.3544	0	50	22.1	22.7
$5\frac{3}{4}$		5.7500	5.5876	5.4523	5.4794	0	49	23.1	23.8
	$5\frac{7}{8}$	5.8750	5.7126	5.5773	5.6044	0	48	24.2	24.9
6		6.0000	5.8376	5.7023	5.7294	0	47	25.3	26.0

<sup>a</sup> British: Effective Diameter.

<sup>b</sup> See formula, pages 1502 and 1510.

<sup>c</sup> Design form for UNR threads. (See figure on page 1733).

<sup>d</sup> Basic minor diameter.

<sup>e</sup> These are standard sizes of the UNC series.

Table 5b. 6-Thread Series, 6-UN and 6-UNR—Basic Dimensions

Sizes		Basic Major Dia., $D$	Basic Pitch Dia., <sup>a</sup> $D_2$	Minor Diameter		Lead Angle $\lambda$ at Basic P.D.		Area of Minor Dia. at $D - 2h_b$	Tensile Stress Area <sup>b</sup>
Primary	Secondary			Ext. Thds., <sup>c</sup> $d_3$ (Ref.)	Int. Thds., <sup>d</sup> $D_1$	Deg.	Min.		
Inches	Inches	Inches	Inches	Inches	Inches			Sq. In.	Sq. In.
1 $\frac{3}{8}$ <sup>e</sup>		1.3750	1.2667	1.1766	1.1946	2	24	1.054	1.155
	1 $\frac{7}{16}$	1.4375	1.3292	1.2391	1.2571	2	17	1.171	1.277
1 $\frac{1}{2}$ <sup>e</sup>		1.5000	1.3917	1.3016	1.3196	2	11	1.294	1.405
	1 $\frac{9}{16}$	1.5625	1.4542	1.3641	1.3821	2	5	1.423	1.54
1 $\frac{5}{8}$		1.6250	1.5167	1.4271	1.4446	2	0	1.56	1.68
	1 $\frac{11}{16}$	1.6875	1.5792	1.4891	1.5071	1	55	1.70	1.83
1 $\frac{3}{4}$		1.7500	1.6417	1.5516	1.5696	1	51	1.85	1.98
	1 $\frac{13}{16}$	1.8125	1.7042	1.6141	1.6321	1	47	2.00	2.14
1 $\frac{7}{8}$		1.8750	1.7667	1.6766	1.6946	1	43	2.16	2.30
	1 $\frac{15}{16}$	1.9375	1.8292	1.7391	1.7571	1	40	2.33	2.47
2		2.0000	1.8917	1.8016	1.8196	1	36	2.50	2.65
	2 $\frac{1}{8}$	2.1250	2.0167	1.9266	1.9446	1	30	2.86	3.03
2 $\frac{1}{4}$		2.2500	2.1417	2.0516	2.0696	1	25	3.25	3.42
	2 $\frac{3}{8}$	2.3750	2.2667	2.1766	2.1946	1	20	3.66	3.85
2 $\frac{1}{2}$		2.5000	2.3917	2.3016	2.3196	1	16	4.10	4.29
	2 $\frac{5}{8}$	2.6250	2.5167	2.4266	2.4446	1	12	4.56	4.76
2 $\frac{3}{4}$		2.7500	2.6417	2.5516	2.5696	1	9	5.04	5.26
	2 $\frac{7}{8}$	2.8750	2.7667	2.6766	2.6946	1	6	5.55	5.78
3		3.0000	2.8917	2.8016	2.8196	1	3	6.09	6.33
	3 $\frac{1}{8}$	3.1250	3.0167	2.9266	2.9446	1	0	6.64	6.89
3 $\frac{1}{4}$		3.2500	3.1417	3.0516	3.0696	0	58	7.23	7.49
	3 $\frac{3}{8}$	3.3750	3.2667	3.1766	3.1946	0	56	7.84	8.11
3 $\frac{1}{2}$		3.5000	3.3917	3.3016	3.3196	0	54	8.47	8.75
	3 $\frac{5}{8}$	3.6250	3.5167	3.4266	3.4446	0	52	9.12	9.42
3 $\frac{3}{4}$		3.7500	3.6417	3.5516	3.5696	0	50	9.81	10.11
	3 $\frac{7}{8}$	3.8750	3.7667	3.6766	3.6946	0	48	10.51	10.83
4		4.0000	3.8917	3.8016	3.8196	0	47	11.24	11.57
	4 $\frac{1}{8}$	4.1250	4.0167	3.9266	3.9446	0	45	12.00	12.33
4 $\frac{1}{4}$		4.2500	4.1417	4.0516	4.0696	0	44	12.78	13.12
	4 $\frac{3}{8}$	4.3750	4.2667	4.1766	4.1946	0	43	13.58	13.94
4 $\frac{1}{2}$		4.5000	4.3917	4.3016	4.3196	0	42	14.41	14.78
	4 $\frac{5}{8}$	4.6250	4.5167	4.4266	4.4446	0	40	15.3	15.6
4 $\frac{3}{4}$		4.7500	4.6417	4.5516	4.5696	0	39	16.1	16.5
	4 $\frac{7}{8}$	4.8750	4.7667	4.6766	4.6946	0	38	17.0	17.5
5		5.0000	4.8917	4.8016	4.8196	0	37	18.0	18.4
	5 $\frac{1}{8}$	5.1250	5.0167	4.9266	4.9446	0	36	18.9	19.3
5 $\frac{1}{4}$		5.2500	5.1417	5.0516	5.0696	0	35	19.9	20.3
	5 $\frac{3}{8}$	5.3750	5.2667	5.1766	5.1946	0	35	20.9	21.3
5 $\frac{1}{2}$		5.5000	5.3917	5.3016	5.3196	0	34	21.9	22.4
	5 $\frac{5}{8}$	5.6250	5.5167	5.4266	5.4446	0	33	23.0	23.4
5 $\frac{3}{4}$		5.7500	5.6417	5.5516	5.5696	0	32	24.0	24.5
	5 $\frac{7}{8}$	5.8750	5.7667	5.6766	5.6946	0	32	25.1	25.6
6		6.0000	5.8917	5.8016	5.8196	0	31	26.3	26.8

<sup>a</sup> British: Effective Diameter.<sup>b</sup> See formula, pages 1502 and 1510.<sup>c</sup> Design form for UNR threads. (See figure on page 1733).<sup>d</sup> Basic minor diameter.<sup>e</sup> These are standard sizes of the UNC series.

Table 5c. 8-Thread Series, 8-UN and 8-UNR—Basic Dimensions

Sizes		Basic Major Dia., $D$	Basic Pitch Dia., $^a D_2$	Minor Diameter		Lead Angle $\lambda$ at Basic P.D.		Area of Minor Dia. at $D - 2h_b$	Tensile Stress Area <sup>b</sup>
Primary	Secondary			Ext. Thds., <sup>c</sup> $d_3$ (Ref.)	Int. Thds., <sup>d</sup> $D_1$	Deg.	Min.		
Inches	Inches	Inches	Inches	Inches	Inches	Deg.	Min.	Sq. In.	Sq. In.
1 <sup>e</sup>		1.0000	0.9188	0.8512	0.8647	2	29	0.551	0.606
	1 <sup>1</sup> / <sub>16</sub>	1.0625	0.9813	0.9137	0.9272	2	19	0.636	0.695
1 <sup>1</sup> / <sub>8</sub>		1.1250	1.0438	0.9792	0.9897	2	11	0.728	0.790
	1 <sup>3</sup> / <sub>16</sub>	1.1875	1.1063	1.0387	1.0522	2	4	0.825	0.892
1 <sup>1</sup> / <sub>4</sub>		1.2500	1.1688	1.1012	1.1147	1	57	0.929	1.000
	1 <sup>5</sup> / <sub>16</sub>	1.3125	1.2313	1.1637	1.1772	1	51	1.039	1.114
1 <sup>3</sup> / <sub>8</sub>		1.3750	1.2938	1.2262	1.2397	1	46	1.155	1.233
	1 <sup>7</sup> / <sub>16</sub>	1.4375	1.3563	1.2887	1.3022	1	41	1.277	1.360
1 <sup>1</sup> / <sub>2</sub>		1.5000	1.4188	1.3512	1.3647	1	36	1.405	1.492
	1 <sup>9</sup> / <sub>16</sub>	1.5625	1.4813	1.4137	1.4272	1	32	1.54	1.63
1 <sup>5</sup> / <sub>8</sub>		1.6250	1.5438	1.4806	1.4897	1	29	1.68	1.78
	1 <sup>11</sup> / <sub>16</sub>	1.6875	1.6063	1.5387	1.5522	1	25	1.83	1.93
1 <sup>3</sup> / <sub>4</sub>		1.7500	1.6688	1.6012	1.6147	1	22	1.98	2.08
	1 <sup>13</sup> / <sub>16</sub>	1.8125	1.7313	1.6637	1.6772	1	19	2.14	2.25
1 <sup>7</sup> / <sub>8</sub>		1.8750	1.7938	1.7262	1.7397	1	16	2.30	2.41
	1 <sup>15</sup> / <sub>16</sub>	1.9375	1.8563	1.7887	1.8022	1	14	2.47	2.59
2		2.0000	1.9188	1.8512	1.8647	1	11	2.65	2.77
	2 <sup>1</sup> / <sub>8</sub>	2.1250	2.0438	1.9762	1.9897	1	7	3.03	3.15
2 <sup>1</sup> / <sub>4</sub>		2.2500	2.1688	2.1012	2.1147	1	3	3.42	3.56
	2 <sup>3</sup> / <sub>8</sub>	2.3750	2.2938	2.2262	2.2397	1	0	3.85	3.99
2 <sup>1</sup> / <sub>2</sub>		2.5000	2.4188	2.3512	2.3647	0	57	4.29	4.44
	2 <sup>5</sup> / <sub>8</sub>	2.6250	2.5438	2.4762	2.4897	0	54	4.76	4.92
2 <sup>3</sup> / <sub>4</sub>		2.7500	2.6688	2.6012	2.6147	0	51	5.26	5.43
	2 <sup>7</sup> / <sub>8</sub>	2.8750	2.7938	2.7262	2.7397	0	49	5.78	5.95
3		3.0000	2.9188	2.8512	2.8647	0	47	6.32	6.51
	3 <sup>1</sup> / <sub>8</sub>	3.1250	3.0438	2.9762	2.9897	0	45	6.89	7.08
3 <sup>1</sup> / <sub>4</sub>		3.2500	3.1688	3.1012	3.1147	0	43	7.49	7.69
	3 <sup>3</sup> / <sub>8</sub>	3.3750	3.2938	3.2262	3.2397	0	42	8.11	8.31
3 <sup>1</sup> / <sub>2</sub>		3.5000	3.4188	3.3512	3.3647	0	40	8.75	8.96
	3 <sup>5</sup> / <sub>8</sub>	3.6250	3.5438	3.4762	3.4897	0	39	9.42	9.64
3 <sup>3</sup> / <sub>4</sub>		3.7500	3.6688	3.6012	3.6147	0	37	10.11	10.34
	3 <sup>7</sup> / <sub>8</sub>	3.8750	3.7938	3.7262	3.7397	0	36	10.83	11.06
4		4.0000	3.9188	3.8512	3.8647	0	35	11.57	11.81
	4 <sup>1</sup> / <sub>8</sub>	4.1250	4.0438	3.9762	3.9897	0	34	12.34	12.59
4 <sup>1</sup> / <sub>4</sub>		4.2500	4.1688	4.1012	4.1147	0	33	13.12	13.38
	4 <sup>3</sup> / <sub>8</sub>	4.3750	4.2938	4.2262	4.2397	0	32	13.94	14.21
4 <sup>1</sup> / <sub>2</sub>		4.5000	4.4188	4.3512	4.3647	0	31	14.78	15.1
	4 <sup>5</sup> / <sub>8</sub>	4.6250	4.5438	4.4762	4.4897	0	30	15.6	15.9
4 <sup>3</sup> / <sub>4</sub>		4.7500	4.6688	4.6012	4.6147	0	29	16.5	16.8
	4 <sup>7</sup> / <sub>8</sub>	4.8750	4.7938	4.7262	4.7397	0	29	17.4	17.7
5		5.0000	4.9188	4.8512	4.8647	0	28	18.4	18.7
	5 <sup>1</sup> / <sub>8</sub>	5.1250	5.0438	4.9762	4.9897	0	27	19.3	19.7
5 <sup>1</sup> / <sub>4</sub>		5.2500	5.1688	5.1012	5.1147	0	26	20.3	20.7
	5 <sup>3</sup> / <sub>8</sub>	5.3750	5.2938	5.2262	5.2397	0	26	21.3	21.7
5 <sup>1</sup> / <sub>2</sub>		5.5000	5.4188	5.3512	5.3647	0	25	22.4	22.7
	5 <sup>5</sup> / <sub>8</sub>	5.6250	5.5438	5.4762	5.4897	0	25	23.4	23.8
5 <sup>3</sup> / <sub>4</sub>		5.7500	5.6688	5.6012	5.6147	0	24	24.5	24.9
	5 <sup>7</sup> / <sub>8</sub>	5.8750	5.7938	5.7262	5.7397	0	24	25.6	26.0
6		6.0000	5.9188	5.8512	5.8647	0	23	26.8	27.1

<sup>a</sup> British: Effective Diameter.<sup>b</sup> See formula, pages 1502 and 1510.<sup>c</sup> Design form for UNR threads. (See figure on page 1733).<sup>d</sup> Basic minor diameter.<sup>e</sup> This is a standard size of the UNC series.



Table 5d. 12-Thread series, 12-UN and 12-UNR—Basic Dimensions

Sizes		Basic Major Dia., D	Basic Pitch Dia., <sup>a</sup> D <sub>2</sub>	Minor Diameter		Lead Angle $\lambda$ at Basic P.D.		Area of Minor Dia. at $D - 2h_b$	Tensile Stress Area <sup>b</sup>
Primary	Secondary			Ext. Thds., <sup>c</sup> d <sub>3</sub> (Ref.)	Int. Thds., <sup>d</sup> D <sub>1</sub>	Deg.	Min.		
Inches	Inches	Inches	Inches	Inches	Inches	Deg.	Sq. In.	Sq. In.	
$\frac{9}{16}^e$		0.5625	0.5084	0.4633	0.4723	2	59	0.162	0.182
$\frac{5}{8}$		0.6250	0.5709	0.5258	0.5348	2	40	0.210	0.232
	$\frac{11}{16}$	0.6875	0.6334	0.5883	0.5973	2	24	0.264	0.289
$\frac{3}{4}$		0.7500	0.6959	0.6508	0.6598	2	11	0.323	0.351
	$\frac{13}{16}$	0.8125	0.7584	0.7133	0.7223	2	0	0.390	0.420
$\frac{7}{8}$		0.8750	0.8209	0.7758	0.7848	1	51	0.462	0.495
	$\frac{15}{16}$	0.9375	0.8834	0.8383	0.8473	1	43	0.540	0.576
1 <sup>e</sup>		1.0000	0.9459	0.9008	0.9098	1	36	0.625	0.663
	$1\frac{1}{16}$	1.0625	1.0084	0.9633	0.9723	1	30	0.715	0.756
$1\frac{1}{8}^e$		1.1250	1.0709	1.0258	1.0348	1	25	0.812	0.856
	$1\frac{3}{16}$	1.1875	1.1334	1.0883	1.0973	1	20	0.915	0.961
$1\frac{1}{4}$		1.2500	1.1959	1.1508	1.1598	1	16	1.024	1.073
	$1\frac{5}{16}$	1.3125	1.2584	1.2133	1.2223	1	12	1.139	1.191
$1\frac{3}{8}$		1.3750	1.3209	1.2758	1.2848	1	9	1.260	1.315
	$1\frac{7}{16}$	1.4375	1.3834	1.3383	1.3473	1	6	1.388	1.445
$1\frac{1}{2}^e$		1.5000	1.4459	1.4008	1.4098	1	3	1.52	1.58
	$1\frac{9}{16}$	1.5625	1.5084	1.4633	1.4723	1	0	1.66	1.72
$1\frac{5}{8}$		1.6250	1.5709	1.5258	1.5348	0	58	1.81	1.87
	$1\frac{11}{16}$	1.6875	1.6334	1.5883	1.5973	0	56	1.96	2.03
$1\frac{3}{4}$		1.7500	1.6959	1.6508	1.6598	0	54	2.12	2.19
	$1\frac{13}{16}$	1.8125	1.7584	1.7133	1.7223	0	52	2.28	2.35
$1\frac{7}{8}$		1.8750	1.8209	1.7758	1.7848	0	50	2.45	2.53
	$1\frac{15}{16}$	1.9375	1.8834	1.8383	1.8473	0	48	2.63	2.71
2		2.0000	1.9459	1.9008	1.9098	0	47	2.81	2.89
	$2\frac{1}{8}$	2.1250	2.0709	2.0258	2.0348	0	44	3.19	3.28
$2\frac{1}{4}$		2.2500	2.1959	2.1508	2.1598	0	42	3.60	3.69
	$2\frac{3}{8}$	2.3750	2.3209	2.2758	2.2848	0	39	4.04	4.13
$2\frac{1}{2}$		2.5000	2.4459	2.4008	2.4098	0	37	4.49	4.60
	$2\frac{5}{8}$	2.6250	2.5709	2.5258	2.5348	0	35	4.97	5.08
$2\frac{3}{4}$		2.7500	2.6959	2.6508	2.6598	0	34	5.48	5.59
	$2\frac{7}{8}$	2.8750	2.8209	2.7758	2.7848	0	32	6.01	6.13
3		3.0000	2.9459	2.9008	2.9098	0	31	6.57	6.69
	$3\frac{1}{8}$	3.1250	3.0709	3.0258	3.0348	0	30	7.15	7.28
$3\frac{1}{4}$		3.2500	3.1959	3.1508	3.1598	0	29	7.75	7.89
	$3\frac{3}{8}$	3.3750	3.3209	3.2758	3.2848	0	27	8.38	8.52
$3\frac{1}{2}$		3.5000	3.4459	3.4008	3.4098	0	26	9.03	9.18
	$3\frac{5}{8}$	3.6250	3.5709	3.5258	3.5348	0	26	9.71	9.86
$3\frac{3}{4}$		3.7500	3.6959	3.6508	3.6598	0	25	10.42	10.57
	$3\frac{7}{8}$	3.8750	3.8209	3.7758	3.7848	0	24	11.14	11.30
4		4.0000	3.9459	3.9008	3.9098	0	23	11.90	12.06
	$4\frac{1}{8}$	4.1250	4.0709	4.0258	4.0348	0	22	12.67	12.84
$4\frac{1}{4}$		4.2500	4.1959	4.1508	4.1598	0	22	13.47	13.65
	$4\frac{3}{8}$	4.3750	4.3209	4.2758	4.2848	0	21	14.30	14.48
$4\frac{1}{2}$		4.5000	4.4459	4.4008	4.4098	0	21	15.1	15.3
	$4\frac{5}{8}$	4.6250	4.5709	4.5258	4.5348	0	20	16.0	16.2
$4\frac{3}{4}$		4.7500	4.6959	4.6508	4.6598	0	19	16.9	17.1
	$4\frac{7}{8}$	4.8750	4.8209	4.7758	4.7848	0	19	17.8	18.0
5		5.0000	4.9459	4.9008	4.9098	0	18	18.8	19.0
	$5\frac{1}{8}$	5.1250	5.0709	5.0258	5.0348	0	18	19.8	20.0
$5\frac{1}{4}$		5.2500	5.1959	5.1508	5.1598	0	18	20.8	21.0
	$5\frac{3}{8}$	5.3750	5.3209	5.2758	5.2848	0	17	21.8	22.0
$5\frac{1}{2}$		5.5000	5.4459	5.4008	5.4098	0	17	22.8	23.1
	$5\frac{5}{8}$	5.6250	5.5709	5.5258	5.5348	0	16	23.9	24.1
$5\frac{3}{4}$		5.7500	5.6959	5.6508	5.6598	0	16	25.0	25.2
	$5\frac{7}{8}$	5.8750	5.8209	5.7758	5.7848	0	16	26.1	26.4
6		6.0000	5.9459	5.9008	5.9098	0	15	27.3	27.5

<sup>a</sup> British: Effective Diameter.<sup>b</sup> See formula, pages 1502 and 1510.<sup>c</sup> Design form for UNR threads. (See figure on page 1733.)<sup>d</sup> Basic minor diameter.<sup>e</sup> These are standard sizes of the UNC or UNF Series.

## UNIFIED SCREW THREADS

Table 5e. 16-Thread Series, 16-UN and 16-UNR—Basic Dimensions

Sizes		Basic Major Dia., $D$	Basic Pitch Dia., $D_2$	Minor Diameter		Lead Angle $\lambda$ at Basic P.D.		Area of Minor Dia. at $D - 2h_b$	Tensile Stress Area <sup>b</sup>
Primary	Secondary			Ext. Thds., <sup>c</sup> $d_3$ (Ref.)	Int. Thds., <sup>d</sup> $D_1$	Deg.	Min.		
Inches	Inches	Inches	Inches	Inches	Inches	Deg.	Min.	Sq. In.	Sq. In.
$\frac{3}{8}$		0.3750	0.3344	0.3005	0.3073	3	24	0.0678	0.0775
$\frac{7}{16}$		0.4375	0.3969	0.3630	0.3698	2	52	0.0997	0.1114
$\frac{1}{2}$		0.5000	0.4594	0.4255	0.4323	2	29	0.1378	0.151
$\frac{9}{16}$		0.5625	0.5219	0.4880	0.4948	2	11	0.182	0.198
$\frac{5}{8}$		0.6250	0.5844	0.5505	0.5573	1	57	0.232	0.250
	$\frac{11}{16}$	0.6875	0.6469	0.6130	0.6198	1	46	0.289	0.308
$\frac{3}{4}$		0.7500	0.7094	0.6755	0.6823	1	36	0.351	0.373
	$\frac{13}{16}$	0.8125	0.7719	0.7380	0.7448	1	29	0.420	0.444
	$\frac{7}{8}$	0.8750	0.8344	0.8005	0.8073	1	22	0.495	0.521
	$\frac{15}{16}$	0.9375	0.8969	0.8630	0.8698	1	16	0.576	0.604
1		1.0000	0.9594	0.9255	0.9323	1	11	0.663	0.693
	$\frac{11}{16}$	1.0625	1.0219	0.9880	0.9948	1	7	0.756	0.788
$1\frac{1}{8}$		1.1250	1.0844	1.0505	1.0573	1	3	0.856	0.889
	$\frac{13}{16}$	1.1875	1.1469	1.1130	1.1198	1	0	0.961	0.997
$1\frac{1}{4}$		1.2500	1.2094	1.1755	1.1823	0	57	1.073	1.111
	$\frac{15}{16}$	1.3125	1.2719	1.2380	1.2448	0	54	1.191	1.230
$1\frac{3}{8}$		1.3750	1.3344	1.3005	1.3073	0	51	1.315	1.356
	$\frac{17}{16}$	1.4375	1.3969	1.3630	1.3698	0	49	1.445	1.488
$1\frac{1}{2}$		1.5000	1.4594	1.4255	1.4323	0	47	1.58	1.63
	$\frac{19}{16}$	1.5625	1.5219	1.4880	1.4948	0	45	1.72	1.77
$1\frac{5}{8}$		1.6250	1.5844	1.5505	1.5573	0	43	1.87	1.92
	$1\frac{11}{16}$	1.6875	1.6469	1.6130	1.6198	0	42	2.03	2.08
$1\frac{3}{4}$		1.7500	1.7094	1.6755	1.6823	0	40	2.19	2.24
	$1\frac{13}{16}$	1.8125	1.7719	1.7380	1.7448	0	39	2.35	2.41
$1\frac{7}{8}$		1.8750	1.8344	1.8005	1.8073	0	37	2.53	2.58
	$1\frac{15}{16}$	1.9375	1.8969	1.8630	1.8698	0	36	2.71	2.77
2		2.0000	1.9594	1.9255	1.9323	0	35	2.89	2.95
	$2\frac{1}{8}$	2.1250	2.0844	2.0505	2.0573	0	33	3.28	3.35
$2\frac{1}{4}$		2.2500	2.2094	2.1755	2.1823	0	31	3.69	3.76
	$2\frac{3}{8}$	2.3750	2.3344	2.3005	2.3073	0	29	4.13	4.21
$2\frac{1}{2}$		2.5000	2.4594	2.4255	2.4323	0	28	4.60	4.67
	$2\frac{5}{8}$	2.6250	2.5844	2.5505	2.5573	0	26	5.08	5.16
$2\frac{3}{4}$		2.7500	2.7094	2.6755	2.6823	0	25	5.59	5.68
	$2\frac{7}{8}$	2.8750	2.8344	2.8005	2.8073	0	24	6.13	6.22
3		3.0000	2.9594	2.9255	2.9323	0	23	6.69	6.78
	$3\frac{1}{8}$	3.1250	3.0844	3.0505	3.0573	0	22	7.28	7.37
$3\frac{1}{4}$		3.2500	3.2094	3.1755	3.1823	0	21	7.89	7.99
	$3\frac{3}{8}$	3.3750	3.3344	3.3005	3.3073	0	21	8.52	8.63
$3\frac{1}{2}$		3.5000	3.4594	3.4255	3.4323	0	20	9.18	9.29
	$3\frac{5}{8}$	3.6250	3.5844	3.5505	3.5573	0	19	9.86	9.98
$3\frac{3}{4}$		3.7500	3.7094	3.6755	3.6823	0	18	10.57	10.69
	$3\frac{7}{8}$	3.8750	3.8344	3.8005	3.8073	0	18	11.30	11.43
4		4.0000	3.9594	3.9255	3.9323	0	17	12.06	12.19
	$4\frac{1}{8}$	4.1250	4.0844	4.0505	4.0573	0	17	12.84	12.97
$4\frac{1}{4}$		4.2500	4.2094	4.1755	4.1823	0	16	13.65	13.78
	$4\frac{3}{8}$	4.3750	4.3344	4.3005	4.3073	0	16	14.48	14.62
$4\frac{1}{2}$		4.5000	4.4594	4.4255	4.4323	0	15	15.34	15.5
	$4\frac{5}{8}$	4.6250	4.5844	4.5505	4.5573	0	15	16.2	16.4
$4\frac{3}{4}$		4.7500	4.7094	4.6755	4.6823	0	15	17.1	17.3
	$4\frac{7}{8}$	4.8750	4.8344	4.8005	4.8073	0	14	18.0	18.2
5		5.0000	4.9594	4.9255	4.9323	0	14	19.0	19.2
	$5\frac{1}{8}$	5.1250	5.0844	5.0505	5.0573	0	13	20.0	20.1
$5\frac{1}{4}$		5.2500	5.2094	5.1755	5.1823	0	13	21.0	21.1
	$5\frac{3}{8}$	5.3750	5.3344	5.3005	5.3073	0	13	22.0	22.2

**Table 5e. (Continued) 16-Thread Series, 16-UN and 16-UNR—Basic Dimensions**

Sizes		Basic Major Dia., $D$	Basic Pitch Dia., <sup>a</sup> $D_2$	Minor Diameter		Lead Angle $\lambda$ at Basic P.D.		Area of Minor Dia. at $D - 2h_b$	Tensile Stress Area <sup>b</sup>
Primary	Secondary			Ext. Thds., <sup>c</sup> $d_3$ (Ref.)	Int. Thds., <sup>d</sup> $D_1$	Deg.	Min.		
Inches	Inches	Inches	Inches	Inches	Inches	Deg.	Min.	Sq. In.	Sq. In.
$5\frac{1}{2}$	$5\frac{5}{8}$	5.5000	5.4594	5.4255	5.4323	0	13	23.1	23.2
		5.6250	5.5844	5.5505	5.5573	0	12	24.1	24.3
$5\frac{3}{4}$	$5\frac{7}{8}$	5.7500	5.7094	5.6755	5.6823	0	12	25.2	25.4
		5.8750	5.8344	5.8005	5.8073	0	12	26.4	26.5
6		6.0000	5.9594	5.9255	5.9323	0	11	27.5	27.7

- <sup>a</sup> British: Effective Diameter.
- <sup>b</sup> See formula, pages 1502 and 1510.
- <sup>c</sup> Design form for UNR threads. (See figure on page 1733.)
- <sup>d</sup> Basic minor diameter.
- <sup>e</sup> These are standard sizes of the UNC or UNF Series.

**Table 5f. 20-Thread Series, 20-UN and 20-UNR—Basic Dimensions**

Sizes		Basic Major Dia., $D$	Basic Pitch Dia., <sup>a</sup> $D_2$	Minor Diameter		Lead Angle $\lambda$ at Basic P.D.		Area of Minor Dia. at $D - 2h_b$	Tensile Stress Area <sup>b</sup>
Primary	Secondary			Ext. Thds., <sup>c</sup> $d_3$ (Ref.)	Int. Thds., <sup>d</sup> $D_1$	Deg.	Min.		
Inches	Inches	Inches	Inches	Inches	Inches	Deg.	Min.	Sq. In.	Sq. In.
$1\frac{1}{4}$	$1\frac{1}{16}$	2.0500	0.2175	0.1905	0.1959	4	11	0.0269	0.0318
		0.3125	0.2800	0.2530	0.2584	3	15	0.0481	0.0547
$5\frac{1}{8}$	$5\frac{1}{16}$	0.3750	0.3425	0.3155	0.3209	2	40	0.0755	0.0836
		0.4375	0.4050	0.3780	0.3834	2	15	0.1090	0.1187
$1\frac{1}{2}$	$1\frac{1}{8}$	0.5000	0.4675	0.4405	0.4459	1	57	0.1486	0.160
		0.5625	0.5300	0.5030	0.5084	1	43	0.194	0.207
$1\frac{3}{8}$	$1\frac{1}{4}$	0.6250	0.5925	0.5655	0.5709	1	32	0.246	0.261
		0.6875	0.6550	0.6280	0.6334	1	24	0.304	0.320
$3\frac{1}{4}$	$3\frac{1}{8}$	0.7500	0.7175	0.6905	0.6959	1	16	0.369	0.386
		0.8125	0.7800	0.7530	0.7584	1	10	0.439	0.458
$7\frac{1}{8}$	$7\frac{1}{16}$	0.8750	0.8425	0.8155	0.8209	1	5	0.515	0.536
		0.9375	0.9050	0.8780	0.8834	1	0	0.0.598	0.620
1 <sup>e</sup>	$1\frac{1}{8}$	1.0000	0.9675	0.9405	0.9459	0	57	0.687	0.711
		1.0625	1.0300	1.0030	1.0084	0	53	0.782	0.807
$1\frac{1}{8}$	$1\frac{1}{4}$	1.1250	1.0925	1.0655	1.0709	0	50	0.882	0.910
		1.1875	1.1550	1.1280	1.1334	0	47	0.990	1.018
$1\frac{1}{4}$	$1\frac{1}{2}$	1.2500	1.2175	1.1905	1.1959	0	45	1.103	1.133
		1.3125	1.2800	1.2530	1.2584	0	43	1.222	1.254
$1\frac{3}{8}$	$1\frac{3}{4}$	1.3750	1.3425	1.3155	1.3209	0	41	1.348	1.382
		1.4375	1.4050	1.3780	1.3834	0	39	1.479	1.51
$1\frac{1}{2}$	$1\frac{3}{8}$	1.5000	1.4675	1.4405	1.4459	0	37	1.62	1.65
		1.5625	1.5300	1.5030	1.5084	0	36	1.76	1.80
$1\frac{5}{8}$	$1\frac{1}{2}$	1.6250	1.5925	1.5655	1.5709	0	34	1.91	1.95
		1.6875	1.6550	1.6280	1.6334	0	33	2.07	2.11
$1\frac{3}{4}$	$1\frac{3}{4}$	1.7500	1.7175	1.6905	1.6959	0	32	2.23	2.27
		1.8125	1.7800	1.7530	1.7584	0	31	2.40	2.44
$1\frac{7}{8}$	$1\frac{7}{8}$	1.8750	1.8425	1.8155	1.8209	0	30	2.57	2.62
		1.9375	1.9050	1.8780	1.8834	0	29	2.75	2.80
2	$2\frac{1}{8}$	2.0000	1.9675	1.9405	1.9459	0	28	2.94	2.99
		2.1250	2.0925	2.0655	2.0709	0	26	3.33	3.39
$2\frac{1}{4}$	$2\frac{1}{4}$	2.2500	2.2175	2.1905	2.1959	0	25	3.75	3.81
		2.3750	2.3425	2.3155	2.3209	0	23	4.19	4.25
$2\frac{1}{2}$	$2\frac{1}{2}$	2.5000	2.4675	2.4405	2.4459	0	22	4.66	4.72
		2.6250	2.5925	2.5655	2.5709	0	21	5.15	5.21
$2\frac{3}{4}$	$2\frac{3}{4}$	2.7500	2.7175	2.6905	2.6959	0	20	5.66	5.73
		2.8750	2.8425	2.8155	2.8209	0	19	6.20	6.27
3		3.0000	2.9675	2.9405	2.9459	0	18	6.77	6.84

- <sup>a</sup> British: Effective Diameter.
- <sup>b</sup> See formula, pages 1502 and 1510.
- <sup>c</sup> Design form for UNR threads. (See figure on page 1733.)
- <sup>d</sup> Basic minor diameter.
- <sup>e</sup> These are standard sizes of the UNC, UNF, or UNEF Series.

UNIFIED SCREW THREADS

**Table 5g. 28-Thread Series, 28-UN and 28-UNR — Basic Dimensions**

Sizes		Basic Major Dia., D	Basic Pitch Dia., <sup>a</sup> D <sub>2</sub>	Minor Diameter		Lead Angle λ at Basic P.D.		Area of Minor Dia. at D-2h <sub>b</sub>	Tensile Stress Area <sup>b</sup>
Primary	Secondary			Ext. Thds., <sup>c</sup> d <sub>3</sub> (Ref.)	Int. Thds., <sup>d</sup> D <sub>1</sub>	Deg.	Min.		
Inches	Inches	Inches	Inches	Inches	Inches	Deg.	Min.	Sq. In.	Sq. In.
	<b>12 (0.216)<sup>e</sup></b>	<b>0.2160</b>	<b>0.1928</b>	<b>0.1734</b>	<b>0.1773</b>	<b>3</b>	<b>22</b>	0.0226	0.0258
1/4		<b>0.2500</b>	<b>0.2268</b>	<b>0.2074</b>	<b>0.2113</b>	<b>2</b>	<b>52</b>	0.0326	0.0364
5/16		<b>0.3125</b>	<b>0.2893</b>	<b>0.2699</b>	<b>0.2738</b>	<b>2</b>	<b>15</b>	0.0556	0.0606
3/8		<b>0.3750</b>	<b>0.3518</b>	<b>0.3324</b>	<b>0.3363</b>	<b>1</b>	<b>51</b>	0.0848	0.0909
7/16 <sup>e</sup>		<b>0.4375</b>	<b>0.4143</b>	<b>0.3949</b>	<b>0.3988</b>	<b>1</b>	<b>34</b>	0.1201	0.1274
1/2		<b>0.5000</b>	<b>0.4768</b>	<b>0.4574</b>	<b>0.4613</b>	<b>1</b>	<b>22</b>	0.162	0.170
9/16		<b>0.5625</b>	<b>0.5393</b>	<b>0.5199</b>	<b>0.5238</b>	<b>1</b>	<b>12</b>	0.209	0.219
5/8		<b>0.6250</b>	<b>0.6018</b>	<b>0.5824</b>	<b>0.5863</b>	<b>1</b>	<b>5</b>	0.263	0.274
	11/16	<b>0.6875</b>	<b>0.6643</b>	<b>0.6449</b>	<b>0.6488</b>	<b>0</b>	<b>59</b>	0.323	0.335
3/4		<b>0.7500</b>	<b>0.7268</b>	<b>0.7074</b>	<b>0.7113</b>	<b>0</b>	<b>54</b>	0.389	0.402
	13/16	<b>0.8125</b>	<b>0.7893</b>	<b>0.7699</b>	<b>0.7738</b>	<b>0</b>	<b>50</b>	0.461	0.475
7/8		<b>0.8750</b>	<b>0.8518</b>	<b>0.8324</b>	<b>0.8363</b>	<b>0</b>	<b>46</b>	0.539	0.554
	15/16	<b>0.9375</b>	<b>0.9143</b>	<b>0.8949</b>	<b>0.8988</b>	<b>0</b>	<b>43</b>	0.624	0.640
<b>1</b>		<b>1.0000</b>	<b>0.9768</b>	<b>0.9574</b>	<b>0.9613</b>	<b>0</b>	<b>40</b>	0.714	0.732
	1 1/16	<b>1.0625</b>	<b>1.0393</b>	<b>1.0199</b>	<b>1.0238</b>	<b>0</b>	<b>38</b>	0.811	0.830
1 1/8		<b>1.1250</b>	<b>1.1018</b>	<b>1.0824</b>	<b>1.0863</b>	<b>0</b>	<b>35</b>	0.914	0.933
	1 3/16	<b>1.1875</b>	<b>1.1643</b>	<b>1.1449</b>	<b>1.1488</b>	<b>0</b>	<b>34</b>	1.023	1.044
1 1/4		<b>1.2500</b>	<b>1.2268</b>	<b>1.2074</b>	<b>1.2113</b>	<b>0</b>	<b>32</b>	1.138	1.160
	1 5/16	<b>1.3125</b>	<b>1.2893</b>	<b>1.2699</b>	<b>1.2738</b>	<b>0</b>	<b>30</b>	1.259	1.282
1 3/8		<b>1.3750</b>	<b>1.3518</b>	<b>1.3324</b>	<b>1.3363</b>	<b>0</b>	<b>29</b>	1.386	1.411
	1 7/16	<b>1.4375</b>	<b>1.4143</b>	<b>1.3949</b>	<b>1.3988</b>	<b>0</b>	<b>28</b>	1.52	1.55
1 1/2		<b>1.5000</b>	<b>1.4768</b>	<b>1.4574</b>	<b>1.4613</b>	<b>0</b>	<b>26</b>	1.66	1.69

- <sup>a</sup> British: Effective Diameter.
- <sup>b</sup> See formula, pages 1502 and 1510.
- <sup>c</sup> Design form for UNR threads. (See figure on page 1733.)
- <sup>d</sup> Basic minor diameter.
- <sup>e</sup> These are standard sizes of the UNF or UNEF Series.

**Table 5h. 32-Thread Series, 32-UN and 32-UNR — Basic Dimensions**

Sizes		Basic Major Dia., D	Basic Pitch Dia., <sup>a</sup> D <sub>2</sub>	Minor Diameter		Lead Angle λ at Basic P.D.		Area of Minor Dia. at D-2h <sub>b</sub>	Tensile Stress Area <sup>b</sup>
Primary	Secondary			Ext. Thds., <sup>c</sup> d <sub>3</sub> (Ref.)	Int. Thds., <sup>d</sup> D <sub>1</sub>	Deg.	Min.		
Inches	Inches	Inches	Inches	Inches	Inches	Deg.	Min.	Sq. In.	Sq. In.
<b>6 (0.138)<sup>e</sup></b>		<b>0.1380</b>	<b>0.1177</b>	<b>0.1008</b>	<b>0.1042</b>	<b>4</b>	<b>50</b>	0.00745	0.00909
<b>8 (0.164)<sup>e</sup></b>		<b>0.1640</b>	<b>0.1437</b>	<b>0.1268</b>	<b>0.1302</b>	<b>3</b>	<b>58</b>	0.01196	0.0140
<b>10 (0.190)<sup>e</sup></b>		<b>0.1900</b>	<b>0.1697</b>	<b>0.1528</b>	<b>0.1562</b>	<b>3</b>	<b>21</b>	0.01750	0.0200
	<b>12 (0.216)<sup>e</sup></b>	<b>0.2160</b>	<b>0.1957</b>	<b>0.1788</b>	<b>0.1822</b>	<b>2</b>	<b>55</b>	0.0242	0.0270
1/4		<b>0.2500</b>	<b>0.2297</b>	<b>0.2128</b>	<b>0.2162</b>	<b>2</b>	<b>29</b>	0.0344	0.0379
5/16		<b>0.3125</b>	<b>0.2922</b>	<b>0.2753</b>	<b>0.2787</b>	<b>1</b>	<b>57</b>	0.0581	0.0625
3/8		<b>0.3750</b>	<b>0.3547</b>	<b>0.3378</b>	<b>0.3412</b>	<b>1</b>	<b>36</b>	0.0878	0.0932
7/16		<b>0.4375</b>	<b>0.4172</b>	<b>0.4003</b>	<b>0.4037</b>	<b>1</b>	<b>22</b>	0.1237	0.1301
1/2		<b>0.5000</b>	<b>0.4797</b>	<b>0.4628</b>	<b>0.4662</b>	<b>1</b>	<b>11</b>	0.166	0.173
9/16		<b>0.5625</b>	<b>0.5422</b>	<b>0.5253</b>	<b>0.5287</b>	<b>1</b>	<b>3</b>	0.214	0.222
5/8		<b>0.6250</b>	<b>0.6047</b>	<b>0.5878</b>	<b>0.5912</b>	<b>0</b>	<b>57</b>	0.268	0.278
	11/16	<b>0.6875</b>	<b>0.6672</b>	<b>0.6503</b>	<b>0.6537</b>	<b>0</b>	<b>51</b>	0.329	0.339
3/4		<b>0.7500</b>	<b>0.7297</b>	<b>0.7128</b>	<b>0.7162</b>	<b>0</b>	<b>47</b>	0.395	0.407
	13/16	<b>0.8125</b>	<b>0.7922</b>	<b>0.7753</b>	<b>0.7787</b>	<b>0</b>	<b>43</b>	0.468	0.480
7/8		<b>0.8750</b>	<b>0.8547</b>	<b>0.8378</b>	<b>0.8412</b>	<b>0</b>	<b>40</b>	0.547	0.560
	15/16	<b>0.9375</b>	<b>0.9172</b>	<b>0.9003</b>	<b>0.9037</b>	<b>0</b>	<b>37</b>	0.632	0.646
<b>1</b>		<b>1.0000</b>	<b>0.9797</b>	<b>0.9628</b>	<b>0.9662</b>	<b>0</b>	<b>35</b>	0.723	0.738

- <sup>a</sup> British: Effective Diameter.
- <sup>b</sup> See formula, pages 1502 and 1510.
- <sup>c</sup> Design form for UNR threads. (See figure on page 1733.)
- <sup>d</sup> Basic minor diameter.
- <sup>e</sup> These are standard sizes of the UNC, UNF, or UNEF Series.

**Thread Classes.**—Thread classes are distinguished from each other by the amounts of tolerance and allowance. Classes identified by a numeral followed by the letters A and B are derived from certain Unified formulas (not shown here) in which the pitch diameter tolerances are based on increments of the basic major (nominal) diameter, the pitch, and the length of engagement. These formulas and the class identification or symbols apply to all of the Unified threads.

Classes 1A, 2A, and 3A apply to external threads only, and Classes 1B, 2B, and 3B apply to internal threads only. The disposition of the tolerances, allowances, and crest clearances for the various classes is illustrated on pages 1774 and 1774.

*Classes 2A and 2B:* Classes 2A and 2B are the most commonly used for general applications, including production of bolts, screws, nuts, and similar fasteners.

The maximum diameters of Class 2A (external) uncoated threads are less than basic by the amount of the allowance. The allowance minimizes galling and seizing in high-cycle wrench assembly, or it can be used to accommodate plated finishes or other coating. However, for threads with additive finish, the maximum diameters of Class 2A may be exceeded by the amount of the allowance, for example, the 2A maximum diameters apply to an unplated part or to a part before plating whereas the basic diameters (the 2A maximum diameter plus allowance) apply to a part after plating. The minimum diameters of Class 2B (internal) threads, whether or not plated or coated, are basic, affording no allowance or clearance in assembly at maximum metal limits.

*Class 2AG:* Certain applications require an allowance for rapid assembly to permit application of the proper lubricant or for residual growth due to high-temperature expansion. In these applications, when the thread is coated and the 2A allowance is not permitted to be consumed by such coating, the thread class symbol is qualified by G following the class symbol.

*Classes 3A and 3B:* Classes 3A and 3B may be used if closer tolerances are desired than those provided by Classes 2A and 2B. The maximum diameters of Class 3A (external) threads and the minimum diameters of Class 3B (internal) threads, whether or not plated or coated, are basic, affording no allowance or clearance for assembly of maximum metal components.

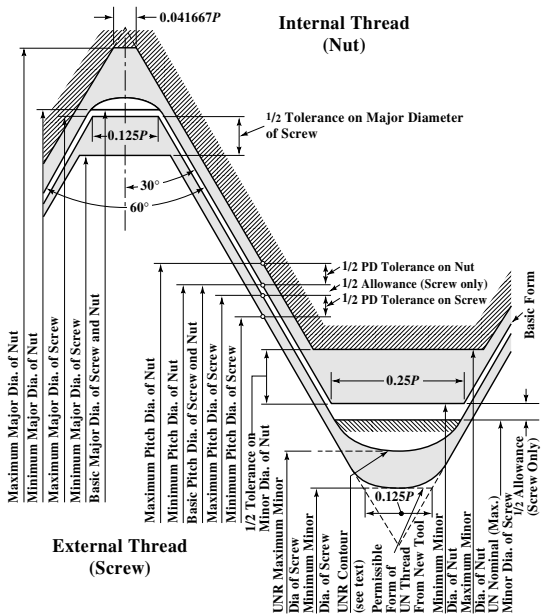
*Classes 1A and 1B:* Classes 1A and 1B threads replaced American National Class 1. These classes are intended for ordnance and other special uses. They are used on threaded components where quick and easy assembly is necessary and where a liberal allowance is required to permit ready assembly, even with slightly bruised or dirty threads.

Maximum diameters of Class 1A (external) threads are less than basic by the amount of the same allowance as applied to Class 2A. For the intended applications in American practice the allowance is not available for plating or coating. Where the thread is plated or coated, special provisions are necessary. The minimum diameters of Class 1B (internal) threads, whether or not plated or coated, are basic, affording no allowance or clearance for assembly with maximum metal external thread components having maximum diameters which are basic.

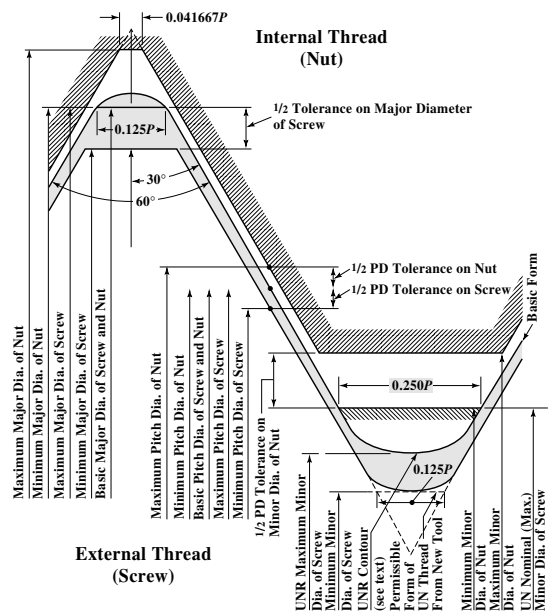
**Coated 60-deg. Threads.**—Although the Standard does not make recommendations for thicknesses of, or specify limits for coatings, it does outline certain principles that will aid mechanical interchangeability if followed whenever conditions permit.

To keep finished threads within the limits of size established in the Standard, external threads should not exceed basic size after plating and internal threads should not be below basic size after plating. This recommendation does not apply to threads coated by certain commonly used processes such as hot-dip galvanizing where it may not be required to maintain these limits.

Class 2A provides both a tolerance and an allowance. Many thread requirements call for coatings such as those deposited by electro-plating processes and, in general, the 2A allow-



Limits of Size Showing Tolerances, Allowances (Neutral Space), and Crest Clearances for Unified Classes 1A, 2A, 1B, and 2B



Limits of Size Showing Tolerances and Crest Clearances for Unified Classes 3A and 3B and American National Classes 2 and 3

ance provides adequate undercut for such coatings. There may be variations in thickness and symmetry of coating resulting from commercial processes but after plating the threads should be accepted by a basic Class 3A size GO gage and a Class 2A gage as a NOT-GO gage. Class 1A provides an allowance which is maintained for both coated and uncoated product, i.e., it is not available for coating.

Class 3A does not include an allowance so it is suggested that the limits of size before plating be reduced by the amount of the 2A allowance whenever that allowance is adequate.

No provision is made for overcutting internal threads as coatings on such threads are not generally required. Further, it is very difficult to deposit a significant thickness of coating on the flanks of internal threads. Where a specific thickness of coating is required on an internal thread, it is suggested that the thread be overcut so that the thread as coated will be accepted by a GO thread plug gage of basic size.

This Standard ASME/ANSI B1.1-1989 (R2001) specifies limits of size that pertain whether threads are coated or uncoated. Only in Class 2A threads is an allowance available to accommodate coatings. Thus, in all classes of internal threads and in all Class 1A, 2AG, and 3A external threads, limits of size must be adjusted to provide suitable provision for the desired coating.

For further information concerning dimensional accommodation of coating or plating for 60-degree threads, see Section 7, ASME/ANSI B1.1-1989 (R2001).

**Screw Thread Selection — Combination of Classes.**—Whenever possible, selection should be made from [Table 2](#), Standard Series Unified Screw Threads, preference being given to the Coarse- and Fine- thread Series. If threads in the standard series do not meet the requirements of design, reference should be made to the selected combinations in [Table 3](#). The third expedient is to compute the limits of size from the tolerance tables or tolerance increment tables given in the Standard. The fourth and last resort is calculation by the formulas given in the Standard.

The requirements for screw thread fits for specific applications depend on end use and can be met by specifying the proper combinations of thread classes for the components. For example, a Class 2A external thread may be used with a Class 1B, 2B, or 3B internal thread.

**Pitch Diameter Tolerances, All Classes.**—The pitch diameter tolerances in [Table 3](#) for all classes of the UNC, UNF, 4-UN, 6-UN, and 8-UN series are based on a length of engagement equal to the basic major (nominal) diameter and are applicable for lengths of engagement up to  $1\frac{1}{2}$  diameters.

The pitch diameter tolerances used in [Table 3](#) for all classes of the UNEF, 12-UN, 16-UN, 20-UN, 28-UN, and 32-UN series and the UNS series, are based on a length of engagement of 9 pitches and are applicable for lengths of engagement of from 5 to 15 pitches.

**Screw Thread Designation.**—The basic method of designating a screw thread is used where the standard tolerances or limits of size based on the standard length of engagement are applicable. The designation specifies in sequence the nominal size, number of threads per inch, thread series symbol, thread class symbol, and the gaging system number per ASME/ANSI B1.3M. The nominal size is the basic major diameter and is specified as the fractional diameter, screw number, or their decimal equivalent. Where decimal equivalents are used for size callout, they shall be interpreted as being nominal size designations only and shall have no dimensional significance beyond the fractional size or number designation. The symbol LH is placed after the thread class symbol to indicate a left-hand thread:

*Examples:*

$\frac{1}{4}$ -20 UNC-2A (21) or 0.250-20 UNC-2A (21)

10–32 UNF-2A (22) or 0.190–32 UNF-2A (22)

$\frac{7}{16}$ –20 UNRF-2A (23) or 0.4375–20 UNRF-2A (23)

2–12 UN-2A (21) or 2.000–12 UN-2A (21)

$\frac{1}{4}$ –20 UNC-3A-LH (21) or 0.250–20 UNC-3A-LH (21)

For uncoated standard series threads these designations may optionally be supplemented by the addition of the pitch diameter limits of size.

*Example:*

$\frac{1}{4}$ –20 UNC-2A (21)

PD 0.2164–0.2127 (Optional for uncoated threads)

**Designating Coated Threads.**—For coated (or plated) Class 2A external threads, the basic (max) major and basic (max) pitch diameters are given followed by the words AFTER COATING. The major and pitch diameter limits of size before coating are also given followed by the words BEFORE COATING.

*Example:*

$\frac{3}{4}$ –10 UNC-2A (21)

<sup>a</sup>Major dia 0.7500 max  
PD 0.6850 max

} AFTER COATING

<sup>b</sup>Major dia 0.7482–0.7353  
PD 0.6832–0.6773

} BEFORE COATING

<sup>a</sup> Major and PD values are equal to basic and correspond to those in Table 3 for Class 3A.

<sup>b</sup> Major and PD limits are those in Table 3 for Class 2A.

Certain applications require an allowance for rapid assembly, to permit application of a proper lubricant, or for residual growth due to high-temperature expansion. In such applications where the thread is to be coated and the 2A allowance is not permitted to be consumed by such coating, the thread class symbol is qualified by the addition of the letter G (symbol for allowance) following the class symbol, and the maximum major and maximum pitch diameters are reduced below basic size by the amount of the 2A allowance and followed by the words AFTER COATING. This arrangement ensures that the allowance is maintained. The major and pitch diameter limits of size before coating are also given followed by SPL and BEFORE COATING. For information concerning the designating of this and other special coating conditions reference should be made to American National Standard ASME/ANSI B1.1-1989 (R2001).

**Designating UNS Threads.**—UNS screw threads that have special combinations of diameter and pitch with tolerance to Unified formulation have the basic form designation set out first followed always by the limits of size.

**Designating Multiple Start Threads.**—If a screw thread is of multiple start, it is designated by specifying in sequence the nominal size, pitch (in decimals or threads per inch) and lead (in decimals or fractions).

**Other Special Designations.**—For other special designations including threads with modified limits of size or with special lengths of engagement, reference should be made to American National Standard ASME/ANSI B1.1-1989 (R2001).

**Hole Sizes for Tapping.**—Hole size limits for tapping Classes 1B, 2B, and 3B threads of various lengths of engagement are given in Table 2 on page 1925.

**Internal Thread Minor Diameter Tolerances.**—Internal thread minor diameter tolerances in Table 3 are based on a length of engagement equal to the nominal diameter. For general applications these tolerances are suitable for lengths of engagement up to  $1\frac{1}{2}$  diameters. However, some thread applications have lengths of engagement which are greater than  $1\frac{1}{2}$  diameters or less than the nominal diameter. For such applications it may be advantageous to increase or decrease the tolerance, respectively, as explained in the Tapping Section.



### American Standard for Unified Miniature Screw Threads

This American Standard (B1.10-1958, R1988) introduces a new series to be known as Unified Miniature Screw Threads and intended for general purpose fastening screws and similar uses in watches, instruments, and miniature mechanisms. Use of this series is recommended on all new products in place of the many improvised and unsystematized sizes now in existence which have never achieved broad acceptance nor recognition by standardization bodies. The series covers a diameter range from 0.30 to 1.40 millimeters (0.0118 to 0.0551 inch) and thus supplements the Unified and American thread series which begins at 0.060 inch (number 0 of the machine screw series). It comprises a total of fourteen sizes which, together with their respective pitches, are those endorsed by the American-British-Canadian Conference of April 1955 as the basis for a Unified standard among the inch-using countries, and coincide with the corresponding range of sizes in ISO (International Organization for Standardization) Recommendation No. 68. Additionally, it utilizes thread forms which are compatible in all significant respects with both the Unified and ISO basic thread profiles. Thus, threads in this series are interchangeable with the corresponding sizes in both the American-British-Canadian and ISO standardization programs.

**Basic Form of Thread.**—The basic profile by which the design forms of the threads covered by this standard are governed is shown in Table 1. The thread angle is 60 degrees and except for basic height and depth of engagement which are  $0.52p$ , instead of  $0.54127p$ , the basic profile for this thread standard is identical with the Unified and American basic thread form. The selection of 0.52 as the exact value of the coefficient for the height of this basic form is based on practical manufacturing considerations and a plan evolved to simplify calculations and achieve more precise agreement between the metric and inch dimensional tables.

Products made to this standard will be interchangeable with products made to other standards which allow a maximum depth of engagement (or combined addendum height) of  $0.54127p$ . The resulting difference is negligible (only 0.00025 inch for the coarsest pitch) and is completely offset by practical considerations in tapping, since internal thread heights exceeding  $0.52p$  are avoided in these (Unified Miniature) small thread sizes in order to reduce excessive tap breakage.

**Design Forms of Threads.**—The design (maximum material) forms of the external and internal threads are shown in Table 2. These forms are derived from the basic profile shown in Table 1 by the application of clearances for the crests of the addenda at the roots of the mating dedendum forms. Basic and design form dimensions are given in Table 3.

**Nominal Sizes:** The thread sizes comprising this series and their respective pitches are shown in the first two columns of Table 5. The fourteen sizes shown in Table 5 have been systematically distributed to provide a uniformly proportioned selection over the entire range. They are separated alternately into two categories: The sizes shown in bold type are selections made in the interest of simplification and are those to which it is recommended that usage be confined wherever the circumstances of design permit. Where these sizes do not meet requirements the intermediate sizes shown in light type are available.

**Table 1. Unified Miniature Screw Threads — Basic Thread Form**

Formulas for Basic Thread Form			
Metric units (millimeters) are used in all formulas			
Thread Element	Symbol	Formula	
Angle of thread	$2\alpha$	60°	
Half angle of thread	$\alpha$	30°	
Pitch of thread	$p$		
No. of threads per inch	$n$	$25.4/p$	
Height of sharp V thread	$H$	$0.86603p$	
Addendum of basic thread	$h_{db}$	$0.32476p$	
Height of basic thread	$h_b$	$0.52p$	

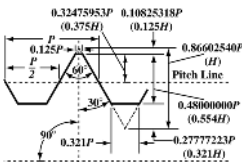
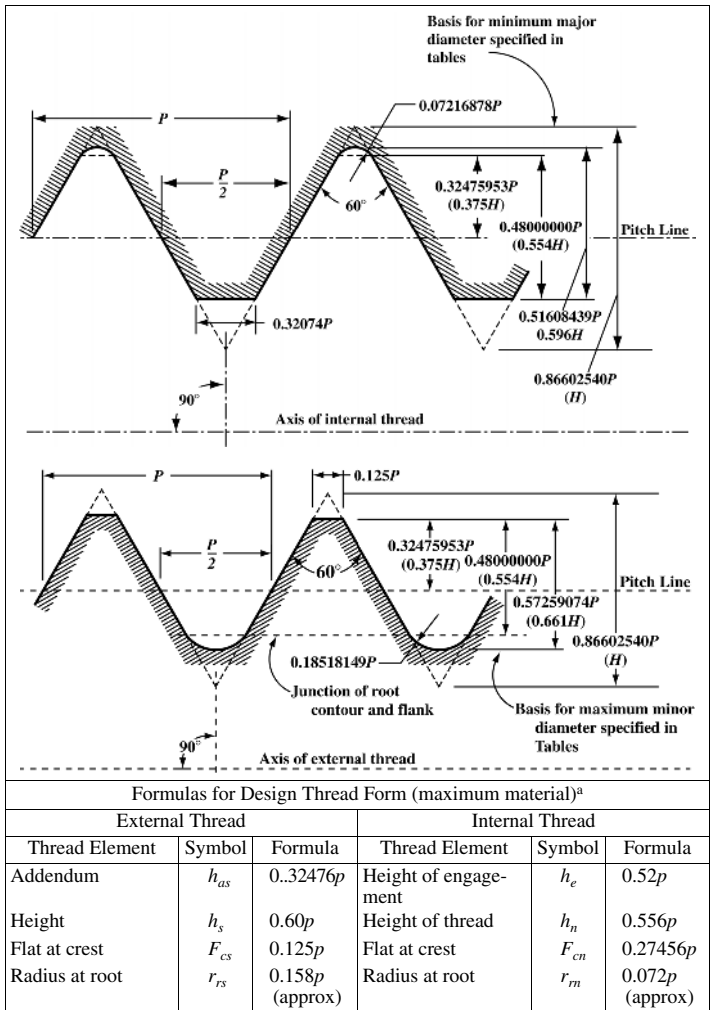


Table 2. Unified Miniature Screw Threads — Design Thread Form



<sup>a</sup> Metric units (millimeters) are used in all formulas.

**Table 3. Unified Miniature Screw Threads—Basic and Design Form Dimensions**

Threads per inch $n^a$	Basic Thread Form				External Thread Design Form			Internal Thread Design Form		
	Pitch $p$	Height of Sharp V $H = 0.86603p$	Height $h_b = 0.52p$	Addendum $h_{ub} = h_{as} = 0.32476p$	Height $h_s = 0.60p$	Flat at Crest $F_{cs} = 0.125p$	Radius at Root $r_{rs} = 0.158p$	Height $h_b = 0.556p$	Flat at Crest $F_{cs} = 0.27456p$	Radius at Root $r_{rs} = 0.072p$
<b>Millimeter Dimensions</b>										
...	.080	.0693	.0416	.0260	.048	.0100	.0126	.0445	.0220	.0058
...	.090	.0779	.0468	.0292	.054	.0112	.0142	.0500	.0247	.0065
...	.100	.0866	.0520	.0325	.060	.0125	.0158	.0556	.0275	.0072
...	.125	.1083	.0650	.0406	.075	.0156	.0198	.0695	.0343	.0090
...	.150	.1299	.0780	.0487	.090	.0188	.0237	.0834	.0412	.0108
...	.175	.1516	.0910	.0568	.105	.0219	.0277	.0973	.0480	.0126
...	.200	.1732	.1040	.0650	.120	.0250	.0316	.1112	.0549	.0144
...	.225	.1949	.1170	.0731	.135	.0281	.0356	.1251	.0618	.0162
...	.250	.2165	.1300	.0812	.150	.0312	.0395	.1390	.0686	.0180
...	.300	.2598	.1560	.0974	.180	.0375	.0474	.1668	.0824	.0216
<b>Inch Dimensions</b>										
317½	.003150	.00273	.00164	.00102	.00189	.00039	.00050	.00175	.00086	.00023
282⅝	.003543	.00307	.00184	.00115	.00213	.00044	.00056	.00197	.00097	.00026
254	.003937	.00341	.00205	.00128	.00236	.00049	.00062	.00219	.00108	.00028
203⅓	.004921	.00426	.00256	.00160	.00295	.00062	.00078	.00274	.00135	.00035
169⅓	.005906	.00511	.00307	.00192	.00354	.00074	.00093	.00328	.00162	.00043
145⅓	.006890	.00597	.00358	.00224	.00413	.00086	.00109	.00383	.00189	.00050
127	.007874	.00682	.00409	.00256	.00472	.00098	.00124	.00438	.00216	.00057
112⅝	.008858	.00767	.00461	.00288	.00531	.00111	.00140	.00493	.00243	.00064
101⅓	.009843	.00852	.00512	.00320	.00591	.00123	.00156	.00547	.00270	.00071
84⅔	.011811	.01023	.00614	.00384	.00709	.00148	.00187	.00657	.00324	.00085

<sup>a</sup>In Tables 5 and 6 these values are shown rounded to the nearest whole number.

**Table 4. Unified Miniature Screw Threads — Formulas for Basic and Design Dimensions and Tolerances**

Formulas for Basic Dimensions	
D = Basic Major Diameter and Nominal Size in millimeters; $p$ = Pitch in millimeters; $E$ = Basic Pitch Diameter in millimeters = $D - 0.64952p$ ; and $K$ = Basic Minor Diameter in millimeters = $D - 1.04p$	
Formulas for Design Dimensions (Maximum Material)	
External Thread	Internal Thread
$D_s$ = Major Diameter = $D$	$D_n$ = Major Diameter = $D + 0.072p$
$E_s$ = Pitch Diameter = $E$	$E_n$ = Pitch Diameter = $E$
$K_s$ = Minor Diameter = $D - 1.20p$	$K_n$ = Minor Diameter = $K$
Formulas for Tolerances on Design Dimensions <sup>a</sup>	
External Thread (-)	Internal Thread (+)
Major Diameter Tol., $0.12p + 0.006$	<sup>b</sup> Major Diameter Tol., $0.168p + 0.008$
Pitch Diameter Tol., $0.08p + 0.008$	Pitch Diameter Tol., $0.08p + 0.008$
<sup>c</sup> Minor Diameter Tol., $0.16p + 0.008$	Minor Diameter Tol., $0.32p + 0.012$

<sup>a</sup>These tolerances are based on lengths of engagement of  $\frac{2}{3}D$  to  $1\frac{1}{2}D$ .

<sup>b</sup>This tolerance establishes the maximum limit of the major diameter of the internal thread. In practice, this limit is applied to the threading tool (tap) and not gaged on the product. Values for this tolerance are, therefore, not given in Table 5.

<sup>c</sup>This tolerance establishes the minimum limit of the minor diameter of the external thread. In practice, this limit is applied to the threading tool and only gaged on the product in confirming new tools. Values for this tolerance are, therefore, not given in Table 5.

Metric units (millimeters) apply in all formulas. Inch tolerances are not derived by direct conversion of the metric values. They are the differences between the rounded off limits of size in inch units.

Table 5. Unified Miniature Screw Threads — Limits of Size and Tolerances

Size Designation <sup>a</sup>	External Threads								Internal Threads				Lead Angle at Basic Pitch Diam.		Sectional Area at Minor Diam. at D — 1.28p	
	Major Diam.		Pitch Diam.		Minor Diam.		Minor Diam.		Pitch Diam.		Major Diam.					
	mm	Max <sup>b</sup> mm	Min mm	Max <sup>b</sup> mm	Min mm	Max <sup>c</sup> mm	Min <sup>d</sup> mm	Min <sup>e</sup> mm	Max mm	Min <sup>b</sup> mm	Max mm	Min <sup>e</sup> mm	Max <sup>d</sup> mm	deg	min	sq mm
<b>0.30 UNM</b>	<b>0.080</b>	<b>0.300</b>	<b>0.284</b>	<b>0.248</b>	<b>0.234</b>	<b>0.204</b>	<b>0.183</b>	<b>0.217</b>	<b>0.254</b>	<b>0.248</b>	<b>0.262</b>	<b>0.306</b>	<b>0.327</b>	<b>5</b>	<b>52</b>	<b>0.0307</b>
0.35 UNM	0.090	0.350	0.333	0.292	0.277	0.242	0.220	0.256	0.297	0.292	0.307	0.356	0.380	5	37	0.0433
<b>0.40 UNM</b>	<b>0.100</b>	<b>0.400</b>	<b>0.382</b>	<b>0.335</b>	<b>0.319</b>	<b>0.280</b>	<b>0.256</b>	<b>0.296</b>	<b>0.340</b>	<b>0.335</b>	<b>0.351</b>	<b>0.407</b>	<b>0.432</b>	<b>5</b>	<b>26</b>	<b>0.0581</b>
0.45 UNM	0.100	0.450	0.432	0.385	0.369	0.330	0.306	0.346	0.390	0.385	0.401	0.457	0.482	4	44	0.0814
<b>0.50 UNM</b>	<b>0.125</b>	<b>0.500</b>	<b>0.479</b>	<b>0.419</b>	<b>0.401</b>	<b>0.350</b>	<b>0.322</b>	<b>0.370</b>	<b>0.422</b>	<b>0.419</b>	<b>0.437</b>	<b>0.509</b>	<b>0.538</b>	<b>5</b>	<b>26</b>	<b>0.0908</b>
0.55 UNM	0.125	0.550	0.529	0.469	0.451	0.400	0.372	0.420	0.472	0.469	0.487	0.559	0.588	4	51	0.1195
<b>0.60 UNM</b>	<b>0.150</b>	<b>0.600</b>	<b>0.576</b>	<b>0.503</b>	<b>0.483</b>	<b>0.420</b>	<b>0.388</b>	<b>0.444</b>	<b>0.504</b>	<b>0.503</b>	<b>0.523</b>	<b>0.611</b>	<b>0.644</b>	<b>5</b>	<b>26</b>	<b>0.1307</b>
0.70 UNM	0.175	0.700	0.673	0.586	0.564	0.490	0.454	0.518	0.586	0.586	0.608	0.713	0.750	5	26	0.1780
<b>0.80 UNM</b>	<b>0.200</b>	<b>0.800</b>	<b>0.770</b>	<b>0.670</b>	<b>0.646</b>	<b>0.560</b>	<b>0.520</b>	<b>0.592</b>	<b>0.668</b>	<b>0.670</b>	<b>0.694</b>	<b>0.814</b>	<b>0.856</b>	<b>5</b>	<b>26</b>	<b>0.232</b>
0.90 UNM	0.225	0.900	0.867	0.754	0.728	0.630	0.586	0.666	0.750	0.754	0.780	0.916	0.962	5	26	0.294
<b>1.00 UNM</b>	<b>0.250</b>	<b>1.000</b>	<b>0.964</b>	<b>0.838</b>	<b>0.810</b>	<b>0.700</b>	<b>0.652</b>	<b>0.740</b>	<b>0.832</b>	<b>0.838</b>	<b>0.866</b>	<b>1.018</b>	<b>1.068</b>	<b>5</b>	<b>26</b>	<b>0.363</b>
1.10 UNM	0.250	1.100	1.064	0.938	0.910	0.800	0.752	0.840	0.932	0.938	0.966	1.118	1.168	4	51	0.478
<b>1.20 UNM</b>	<b>0.250</b>	<b>1.200</b>	<b>1.164</b>	<b>1.038</b>	<b>1.010</b>	<b>0.900</b>	<b>0.852</b>	<b>0.940</b>	<b>1.032</b>	<b>1.038</b>	<b>1.066</b>	<b>1.218</b>	<b>1.268</b>	<b>4</b>	<b>23</b>	<b>0.608</b>
1.40 UNM	0.300	1.400	1.358	1.205	1.173	1.040	0.984	1.088	1.196	1.205	1.237	1.422	1.480	4	32	0.811
	Thds. per in.	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	inch	deg	min	sq in
<b>0.30 UNM</b>	<b>318</b>	<b>0.0118</b>	<b>0.0112</b>	<b>0.0098</b>	<b>0.0092</b>	<b>0.0080</b>	<b>0.0072</b>	<b>0.0085</b>	<b>0.0100</b>	<b>0.0098</b>	<b>0.0104</b>	<b>0.0120</b>	<b>0.0129</b>	<b>5</b>	<b>52</b>	<b>0.0000475</b>
0.35 UNM	282	0.0138	0.0131	0.0115	0.0109	0.0095	0.0086	0.0101	0.0117	0.0115	0.0121	0.0140	0.0149	5	37	0.0000671
<b>0.40 UNM</b>	<b>254</b>	<b>0.0157</b>	<b>0.0150</b>	<b>0.0132</b>	<b>0.0126</b>	<b>0.0110</b>	<b>0.0101</b>	<b>0.0117</b>	<b>0.0134</b>	<b>0.0132</b>	<b>0.0138</b>	<b>0.0160</b>	<b>0.0170</b>	<b>5</b>	<b>26</b>	<b>0.0000901</b>
0.45 UNM	254	0.0177	0.0170	0.0152	0.0145	0.0130	0.0120	0.0136	0.0154	0.0152	0.0158	0.0180	0.0190	4	44	0.0001262
<b>0.50 UNM</b>	<b>203</b>	<b>0.0197</b>	<b>0.0189</b>	<b>0.0165</b>	<b>0.0158</b>	<b>0.0138</b>	<b>0.0127</b>	<b>0.0146</b>	<b>0.0166</b>	<b>0.0165</b>	<b>0.0172</b>	<b>0.0200</b>	<b>0.0212</b>	<b>5</b>	<b>26</b>	<b>0.0001407</b>
0.55 UNM	203	0.0217	0.0208	0.0185	0.0177	0.0157	0.0146	0.0165	0.0186	0.0185	0.0192	0.0220	0.0231	4	51	0.0001852
<b>0.60 UNM</b>	<b>169</b>	<b>0.0236</b>	<b>0.0227</b>	<b>0.0198</b>	<b>0.0190</b>	<b>0.0165</b>	<b>0.0153</b>	<b>0.0175</b>	<b>0.0198</b>	<b>0.0198</b>	<b>0.0206</b>	<b>0.0240</b>	<b>0.0254</b>	<b>5</b>	<b>26</b>	<b>0.000203</b>
0.70 UNM	145	0.0276	0.0265	0.0231	0.0222	0.0193	0.0179	0.0204	0.0231	0.0231	0.0240	0.0281	0.0295	5	26	0.000276
<b>0.80 UNM</b>	<b>127</b>	<b>0.0315</b>	<b>0.0303</b>	<b>0.0264</b>	<b>0.0254</b>	<b>0.0220</b>	<b>0.0205</b>	<b>0.0233</b>	<b>0.0263</b>	<b>0.0264</b>	<b>0.0273</b>	<b>0.0321</b>	<b>0.0337</b>	<b>5</b>	<b>26</b>	<b>0.000360</b>
0.90 UNM	113	0.0354	0.0341	0.0297	0.0287	0.0248	0.0231	0.0262	0.0295	0.0297	0.0307	0.0361	0.0379	5	26	0.000456
<b>1.00 UNM</b>	<b>102</b>	<b>0.0394</b>	<b>0.0380</b>	<b>0.0330</b>	<b>0.0319</b>	<b>0.0276</b>	<b>0.0257</b>	<b>0.0291</b>	<b>0.0327</b>	<b>0.0330</b>	<b>0.0341</b>	<b>0.0401</b>	<b>0.0420</b>	<b>5</b>	<b>26</b>	<b>0.000563</b>
1.10 UNM	102	0.0433	0.0419	0.0369	0.0358	0.0315	0.0296	0.0331	0.0367	0.0369	0.0380	0.0440	0.0460	4	51	0.000741
<b>1.20 UNM</b>	<b>102</b>	<b>0.0472</b>	<b>0.0458</b>	<b>0.0409</b>	<b>0.0397</b>	<b>0.0354</b>	<b>0.0335</b>	<b>0.0370</b>	<b>0.0406</b>	<b>0.0409</b>	<b>0.0420</b>	<b>0.0480</b>	<b>0.0499</b>	<b>4</b>	<b>23</b>	<b>0.000943</b>
1.40 UNM	85	0.0551	0.0535	0.0474	0.0462	0.0409	0.0387	0.0428	0.0471	0.0474	0.0487	0.0560	0.0583	4	32	0.001257

<sup>a</sup> Sizes shown in bold type are preferred.

<sup>b</sup> This is also the basic dimension.

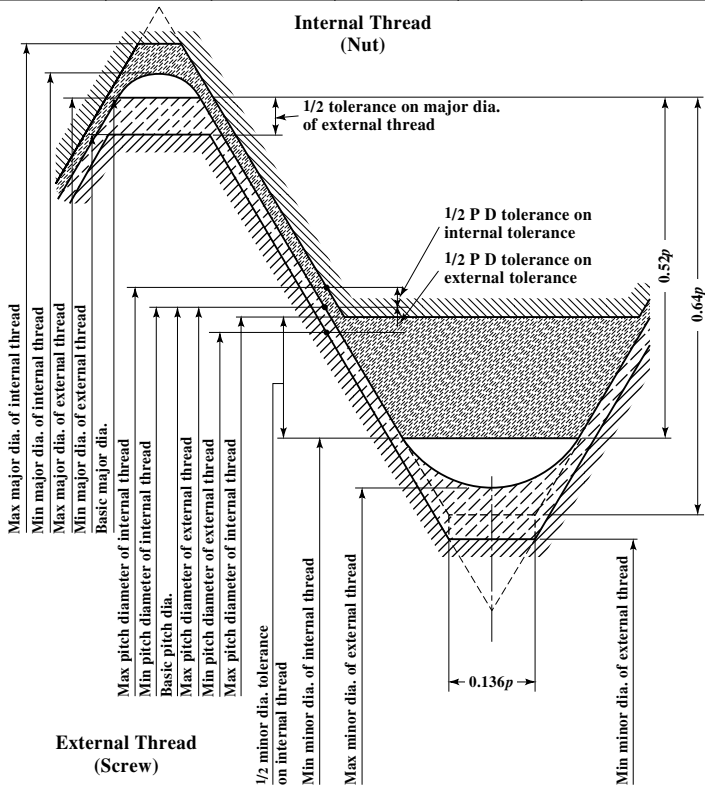
<sup>c</sup> This limit, in conjunction with root form shown in Table 2, is advocated for use when optical projection methods of gaging are employed. For mechanical gaging the minimum minor diameter of the internal thread is applied.

<sup>d</sup> This limit is provided for reference only. In practice, the form of the threading tool is relied upon for this limit.

<sup>e</sup> This limit is provided for reference only, and is not gaged. For gaging, the maximum major diameter of the external thread is applied.

**Table 6. Unified Miniature Screw Threads—  
Minimum Root Flats for External Threads**

Pitch mm	No. of Threads Per Inch	Thread Height for Min. Flat at Root $0.64p$		Minimum Flat at Root $F_{rs} = 0.136p$	
		mm	Inch	mm	Inch
0.080	318	0.0512	0.00202	0.0109	0.00043
0.090	282	0.0576	0.00227	0.0122	0.00048
0.100	254	0.0640	0.00252	0.0136	0.00054
0.125	203	0.0800	0.00315	0.0170	0.00067
0.150	169	0.0960	0.00378	0.0204	0.00080
0.175	145	0.1120	0.00441	0.0238	0.00094
0.200	127	0.1280	0.00504	0.0272	0.00107
0.225	113	0.1440	0.00567	0.0306	0.00120
0.250	102	0.1600	0.00630	0.0340	0.00134
0.300	85	0.1920	0.00756	0.0408	0.00161



Limits of Size Showing Tolerances and Crest Clearances for UNM Threads

*Limits of Size:* Formulas used to determine limits of size are given in [Table 4](#); the limits of size are given in [Table 5](#). The diagram on page [1781](#) illustrates the limits of size and [Table 6](#) gives values for the minimum flat at the root of the external thread shown on the diagram.

*Classes of Threads:* The standard establishes one class of thread with zero allowance on all diameters. When coatings of a measurable thickness are required, they should be included within the maximum material limits of the threads since these limits apply to both coated and uncoated threads.

*Hole Sizes for Tapping:* Suggested hole sizes are given in the Tapping Section.

#### **British Standard Unified Screw Threads of UNJ Basic Profile**

This British Standard B.S. 4084: 1978 arises from a request originating from within the British aircraft industry and is based upon specifications for Unified screw threads and American military standard MIL-S-8879.

These UNJ threads, having an enlarged root radius, were introduced for applications requiring high fatigue strength where working stress levels are high, in order to minimize size and weight, as in aircraft engines, airframes, missiles, space vehicles and similar designs where size and weight are critical. To meet these requirements the root radius of external Unified threads is controlled between appreciably enlarged limits, the minor diameter of the mating internal threads being appropriately increased to insure the necessary clearance. The requirement for high strength is further met by restricting the tolerances for UNJ threads to the highest classes, Classes 3A and 3B, of Unified screw threads.

The standard, not described further here, contains both a coarse and a fine pitch series of threads.

## METRIC SCREW THREADS

### American National Standard Metric Screw Threads M Profile

American National Standard ANSI/ASME B1.13M-1983 (R1995) describes a system of metric threads for general fastening purposes in mechanisms and structures. The standard is in basic agreement with ISO screw standards and resolutions, as of the date of publication, and features detailed information for diameter-pitch combinations selected as to preferred standard sizes. This Standard contains general metric standards for a 60-degree symmetrical screw thread with a basic ISO 68 designated profile.

**Application Comparison with Inch Threads.**—The metric M profile threads of tolerance class 6H/6g (see page 1790) are intended for metric applications where the 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 are 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. It may be noted that a 4H5H/4h6h fit is approximately equivalent to class 3A/3B fit in the inch system.

**Interchangeability with Other System Threads.**—Threads produced to this Standard ANSI/ASME B1.13M are fully interchangeable with threads conforming to other National Standards that are based on ISO 68 basic profile and ISO 965/1 tolerance practices.

Threads produced to this Standard should be mechanically interchangeable with those produced to ANSI B1.18M-1982 (R1987) "Metric Screw Threads for Commercial Mechanical Fasteners—Boundary Profile Defined," of the same size and tolerance class. However, there is a possibility that some parts may be accepted by conventional gages used for threads made to ANSI/ASME B1.13M and rejected by the Double-NOT-GO gages required for threads made to ANSI B1.18M.

Threads produced in accordance with M profile and MJ profile ANSI/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.

**Definitions.**—The following definitions apply to metric screw threads — M profile.

*Allowance:* The minimum nominal clearance between a prescribed dimension and its basic dimension. Allowance is not an ISO metric screw thread term but it is numerically equal to the absolute value of the ISO term *fundamental deviation*.

*Basic Thread Profile:* The cyclical 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 5.)

*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 lower case letters. This Standard uses the term external threads in accordance with United States practice.

*Clearance:* The difference between the size of the internal thread and the size of the external thread when the latter is smaller.

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

**Fit:** The relationship existing between two corresponding external and internal threads with respect to the amount of clearance or interference which is present when they are assembled.

**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. 5.)

**Limiting Profiles:** The limiting M profile for internal threads is shown in Fig. 6. The limiting M profile for external threads is shown in Fig. 7.

**Lower Deviation:** The algebraic difference between the minimum limit of size and the corresponding basic size.

**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 upper case letters. This Standard uses the term *internal thread* in accordance with United States 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., the algebraic 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 the minimum material. On external threads the tolerance is applied negatively. On internal threads the tolerance is applied positively.

**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 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.

**Basic M Profile.**—The basic M thread profile also known as ISO 68 basic profile for metric screw threads is shown in Fig. 1 with associated dimensions listed in Table 3.

**Design M Profile for Internal Thread.**—The design M profile for the internal thread at maximum material condition is the basic ISO 68 profile. It is shown in Fig. 2 with associated thread data listed in Table 3.

**Design M Profile for External Thread.**—The design M profile for the external thread at the no allowance maximum material condition is the basic ISO 68 profile except where a rounded root is required. For the standard 0.125*P* minimum radius, the ISO 68 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 as shown in Fig. 3 with associated thread data in Table 3.

**M Crest and Root Form.**—The form of crest at the major diameter of the external thread is flat, permitting corner rounding. The external thread is truncated 0.125*H* from a sharp crest. The form of the crest at the minor diameter of the internal thread is flat. It is truncated 0.25*H* from a sharp crest.

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

The root profile of the external thread must lie within the "section lined" tolerance zone shown in Fig. 4. For the rounded root thread, the root profile must lie within the "section lined" rounded root tolerance zone shown in Fig. 4. The profile must be a continuous, smoothly blended non-reversing curve, no part of which has a radius of less than 0.125*P*, and 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 root profile of the internal thread must not be smaller than the basic profile. The maximum major diameter must not be sharp.

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

**Table 1. American National Standard Symbols for Metric Threads  
ANSI/ASME B1.13M-1983 (R1995)**

Symbol	Explanation
$D$	Major Diameter Internal Thread
$D_1$	Minor Diameter Internal Thread
$D_2$	Pitch Diameter Internal Thread
$d$	Major Diameter External Thread
$d_1$	Minor Diameter External Thread
$d_2$	Pitch Diameter External Thread
$d_3$	Rounded Form Minor Diameter External Thread
$P$	Pitch
$r$	External Thread Root Radius
$T$	Tolerance
$T_{D1}, T_{D2}$	Tolerances for $D_1, D_2$
$T_d, T_{d2}$	Tolerances for $d, d_2$
$ES$	Upper Deviation, Internal Thread [Equals the Allowance (Fundamental Deviation) Plus the Tolerance]. See Fig. 5.
$EI$	Lower Deviation, Internal Thread Allowance (Fundamental Deviation). See Fig. 5.
$G, H$	Letter Designations for Tolerance Positions for Lower Deviation, Internal Thread
$g, h$	Letter Designations for Tolerance Positions for Upper Deviation, External Thread
$es$	Upper Deviation, External Thread Allowance (Fundamental Deviation). See Fig. 5. In the ISO system $es$ is always negative for an allowance fit or zero for no allowance.
$ei$	Lower Deviation, External Thread [Equals the Allowance (Fundamental Deviation) Plus the Tolerance]. See Fig. 5. In the ISO system $ei$ is always negative for an allowance fit.
$H$	Height of Fundamental Triangle
$LE$	Length of Engagement
$LH$	Left Hand Thread

**Standard M Profile Screw Thread Series.**—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 shown in Table 4. These diameter/pitch combinations are the preferred sizes and should be the first choice as applicable. Additional *fine pitch* diameter/pitch combinations are shown in Table 5.

**Table 2. American National Standard General Purpose and Mechanical Fastener  
Coarse Pitch Metric Thread—M Profile Series ANSI/ASME B1.13M-1983 (R1995)**

Nom.Size	Pitch	Nom.Size	Pitch	Nom.Size	Pitch	Nom.Size	Pitch
1.6	0.35	6	1	22	2.5 <sup>a</sup>	56	5.5
2	0.4	8	1.25	24	3	64	6
2.5	0.45	10	1.5	27	3 <sup>a</sup>	72	6
3	0.5	12	1.75	30	3.5	80	6
3.5	0.6	14	2	36	4	90	6
4	0.7	16	2	42	4.5	100	6
5	0.8	20	2.5	48	5	...	...

<sup>a</sup> For high strength structural steel fasteners only.

All dimensions are in millimeters.

Table 3. American National Standard Metric Thread — M Profile Data ANSI/ASME B1.13M-1983 (R1995)

Pitch $P$	Truncation of Internal Thread and External Thread Crest $\frac{H}{8}$	Addendum of Internal Thread and Truncation of Internal Thread $\frac{H}{4}$	DEDENDUM OF INTERNAL THREAD AND ADDENDUM EXTERNAL THREAD $\frac{3}{8}H$	Difference <sup>a</sup> $\frac{H}{2}$	Height of Internal Thread and Depth of Thread Engagement $\frac{5}{8}H$	Difference <sup>b</sup> $0.711325H$	Twice the External Thread Addendum $\frac{3}{4}H$	Difference <sup>c</sup> $\frac{11}{12}H$	Height of Sharp V-Thread $\frac{H}{4}$	Double Height of Internal Thread $\frac{5}{4}H$
	0.108253P	0.216506P	0.324760P	0.433013P	0.541266P	0.616025P	0.649519P	0.793857P	0.8660254P	1.082532P
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	0.24541	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	0.64952
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	0.64652	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	3.64410	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	1.19078	1.78618	2.38157	2.97696	3.38814	3.57235	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

<sup>a</sup> Difference between max theoretical pitch diameter and max minor diameter of external thread and between min theoretical pitch diameter and min minor diameter of internal thread.

<sup>b</sup> Difference between min theoretical pitch diameter and min design minor diameter of external thread for 0.125P root radius.

<sup>c</sup> Difference between max major diameter and max theoretical pitch diameter of internal thread.

All dimensions are in millimeters.

**Table 4. American National Standard General Purpose and Mechanical Fastener Coarse Pitch Metric Thread—M Profile Series ANSI/ASME B1.13M-1983 (R1995)**

Nom. Size	Pitch	Nom. Size	Pitch	Nom. Size	Pitch	Nom. Size	Pitch
1.6	0.35	6	1	22	2.5 <sup>a</sup>	56	5.5
2	0.4	8	1.25	24	3	64	6
2.5	0.45	10	1.5	27	3 <sup>a</sup>	72	6
3	0.5	12	1.75	30	3.5	80	6
3.5	0.6	14	2	36	4	90	6
4	0.7	16	2	42	4.5	100	6
5	0.8	20	2.5	48	5	...	...

<sup>a</sup> For high strength structural steel fasteners only.

All dimensions are in millimeters.

**Table 5. American National Standard Fine Pitch Metric Thread—M Profile Series ANSI/ASME B1.13M-1983 (R1995)**

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

<sup>a</sup> Only for wheel studs and nuts.

All dimensions are in millimeters.

**Limits and Fits for Metric Screw Threads — M Profile.**—The International (ISO) metric tolerance system is based on a system of limits and fits. The limits of the tolerances on the mating parts together with their allowances (fundamental deviations) determine the fit of the assembly. For simplicity the system is described for cylindrical parts (see *British Standard for Metric ISO Limits and Fits* starting on page 679) but in this Standard it is applied to screw threads. Holes are equivalent to internal threads and shafts to external threads.

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

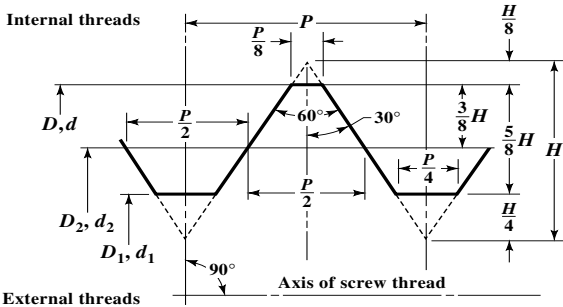
**Upper Deviation:** This is the algebraic difference between the maximum limit of size and the basic size. It is designated by the French term “écart supérieur” (ES for internal and es for external threads).

**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 inférieur” (EI for internal and ei for external threads).

\* Basic,” when used to identify a particular dimension in this Standard, such as basic major diameter, refers to the h/H tolerance position (zero fundamental deviation) value.

*Fundamental Deviations (Allowances):* These are the deviations which are closest to the basic size. In the accompanying figure they would be *EI* and *es*.

*Fits:* Fits are determined by the fundamental deviations assigned to the mating parts and may be positive or negative. The selected fits can be clearance, transition, or interference. To illustrate the fits schematically, a zero line is drawn to represent the basic size as shown in Fig. 5. By convention, the external thread lies below the zero line and the internal thread lies above it (except for interference fits). This makes the fundamental deviation negative for the external thread and equal to its upper deviation (*es*). The fundamental deviation is positive for the internal thread and equal to its lower deviation (*EI*).



$$H = \frac{\sqrt{3}}{2} \times P = 0.866025P$$

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

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

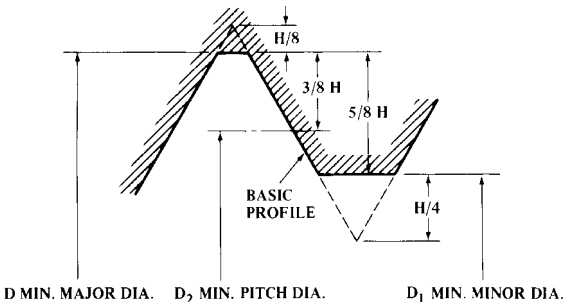


Fig. 2. Internal Thread Design M Profile with No Allowance (Fundamental Deviation) (Maximum Material Condition). For Dimensions see Table 3

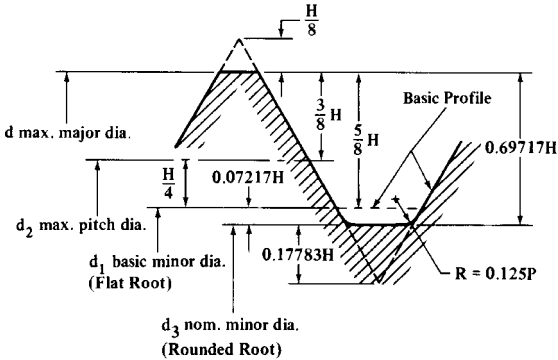


Fig. 3. External Thread Design M Profile with No Allowance (Fundamental Deviation) (Flanks at Maximum Material Condition). For Dimensions see Table 3

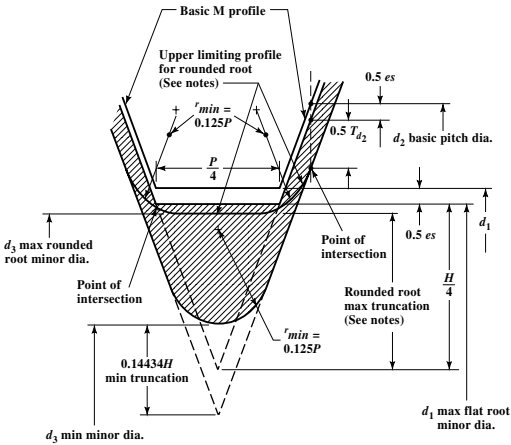


Fig. 4. M Profile, External Thread Root, Upper and Lower Limiting Profiles for  $r_{min} = 0.125 P$  and for Flat Root (Shown for Tolerance Position g)

Notes:

- 1) "Section lined" portions identify tolerance zone and unshaded portions identify allowance (fundamental deviation).
- 2) The upper limiting profile for rounded root is not a design profile; rather it indicates the limiting acceptable condition for the rounded root which will pass a GO thread gage.
- 3) Max truncation =  $\frac{H}{4} - r_{min} \left( 1 - \cos \left[ 60^\circ - \arccos \left( 1 - \frac{T_{d2}}{4r_{min}} \right) \right] \right)$

where

$H$  = Height of fundamental triangle  
 $r_{min}$  = Minimum external thread root radius  
 $T_{d2}$  = Tolerance on pitch diameter of external thread

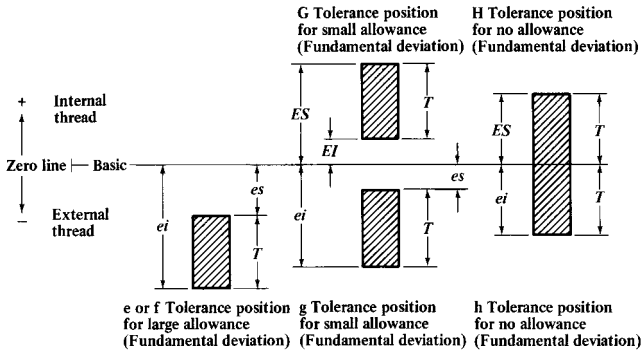


Fig. 5. Metric Tolerance System for Screw Threads

**Tolerance:** The tolerance is defined by a series of numerical grades. Each grade provides numerical values for the various nominal sizes corresponding to the standard tolerance for that grade.

In the schematic diagram the tolerance for the external thread is shown as negative. Thus the tolerance plus the fit define the lower deviation ( $ei$ ). The tolerance for the mating internal thread is shown as positive. Thus the tolerance plus the fit defines the upper deviation ( $ES$ ).

**Tolerance Grade:** This is indicated by a number. The system provides for a series of tolerance grades for each of the four screw thread parameters: minor diameter, internal thread,  $D_1$ ; major diameter, external thread,  $d$ ; pitch diameter, internal thread,  $D_2$ ; and pitch diameter, external thread,  $d_2$ . The tolerance grades for this Standard ANSI B1.13M were selected from those given in ISO 965/1.

Dimension	Tolerance Grades	Table
$D_1$	4, 5, <u>6</u> , 7, 8	<a href="#">Table 8</a>
$d$	4, <u>6</u> , 8	<a href="#">Table 9</a>
$D_2$	4, 5, <u>6</u> , 7, 8	<a href="#">Table 10</a>
$d_2$	3, <u>4</u> , 5, <u>6</u> , 7, 8, 9	<a href="#">Table 11</a>

*Note:* The underlined tolerance grades are used with normal length of thread engagement.

**Tolerance Position:** This position is the allowance (fundamental deviation) and is indicated by a letter. A capital letter is used for internal threads and a lower case letter for external threads. The system provides a series of tolerance positions for internal and external threads. The underlined letters are used in this Standard:

Internal threads	G, <u>H</u>	<a href="#">Table 6</a>
External threads	e, f, <u>g</u> , h	<a href="#">Table 6</a>

**Designations of Tolerance Grade, Tolerance Position, and Tolerance Class:** The tolerance grade is given first followed by the tolerance position, thus: 4g or 5H. To designate the tolerance class the grade and position of the pitch diameter is shown first followed by that for the major diameter in the case of the external thread or that for the minor diameter in the case of the internal thread, thus 4g6g for an external thread and 5H6H for an internal thread. If the two grades and positions are identical, it is not necessary to repeat the symbols, thus 4g, alone, stands for 4g4g and 5H, alone, stands for 5H5H.

**Table 6. American National Standard Allowance (Fundamental Deviation) for Internal and External Metric Threads**  
*ISO 965/1 ANSI/ASME B1.13M-1983 (R1995)*

Pitch <i>P</i>	Allowance (Fundamental Deviation) <sup>a</sup>					
	Internal Thread <i>D<sub>2</sub>, D<sub>1</sub></i>		External Thread <i>d, d<sub>2</sub></i>			
	G	H	e	f	g	h
	<i>EI</i>	<i>EI</i>	<i>es</i>	<i>es</i>	<i>es</i>	<i>es</i>
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

All dimensions are in millimeters.

<sup>a</sup> Allowance is the absolute value of fundamental deviation.

**Lead and Flank Angle Tolerances:** For acceptance of lead and flank angles of product screw threads, see Section 10 of ANSI/ASME B1.13M-1983 (R1995).

**Short and Long Lengths of Thread Engagement when Gaged with Normal Length Contacts:** For short lengths of thread engagement, LE, reduce the pitch diameter tolerance of the external thread by one tolerance grade number. For long lengths of thread engagement, LE, increase the allowance (fundamental deviation) at the pitch diameter of the external thread. Examples of tolerance classes required for normal, short, and long gage length contacts are given in the following table.

Normal LE	Short LE	Long LE
6g	5g6g	6e6g
4g6g	3g6g	4e6g
6h <sup>a</sup>	5h6h	6g6h
4h6h <sup>a</sup>	3h6h	4g6h

<sup>a</sup> Applies to maximum material functional size (GO thread gage) for plated 6g and 4g6g class threads, respectively.

For lengths of thread engagement classified as normal, short, and long, see [Table 7](#).

**Coated or Plated Threads:** Coating is one or more applications of additive material to the threads, including dry-film lubricants, but excluding soft or liquid lubricants that are readily displaced in assembly or gaging. Plating is included as coating in the Standard.

**Table 7. American National Standard Length of Metric Thread Engagement**  
*ISO 965/1 and ANSI/ASME B1.13M-1983 (R1995)*

Basic Major Diameter $d_{\text{bsc}}$		Pitch $P$	Length of Thread Engagement			
			Short LE	Normal LE		Long LE
Over	Up to and incl.		Up to and incl.	Over	Up to and incl.	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
5.6	11.2	0.8	2.5	2.5	7.5	7.5
		0.75	2.4	2.4	7.1	7.1
		1	3	3	9	9
		1.25	4	4	12	12
11.2	22.4	1.5	5	5	15	15
		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
22.4	45	2	8	8	24	24
		2.5	10	10	30	30
		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
45	90	3.5	15	15	45	45
		4	18	18	53	53
		4.5	21	21	63	63
		1.5	7.5	7.5	22	22
		2	9.5	9.5	28	28
		3	15	15	45	45
90	180	4	19	19	56	56
		5	24	24	71	71
		5.5	28	28	85	85
		6	32	32	95	95
		2	12	12	36	36
180	355	3	18	18	53	53
		4	24	24	71	71
		6	36	36	106	106
		3	20	20	60	60
		4	26	26	80	80
		6	40	40	118	118

All dimensions are in millimeters.

Unless otherwise specified, size limits for standard external 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 no more than one-quarter of the allowance. Thus, the thread after coating is subject to acceptance using a basic (tolerance position h) size GO thread gage and tolerance position g thread gage for either minimum material, LO, or NOT-GO. Where the external thread has no allowance or the 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 6 for position G or g, respectively, should be applied wherever possible.

**Dimensional Effect of Coating.**—On a cylindrical surface, the effect of coating is to change the diameter by twice the coating thickness. On a 60-degree thread, however, since the coating thickness is measured perpendicular to the thread surface while the pitch diameter is measured perpendicular to the thread axis, the effect of a uniformly coated flank on the pitch diameter is to change it by four times the thickness of the coating on the flank.

*External Thread with No Allowance for Coating:* To determine gaging limits before coating for a uniformly coated thread, decrease: 1) maximum pitch diameter by four times maximum coating thickness; 2) minimum pitch diameter by four times minimum coating thickness; 3) maximum major diameter by two times maximum coating thickness; and 4) minimum major diameter by two times minimum coating thickness.

*External Thread with Only Nominal or Minimum Thickness Coating:* If no coating thickness tolerance is given, it is recommended that a tolerance of plus 50 per cent of the nominal or minimum thickness be assumed.

Then, to determine before coating gaging limits for a uniformly coated thread, decrease: 1) maximum pitch diameter by six times coating thickness; 2) minimum pitch diameter by four times coating thickness; 3) maximum major diameter by three times coating thickness; and 4) minimum major diameter by two times coating thickness.

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

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

*Internal Threads:* Standard internal threads provide no allowance for coating thickness.

To determine before coating, gaging limits for a uniformly coated thread, increase: 1) minimum pitch diameter by four times maximum coating thickness, if specified, or by six times minimum or nominal coating thickness when a tolerance is not specified; 2) maximum pitch diameter by four times minimum or nominal coating thickness; 3) minimum minor diameter by two times maximum coating thickness, if specified, or by three times minimum or nominal coating thickness; and 4) maximum minor diameter by two times minimum or nominal coating thickness.

**Other Considerations.**—It is essential to review all possibilities adequately and consider limitations in the threading and coating production processes before finally deciding on the coating process and the allowance required to accommodate the coating. A no-allowance thread after coating must not transgress the basic profile and is, therefore, subject to acceptance using a basic (tolerance position H/h) size GO thread gage.

**Formulas for M Profile Screw Thread Limiting Dimensions.**—The limiting dimensions for M profile screw threads are calculated from the following formulas.

**Internal Threads:**

*Min major dia.* = basic major dia. +  $EI$  (Table 6)

*Min pitch dia.* = basic major dia. -  $0.649519P$  (Table 3) +  $EI$  for  $D_2$  (Table 6)

*Max pitch dia.* = min pitch dia. +  $T_{D_2}$  (Table 10)

*Max major dia.* = max pitch dia. +  $0.793857P$  (Table 3)

*Min minor dia.* = min major dia. -  $1.082532P$  (Table 3)

*Max minor dia.* = min minor dia. +  $T_{D_1}$  (Table 8)

**External Threads:**

*Max major dia.* = basic major dia. -  $es$  (Table 6) (Note that  $es$  is an absolute value.)

*Min major dia.* = max major dia. -  $T_d$  (Table 9)

*Max pitch dia.* = basic major dia. -  $0.649519P$  (Table 3) -  $es$  for  $d_2$  (Table 6)

*Min pitch dia.* = max pitch dia. -  $T_{d_2}$  (Table 11)

*Max flat form minor dia.* = max pitch dia. -  $0.433013P$  (Table 3)

*Max rounded root minor dia.* = max pitch dia. -  $2 \times$  max trunc. (See Fig. 4)

*Min rounded root minor dia.* = min pitch dia. -  $0.616025P$  (Table 3)

*Min root radius* =  $0.125P$

**Table 8. ANSI Standard Minor Diameter Tolerances of Internal Metric Threads  $T_{D1}$  ISO 965/1 ANSI/ASME B1.13M-1983 (R1995)**

Pitch $P$	Tolerance Grade				
	4	5	6	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

All dimensions are in millimeters.

**Table 9. ANSI Standard Major Diameter Tolerances of External Metric Threads,  $T_d$  ISO 965/1 ANSI/ASME B1.13M-1983 (R1995)**

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

All dimensions are in millimeters.

**Table 10. ANSI Standard Pitch-Diameter Tolerances of Internal Metric Threads,  $T_{D2}$  ISO 965/1 ANSI/ASME B1.13M-1983 (R1995)**

Basic Major Diameter, $D$		Pitch $P$	Tolerance Grade				
Over	Up to and incl.		4	5	6	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

**Table 10. (Continued) ANSI Standard Pitch-Diameter Tolerances of Internal Metric Threads,  $T_{D2}$  ISO 965/1 ANSI/ASME B1.13M-1983 (R1995)**

Basic Major Diameter, $D$		Pitch $P$	Tolerance Grade				
Over	Up to and incl.		4	5	6	7	8
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
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

All dimensions are in millimeters.

**Table 11. ANSI Standard Pitch-Diameter Tolerances of External Metric Threads,  $T_{d2}$  ISO 965/1 ANSI/ASME B1.13M-1983 (R1995)**

Basic Major Diameter, $d$		Pitch $P$	Tolerance Grade						
Over	Up to and incl.		3	4	5	6	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	...	...
5.6	11.2	0.8	0.048	0.060	0.075	0.095	0.118	0.150	0.190
		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
11.2	22.4	1.5	0.067	0.085	0.106	0.132	0.170	0.212	0.265
		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
22.4	45	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
		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
45	90	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
90	180	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
180	355	6	0.140	0.180	0.224	0.280	0.355	0.450	0.560
		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
180	355	6	0.150	0.190	0.236	0.300	0.375	0.475	0.600
		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
180	355	6	0.160	0.200	0.250	0.315	0.400	0.500	0.630

All dimensions are in millimeters.

**Tolerance Grade Comparisons.**—The approximate ratios of the tolerance grades shown in Tables 8, 9, 10, and 11 in terms of Grade 6 are as follows:

*Minor Diameter Tolerance of Internal Thread:*  $T_{D_1}$  (Table 8): Grade 4 is  $0.63 T_{D_1}$  (6); Grade 5 is  $0.8 T_{D_1}$  (6); Grade 7 is  $1.25 T_{D_1}$  (6); and Grade 8 is  $1.6 T_{D_1}$  (6).

*Pitch Diameter Tolerance of Internal Thread:*  $T_{D_2}$  (Table 10): Grade 4 is  $0.85 T_{D_2}$  (6); Grade 5 is  $1.06 T_{D_2}$  (6); Grade 6 is  $1.32 T_{D_2}$  (6); Grade 7 is  $1.7 T_{D_2}$  (6); and Grade 8 is  $2.12 T_{D_2}$  (6). It should be noted that these ratios are in terms of the Grade 6 pitch diameter tolerance for the external thread.

*Major Diameter Tolerance of External Thread:*  $T_d$  (Table 9): Grade 4 is  $0.63 T_d$  (6); and Grade 8 is  $1.6 T_d$  (6).

*Pitch Diameter Tolerance of External Thread:*  $T_{d_2}$  (Table 11): Grade 3 is  $0.5 T_{d_2}$  (6); Grade 4 is  $0.63 T_{d_2}$  (6); Grade 5 is  $0.8 T_{d_2}$  (6); Grade 7 is  $1.25 T_{d_2}$  (6); Grade 8 is  $1.6 T_{d_2}$  (6); and Grade 9 is  $2 T_{d_2}$  (6).

**Standard M Profile Screw Threads, Limits of Size.**—The limiting M profile for internal threads is shown in Fig. 6 with associated dimensions for standard sizes in Table 12. The limiting M profiles for external threads are shown in Fig. 7 with associated dimensions for standard sizes in Table 13.

If the required values are not listed in these tables, they may be calculated using the data in Tables 3, 6, 7, 8, 9, 10, and 11 together with the preceding formulas. If the required data are not included in any of the tables listed above, reference should be made to Sections 6 and 9.3 of ANSI/ASME B1.13M, which gives design formulas.

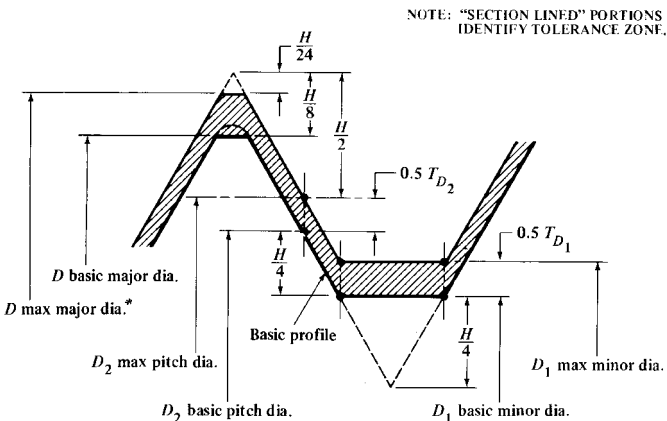
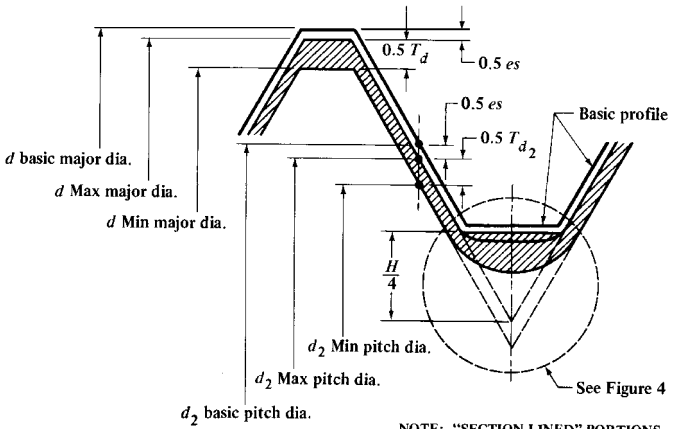


Fig. 6. Internal Thread—Limiting M Profile. Tolerance Position H

\*This dimension is used in the design of tools, etc. For internal threads it is not normally specified. Generally, major diameter acceptance is based on maximum material condition gaging.

METRIC SCREW THREADS M PROFILE



NOTE: "SECTION LINED" PORTIONS IDENTIFY TOLERANCE ZONE AND UNSHADED PORTIONS IDENTIFY ALLOWANCE (FUNDAMENTAL DEVIATION)

Fig. 7. External Thread — Limiting M Profile. Tolerance Position g

Table 12. Internal Metric Thread - M Profile Limiting Dimensions, ANSI/ASME B1.13M-1983 (R1995)

Basic Thread Designation	Toler. Class	Minor Diameter $D_1$		Pitch Diameter $D_2$			Major Diameter $D$	
		Min	Max	Min	Max	Tol	Min	Max <sup>a</sup>
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	3.699
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	10.396
M10 × 1.25	6H	8.647	8.912	9.188	9.348	0.160	10.000	10.340
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	12.453
M12 × 1.5	6H	10.376	10.676	11.026	11.216	0.190	12.000	12.406
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	14.406
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	16.406
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	18.406
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	20.406
M20 × 1	6H	18.917	19.153	19.350	19.510	0.160	20.000	20.304

**Table 12. (Continued) Internal Metric Thread - M Profile Limiting Dimensions, ANSI/ASME B1.13M-1983 (R1995)**

Basic Thread Designation	Toler. Class	Minor Diameter $D_1$		Pitch Diameter $D_2$			Major Diameter $D$	
		Min	Max	Min	Max	Tol	Min	Max <sup>a</sup>
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	22.406
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	25.416
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	30.785
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	30.416
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	35.416
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	40.416
M42 × 4.5	6H	37.129	37.799	39.077	39.392	0.315	42.000	42.965
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	45.416
M48 × 5	6H	42.587	43.297	44.752	45.087	0.335	48.000	49.057
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	50.428
M55 × 1.5	6H	53.376	53.676	54.026	54.238	0.212	55.000	55.428
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	60.428
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	65.428
M70 × 1.5	6H	68.376	68.676	69.026	69.238	0.212	70.000	70.428
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	75.428
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	80.428
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

<sup>a</sup> This reference dimension is used in design of tools, etc., and is not normally specified. Generally, major diameter acceptance is based upon maximum material condition gaging.

All dimensions are in millimeters.

**Table 13. External Metric Thread—M Profile Limiting Dimensions ANSI/ASME B1.13M-1983 (R1995)**

Basic Thread Desig.	Toler. Class	Allow. $es^a$	Major Diam. <sup>b</sup> $d$		Pitch Diam. <sup>b</sup> $d_2$			Minor-Diam. <sup>b</sup> $d_1$	Minor Diam. <sup>c</sup> $d_3$
			Max	Min	Max	Min	Tol.	Max	Min
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	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	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	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	2.439	2.272
M3 × 0.5	4g6g	0.020	2.980	2.874	2.655	2.607	0.048	2.439	2.299
M3.5 × 0.6	6g	0.021	3.479	3.354	3.089	3.004	0.085	2.829	2.635
M3.5 × 0.6	4g6g	0.021	3.479	3.354	3.089	3.036	0.053	2.829	2.667
M4 × 0.7	6g	0.022	3.978	3.838	3.523	3.433	0.090	3.220	3.002
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	3.869
M5 × 0.8	4g6g	0.024	4.976	4.826	4.456	4.396	0.060	4.110	3.904
M6 × 1	6g	0.026	5.974	5.794	5.324	5.212	0.112	4.891	4.596
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	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	4g6g	0.026	7.974	7.794	7.324	7.253	0.071	6.891	6.637
M10 × 1.5	6g	0.032	9.968	9.732	8.994	8.862	0.132	8.344	7.938
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	4g6g	0.028	9.972	9.760	9.160	9.085	0.075	8.619	8.315
M10 × 0.75	6g	0.022	9.978	9.838	9.491	9.391	0.100	9.166	8.929
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	10.072	9.601
M12 × 1.75	4g6g	0.034	11.966	11.701	10.829	10.734	0.095	10.072	9.656
M12 × 1.5	6g	0.032	11.968	11.732	10.994	10.854	0.140	10.344	9.930
M12 × 1.25	6g	0.028	11.972	11.760	11.160	11.028	0.132	10.619	10.258
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	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	12.563	0.100	11.797	11.271
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	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	4g6g	0.026	14.974	14.794	14.324	14.249	0.075	13.891	13.633
M16 × 2	6g	0.038	15.962	15.682	14.663	14.503	0.160	13.797	13.271
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	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	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	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	17.252	16.624
M20 × 2.5	4g6g	0.042	19.958	19.623	18.334	18.228	0.106	17.252	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	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	4g6g	0.026	19.974	19.794	19.324	19.249	0.075	18.891	18.633
M22 × 2.5	6g	0.042	21.9587	21.623	20.334	20.164	0.170	19.252	18.624
M22 × 1.5	6g	0.032	21.968	21.732	20.994	20.854	0.140	20.344	19.930
M22 × 1.5	4g6g	0.032	21.968	21.732	20.994	20.904	0.090	20.344	19.980



**Table 13. (Continued) External Metric Thread—M Profile Limiting Dimensions ANSI/ASME B1.13M-1983 (R1995)**

Basic Thread Desig.	Toler. Class	Allow. $e_s^a$	Major Diam. <sup>b</sup> $d$		Pitch Diam. <sup>b</sup> $d_2$			Minor-Diam. <sup>a,d</sup> <sub>1</sub> <sup>b</sup>	Minor Diam. <sup>a,d</sup> <sub>3</sub> <sup>c</sup>
			Max	Min	Max	Min	Tol.	Max	Min
			M24 × 3	6g	0.048	23.952	23.577	22.003	21.803
M24 × 3	4g6g	0.048	23.952	23.557	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	4g6g	0.038	23.962	23.682	22.663	22.557	0.106	21.797	21.325
M25 × 1.5	6g	0.032	24.968	24.732	23.994	23.844	0.150	23.344	22.920
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 × 2	6g	0.038	26.962	26.682	25.663	25.493	0.170	24.797	24.261
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	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	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	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	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	33.920
M36 × 4	6g	0.060	35.940	35.465	33.342	33.118	0.224	31.610	30.654
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	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	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	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	37.066	36.006
M42 × 4.5	4g6g	0.063	41.937	41.437	39.014	38.864	0.150	37.066	36.092
M42 × 2	6g	0.038	41.962	41.682	40.663	40.493	0.170	39.797	39.261
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	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	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	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	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	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	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	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	4g6g	0.032	59.968	59.732	58.994	58.894	0.100	58.344	57.970
M64 × 6	6g	0.080	63.920	63.320	60.023	59.743	0.280	57.425	56.047
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	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	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	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	4g6g	0.080	71.920	71.320	68.023	67.843	0.180	65.425	64.147

**Table 13. (Continued) External Metric Thread—M Profile Limiting Dimensions ANSI/ASME B1.13M-1983 (R1995)**

Basic Thread Desig.	Toler. Class	Allow. $e_s^a$	Major Diam. <sup>b</sup> $d$		Pitch Diam. <sup>b</sup> $d_2$			Minor-Diam.. <sup>a,b</sup> $d_1$	Minor Diam.. <sup>a,c</sup> $d_2$
			Max	Min	Max	Min	Tol.	Max	Min
M72 × 2	6g	0.038	71.962	71.682	70.663	70.483	0.180	69.797	69.251
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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	4g6g	0.038	139.962	139.682	138.663	138.545	0.118	137.797	137.313
M150 × 2	6g	0.038	149.962	149.682	148.663	148.473	0.190	147.797	147.241
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	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	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	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	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	4g6g	0.048	199.952	199.577	198.003	197.843	0.160	196.704	195.995

<sup>a</sup>  $e_s$  is an absolute value.

<sup>b</sup> (Flat form) For screw threads at maximum limits of tolerance position  $h$ , add the absolute value  $e_s$  to the maximum diameters required. For maximum major diameter this value is the basic thread size listed in Table 12 as Minimum Major Diameter ( $D_{1min}$ ); for maximum pitch diameter this value is the same as listed in Table 12 as Minimum Pitch Diameter ( $D_{2min}$ ); and for maximum minor diameter this value is the same as listed in Table 12 as Minimum Minor Diameter ( $D_{1min}$ ).

<sup>c</sup> (Rounded form) This reference dimension is used in the design of tools, etc. In dimensioning external threads it is not normally specified. Generally minor diameter acceptance is based upon maximum material condition gaging.

All dimensions are in millimeters.

**Metric Screw Thread Designations.**—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 metric screw threads is to leave off the pitch. Thus a M14 × 2 thread is designated just M14. However, to prevent misunderstanding, it is mandatory to use the value for pitch in all designations.

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

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

*Examples:* External thread of M profile, right hand: M6 × 1 – 4g6g (22)  
Internal thread of M profile, right hand: M6 × 1 – 5H6H (21)

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

*Example:* M6 × 1 – 5H6H – LH (23)

*Designation for 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)

*Designation 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 is followed by the abbreviations EXT or INT in capital letters.

*Examples:* M6 × 1 – 4G6G EXT; M6 × 1 – 6H INT

*Designation for Thread Fit:* A fit between mating threads is indicated by the internal thread tolerance class followed by the external thread tolerance class and separated by a slash.

*Examples:* M6 × 1 – 6H/6g; M6 × 1 – 6H/4g6g

*Designation for Rounded Root External Thread:* The M profile with a minimum root radius of 0.125P on the external thread is desirable for all threads but is mandatory for threaded mechanical fasteners of ISO 898/I property class 8.8 (minimum tensile strength 800 MPa) and stronger. No special designation is required for these threads. Other parts requiring a 0.125P root radius must have that radius specified.

When a special rounded root is required, its external thread designation is suffixed by the minimum root radius value in millimeters and the letter R.

*Example:* M42 × 4.5 – 6g – 0.63R

*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.

*Examples:*

External thread M profile, major diameter reduced 0.075 mm. M6 × 1 – 4h6h MOD Major dia = 5.745 – 5.925 MOD	Internal thread M profile, minor diameter increased 0.075 mm. M6 × 1 – 4H5H MOD Minor dia = 5.101 – 5.291 MOD
---	---

*Designation of Special Threads:* Special diameter-pitch threads developed in accordance with this Standard ANSI/ASME B1.13M are identified by the letters SPL following the tolerance class. The limits of size for the major diameter, pitch diameter, and minor diameter are specified below this designation.

*Examples:*

External thread	Internal thread
M6.5 × 1 – 4h6h – SPL (22)	M6.5 × 1 – 4H5H – SPL (23)
Major dia = 6.320 – 6.500	Major dia = 6.500 min
Pitch dia = 5.779 – 5.850	Pitch dia = 5.850 – 5.945
Minor dia = 5.163 – 5.386	Minor dia = 5.417 – 5.607

*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, dash, P for pitch, pitch value, dash, tolerance class, parenthesis, script number of starts, and the word starts, close parenthesis.

*Examples:* M16 × L4 – P2 – 4h6h (TWO STARTS)  
M14 × L6 – P2 – 6H (THREE STARTS)

*Designation of Coated or Plated Threads:* In designating coated or plated M threads the tolerance class should be specified as 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 must 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

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 minor and pitch diameters of internal threads or major and pitch diameters for external threads before coating or plating.

*Example:* Allowance on external thread M profile based on 0.010 mm minimum coating thickness.

M6 × 1 – 4h6h – AFTER COATING  
BEFORE COATING  
Major dia = 5.780 – 5.940  
Pitch dia = 5.239 – 5.290

**Metric Screw Threads—MJ Profile**

The MJ screw thread is intended for aerospace metric threaded parts and for other highly stressed applications requiring high temperature or high fatigue strength, or for “no allowance” applications. The MJ profile thread is a hard metric version similar to the UNJ inch standards, ANSI/ASME B1.15 and MIL-S-8879. The MJ profile thread has a 0.15011P to 0.180424P controlled root radius in the external thread and the internal thread minor diameter truncated to accommodate the external thread maximum root radius.

First issued in 1978, the American National Standard ANSI/ASME B1.21M-1997 establishes the basic triangular profile for the MJ form of thread; gives a system of designations; lists the standard series of diameter-pitch combinations for diameters from 1.6 to 200 mm; and specifies limiting dimensions and tolerances. Changes included in the 1997 revision are the addition of tolerance class 4G6G and 4G5G/4g6g comparable to ANSI/ASME B1.15 (UNJ thread); the addition of tolerance class 6H/6g comparable to ANSI/ASME B1.13M; and changes in the rounding procedure as set forth in ANSI/ASME B1.30M.

**Diameter-Pitch Combinations.**—This Standard includes a selected series of diameter-pitch combinations of threads taken from International Standard ISO 261 plus some additional sizes in the constant pitch series. These are given in [Table 1](#). It also includes the standard series of diameter-pitch combinations for aerospace screws, bolts, nuts, and fluid system fittings as shown in [Table 2](#).

**Table 1. ANSI Standard Metric Screw Threads MJ Profile  
Diameter-Pitch Combinations ANSI/ASME B1.21M-1997**

Nominal Diameter		Pitches		Nominal Diameter		Pitches	
Choices		Coarse	Fine	Choices		Coarse	Fine
1st	2nd			1st	2nd		
1.6	...	0.35	...	...	52	...	3, 2, 1.5
...	1.8	0.35	...	55	...	...	3, 2, 1.5
2.0	...	0.4	...	...	56	5.5	3, 2, 1.5
...	2.2	0.45	...	...	58	...	3, 2, 1.5
2.5	...	0.45	...	60	...	...	3, 2, 1.5
3	...	0.5	...	...	62	...	3, 2, 1.5
3.5	...	0.6	...	...	64	6	3, 2, 1.5
4	...	0.7	...	65	...	...	3, 2, 1.5
...	4.5	0.75	...	...	68	...	3, 2, 1.5
5	...	0.8	...	70	...	...	3, 2, 1.5
6	...	1	0.75	...	72	6	3, 2, 1.5
7	...	1	0.75	75	...	...	3, 2, 1.5
8	...	1.25	1, 0.75	...	76	...	3, 2, 1.5
...	9	1.25	1, 0.75	...	78	...	3 <sup>a</sup> , 2, 1.5 <sup>a</sup>
10	...	1.5	1.25, 1, 0.75	80	...	6	3, 2, 1.5
...	11	1.5	1.25 <sup>b</sup> , 1, 0.75	...	82	...	3 <sup>a</sup> , 2, 1.5 <sup>a</sup>
12	...	1.75	1.5, 1.25, 1	85	...	...	3, 2, 1.5 <sup>a</sup>
14	...	2	1.5, 1.25 <sup>c</sup> , 1	90	...	6	3, 2, 1.5 <sup>a</sup>
...	15	...	1.5, 1	95	...	...	3, 2, 1.5 <sup>a</sup>
16	...	2	1.5, 1	100	...	6	3, 2, 1.5 <sup>a</sup>
...	17	...	1.5, 1	105	...	...	3, 2, 1.5 <sup>a</sup>
18	...	2.5	2, 1.5, 1	110	...	...	3, 2, 1.5 <sup>a</sup>
20	...	2.5	2, 1.5, 1	...	115	...	3, 2, 1.5 <sup>a</sup>
22	...	2.5	2, 1.5, 1	120	...	...	3, 2, 1.5 <sup>a</sup>
24	...	3	2, 1.5, 1	...	125	...	3, 2, 1.5 <sup>a</sup>
...	25	...	2, 1.5, 1	130	...	...	3, 2, 1.5 <sup>a</sup>
...	26	...	1.5	...	135	...	3, 2, 1.5 <sup>a</sup>
27	...	3	2, 1.5, 1	140	...	...	3, 2, 1.5 <sup>a</sup>
...	28	...	2, 1.5, 1	...	145	...	3, 2, 1.5 <sup>a</sup>
30	...	3.5	3, 2, 1.5, 1	150	...	...	3, 2, 1.5 <sup>a</sup>
...	32	...	2, 1.5	...	155	...	3
33	...	...	3, 2, 1.5	160	...	...	3
...	35	...	1.5	...	165	...	3
36	...	4	3, 2, 1.5	170	...	...	3
...	38	...	1.5	...	175	...	3
39	...	...	3, 2, 1.5	180	...	...	3
...	40	...	3, 2, 1.5	...	185	...	3
...	42	4.5	3, 2, 1.5	190	...	...	3
45	...	...	3, 2, 1.5	...	195	...	3
...	48	5	3, 2, 1.5	200	...	...	3
50	...	...	3, 2, 1.5	...	...	...	...

<sup>a</sup>Not included in ISO 261.<sup>b</sup>Only for aircraft control cable fittings.<sup>c</sup>Only for spark plugs for engines.

All dimensions are in millimeters. Pitches in parentheses ( ) are to be avoided as far as possible.

**Table 2. ANSI Standard Metric Screw Threads MJ Profile, Diameter-Pitch Combinations for Aerospace ANSI/ASME B1.21M-1997**

Aerospace Screws, Bolts and Nuts								Aerospace Fluid System Fittings					
Nom. Size <sup>a</sup>	Pitch	Nom. Size	Pitch	Nom. Size	Pitch	Nom. Size	Pitch	Nom. Size	Pitch	Nom. Size	Pitch	Nom. Size	Pitch
1.6	0.35	5	0.8	14	1.5	27	2	8	1	20	1.5	36	1.5
2	0.4	6	1	16	1.5	30	2	10	1	22	1.5	39	1.5
2.5	0.45	7	1	18	1.5	33	2	12	1.25	24	1.5	42	2
3	0.5	8	1	20	1.5	36	2	14	1.5	27	1.5	48	2
3.5	0.6	10	1.25	22	1.5	39	2	16	1.5	30	1.5	50	2
4	0.7	12	1.25	24	2	...	...	18	1.5	33	1.5	...	...

All dimensions are in millimeters.

<sup>a</sup>For threads smaller than 1.6 mm nominal size, use miniature screw threads (ANSI B1.10M).

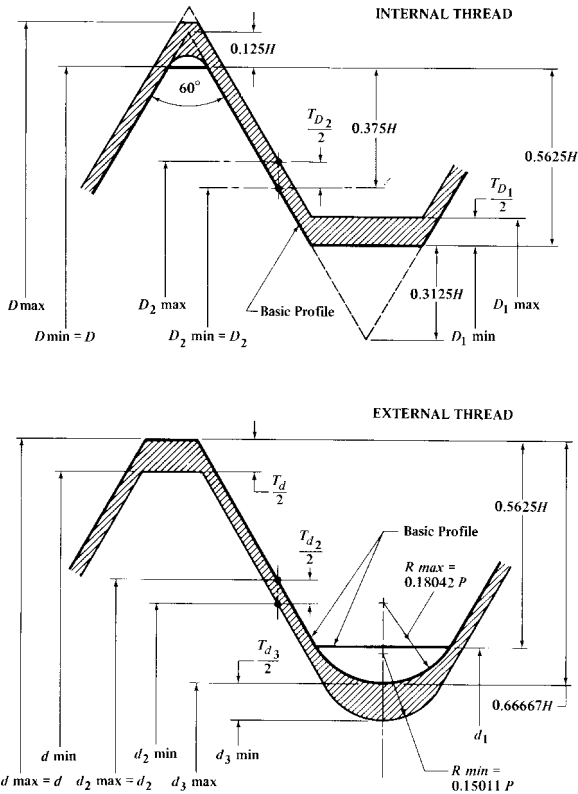


Fig. 1. Internal MJ Thread Basic and Design Profiles (Top) and External MJ Thread Basic and Design Profiles (Bottom) Showing Tolerance Zones

*Tolerances:* The thread tolerance system is based on ISO 965/1, *Metric Screw thread System of Tolerance Positions and Grades*. Tolerances are positive for internal threads and negative for external threads, that is, in the direction of minimum material.

For aerospace applications, except for fluid fittings, tolerance classes 4H5H or 4G6G and 4g6g should be used. These classes approximate classes 3B/3A in the inch system. Aerospace fluid fittings use classes 4H5H or 4H6H and 4g6g.

Tolerance classes 4G5G or 4G6G and 4g6g are provided for use when thread allowances are required. These classes provide a slightly tighter fit than the inch classes 2B/2A at minimum material condition.

Additional tolerance classes 6H/6g are included in this Standard to provide appropriate product selection based on general applications. These classes and the selection of standard diameter/pitch combinations are the same as those provided for the M profile metric screw threads in ANSI/ASME B1.13M. Classes 6H/6g result in a slightly looser fit than inch classes 2B/2A at minimum material condition.

*Symbols:* Standard symbols appearing in Fig. 1 are:

$D$  = Basic major diameter of internal thread

$D_2$  = Basic pitch diameter of internal thread

$D_1$  = Basic minor diameter of internal thread

$d$  = Basic major diameter of external thread

$d_2$  = Basic pitch diameter of external thread

$d_1$  = Basic minor diameter of internal thread

$d_3$  = Diameter to bottom of external thread root radius

$H$  = Height of fundamental triangle

$P$  = Pitch

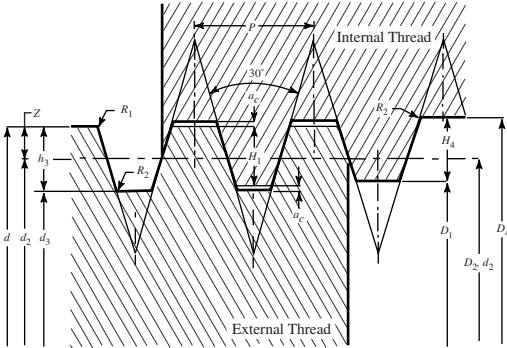
*Basic Designations:* The aerospace metric screw thread is designated by the letters "MJ" to identify the metric J thread form, followed by the nominal size and pitch in millimeters (separated by the sign "×") and followed by the tolerance class (separated by a dash from the pitch). Unless otherwise specified in the designation, the thread helix is right hand.

*Example:* MJ6 × 1 – 4h6h

For further details concerning limiting dimensions, allowances for coating and plating, modified and special threads, etc., reference should be made to the Standard.

### Trapezoidal Metric Thread

**Comparison of ISO and DIN Standards.**—ISO metric trapezoidal screw threads standard, ISO 2904-1977, describes the system of general purpose metric threads for use in mechanisms and structures. The standard is in basic agreement with trapezoidal metric thread DIN 103. The DIN 103 standard applies a particular pitch for a particular diameter of thread, but the ISO standard applies a variety of pitches for a particular diameter. In ISO 2904-1977, the same clearance is applied to both the major diameter and minor diameter, but in DIN 103 the clearance in the minor diameter is two or three times greater than clearance in the major diameter. A comparison of ISO 2904 and DIN 103 is given in Table 1.



Metric Trapezoidal Thread, ISO 2904

**Terminology:** The term "bolt threads" is used for external screw threads, the term "nut threads" for internal screw threads.

**Calculation:** The value given in the International standards have been calculated by using the following formulas:

$$\begin{aligned}
 H_1 &= 0.5P & H_4 &= H_1 + a_c = 0.5P + a_c & H_3 &= H_1 + a_c = 0.5P + a_c \\
 D_4 &= d + 2a_c & Z &= 0.25P = H_1/2 & D_1 &= d - 2H_1 = d - p \\
 D_3 &= D - 2h_3 & d_2 &= D_2 = d - 2Z = d - 0.5P & R_{1max.} &= 0.5a_c & R_{2max.} &= a_c
 \end{aligned}$$

where  $a_c$  = clearance on the crest;  $D$  = major diameter for nut threads;  $D_2$  = pitch diameter for nut threads;  $D_1$  = minor diameter for nut threads;  $d$  = major diameter for bolt threads = nominal diameter;  $d_2$  = pitch diameter for bolt threads;  $d_3$  = minor diameter for bolt threads;  $h_1$  = Height of overlapping;  $h_4$  = height of nut threads;  $h_3$  = height of bolt threads; and,  $P$  = pitch.

**Table 1. Comparison of ISO Metric Trapezoidal Screw Thread ISO 2904-1977 and Trapezoidal Metric Screw Thread DIN 103**

	ISO 2904	DIN 103	Comment
Nominal Diameter	$D$	$D_S$	
Pitch	$p$	$p$	Same
Clearances (Bolt Circle)	$a_c$	$b$	Same
Clearances (Nut Circle)	$a_c$	$a$	Not same
Height of Overlapping	$h_1$	$h_e$	Same
Bolt Circle			
	$h_3 = 0.50P + a_c$	$h_s = 0.50P + a$	Same
	$h_{as} = 0.25p$	$z = 0.25p$	Same
Minor diameter for external thread	$D_3 = d - 2h_3$	$k_s = d - 2h_s$	Same
Pitch diameter for external thread	$D_2 = d - 2h_{as}$	$d_2 = d - 2z$	Same
Nut Circle			
Basic major diameter for nut thread	$D_4 = d + 2a_c$	$d_n = d + a + b$	Not same
Height of internal thread	$h_4 = h_3$	$h_n = h_3 + a$	Not same
Minor diameter of internal thread	$D_1 = D - 2h_1$	$K_n = D_n - 2h_n$	Not same



**Table 2. ISO Metric Trapezoidal Screw Thread ISO 2904-1977**

Nominal Diameter, $d$			Pitch, $P$	Pitch Diam. $d_2 = D_2$	Major Diam. $D_4$	Minor Diameter	
						$d_3$	$D_1$
8			1.5	7.250	8.300	6.200	6.500
	9		1.5	8.250	9.300	7.200	7.500
			2	8.000	9.500	6.500	7.000
10			1.5	9.250	10.300	8.200	8.500
			2	9.000	10.500	7.500	8.000
	11		2	10.000	11.500	8.500	9.000
			3	9.500	11.500	7.500	8.000
12			2	11.000	12.500	9.500	10.000
			3	10.500	12.500	8.500	9.000
	14		2	13.000	14.500	11.500	12.000
			3	12.500	14.500	10.500	11.000
16			2	15.000	16.500	13.500	14.000
			3	14.500	16.500	12.500	13.000
	18		2	17.000	18.500	15.500	16.000
			4	16.000	18.500	13.500	14.000
20			2	19.000	20.500	17.500	18.000
			4	18.000	20.500	15.500	16.000
	22		3	20.500	22.500	18.500	19.000
			5	19.500	22.500	16.500	17.000
			8	18.000	23.000	13.000	14.000
24			3	22.500	24.500	20.500	21.000
			5	21.500	24.500	18.500	19.000
			8	20.000	25.000	15.000	16.000
	26		3	24.500	26.500	22.500	23.000
			5	23.500	26.500	20.500	21.000
			8	22.000	27.000	17.000	18.000
28			3	26.500	28.500	24.500	25.000
			5	25.500	28.500	22.500	23.000
			8	24.000	29.000	19.000	20.000
	30		3	28.500	30.500	26.500	27.000
			6	27.000	31.000	23.000	24.000
			10	25.000	31.000	19.000	20.000
32			3	30.500	32.500	28.500	29.000
			6	29.000	33.000	25.000	26.000
			10	27.000	33.000	21.000	22.000
	34		3	32.500	34.500	30.500	31.000
			6	31.000	35.000	27.000	28.000
			10	29.000	35.000	23.000	24.000
36			3	34.500	36.500	32.500	33.000
			6	33.000	37.000	29.000	30.000
			10	31.000	37.000	25.000	26.000
	38		3	36.500	38.500	34.500	35.000
			7	34.500	39.000	30.000	31.000
			10	33.000	39.000	27.000	28.000
40			3	38.500	40.500	36.500	37.000
			7	36.500	41.000	32.000	33.000
			10	35.000	41.000	29.000	30.000

**Table 2. (Continued) ISO Metric Trapezoidal Screw Thread ISO 2904-1977**

Nominal Diameter, $d$			Pitch, $P$	Pitch Diam. $d_2 = D_2$	Major Diam. $D_4$	Minor Diameter	
						$d_3$	$D_1$
42			3	40.500	42.500	38.500	39.000
			7	38.500	43.000	34.000	35.000
			10	37.000	43.000	31.000	32.000
44			3	42.500	44.500	40.500	41.000
			7	40.500	45.000	36.000	37.000
			12	38.000	45.000	31.000	32.000
46			3	44.500	46.500	42.500	43.000
			8	42.000	47.000	37.000	38.000
			12	40.000	47.000	33.000	34.000
48			3	46.500	48.500	44.500	45.000
			8	44.000	49.000	39.000	40.000
			12	42.000	49.000	35.000	36.000
50			3	48.500	50.500	46.500	47.000
			8	46.000	51.000	41.000	42.000
			12	44.000	51.000	37.000	38.000
52			3	50.500	52.500	48.500	49.000
			8	48.000	53.000	43.000	44.000
			12	46.000	53.000	39.000	40.000
55			3	53.500	55.500	51.500	52.000
			9	50.500	56.000	45.000	46.000
			14	48.000	57.000	39.000	41.000
60			3	58.500	60.500	56.500	57.000
			9	55.500	61.000	50.000	51.000
			14	53.000	62.000	44.000	46.000
65			4	63.000	65.500	60.500	61.000
			10	60.000	66.000	54.000	55.000
			16	57.000	67.000	47.000	49.000
70			4	68.000	70.500	65.500	66.000
			10	65.000	71.000	59.000	60.000
			16	62.000	72.000	52.000	54.000
75			4	73.000	75.500	70.500	71.000
			10	70.000	76.000	64.000	65.000
			16	67.000	77.000	57.000	59.000
80			4	78.000	80.500	75.500	76.000
			10	75.000	81.000	69.000	70.000
			16	72.000	82.000	62.000	64.000
85			4	83.000	85.500	80.500	81.000
			12	79.000	86.000	72.000	73.000
			18	76.000	87.000	65.000	67.000
90			4	88.000	90.500	85.500	86.000
			12	84.000	91.000	77.000	78.000
			18	81.000	92.000	70.000	72.000
95			4	93.000	95.500	90.500	91.000
			12	89.000	96.000	82.000	83.000
95			18	86.000	97.000	75.000	77.000
			4	98.000	100.500	95.500	96.000
100			12	94.000	101.000	87.000	88.000
			20	90.000	102.000	78.000	80.000

**Table 2. (Continued) ISO Metric Trapezoidal Screw Thread ISO 2904-1977**

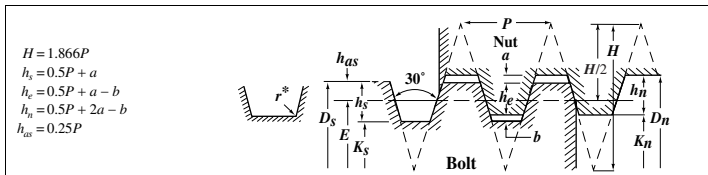
Nominal Diameter, $d$			Pitch, $P$	Pitch Diam. $d_2 = D_2$	Major Diam. $D_4$	Minor Diameter	
						$d_3$	$D_1$
	105	4	4	103.000	105.500	100.500	101.000
		12	12	103.000	106.000	92.000	93.000
		20	20	95.000	107.000	83.000	85.000
	110	4	4	108.000	110.500	105.500	106.000
		12	12	104.000	111.000	97.000	98.000
		20	20	100.000	112.000	88.000	90.000
	115	6	6	112.000	116.000	108.000	109.000
		14	14	112.000	117.000	99.000	101.000
		22	22	104.000	117.000	91.000	93.000
120		6	6	117.000	121.000	113.000	114.000
		14	14	113.000	122.000	104.000	106.000
		22	22	109.000	122.000	96.000	98.000
	125	6	6	122.000	126.000	118.000	119.000
		14	14	122.000	127.000	109.000	111.000
		22	22	114.000	127.000	101.000	103.000
	130	6	6	127.000	131.000	123.000	124.000
		14	14	123.000	132.000	114.000	116.000
		22	22	119.000	132.000	106.000	108.000
	135	6	6	132.000	136.000	128.000	129.000
		14	14	132.000	137.000	119.000	121.000
		24	24	123.000	137.000	109.000	111.000
140		6	6	137.000	141.000	133.000	134.000
		14	14	133.000	142.000	124.000	126.000
		24	24	128.000	142.000	114.000	116.000
	145	6	6	142.000	146.000	138.000	139.000
		14	14	142.000	147.000	129.000	131.000
		24	24	133.000	147.000	119.000	121.000
	150	6	6	147.000	151.000	143.000	144.000
		16	16	142.000	152.000	132.000	134.000
		24	24	138.000	152.000	124.000	126.000
	155	6	6	152.000	156.000	148.000	149.000
		16	16	152.000	157.000	137.000	139.000
		24	24	143.000	157.000	129.000	131.000
160		6	6	157.000	161.000	153.000	154.000
		16	16	152.000	162.000	142.000	144.000
		28	28	146.000	162.000	130.000	132.000
	165	6	6	162.000	166.000	158.000	159.000
		16	16	162.000	167.000	147.000	149.000
		28	28	151.000	167.000	135.000	137.000
	170	6	6	167.000	171.000	163.000	164.000
		16	16	162.000	172.000	152.000	154.000
		28	28	156.000	172.000	140.000	142.000
	175	8	8	171.000	176.000	166.000	167.000
		16	16	171.000	177.000	157.000	159.000
		28	28	161.000	177.000	145.000	147.000
180		8	8	176.000	181.000	171.000	172.000
		18	18	171.000	182.000	160.000	162.000
		28	28	166.000	182.000	150.000	152.000

**Table 2. (Continued) ISO Metric Trapezoidal Screw Thread ISO 2904-1977**

Nominal Diameter, $d$			Pitch, $P$	Pitch Diam. $d_2 = D_2$	Major Diam. $D_4$	Minor Diameter	
						$d_3$	$D_1$
185			8	181.000	186.000	176.000	177.000
			18	181.000	187.000	165.000	167.000
			32	169.000	187.000	151.000	153.000
190			8	186.000	191.000	181.000	182.000
			18	181.000	192.000	170.000	172.000
			32	174.000	192.000	156.000	158.000
195			8	191.000	196.000	186.000	187.000
			18	191.000	197.000	175.000	177.000
			32	179.000	197.000	161.000	163.000
200			8	196.000	201.000	191.000	192.000
			18	191.000	202.000	180.000	182.000
			32	184.000	202.000	166.000	168.000
210			8	206.000	211.000	201.000	202.000
			20	200.000	212.000	188.000	190.000
			36	192.000	212.000	172.000	174.000
220			8	216.000	221.000	211.000	212.000
			20	210.000	222.000	198.000	200.000
			36	202.000	222.000	182.000	184.000
230			8	226.000	231.000	221.000	222.000
			20	220.000	232.000	208.000	210.000
			36	212.000	232.000	192.000	194.000
240			8	236.000	241.000	231.000	232.000
			22	229.000	242.000	216.000	218.000
			36	222.000	242.000	202.000	204.000
250			12	244.000	251.000	237.000	238.000
			22	239.000	252.000	226.000	228.000
			40	230.000	252.000	208.000	210.000
260			12	254.000	261.000	247.000	248.000
			22	249.000	262.000	236.000	238.000
			40	240.000	262.000	218.000	220.000
270			12	264.000	271.000	257.000	258.000
			24	258.000	272.000	244.000	246.000
			40	250.000	272.000	228.000	230.000
280			12	274.000	281.000	267.000	268.000
			24	268.000	282.000	254.000	256.000
			40	260.000	282.000	238.000	240.000
290			12	284.000	291.000	277.000	278.000
			24	278.000	292.000	264.000	266.000
			44	268.000	292.000	244.000	246.000
300			12	294.000	301.000	287.000	288.000
			24	288.000	302.000	274.000	276.000
			44	278.000	302.000	254.000	256.000

All dimensions in millimeters

Trapezoidal Metric Thread — Preferred Basic Sizes DIN 103



$H = 1.866P$   
 $h_e = 0.5P + a$   
 $h_s = 0.5P + a - b$   
 $h_n = 0.5P + 2a - b$   
 $h_{as} = 0.25P$

Nom. & Major Diam. of Bolt, $D_s$	Pitch, $P$	Pitch Diam., $E$	Depth of Engagement, $h_e$	Clearance		Bolt		Nut		
				$a$	$b$	Minor Diam., $K_s$	Depth of Thread, $h_s$	Major Diam., $D_n$	Minor Diam., $K_n$	Depth of Thread, $h_n$
10	3	8.5	1.25	0.25	0.5	6.5	1.75	10.5	7.5	1.50
12	3	10.5	1.25	0.25	0.5	8.5	1.75	12.5	9.5	1.50
14	4	12	1.75	0.25	0.5	9.5	2.25	14.5	10.5	2.00
16	4	14	1.75	0.25	0.5	11.5	2.25	16.5	12.5	2.00
18	4	16	1.75	0.25	0.5	13.5	2.25	18.5	14.5	2.00
20	4	18	1.75	0.25	0.5	15.5	2.25	20.5	16.5	2.00
22	5	19.5	2	0.25	0.75	16.5	2.75	22.5	18	2.00
24	5	21.5	2	0.25	0.75	18.5	2.75	24.5	20	2.25
26	5	23.5	2	0.25	0.75	20.5	2.75	26.5	22	2.25
28	5	25.5	2	0.25	0.75	22.5	2.75	28.5	24	2.25
30	6	27	2.5	0.25	0.75	23.5	3.25	30.5	25	2.75
32	6	29	2.5	0.25	0.75	25.5	3.25	32.5	27	2.75
36	6	33	2.5	0.25	0.75	29.5	3.25	36.5	31	2.75
40	7	36.5	3	0.25	0.75	32.5	3.75	40.5	34	3.25
44	7	40.5	3	0.25	0.75	36.5	3.75	44.5	38	3.25
48	8	44	3.5	0.25	0.75	39.5	4.25	48.5	41	3.75
50	8	46	3.5	0.25	0.75	41.5	4.25	50.5	43	3.75
52	8	48	3.5	0.25	0.75	43.5	4.25	52.5	45	3.75
55	9	50.5	4	0.25	0.75	45.5	4.75	55.5	47	4.25
60	9	55.5	4	0.25	0.75	50.5	4.75	60.5	52	4.25
65	10	60	4.5	0.25	0.75	54.5	5.25	65.5	56	4.75
70	10	65	4.5	0.25	0.75	59.5	5.25	70.5	61	4.75
75	10	70	4.5	0.25	0.75	64.5	5.25	75.5	66	4.75
80	10	75	4.5	0.25	0.75	69.5	5.25	80.5	71	4.75
85	12	79	5.5	0.25	0.75	72.5	6.25	85.5	74	5.75
90	12	84	5.5	0.25	0.75	77.5	6.25	90.5	79	5.75
95	12	89	5.5	0.25	0.75	82.5	6.25	95.5	84	5.75
100	12	94	5.5	0.25	0.75	87.5	6.25	100.5	89	5.75
110	12	104	5.5	0.25	0.75	97.5	6.25	110.5	99	5.75
120	14	113	6	0.5	1.5	105	7.5	121	108	6.5
130	14	123	6	0.5	1.5	115	7.5	131	118	6.5
140	14	133	6	0.5	1.5	125	7.5	141	128	6.5
150	16	142	7	0.5	1.5	133	8.5	151	136	7.5
160	16	152	7	0.5	1.5	143	8.5	161	146	7.5
170	16	162	7	0.5	1.5	153	8.5	171	156	7.5
180	18	171	8	0.5	1.5	161	9.5	181	164	8.5
190	18	181	8	0.5	1.5	171	9.5	191	174	8.5
200	18	191	8	0.5	1.5	181	9.5	201	184	8.5
210	20	200	9	0.5	1.5	189	10.5	211	192	9.5
220	20	210	9	0.5	1.5	199	10.5	221	202	9.5
230	20	220	9	0.5	1.5	209	10.5	231	212	9.5
240	22	229	10	0.5	1.5	217	11.5	241	220	10.5
250	22	239	10	0.5	1.5	227	11.5	251	230	10.5
260	22	249	10	0.5	1.5	237	11.5	261	240	10.5
270	24	258	11	0.5	1.5	245	12.5	271	248	11.5
280	24	268	11	0.5	1.5	255	12.5	281	258	11.5
290	24	278	11	0.5	1.5	265	12.5	291	268	11.5
300	26	287	12	0.5	1.5	273	13.5	301	276	12.5

All dimensions are in millimeters.

\*Roots are rounded to a radius,  $r$ , equal to 0.25 mm for pitches of from 3 to 12 mm inclusive and 0.5 mm for pitches of from 14 to 26 mm inclusive for power transmission.

## ISO Miniature Screw Threads

## ISO Miniature Screw Threads, Basic Form ISO/R 1501:1970

Pitch $P$	$H = 0.866025P$	$0.554256H = 0.48P$	$0.375H = 0.324760P$	$0.320744H = 0.320744P$	$0.125H = 0.108253P$
0.08	0.069282	0.038400	0.025981	0.022222	0.008660
0.09	0.077942	0.043200	0.029228	0.024999	0.009743
0.1	0.086603	0.048000	0.032476	0.027777	0.010825
0.125	0.108253	0.060000	0.040595	0.034722	0.013532
0.15	0.129904	0.072000	0.048714	0.041666	0.016238
0.175	0.151554	0.084000	0.056833	0.048610	0.018944
0.2	0.173205	0.096000	0.064952	0.055554	0.021651
0.225	0.194856	0.108000	0.073071	0.062499	0.024357
0.25	0.216506	0.120000	0.081190	0.069443	0.027063
0.3	0.259808	0.144000	0.097428	0.083332	0.032476

## ISO Miniature Screw Threads, Basic Dimensions ISO/R 1501:1970

Nominal Diameter	Pitch $P$	Major Diameter $D, d$	Pitch Diameter $D_2, d_2$	Minor Diameter $D_1, d_1$
0.30	0.080	0.300000	0.248039	0.223200
0.35	0.090	0.350000	0.291543	0.263600
0.40	0.100	0.400000	0.335048	0.304000
0.45	0.100	0.450000	0.385048	0.354000
0.50	0.125	0.500000	0.418810	0.380000
0.55	0.125	0.550000	0.468810	0.430000
0.60	0.150	0.600000	0.502572	0.456000
0.70	0.175	0.700000	0.586334	0.532000
0.80	0.200	0.800000	0.670096	0.608000
0.90	0.225	0.900000	0.753858	0.684000
1.00	0.250	1.000000	0.837620	0.760000
1.10	0.250	1.100000	0.937620	0.860000
1.20	0.250	1.200000	1.037620	0.960000
1.40	0.300	1.400000	1.205144	1.112000

$D$  and  $d$  dimensions refer to the nut (internal) and screw (external) threads, respectively.

## British Standard ISO Metric Screw Threads

BS 3643:Part 1:1981 (1998) provides principles and basic data for ISO metric screw threads. It covers single-start, parallel screw threads of from 1 to 300 millimeters in diameter. Part 2 of the Standard gives the specifications for selected limits of size.

**Basic Profile.**—The ISO basic profile for triangular screw threads is shown in Fig. 1, and basic dimensions of this profile are given in Table 1.

**Table 1. British Standard ISO Metric Screw Threads  
Basic Profile Dimensions BS 3643:1981 (1998)**

Pitch $P$	$H = 0.86603P$	$\frac{5}{8}H = 0.54127P$	$\frac{3}{8}H = 0.32476P$	$H/4 = 0.21651P$	$H/8 = 0.10825P$
0.2	0.173 205	0.108 253	0.064 952	0.043 301	0.021 651
0.25	0.216 506	0.135 316	0.081 190	0.054 127	0.027 063
0.3	0.259 808	0.162 380	0.097 428	0.064 952	0.032 476
0.35	0.303 109	0.189 443	0.113 666	0.075 777	0.037 889
0.4	0.346 410	0.216 506	0.129 904	0.086 603	0.043 301
0.45	0.389 711	0.243 570	0.146 142	0.097 428	0.048 714
0.5	0.433 013	0.270 633	0.162 380	0.108 253	0.054 127
0.6	0.519 615	0.324 760	0.194 856	0.129 904	0.064 952

**Table 1. (Continued) British Standard ISO Metric Screw Threads  
Basic Profile Dimensions BS 3643:1981 (1998)**

Pitch <i>P</i>	<i>H</i> = 0.086603 <i>P</i>	$\frac{5}{8}H$ = 0.54127 <i>P</i>	$\frac{3}{8}H$ = 0.32476 <i>P</i>	<i>H</i> /4 = 0.21651 <i>P</i>	<i>H</i> /8 = 0.10825 <i>P</i>
0.7	0.606 218	0.378 886	0.227 322	0.151 554	0.075 777
0.75	0.649 519	0.405 949	0.243 570	0.162 380	0.081 190
0.8	0.692 820	0.433 013	0.259 808	0.173 205	0.086 603
1	0.866 025	0.541 266	0.324 760	0.216 506	0.108 253
1.25	1.082 532	0.676 582	0.405 949	0.270 633	0.135 316
1.5	1.299 038	0.811 899	0.487 139	0.324 760	0.162 380
1.75	1.515 544	0.947 215	0.568 329	0.378 886	0.189 443
2	1.732 051	1.082 532	0.649 519	0.433 013	0.216 506
2.5	2.165 063	1.353 165	0.811 899	0.541 266	0.270 633
3	2.598 076	1.623 798	0.974 279	0.649 519	0.324 760
3.5	3.031 089	1.894 431	1.136 658	0.757 772	0.378 886
4	3.464 102	2.165 063	1.299 038	0.866 025	0.433 013
4.5	3.897 114	2.435 696	1.461 418	0.974 279	0.487 139
5	4.330 127	2.706 329	1.623 798	1.082 532	0.541 266
5.5	4.763 140	2.976 962	1.786 177	1.190 785	0.595 392
6	5.196 152	3.247 595	1.948 557	1.299 038	0.649 519
8 <sup>a</sup>	6.928 203	4.330 127	2.598 076	1.732 051	0.866 025

<sup>a</sup>This pitch is not used in any of the ISO metric standard series.  
All dimensions are given in millimeters.

**Tolerance System.**—The tolerance system defines *tolerance classes* in terms of a combination of a *tolerance grade* (figure) and a *tolerance position* (letter). The tolerance position is defined by the distance between the basic size and the nearest end of the tolerance zone, this distance being known as the *fundamental deviation*, EI, in the case of internal threads, and es in the case of external threads. These tolerance positions with respect to the basic size (zero line) are shown in Fig. 2 and fundamental deviations for nut and bolt threads are given in Table 2.

**Table 2. Fundamental Deviations for Nut Threads and Bolt Threads**

Pitch <i>P</i> mm	Nut Thread <i>D</i> <sub>2</sub> , <i>D</i> <sub>1</sub>		Bolt Thread <i>d</i> , <i>d</i> <sub>2</sub>				Pitch <i>P</i> mm	Nut Thread <i>D</i> <sub>2</sub> , <i>D</i> <sub>1</sub>		Bolt Thread <i>d</i> , <i>d</i> <sub>2</sub>			
	Tolerance Position							Tolerance Position					
	G	H	e	f	g	h		G	H	e	f	g	h
	Fundamental Deviation							Fundamental Deviation					
	EI	EI	es	es	es	es		EI	EI	es	es	es	es
μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm	μm		
0.2	+17	0	...	...	-17	0	1.25	+28	0	-63	-42	-28	0
0.25	+18	0	...	...	-18	0	1.5	+32	0	-67	-45	-32	0
0.3	+18	0	...	...	-18	0	1.75	+34	0	-71	-48	-34	0
0.35	+19	0	...	-34	-19	0	2	+38	0	-71	-52	-38	0
0.4	+19	0	...	-34	-19	0	2.5	+42	0	-80	-58	-42	0
0.45	+20	0	...	-35	-20	0	3	+48	0	-85	-63	-48	0
0.5	+20	0	-50	-36	-20	0	3.5	+53	0	-90	-70	-53	0
0.6	+21	0	-53	-36	-21	0	4	+60	0	-95	-75	-60	0
0.7	+22	0	-56	-38	-22	0	4.5	+63	0	-100	-80	-63	0
0.75	+22	0	-56	-38	-22	0	5	+71	0	-106	-85	-71	0
0.8	+24	0	-60	-38	-24	0	5.5	+75	0	-112	-90	-75	0
1	+26	0	-60	-40	-26	0	6	+80	0	-118	-95	-80	0

See Figs. 1 and 2 for meaning of symbols.





**Table 4. Lengths of Thread Engagements for Short, Normal, and Long Categories**

Basic Major Diameter $d$		Pitch $P$	Short	Normal		Long	Basic Major Diameter $d$		Pitch $P$	Short	Normal		Long		
Over	Up to and Incl.		Length of Thread Engagement					Over		Up to and Incl.	Length of Thread Engagement				
			Up to and Incl.	Over	Up to and Incl.	Over	Over				Up to and Incl.	Over	Up to and Incl.	Over	
0.99	1.4	0.2	0.5	0.5	1.4	1.4	22.4	45	1	4	4	12	12		
		0.25	0.6	0.6	1.7	1.7			1.5	6.3	6.3	19	19		
		0.3	0.7	0.7	2	2			2	8.5	8.5	25	25		
1.4	2.8	0.2	0.5	0.5	1.5	1.5			3	12	12	36	36		
		0.25	0.6	0.6	1.9	1.9			3.5	15	15	45	45		
		0.35	0.8	0.8	2.6	2.6			4	18	18	53	53		
		0.4	1	1	3	3			4.5	21	21	63	63		
2.8	5.6	0.45	1.3	1.3	3.8	3.8			45	90	1.5	7.5	7.5	22	22
		0.35	1	1	3	3					2	9.5	9.5	28	28
		0.5	1.5	1.5	4.5	4.5					3	15	15	45	45
		0.6	1.7	1.7	5	5					4	19	19	56	56
		0.7	2	2	6	6					5	24	24	71	71
		0.75	2.2	2.2	6.7	6.7	5.5	28			28	85	85		
5.6	11.2	0.8	2.5	2.5	7.5	7.5	6	32			32	95	95		
		0.75	2.4	2.4	7.1	7.1	90	180			2	12	12	36	36
		1	3	3	9	9					3	18	18	53	53
		1.25	4	4	12	12					4	24	24	71	71
1.5	5	5	15	15	6	36					36	106	106		
11.2	22.4	1	3.8	3.8	11	11	180	300			3	20	20	60	60
		1.25	4.5	4.5	13	13			4	26	26	80	80		
		1.5	5.6	5.6	16	16			6	40	40	118	118		
		1.75	6	6	18	18									
		2	8	8	24	24									
2.5	10	10	30	30											

All dimensions are given in millimeters

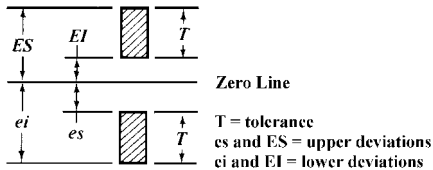


Fig. 2. Tolerance Positions with Respect to Zero Line (Basic Size)

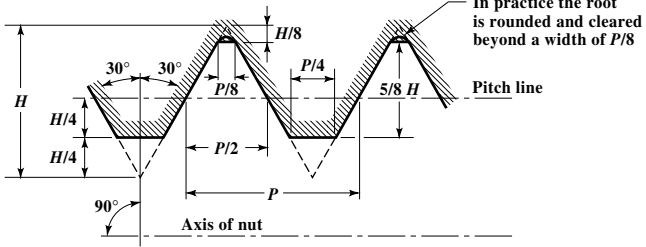
**Design Profiles.**—The design profiles for ISO metric internal and external screw threads are shown in Fig. 3. These represent the profiles of the threads at their maximum metal condition. It may be noted that the root of each thread is deepened so as to clear the basic flat crest of the other thread. The contact between the thread is thus confined to their sloping flanks. However, for nut threads as well as bolt threads, the actual root contours shall not at any point violate the basic profile.

**Designation.**—Screw threads complying with the requirements of the Standard shall be designated by the letter M followed by values of the nominal diameter and of the pitch, expressed in millimeters, and separated by the sign  $\times$ . *Example:* M6  $\times$  0.75. The absence of the indication of pitch means that a coarse pitch is specified.

The complete designation of a screw thread consists of a designation for the thread system and size, and a designation for the crest diameter tolerance. Each class designation consists of: a figure indicating the tolerance grade; and a letter indicating the tolerance

position, capital for nuts, lower case for bolts. If the two class designations for a thread are the same (one for the pitch diameter and one for the crest diameter), it is not necessary to repeat the symbols. As examples, a bolt thread designated M10-6g signifies a thread of 10 mm nominal diameter in the Coarse Thread Series having a tolerance class 6g for both pitch and major diameters. A designation M10 × 1-5g6g signifies a bolt thread of 10 mm nominal diameter having a pitch of 1 mm, a tolerance class 5g for pitch diameter, and a tolerance class 6g for major diameter. A designation M10-6H signifies a nut thread of 10 mm diameter in the Coarse Thread Series having a tolerance class 6H for both pitch and minor diameters.

## Nut (Internal Thread)



## Bolt (External Thread)

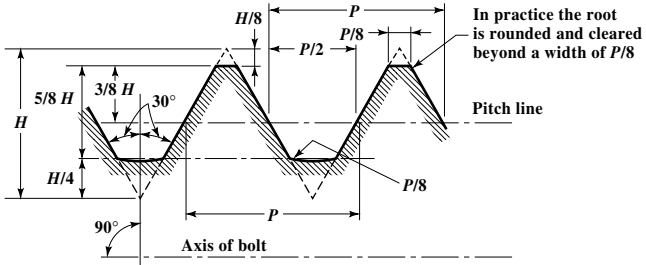


Fig. 3. Maximum Material Profiles for Internal and External Threads

A fit between mating parts is indicated by the nut thread tolerance class followed by the bolt thread tolerance class separated by an oblique stroke. *Examples:* M6-6H/6g and M20 × 2-6H/5g6g. For coated threads, the tolerances apply to the parts before coating, unless otherwise specified. After coating, the actual thread profile shall not at any point exceed the maximum material limits for either tolerance position H or h.

**Fundamental Deviation Formulas.**—The formulas used to calculate the fundamental deviations in Table 2 are:

$$EI_G = +(15 + 11P)$$

$$EI_H = 0$$

$$es_e = -(50 + 11P) \text{ except for threads with } P \leq 0.45 \text{ mm}$$

$$es_f = -(30 + 11P)$$

$$es_g = -(15 + 11P)$$

$$es_h = 0$$

In these formulas, EI and es are expressed in micrometers and P is in millimeters.

**Crest Diameter Tolerance Formulas.**—The tolerances for the major diameter of bolt threads ( $T_d$ ), grade 6, in Table 5, were calculated from the formula:

$$T_d(6) = 180 \sqrt[3]{P^2} - \frac{3.15}{\sqrt{P}}$$

In this formula,  $T_d(6)$  is in micrometers and  $P$  is in millimeters. For tolerance grades 4 and 8:  $T_d(4) = 0.63 T_d(6)$  and  $T_d(8) = 1.6 T_d(6)$ , respectively.

The tolerances for the minor diameter of nut threads ( $T_{D1}$ ), grade 6, in Table 5, were calculated as follows:

For pitches 0.2 to 0.8 mm,  $T_{D1}(6) = 433P - 190P^{1.22}$ .

For pitches 1 mm and coarser,  $T_{D1}(6) = 230P^{0.7}$ .

In these formulas,  $T_{D1}(6)$  is in micrometers and  $P$  is in millimeters. For tolerance grades 4, 5, 7, and 8:  $T_{D1}(4) = 0.63 T_{D1}(6)$ ;  $T_{D1}(5) = 0.8 T_{D1}(6)$ ;  $T_{D1}(7) = 1.25 T_{D1}(6)$ ; and  $T_{D1}(8) = 1.6 T_{D1}(6)$ , respectively.

**Table 5. British Standard ISO Metric Screw Threads: Limits and Tolerances for Finished Uncoated Threads for Normal Lengths of Engagement BS 3643: Part 2: 1981**

Nominal Diameter <sup>a</sup>	Pitch			External Threads (Bolts)					Internal Threads (Nuts) <sup>b</sup>							
	Course	Fine	Tol. Class	Fund. dev.	Major Dia.		Pitch Dia.		Minor Dia	Tol. Class	Major Dia.		Pitch Dia.		Minor Dia	
					Max	Tol(-)	Max	Tol(-)	Min		Min	Max	Tol(-)	Max	Tol(-)	
1	0.2		4h	0	1.000	0.036	0.870	0.030	0.717	4H	1.000	0.910	0.040	0.821	0.038	
			6g	0.017	0.983	0.056	0.853	0.048	0.682							
	0.25		4h	0	1.000	0.042	0.838	0.034	0.649	4H	1.000	0.883	0.045	0.774	0.045	
			6g	0.018	0.982	0.067	0.820	0.053	0.613	5H	1.000	0.894	0.056	0.785	0.056	
	1.1	0.2		4h	0	1.100	0.036	0.970	0.030	0.817	4H	1.100	1.010	0.040	0.921	0.038
				6g	0.017	1.083	0.056	0.953	0.048	0.782						
0.25			4h	0	1.100	0.042	0.938	0.034	0.750	4H	1.100	0.983	0.045	0.874	0.045	
			6g	0.018	1.082	0.067	0.920	0.053	0.713	5H	1.100	0.994	0.056	0.885	0.056	
1.2	0.2		4h	0	1.200	0.036	1.070	0.030	0.917	4H	1.200	1.110	0.040	1.021	0.038	
			6g	0.017	1.183	0.056	1.053	0.048	0.882							
	0.25		4h	0	1.200	0.042	1.038	0.034	0.850	4H	1.200	1.083	0.045	0.974	0.045	
			6g	0.018	1.182	0.067	1.020	0.053	0.813	5H	1.200	1.094	0.056	0.985	0.056	
1.4	0.2		4h	0	1.400	0.036	1.270	0.030	1.117	4H	1.400	1.310	0.040	1.221	0.038	
			6g	0.017	1.383	0.056	1.253	0.048	1.082							
	0.3		4h	0	1.400	0.048	1.205	0.036	0.984	4H	1.400	1.253	0.048	1.128	0.053	
			6g	0.018	1.382	0.075	1.187	0.056	0.946	5H	1.400	1.265	0.060	1.142	0.067	
1.6	0.2		4h	0	1.600	0.036	1.470	0.032	1.315	4H	1.600	1.512	0.042	1.421	0.038	
			6g	0.017	1.583	0.056	1.453	0.050	1.280							
	0.35		4h	0	1.600	0.053	1.373	0.040	1.117	4H	1.600	1.426	0.053	1.284	0.063	
			6g	0.019	1.581	0.085	1.354	0.063	1.075	5H	1.600	1.440	0.067	1.301	0.080	
										6H	1.600	1.458	0.085	1.321	0.100	
1.8	0.2		4h	0	1.800	0.036	1.670	0.032	1.515	4H	1.800	1.712	0.042	1.621	0.038	
			6g	0.017	1.783	0.056	1.653	0.050	1.480							
	0.35		4h	0	1.800	0.053	1.573	0.040	1.317	4H	1.800	1.626	0.053	1.484	0.063	
			6g	0.019	1.781	0.085	1.554	0.063	1.275	5H	1.800	1.640	0.067	1.501	0.080	
2	0.25		4h	0	2.000	0.042	1.838	0.036	1.648	4H	2.000	1.886	0.048	1.774	0.045	
			6g	0.018	1.982	0.067	1.820	0.056	1.610	5H	2.000	1.898	0.060	1.785	0.056	
	0.4		4h	0	2.000	0.060	1.740	0.042	1.452	4H	2.000	1.796	0.056	1.638	0.071	
			6g	0.019	1.981	0.095	1.721	0.067	1.408	5H	2.000	1.811	0.071	1.657	0.090	
										6H	2.000	1.830	0.090	1.679	0.112	
2.2	0.25		4h	0	2.200	0.042	2.038	0.036	1.848	4H	2.200	2.086	0.048	1.974	0.045	
			6g	0.018	2.182	0.067	2.020	0.056	1.810	5H	2.200	2.098	0.060	1.985	0.056	
	0.45		4h	0	2.200	0.063	1.908	0.045	1.585	4H	2.200	1.968	0.060	1.793	0.080	
			6g	0.020	2.180	0.100	1.888	0.071	1.539	5H	2.200	1.983	0.075	1.813	0.100	
								6H	2.200	2.003	0.095	1.838	0.125			

**Table 5. (Continued) British Standard ISO Metric Screw Threads: Limits and Tolerances for Finished Uncoated Threads for Normal Lengths of Engagement BS 3643: Part 2: 1981**

Nominal Diameter <sup>a</sup>	Pitch		External Threads (Bolts)						Internal Threads (Nuts) <sup>b</sup>							
	Coarse	Fine	Tol. Class	Fund. dev.	Major Dia.		Pitch Dia.		Minor Dia	Tol. Class	Major Dia.		Pitch Dia.		Minor Dia	
					Max	Tol(-)	Max	Tol(-)			Min	Min	Max	Tol(-)	Max	Tol(-)
2.5	0.35		4h	0	2.500	0.053	2.273	0.040	2.017	4H	2.500	2.326	0.053	2.184	0.063	
			6g	0.019	2.481	0.085	2.254	0.063	1.975	5H	2.500	2.340	0.067	2.201	0.080	
			6H							6H	2.500	2.358	0.085	2.221	0.100	
	0.45		4h	0	2.500	0.063	2.208	0.045	1.885	4H	2.500	2.268	0.060	2.093	0.080	
			6g	0.020	2.480	0.100	2.188	0.071	1.839	5H	2.500	2.283	0.075	2.113	0.100	
			6H							6H	2.500	2.303	0.095	2.138	0.125	
3	0.35		4h	0	3.000	0.053	2.773	0.042	2.515	4H	3.000	2.829	0.056	2.684	0.063	
			6g	0.019	2.981	0.085	2.754	0.067	2.471	5H	3.000	2.844	0.071	2.701	0.080	
			6H							6H	3.000	2.863	0.090	2.721	0.100	
	0.5		4h	0	3.000	0.067	2.675	0.048	2.319	5H	3.000	2.755	0.080	2.571	0.112	
			6g	0.020	2.980	0.106	2.655	0.075	2.272	6H	3.000	2.775	0.100	2.599	0.140	
			7H							7H	3.000	2.800	0.125	2.639	0.180	
3.5	0.35		4h	0	3.500	0.053	3.273	0.042	3.015	4H	3.500	3.329	0.056	3.184	0.063	
			6g	0.019	3.481	0.085	3.254	0.067	2.971	5H	3.500	3.344	0.071	3.201	0.080	
			6H							6H	3.500	3.363	0.090	3.221	0.100	
	0.6		4h	0	3.500	0.080	3.110	0.053	2.688	5H	3.500	3.200	0.090	2.975	0.125	
			6g	0.021	3.479	0.125	3.089	0.085	2.635	6H	3.500	3.222	0.112	3.010	0.160	
			7H							7H	3.500	3.250	0.140	3.050	0.200	
4	0.5		4h	0	4.000	0.067	3.675	0.048	3.319	5H	4.000	3.755	0.080	3.571	0.112	
			6g	0.020	3.980	0.106	3.655	0.075	3.272	6H	4.000	3.775	0.100	3.599	0.140	
			7H							7H	4.000	3.800	0.125	3.639	0.180	
	0.7		4h	0	4.000	0.090	3.545	0.056	3.058	5H	4.000	3.640	0.095	3.382	0.140	
			6g	0.022	3.978	0.140	3.523	0.090	3.002	6H	4.000	3.663	0.118	3.422	0.180	
			7H							7H	4.000	3.695	0.150	3.466	0.224	
4.5	0.5		4h	0	4.500	0.067	4.175	0.048	3.819	5H	4.500	4.255	0.080	4.071	0.112	
			6g	0.020	4.480	0.106	4.155	0.075	3.772	6H	4.500	4.275	0.100	4.099	0.140	
			7H							7H	4.500	4.300	0.125	4.139	0.180	
	0.75		4h	0	4.500	0.090	4.013	0.056	3.495	5H	4.500	4.108	0.095	3.838	0.150	
			6g	0.022	4.478	0.140	3.991	0.090	3.439	6H	4.500	4.131	0.118	3.878	0.190	
			7H							7H	4.500	4.163	0.150	3.924	0.236	
5	0.5		4h	0	5.000	0.067	4.675	0.048	4.319	5H	5.000	4.755	0.080	4.571	0.112	
			6g	0.020	4.980	0.106	4.655	0.075	4.272	6H	5.000	4.775	0.100	4.599	0.140	
			7H							7H	5.000	4.800	0.125	4.639	0.180	
	0.8		4h	0	5.000	0.095	4.480	0.060	3.927	5H	5.000	4.580	0.100	4.294	0.160	
			6g	0.024	4.976	0.150	4.456	0.095	3.868	6H	5.000	4.605	0.125	4.334	0.200	
			7H							7H	5.000	4.640	0.160	4.384	0.250	
5.5	0.5		4h	0	5.500	0.067	5.175	0.048	4.819	5H	5.500	5.255	0.080	5.071	0.112	
			6g	0.020	5.480	0.106	5.155	0.075	4.772	6H	5.500	5.275	0.100	5.099	0.140	
			7H							7H	5.500	5.300	0.125	5.139	0.180	
	0.75		4h	0	6.000	0.090	5.513	0.063	4.988	5H	6.000	5.619	0.106	5.338	0.150	
			6g	0.022	5.978	0.140	5.491	0.100	4.929	6H	6.000	5.645	0.132	5.378	0.190	
			7H							7H	6.000	5.683	0.170	5.424	0.236	
6	1		4h	0	6.000	0.112	5.350	0.071	4.663	5H	6.000	5.468	0.118	5.107	0.190	
			6g	0.026	5.974	0.180	5.324	0.112	4.597	6H	6.000	5.500	0.150	5.153	0.236	
			8g	0.026	5.974	0.280	5.324	0.180	4.528	7H	6.000	5.540	0.190	5.217	0.300	
	0.75		4h	0	7.000	0.090	6.513	0.063	5.988	5H	7.000	6.619	0.106	6.338	0.150	
			6g	0.022	6.978	0.140	6.491	0.100	5.929	6H	7.000	6.645	0.132	6.378	0.190	
			7H							7H	7.000	6.683	0.170	6.424	0.236	
1		4h	0	7.000	0.112	6.350	0.071	5.663	5H	7.000	6.468	0.118	6.107	0.190		
		6g	0.026	6.974	0.180	6.324	0.112	5.596	6H	7.000	6.500	0.150	6.153	0.236		
		8g	0.026	6.974	0.280	6.324	0.180	5.528	7H	7.000	6.540	0.190	6.217	0.300		
8	1		4h	0	8.000	0.112	7.350	0.071	6.663	5H	8.000	7.468	0.118	7.107	0.190	
			6g	0.026	7.974	0.180	7.324	0.112	6.596	6H	8.000	7.500	0.150	7.153	0.236	
			8g	0.026	7.974	0.280	7.324	0.180	6.528	7H	8.000	7.540	0.190	7.217	0.300	
	1.25		4h	0	8.000	0.132	7.188	0.075	6.343	5H	8.000	7.313	0.125	6.859	0.212	
			6g	0.028	7.972	0.212	7.160	0.118	6.272	6H	8.000	7.348	0.160	6.912	0.265	
			8g	0.028	7.972	0.335	7.160	0.190	6.200	7H	8.000	7.388	0.200	6.982	0.335	

**Table 5. (Continued) British Standard ISO Metric Screw Threads: Limits and Tolerances for Finished Uncoated Threads for Normal Lengths of Engagement BS 3643: Part 2: 1981**

Nominal Diameter <sup>a</sup>	Pitch		External Threads (Bolts)						Internal Threads (Nuts) <sup>b</sup>							
	Coarse	Fine	Tot. Class	Fund dev.	Major Dia.		Pitch Dia.		Minor Dia	Tot. Class	Major Dia.		Pitch Dia.		Minor Dia	
					Max	Tol(-)	Max	Tol(-)	Min		Max	Max	Tol(-)	Max	Tol(-)	
9	1.25		4h	0	9.000	0.132	8.188	0.075	7.343	5H	9.000	8.313	0.125	7.859	0.212	
			6g	0.028	8.972	0.212	8.160	0.008	7.272	6H	9.000	8.348	0.160	7.912	0.265	
			8g	0.028	8.972	0.335	8.160	0.190	7.200	7H	9.000	8.388	0.200	7.982	0.335	
10	1.25		4h	0	10.000	0.132	9.188	0.075	8.343	5H	10.000	9.313	0.125	8.859	0.212	
			6g	0.028	9.972	0.212	9.160	0.118	8.272	6H	10.000	9.348	0.160	8.912	0.265	
			8g	0.028	9.972	0.335	9.160	0.190	8.200	7H	10.000	9.388	0.200	8.982	0.335	
	1.5		4h	0	10.000	0.150	9.026	0.085	8.018	5H	10.000	9.166	0.140	8.612	0.236	
			6g	0.032	9.968	0.236	8.994	0.132	7.938	6H	10.000	9.206	0.180	8.676	0.300	
			8g	0.032	9.968	0.375	8.994	0.212	7.858	7H	10.000	9.250	0.224	8.751	0.375	
11	1.5		4h	0	11.000	0.150	10.026	0.085	9.018	5H	11.000	10.166	0.140	9.612	0.236	
			6g	0.032	10.968	0.236	9.994	0.132	8.938	6H	11.000	10.206	0.180	9.676	0.300	
			8g	0.032	10.968	0.375	9.994	0.212	8.858	7H	11.000	10.250	0.224	9.751	0.375	
12	1.25		4h	0	12.000	0.132	11.188	0.085	10.333	5H	12.000	11.328	0.140	10.859	0.212	
			6g	0.028	11.972	0.212	11.160	0.132	10.257	6H	12.000	11.398	0.180	10.912	0.265	
			8g	0.028	11.972	0.335	11.160	0.212	10.177	7H	12.000	11.412	0.224	10.985	0.335	
	1.75		4h	0	12.000	0.170	10.863	0.095	9.692	5H	12.000	11.023	0.160	10.371	0.265	
			6g	0.034	11.966	0.265	10.829	0.150	9.602	6H	12.000	11.063	0.200	10.441	0.335	
			8g	0.034	11.966	0.425	10.829	0.236	9.516	7H	12.000	11.113	0.250	10.531	0.425	
14	1.5		4h	0	14.000	0.150	13.026	0.090	12.012	5H	14.000	13.176	0.150	12.612	0.236	
			6g	0.032	13.968	0.236	12.994	0.140	11.930	6H	14.000	13.216	0.190	12.676	0.300	
			8g	0.032	13.968	0.375	12.994	0.224	11.846	7H	14.000	13.262	0.236	12.751	0.375	
	2		4h	0	14.000	0.180	12.701	0.100	11.369	5H	14.000	12.871	0.170	12.135	0.300	
			6g	0.038	13.962	0.280	12.663	0.160	11.271	6H	14.000	12.913	0.212	12.210	0.375	
			8g	0.038	13.962	0.450	12.663	0.250	11.181	7H	14.000	12.966	0.265	12.310	0.475	
16	1.5		4h	0	16.000	0.150	15.026	0.090	14.012	5H	16.000	15.176	0.150	14.612	0.236	
			6g	0.032	15.968	0.236	14.994	0.140	13.930	6H	16.000	15.216	0.190	14.676	0.300	
			8g	0.032	15.968	0.375	14.994	0.224	13.846	7H	16.000	15.262	0.236	14.751	0.375	
	2		4h	0	16.000	0.180	14.701	0.100	13.369	5H	16.000	14.871	0.170	14.135	0.300	
			6g	0.038	15.962	0.280	14.663	0.160	13.271	6H	16.000	14.913	0.212	14.210	0.375	
			8g	0.038	15.962	0.450	14.663	0.250	13.181	7H	16.000	14.966	0.265	14.310	0.475	
18	1.5		4h	0	18.000	0.150	17.026	0.090	16.012	5H	18.000	17.176	0.150	16.612	0.236	
			6g	0.032	17.968	0.236	16.994	0.140	15.930	6H	18.000	17.216	0.190	16.676	0.300	
			8g	0.032	17.968	0.375	16.994	0.224	15.846	7H	18.000	17.262	0.236	16.751	0.375	
	2.5		4h	0	18.000	0.212	16.376	0.106	14.730	5H	18.000	16.556	0.180	15.649	0.355	
			6g	0.042	17.958	0.335	16.334	0.170	14.624	6H	18.000	16.600	0.224	15.774	0.450	
			8g	0.042	17.958	0.530	16.334	0.265	14.529	7H	18.000	16.656	0.280	15.854	0.560	
20	1.5		4h	0	20.000	0.150	19.026	0.090	18.012	5H	20.000	19.176	0.150	18.612	0.236	
			6g	0.032	19.968	0.236	18.994	0.140	17.930	6H	20.000	0.190	0.190	18.676	0.300	
			8g	0.032	19.968	0.375	18.994	0.224	17.846	7H	20.000	19.262	0.236	18.751	0.375	
	2.5		4h	0	20.000	0.212	18.376	0.106	16.730	5H	20.000	18.556	0.180	17.649	0.355	
			6g	0.042	19.958	0.335	18.334	0.170	16.624	6H	20.000	18.600	0.224	17.744	0.450	
			8g	0.042	19.958	0.530	18.334	0.265	16.529	7H	20.000	18.650	0.280	17.854	0.560	
22	1.5		4h	0	22.000	0.150	21.026	0.090	20.012	5H	22.000	21.176	0.150	20.612	0.236	
			6g	0.032	21.968	0.236	20.994	0.140	19.930	6H	22.000	21.216	0.190	20.676	0.300	
			8g	0.032	21.968	0.375	20.994	0.224	19.846	7H	22.000	21.262	0.236	20.751	0.375	
	2.5		4h	0	22.000	0.212	20.376	0.106	18.730	5H	22.000	20.556	0.180	19.649	0.355	
			6g	0.042	21.958	0.335	20.334	0.170	18.624	6H	22.000	20.600	0.224	19.744	0.450	
			8g	0.042	21.958	0.530	20.334	0.265	18.529	7H	22.000	20.656	0.280	19.854	0.560	
24	2		4h	0	24.000	0.180	22.701	0.106	21.363	5H	24.000	22.881	0.180	22.135	0.300	
			6g	0.038	23.962	0.280	22.663	0.170	21.261	6H	24.000	22.925	0.224	22.210	0.375	
			8g	0.038	23.962	0.450	22.663	0.265	21.166	7H	24.000	22.981	0.280	22.310	0.475	
	3		4h	0	24.000	0.236	22.051	0.125	20.078	5H	24.000	22.263	0.212	21.152	0.400	
			6g	0.048	23.952	0.375	22.003	0.200	19.955	6H	24.000	22.316	0.265	21.252	0.500	
			8g	0.048	23.952	0.600	22.003	0.315	19.840	7H	24.000	22.386	0.335	21.382	0.630	
27	2		4h	0	27.000	0.180	25.701	0.106	24.363	5H	27.000	25.881	0.180	25.135	0.300	
			6g	0.038	26.962	0.280	25.663	0.170	24.261	6H	27.000	25.925	0.224	25.210	0.375	
			8g	0.038	26.962	0.450	25.663	0.265	24.166	7H	27.000	25.981	0.280	25.310	0.475	
	3		4h	0	27.000	0.236	25.051	0.125	23.078	5H	27.000	25.263	0.212	24.152	0.400	
			6g	0.048	26.952	0.375	25.003	0.200	22.955	6H	27.000	25.316	0.265	24.252	0.500	
			8g	0.048	26.952	0.600	25.003	0.315	22.840	7H	27.000	25.386	0.335	24.382	0.630	

**Table 5. (Continued) British Standard ISO Metric Screw Threads: Limits and Tolerances for Finished Uncoated Threads for Normal Lengths of Engagement BS 3643: Part 2: 1981**

Nominal Diameter <sup>a</sup>	Pitch		External Threads (Bolts)						Internal Threads (Nuts) <sup>b</sup>							
	Coarse	Fine	Tol. Class	Fund. dev.	Major Dia.		Pitch Dia.		Minor Dia	Tol. Class	Major Dia.		Pitch Dia.		Minor Dia	
					Max	Tol(-)	Max	Tol(-)	Min		Min	Max	Tol(-)	Max	Tol(-)	
	4h	0	30.000	0.180	28.701	0.106	27.363	5H	30.000	28.881	0.180	28.135	0.300			
30		2	6g	0.038	29.962	0.280	28.663	0.170	27.261	6H	30.000	27.925	0.224	28.210	0.375	
			8g	0.038	29.962	0.450	28.663	0.265	27.166	7H	30.000	28.981	0.280	28.310	0.475	
			4h	0	30.000	0.265	27.727	0.132	25.439	5H	30.000	27.951	0.224	26.661	0.450	
	3.5			6g	0.053	29.947	0.425	27.674	0.212	25.305	6H	30.000	28.007	0.280	26.771	0.560
				8g	0.053	29.947	0.670	27.674	0.335	25.183	7H	30.000	28.082	0.355	26.921	0.710
				4h	0	33.000	0.180	31.701	0.106	30.363	5H	33.000	31.881	0.180	31.135	0.300
33	2		6g	0.038	32.962	0.280	31.663	0.170	30.261	6H	33.000	31.925	0.224	31.210	0.375	
			8g	0.038	32.962	0.450	30.663	0.265	30.166	7H	33.000	31.981	0.280	31.310	0.475	
			4h	0	33.000	0.265	30.727	0.132	28.438	5H	33.000	30.951	0.224	29.661	0.450	
	3.5			6g	0.053	32.947	0.425	30.674	0.212	28.305	6H	33.000	31.007	0.280	29.771	0.560
				8g	0.053	32.947	0.670	30.674	0.335	28.182	7H	33.000	31.082	0.355	29.921	0.710
				4h	0	36.000	0.300	33.402	0.140	30.798	5H	36.000	33.638	0.236	32.145	0.475
36	4		6g	0.060	35.940	0.475	33.342	0.224	30.654	6H	36.000	33.702	0.300	32.270	0.600	
			8g	0.060	35.940	0.750	33.342	0.355	30.523	7H	36.000	33.777	0.375	32.420	0.750	
			4h	0	39.000	0.300	36.402	0.140	33.798	5H	39.000	36.638	0.236	35.145	0.475	
39	4		6g	0.060	38.940	0.475	36.342	0.224	33.654	6H	39.000	36.702	0.300	35.270	0.600	
			8g	0.060	38.940	0.750	36.342	0.355	33.523	7H	39.000	36.777	0.375	35.420	0.750	

<sup>a</sup> This table provides coarse- and fine-pitch series data for threads listed in Table 6 for first, second, and third choices. For constant-pitch series and for larger sizes than are shown, refer to the Standard.

<sup>b</sup> The fundamental deviation for internal threads (nuts) is zero for threads in this table.

All dimensions are in millimeters.

**Diameter/Pitch Combinations.**—Part 1 of BS 3643 provides a choice of diameter/pitch combinations shown here in Table 6. The use of first-choice items is preferred but if necessary, second, then third choice combinations may be selected. If pitches finer than those given in Table 6 are necessary, only the following pitches should be used: 3, 2, 1.5, 1, 0.75, 0.5, 0.35, 0.25, and 0.2 mm. When selecting such pitches it should be noted that there is increasing difficulty in meeting tolerance requirements as the diameter is increased for a given pitch. It is suggested that diameters greater than the following should not be used with the pitches indicated:

Pitch, mm	0.5	0.75	1	1.5	2	3
Maximum Diameter, mm	22	33	80	150	200	300

In cases where it is necessary to use a thread with a pitch larger than 6 mm, in the diameter range of 150 to 300 mm, the 8 mm pitch should be used.

**Limits and Tolerances for Finished Uncoated Threads.**—Part 2 of BS 3643 specifies the fundamental deviations, tolerances, and limits of size for the tolerance classes 4H, 5H, 6H, and 7H for internal threads (nuts) and 4h, 6g, and 8g for external threads (bolts) for coarse-pitch series within the range of 1 to 68 mm; fine-pitch series within the range of 1 to 33 mm; and constant pitch series within the range of 8 to 300 mm diameter.

The data in Table 5 provide the first, second, and third choice combinations shown in Table 6 except that constant-pitch series threads are omitted. For diameters larger than shown in Table 5, and for constant-pitch series data, refer to the Standard.

**Table 6. British Standard ISO Metric Screw Threads — Diameter/Pitch Combinations BS 3643:Part 1:1981 (1998)**

Nominal Diameter			Coarse Pitch	Fine Pitch	Constant Pitch	Nominal Diameter			Constant Pitch
Choices						Choices			
1st	2nd	3rd				1st	2nd	3rd	
1	...	...	0.25	0.2	...	...	...	70	6, 4, 3, 2, 1.5
...	1.1	...	0.25	0.2	...	72	...	...	6, 4, 3, 2, 1.5
1.2	...	...	0.25	0.2	...	...	...	75	4, 3, 2, 1.5
...	1.4	...	0.3	0.2	...	...	76	...	6, 4, 3, 2, 1.5
1.6	...	...	0.35	0.2	...	...	...	78	2
...	1.8	...	0.35	0.2	...	80	...	...	6, 4, 3, 2, 1.5
2.0	...	...	0.4	0.25	...	...	...	82	2
...	2.2	...	0.45	0.25	...	...	85	...	6, 4, 3, 2
2.5	...	...	0.45	0.35	...	90	...	...	6, 4, 3, 2
3	...	...	0.5	0.35	...	...	95	...	6, 4, 3, 2
...	3.5	...	0.6	0.35	...	100	...	...	6, 4, 3, 2
4	...	...	0.7	0.5	...	...	105	...	6, 4, 3, 2
...	4.5	...	0.75	0.5	...	110	...	...	6, 4, 3, 2
5	...	...	0.8	0.5	...	...	115	...	6, 4, 3, 2
...	...	5.5	...	(0.5)	...	...	120	...	6, 4, 3, 2
6	...	...	1	0.75	...	125	...	...	6, 4, 3, 2
...	7	...	1	0.75	...	...	130	...	6, 4, 3, 2
8	...	...	1.25	1	0.75	...	...	135	6, 4, 3, 2
...	...	9	1.25	...	1, 0.75	140	...	...	6, 4, 3, 2
10	...	...	1.5	1.25	1, 0.75	...	...	145	6, 4, 3, 2
...	...	11	1.5	...	1, 0.75	...	150	...	6, 4, 3, 2
12	...	...	1.75	1.25	1.5, 1	...	...	155	6, 4, 3
...	14	...	2	1.5	1.25 <sup>a</sup> , 1	160	...	...	6, 4, 3
...	...	15	...	...	1.5, 1	...	...	165	6, 4, 3
16	...	...	2	1.5	1	...	170	...	6, 4, 3
...	...	17	...	...	1.5, 1	...	...	175	6, 4, 3
...	18	...	2.5	1.5	2, 1	180	...	...	6, 4, 3
20	...	...	2.5	1.5	2, 1	...	...	185	6, 4, 3
...	22	...	2.5	1.5	2, 1	...	190	...	6, 4, 3
24	...	...	3	2	1.5, 1	...	...	195	6, 4, 3
...	...	25	...	...	2, 1.5, 1	200	...	...	6, 4, 3
...	...	26	...	...	1.5	...	...	205	6, 4, 3
...	27	...	3	2	1.5, 1	...	210	...	6, 4, 3
...	...	28	...	...	2, 1.5, 1	...	...	215	6, 4, 3
30	...	...	3.5	2	(3), 1.5, 1	220	...	...	6, 4, 3
...	...	32	...	...	2, 1.5	...	...	225	6, 4, 3
...	33	...	3.5	2	(3), 1.5	...	...	230	6, 4, 3
...	...	35 <sup>b</sup>	...	...	1.5	...	...	235	6, 4, 3
36	...	...	4	...	3, 2, 1.5	...	240	...	6, 4, 3
...	...	38	...	...	1.5	...	...	245	6, 4, 3
...	39	...	4	...	3, 2, 1.5	250	...	...	6, 4, 3
...	...	40	...	...	3, 2, 1.5	...	...	255	6, 4
42	45	...	4.5	...	4, 3, 2, 1.5	...	260	...	6, 4
48	...	...	5	...	4, 3, 2, 1.5	...	...	265	6, 4
...	...	50	...	...	3, 2, 1.5	...	...	270	6, 4
...	52	...	5	...	4, 3, 2, 1.5	...	...	275	6, 4
...	...	55	...	...	4, 3, 2, 1.5	280	...	...	6, 4
56	...	...	5.5	...	4, 3, 2, 1.5	...	...	285	6, 4
...	...	58	...	...	4, 3, 2, 1.5	...	...	290	6, 4
...	60	...	5.5	...	4, 3, 2, 1.5	...	...	295	6, 4
...	...	62	...	...	4, 3, 2, 1.5	...	300	...	6, 4
64	...	...	6	...	4, 3, 2, 1.5	...	...	...	...
...	...	65	...	...	4, 3, 2, 1.5	...	...	...	...
...	68	...	6	...	4, 3, 2, 1.5	...	...	...	...

<sup>a</sup>Only for spark plugs for engines.<sup>b</sup>Only for locking nuts for bearings.

All dimensions are in millimeters. Pitches in parentheses ( ) are to be avoided as far as possible.

## Comparison of Various Metric Thread Systems

**Metric Series Threads — A comparison of Maximum Metal Dimensions of British (BS 1095), French (NF E03-104), German (DIN 13), and Swiss (VSM 12003) Systems**

Nominal Size and Major Bolt Diam.	Pitch	Pitch Diam.	Bolt				Nut				
			Minor Diameter				Major Diameter			Minor Diameter	
			British	French	German	Swiss	British & German	French	Swiss	French, German & Swiss	British
6	1	5.350	4.863	4.59	4.700	4.60	6.000	6.108	6.100	4.700	4.863
7	1	6.350	5.863	5.59	5.700	5.60	7.000	7.108	7.100	5.700	5.863
8	1.25	7.188	6.579	6.24	6.376	6.25	8.000	8.135	8.124	6.376	6.579
9	1.25	8.188	7.579	7.24	7.376	7.25	9.000	9.135	9.124	7.376	7.579
10	1.5	9.026	8.295	7.89	8.052	7.90	10.000	10.162	10.150	8.052	8.295
11	1.5	10.026	9.295	8.89	9.052	8.90	11.000	11.162	11.150	9.052	9.295
12	1.75	10.863	10.011	9.54	9.726	9.55	12.000	12.189	12.174	9.726	10.011
14	2	12.701	11.727	11.19	11.402	11.20	14.000	14.216	14.200	11.402	11.727
16	2	14.701	13.727	13.19	13.402	13.20	16.000	16.216	16.200	13.402	13.727
18	2.5	16.376	15.158	14.48	14.752	14.50	18.000	18.270	18.250	14.752	15.158
20	2.5	18.376	17.158	16.48	16.752	16.50	20.000	20.270	20.250	16.752	17.158
22	2.5	20.376	19.158	18.48	18.752	18.50	22.000	22.270	22.250	18.752	19.158
24	3	22.051	20.590	19.78	20.102	19.80	24.000	24.324	24.300	20.102 <sup>a</sup>	20.590
27	3	25.051	23.590	22.78	23.102	22.80	27.000	27.324	27.300	23.102 <sup>b</sup>	23.590
30	3.5	27.727	26.022	25.08	25.454	25.10	30.000	30.378	30.350	25.454	26.022
33	3.5	30.727	29.022	28.08	28.454	28.10	33.000	33.378	33.350	28.454	29.022
36	4	33.402	31.453	30.37	30.804	30.40	36.000	36.432	36.400	30.804	31.453
39	4	36.402	34.453	33.37	33.804	33.40	39.000	39.432	39.400	33.804	34.453
42	4.5	39.077	36.885	35.67	36.154	35.70	42.000	42.486	42.450	36.154	36.885
45	4.5	42.077	39.885	38.67	39.154	38.70	45.000	45.486	45.450	39.154	39.885
48	5	41.752	42.316	40.96	41.504	41.00	48.000	48.540	48.500	41.504	42.316
52	5	48.752	46.316	44.96	45.504	45.00	52.000	52.540	52.500	45.504	46.316
56	5.5	52.428	49.748	48.26	48.856	48.30	56.000	56.594	56.550	48.856	49.748
60	5.5	56.428	53.748	52.26	52.856	52.30	60.000	60.594	60.550	52.856	53.748

<sup>a</sup>The value shown is given in the German Standard; the value in the French Standard is 20.002; and in the Swiss Standard, 20.104.

<sup>b</sup>The value shown is given in the German Standard; the value in the French Standard is 23.002; and in the Swiss Standard, 23.104.

All dimensions are in mm.



## ACME SCREW THREADS

### American National Standard Acme Screw Threads

This American National Standard ASME/ANSI B1.5-1997 is a revision of American Standard ANSI B1.5-1988 and provides for two general applications of Acme threads, namely, General Purpose and Centralizing.

The limits and tolerances in this standard relate to single-start Acme threads, and may be used, if considered suitable, for multi-start Acme threads, which provide fast relative traversing motion when this is necessary. For information on additional allowances for multi-start Acme threads, see later section on page 1827.

**General Purpose Acme Threads.**—Three classes of General Purpose threads, 2G, 3G, and 4G, are provided in the standard, each having clearance on all diameters for free movement, and may be used in assemblies with the internal thread rigidly fixed and movement of the external thread in a direction perpendicular to its axis limited by its bearing or bearings. It is suggested that external and internal threads of the same class be used together for general purpose assemblies, Class 2G being the preferred choice. If less backlash or end play is desired, Classes 3G and 4G are provided. Class 5G is not recommended for new designs.

**Thread Form:** The accompanying Fig. 1 shows the thread form of these General Purpose threads, and the formulas accompanying the figure determine their basic dimensions. Table 1 gives the basic dimensions for the most generally used pitches.

**Angle of Thread:** The angle between the sides of the thread, measured in an axial plane, is 29 degrees. The line bisecting this 29-degree angle shall be perpendicular to the axis of the screw thread.

**Thread Series:** A series of diameters and associated pitches is recommended in the Standard as preferred. These diameters and pitches have been chosen to meet present needs with the fewest number of items in order to reduce to a minimum the inventory of both tools and gages. This series of diameters and associated pitches is given in Table 3.

**Chamfers and Fillets:** General Purpose external threads may have the crest corner chamfered to an angle of 45 degrees with the axis to a maximum width of  $P/15$ , where  $P$  is the pitch. This corresponds to a maximum depth of chamfer flat of  $0.0945P$ .

**Basic Diameters:** The max major diameter of the external thread is basic and is the nominal major diameter for all classes. The min pitch diameter of the internal thread is basic and is equal to the basic major diameter minus the basic height of the thread,  $h$ . The basic minor diameter is the min minor diameter of the internal thread. It is equal to the basic major diameter minus twice the basic thread height,  $2h$ .

**Length of Engagement:** The tolerances specified in this standard are applicable to lengths of engagement not exceeding twice the nominal major diameter.

**Major and Minor Diameter Allowances:** A minimum diametral clearance is provided at the minor diameter of all external threads by establishing the maximum minor diameter 0.020 inch below the basic minor diameter of the nut for pitches of 10 threads per inch and coarser, and 0.10 inch for finer pitches. A minimum diametral clearance at the major diameter is obtained by establishing the minimum major diameter of the internal thread 0.020 inch above the basic major diameter of the screw for pitches of 10 threads per inch and coarser, and 0.010 inch for finer pitches.

**Major and Minor Diameter Tolerances:** The tolerance on the external thread major diameter is  $0.05P$ , where  $P$  is the pitch, with a minimum of 0.005 inch. The tolerance on the internal thread major diameter is 0.020 inch for 10 threads per inch and coarser and 0.010 for finer pitches. The tolerance on the external thread minor diameter is  $1.5 \times$  pitch diameter tolerance. The tolerance on the internal thread minor diameter is  $0.05P$  with a minimum of 0.005 inch.

**ANSI General Purpose Acme Thread Form ASME/ANSI B1.5-1997,  
and Stub Acme Screw Thread Form ASME/ANSI B1.8-1988 (R2001)**

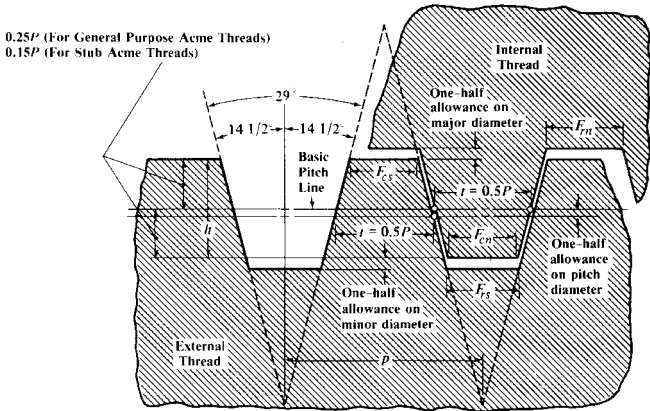


Fig. 1. General Purpose and Stub Acme Thread Forms

**Formulas for Basic Dimensions of General Purpose and Stub Acme Screw Threads**

General Purpose	Stub Acme Threads
Pitch = $P = 1 \div$ No. threads per inch, $n$	Pitch = $P = 1 \div$ No. threads per inch, $n$
Basic thread height $h = 0.5P$	Basic thread height $h = 0.3P$
Basic thread thickness $t = 0.5P$	Basic thread thickness $t = 0.5P$
Basic flat at crest $F_{cs} = 0.3707P$ (internal thread)	Basic flat at crest $F_{cs} = 0.4224P$ (internal thread)
Basic flat at crest $F_{cs} = 0.3707P - 0.259 \times$ (pitch dia. allowance on ext. thd.)	Basic flat at crest $F_{cs} = 0.4224P - 0.259 \times$ (pitch dia. allowance on ext. thread)
$F_{rn} = 0.3707P - 0.259 \times$ (major dia. allowance on internal thread)	$F_{rn} = 0.4224P - 0.259 \times$ (major dia. allowance on internal thread)
$F_{rs} = 0.3707P - 0.259 \times$ (minor dia. allowance on ext. thread - pitch dia. allowance on ext. thread)	$F_{rs} = 0.4224P - 0.259 \times$ (minor dia. allowance on ext. thread - pitch dia. allowance on ext. thread)

**Pitch Diameter Allowances and Tolerances:** Allowances on the pitch diameter of General Purpose Acme threads are given in Table 4. Pitch diameter tolerances are given in Table 5. The ratios of the pitch diameter tolerances of Classes 2G, 3G, and 4G, General Purpose threads are 3.0, 1.4, and 1, respectively.

An increase of 10 per cent in the allowance is recommended for each inch, or fraction thereof, that the length of engagement exceeds two diameters.

**Application of Tolerances:** The tolerances specified are designed to ensure interchangeability and maintain a high grade of product. The tolerances on diameters of the internal thread are plus, being applied from minimum sizes to above the minimum sizes. The tolerances on diameters of the external thread are minus, being applied from the maximum sizes to below the maximum sizes. The pitch diameter (or thread thickness) tolerances for an external or internal thread of a given class are the same. The thread thickness tolerance is 0.259 times the pitch diameter tolerance.

*Limiting Dimensions:* Limiting dimensions of General Purpose Acme screw threads in the recommended series are given in [Table 2b](#). These limits are based on the formulas in [Table 2a](#).

For combinations of pitch and diameter other than those in the recommended series, the formulas in [Table 2a](#) and the data in [Tables 4](#) and [5](#) make it possible to readily determine the limiting dimensions required.

A diagram showing the disposition of allowances, tolerances, and crest clearances for General Purpose Acme threads appears on page [1826](#).

*Stress Area of General Purpose Acme Threads:* For computing the tensile strength of the thread section, the minimum stress area based on the mean of the minimum pitch diameter  $d_2$  min. and the minimum minor diameter  $d_1$  max. of the external thread is used:

$$\text{Stress Area} = 3.1416 \left( \frac{d_2 \text{ min.} + d_1 \text{ max.}}{4} \right)^2$$

where  $d_2$  min. and  $d_1$  max. may be computed by Formulas 4 and 6, [Table 2a](#) or taken from [Table 2b](#).

*Shear Area of General Purpose Acme Threads:* For computing the shear area per inch length of engagement of the external thread, the maximum minor diameter of the internal thread  $D_1$  max., and the minimum pitch diameter of the external thread  $D_2$  min., [Table 2b](#) or Formulas 12 and 4, [Table 2a](#), are used:

$$\text{Shear Area} = 3.1416 D_1 \text{ max.} [0.5 + n \tan 14\frac{1}{2}^\circ (D_2 \text{ min.} - D_1 \text{ max.})]$$

**Acme Thread Abbreviations.**—The following abbreviations are recommended for use on drawings and in specifications, and on tools and gages:

ACME = Acme threads  
 G = General Purpose  
 C = Centralizing  
 P = pitch  
 L = lead  
 LH = left hand

**Designation of General Purpose Acme Threads.**—The examples listed below are given here to show how General Purpose Acme threads are designated on drawings and tools:

1.750-4 ACME-2G indicates a General Purpose Class 2G Acme thread of 1.750-inch major diameter, 4 threads per inch, single thread, right hand. The same thread, but left hand, is designated 1.750-4 ACME-2G-LH.

2.875-0.4P-0.8L-ACME-3G indicates a General Purpose Class 3G Acme thread of 2.875-inch major diameter, pitch 0.4 inch, lead 0.8 inch, double thread, right hand.

**Multiple Start Acme Threads.**—The tabulated diameter-pitch data with allowances and tolerances relate to single-start threads. These data, as tabulated, may be and often are used for two-start Class 2G threads but this usage generally requires reduction of the full working tolerances to provide a greater allowance or clearance zone between the mating threads to assure satisfactory assembly.

When the class of thread requires smaller working tolerances than the 2G class or when threads with 3, 4, or more starts are required, some additional allowances or increased tolerances or both may be needed to ensure adequate working tolerances and satisfactory assembly of mating parts.

It is suggested that the allowances shown in [Table 4](#) be used for all external threads and that allowances be applied to internal threads in the following ratios: for two-start threads, 50 per cent of the allowances shown in the Class 2G, 3G and 4G columns of [Table 4](#); for

**Table 1. American National Standard General Purpose Acme Screw Thread Form — Basic Dimensions ASME/ANSI B1.5-1997**

Thds. per Inch <i>n</i>	Pitch, $P = 1/n$	Height of Thread (Basic), $h = P/2$	Total Height of Thread, $h_s = P/2 + \frac{1}{2}$ allowance <sup>a</sup>	Thread Thickness (Basic), $t = P/2$	Width of Flat	
					Crest of Internal Thread (Basic), $F_{en} = 0.3707P$	Root of Internal Thread, $F_m$ $0.3707P - 0.259 \times$ allowance <sup>a</sup>
16	0.06250	0.03125	0.0362	0.03125	0.0232	0.0206
14	0.07143	0.03571	0.0407	0.03571	0.0265	0.0239
12	0.08333	0.04167	0.0467	0.04167	0.0309	0.0283
10	0.010000	0.05000	0.0600	0.05000	0.0371	0.0319
8	0.12500	0.06250	0.0725	0.06250	0.0463	0.0411
6	0.16667	0.08333	0.0933	0.08333	0.0618	0.0566
5	0.20000	0.10000	0.1100	0.10000	0.0741	0.0689
4	0.25000	0.12500	0.1350	0.12500	0.0927	0.0875
3	0.33333	0.16667	0.1767	0.16667	0.1236	0.1184
2½	0.40000	0.20000	0.2100	0.20000	0.1483	0.1431
2	0.50000	0.25000	0.2600	0.25000	0.1853	0.1802
1½	0.66667	0.33333	0.3433	0.33333	0.2471	0.2419
1⅓	0.75000	0.37500	0.3850	0.37500	0.2780	0.2728
1	1.00000	0.50000	0.5100	0.50000	0.3707	0.3655

All dimensions are in inches.

<sup>a</sup> Allowance is 0.020 inch for 10 threads per inch and coarser, and 0.010 inch for finer threads.

**Table 2a. American National Standard General Purpose Acme Single-Start Screw Threads — Formulas for Determining Diameters ASME/ANSI B1.5-1997**

<p><math>D</math> = Basic Major Diameter and Nominal Size, in Inches.  <math>P</math> = Pitch = <math>1 \div</math> Number of Threads per Inch.  <math>E</math> = Basic Pitch Diameter = <math>D - 0.5P</math>  <math>K</math> = Basic Minor Diameter = <math>D - P</math></p>	
No.	External Threads (Screws)
1	Major Dia., Max. = $D$
2	Major Dia., Min. = $D$ minus $0.05P^a$ but not less than 0.005.
3	Pitch Dia., Max. = $E$ minus allowance from Table 4.
4	Pitch Dia., Min. = Pitch Dia., Max. (Formula 3) minus tolerance from Table 5.
5	Minor Dia., Max. = $K$ minus 0.020 for 10 threads per inch and coarser and 0.010 for finer-pitches.
6	Minor Dia., Min. = Minor Dia., Max. (Formula 5) minus $1.5 \times$ pitch diameter tolerance from Table 5.
Internal Threads (Nuts)	
7	Major Dia., Min. = $D$ plus 0.020 for 10 threads per inch and coarser and 0.010 for finer pitches.
8	Major Dia., Max. = Major Dia., Min. (Formula 7) plus 0.020 for 10 threads per inch and coarser and 0.010 for finer pitches.
9	Pitch Dia., Min. = $E$
10	Pitch Dia., Max. = Pitch Dia., Min. (Formula 9) plus tolerance from Table 5.
11	Minor Dia., Min. = $K$
12	Minor Dia., Max. = Minor Dia., Min. (Formula 11) plus $0.05P^a$ but not less than 0.005.

<sup>a</sup> If  $P$  is between two recommended pitches listed in Table 3, use the coarser of the two pitches in this formula instead of the actual value of  $P$ .

**Table 2b. Limiting Dimensions of ANSI General Purpose Acme Single-Start Screw Threads ASME/ANSI B1.5-1988**

Nominal Diameter, $D$		$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$
		Threads per Inch <sup>a</sup>											
Limiting Diameters		16	14	12	12	10	8	6	6	5	5	5	4
		External Threads											
Classes 2G, 3G, and 4G Major Diameter	Max ( $D$ )	0.2500	0.3125	0.3750	0.4375	0.5000	0.6250	0.7500	0.8750	1.0000	1.1250	1.2500	1.3750
	Min	0.2450	0.3075	0.3700	0.4325	0.4950	0.6188	0.7417	0.8667	0.9900	1.1150	1.2400	1.3625
Classes 2G, 3G, and 4G Minor Diameter	Max	0.1775	0.2311	0.2817	0.3442	0.3800	0.4800	0.5633	0.6883	0.7800	0.9050	1.0300	1.1050
	Min	0.1618	0.2140	0.2632	0.3253	0.3594	0.4570	0.5372	0.6615	0.7509	0.8753	0.9998	1.0720
Class 2G, Minor Diameter	Max	0.1702	0.2231	0.2730	0.3354	0.3704	0.4693	0.5511	0.6758	0.7664	0.8912	1.0159	1.0896
	Min	0.1722	0.2254	0.2755	0.3379	0.3731	0.4723	0.5546	0.6794	0.7703	0.8951	1.0199	1.0940
Class 3G, Minor Diameter	Max	0.2148	0.2728	0.3284	0.3909	0.4443	0.5562	0.6598	0.7842	0.8920	1.0165	1.1411	1.2406
	Min	0.2043	0.2614	0.3161	0.3783	0.4306	0.5408	0.6424	0.7663	0.8726	0.9967	1.1210	1.2188
Class 4G, Minor Diameter	Max	0.2158	0.2738	0.3296	0.3921	0.4458	0.5578	0.6615	0.7861	0.8940	1.0186	1.1433	1.2430
	Min	0.2109	0.2685	0.3238	0.3862	0.4394	0.5506	0.6534	0.7778	0.8849	1.0094	1.1339	1.2327
Class 2G, Pitch Diameter	Max	0.2168	0.2748	0.3309	0.3934	0.4472	0.5593	0.6632	0.7880	0.8960	1.0208	1.1455	1.2453
	Min	0.2133	0.2710	0.3268	0.3892	0.4426	0.5542	0.6574	0.7820	0.8895	1.0142	1.1388	1.2380
		Internal Threads											
Classes 2G, 3G, and 4G Major Diameter	Min	0.2600	0.3225	0.3850	0.4475	0.5200	0.6450	0.7700	0.8950	1.0200	1.1450	1.2700	1.3950
	Max	0.2700	0.3325	0.3950	0.4575	0.5400	0.6650	0.7900	0.9150	1.0400	1.1650	1.2900	1.4150
Classes 2G, 3G, and 4G Minor Diameter	Min	0.1875	0.2411	0.2917	0.3542	0.4000	0.5000	0.5833	0.7083	0.8000	0.9250	1.0500	1.1250
	Max	0.1925	0.2461	0.2967	0.3592	0.4050	0.5062	0.5916	0.7166	0.8100	0.9350	1.0600	1.1375
Class 2G, Pitch Diameter	Min	0.2188	0.2768	0.3333	0.3958	0.4500	0.5625	0.6667	0.7917	0.9000	1.0250	1.1500	1.2500
	Max	0.2293	0.2882	0.3456	0.4084	0.4637	0.5779	0.6841	0.8096	0.9194	1.0448	1.1701	1.2720
Class 3G, Pitch Diameter	Min	0.2188	0.2768	0.3333	0.3958	0.4500	0.5625	0.6667	0.7917	0.9000	1.0250	1.1500	1.2500
	Max	0.2237	0.2821	0.3391	0.4017	0.4564	0.5697	0.6748	0.8000	0.9091	1.0342	1.1594	1.2603
Class 4G, Pitch Diameter	Min	0.2188	0.2768	0.3333	0.3958	0.4500	0.5625	0.6667	0.7917	0.9000	1.0250	1.1500	1.2500
	Max	0.2223	0.2806	0.3374	0.4000	0.4546	0.5676	0.6725	0.7977	0.9065	1.0316	1.1567	1.2573

**Table 2b. (Continued) Limiting Dimensions of ANSI General Purpose Acme Single-Start Screw Threads ASME/ANSI B1.5-1988**

Nominal Diameter, $D$		$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
		Threads per Inch <sup>a</sup>										
Limiting Dimensions		External Threads										
Classes 2G, 3G, and 4G	Max ( $D$ )	1.5000	1.7500	2.0000	2.2500	2.5000	2.7500	3.0000	3.5000	4.0000	4.5000	5.0000
	Major Diameter	1.4875	1.7375	1.9875	2.2333	2.4833	2.7333	2.9750	3.4750	3.9750	4.4750	4.9750
Classes 2G, 3G, and 4G	Minor Diameter	1.2300	1.4800	1.7300	1.8967	2.1467	2.3967	2.4800	2.9800	3.4800	3.9800	4.4800
	Class 2G, Minor Diameter	1.1965	1.4456	1.6948	1.8572	2.1065	2.3558	2.4326	2.9314	3.4302	3.9291	4.4281
Class 3G, Minor Diameter	Min	1.2144	1.4640	1.7136	1.8783	2.1279	2.3776	2.4579	2.9574	3.4568	3.9563	4.4558
	Class 4G, Minor Diameter	1.2189	1.4686	1.7183	1.8835	2.1333	2.3831	2.4642	2.9638	3.4634	3.9631	4.4627
Class 2G, Pitch Diameter	Max	1.3652	1.6145	1.8637	2.0713	2.3207	2.5700	2.7360	3.2350	3.7340	4.2330	4.7319
	Min	1.3429	1.5916	1.8402	2.0450	2.2939	2.5427	2.7044	3.2026	3.7008	4.1991	4.6973
Class 3G, Pitch Diameter	Max	1.3677	1.6171	1.8665	2.0743	2.3238	2.5734	2.7395	3.2388	3.7380	4.2373	4.7364
	Min	1.3573	1.6064	1.8555	2.0620	2.3113	2.5607	2.7248	3.2237	3.7225	4.2215	4.7202
Class 4G, Pitch Diameter	Max	1.3701	1.6198	1.8693	2.0773	2.3270	2.5767	2.7430	3.2425	3.7420	4.2415	4.7409
	Min	1.3627	1.6122	1.8615	2.0685	2.3181	2.5676	2.7325	3.2317	3.7309	4.2302	4.7294
		Internal Threads										
Classes 2G, 3G, and 4G	Min	1.5200	1.7700	2.0200	2.2700	2.5200	2.7700	3.0200	3.5200	4.0200	4.5200	5.0200
	Major Diameter	1.5400	1.7900	2.0400	2.2900	2.5400	2.7900	3.0400	3.5400	4.0400	4.5400	5.0400
Classes 2G, 3G, and 4G	Minor Diameter	1.2500	1.5000	1.7500	1.9167	2.1667	2.4167	2.5000	3.0000	3.5000	4.0000	4.5000
	Max	1.2625	1.5125	1.7625	1.9334	2.1834	2.4334	2.5250	3.0250	3.5250	4.0250	4.5250
Class 2G, Pitch Diameter	Min	1.3750	1.6250	1.8750	2.0833	2.3333	2.5833	2.7500	3.2500	3.7500	4.2500	4.7500
	Max	1.3973	1.6479	1.8985	2.1096	2.3601	2.6106	2.7816	3.2824	3.7832	4.2839	4.7846
Class 3G, Pitch Diameter	Min	1.3750	1.6250	1.8750	2.0833	2.3333	2.5833	2.7500	3.2500	3.7500	4.2500	4.7500
	Max	1.3854	1.6357	1.8860	2.0956	2.3458	2.5960	2.7647	3.2651	3.7655	4.2658	4.7662
Class 4G, Pitch Diameter	Min	1.3750	1.6250	1.8750	2.0833	2.3333	2.5833	2.7500	3.2500	3.7500	4.2500	4.7500
	Max	1.3824	1.6326	1.8828	2.0921	2.3422	2.5924	2.7605	3.2608	3.7611	4.2613	4.7615

<sup>a</sup> All other dimensions are given in inches. The selection of threads per inch is arbitrary and for the purpose of establishing a standard.

**Table 3. General Purpose Acme Single-Start Screw Thread Data ASME/ANSI B1.5-1988**

Identification		Basic Diameters			Thread Data							
Nominal Sizes (All Classes)	Threads per Inch, <sup>a</sup> <i>n</i>	Classes 2G, 3G, and 4G			Pitch, <i>P</i>	Thickness at Pitch Line, <i>t = P/2</i>	Basic Height of Thread, <i>h = P/2</i>	Basic Width of Flat, <i>F = 0.3707P</i>	Lead Angle $\lambda$ at Basic Pitch Diameter <sup>b</sup> Classes 2G, 3G, and 4G		Shear Area <sup>b</sup> Class 3G	Stress Area <sup>c</sup> Class 3G
		Major Diameter, <i>D</i>	Pitch Diameter, <i>D<sub>2</sub> = D - h</i>	Minor Diameter, <i>D<sub>1</sub> = D - 2h</i>					Deg	Min		
1/4	16	0.2500	0.2188	0.1875	0.06250	0.03125	0.03125	0.0232	5	12	0.350	0.0285
5/16	14	0.3125	0.2768	0.2411	0.07143	0.03571	0.03571	0.0265	4	42	0.451	0.0474
3/8	12	0.3750	0.3333	0.2917	0.08333	0.04167	0.04167	0.0309	4	33	0.545	0.0699
7/16	12	0.4375	0.3958	0.3542	0.08333	0.04167	0.04167	0.0309	3	50	0.660	0.1022
1/2	10	0.5000	0.4500	0.4000	0.10000	0.05000	0.05000	0.0371	4	3	0.749	0.1287
5/8	8	0.6250	0.5625	0.5000	0.12500	0.06250	0.06250	0.0463	4	3	0.941	0.2043
3/4	6	0.7500	0.6667	0.5833	0.16667	0.08333	0.08333	0.0618	4	33	1.108	0.2848
7/8	6	0.8750	0.7917	0.7083	0.16667	0.08333	0.08333	0.0618	3	50	1.339	0.4150
1	5	1.0000	0.9000	0.8000	0.20000	0.10000	0.10000	0.0741	4	3	1.519	0.5354
1 1/8	5	1.1250	1.0250	0.9250	0.20000	0.10000	0.10000	0.0741	3	33	1.751	0.709
1 1/4	5	1.2500	1.1500	1.0500	0.20000	0.10000	0.10000	0.0741	3	10	1.983	0.907
1 3/8	4	1.3750	1.2500	1.1250	0.25000	0.12500	0.12500	0.0927	3	39	2.139	1.059
1 1/2	4	1.5000	1.3750	1.2500	0.25000	0.12500	0.12500	0.0927	3	19	2.372	1.298
1 3/4	4	1.7500	1.6250	1.5000	0.25000	0.12500	0.12500	0.0927	2	48	2.837	1.851
2	4	2.0000	1.8750	1.7500	0.25000	0.12500	0.12500	0.0927	2	26	3.301	2.501
2 1/4	3	2.2500	2.0833	1.9167	0.33333	0.16667	0.16667	0.1236	2	55	3.643	3.049
2 1/2	3	2.5000	2.3333	2.1667	0.33333	0.16667	0.16667	0.1236	2	36	4.110	3.870
2 3/4	3	2.7500	2.5833	2.4167	0.33333	0.16667	0.16667	0.1236	2	21	4.577	4.788
3	2	3.0000	2.7500	2.5000	0.50000	0.25000	0.25000	0.1853	3	19	4.786	5.27
3 1/2	2	3.5000	3.2500	3.0000	0.50000	0.25000	0.25000	0.1853	2	48	5.73	7.50
4	2	4.0000	3.7500	3.5000	0.50000	0.25000	0.25000	0.1853	2	26	6.67	10.12
4 1/2	2	4.5000	4.2500	4.0000	0.50000	0.25000	0.25000	0.1853	2	9	7.60	13.13
5	2	5.0000	4.7500	4.5000	0.50000	0.25000	0.25000	0.1853	1	55	8.54	16.53

<sup>a</sup> All other dimensions are given in inches.<sup>b</sup> Per inch length of engagement of the external thread in line with the minor diameter crests of the internal thread. Figures given are the minimum shear area based on max  $D_1$  and min  $d_2$ .<sup>c</sup> Figures given are the minimum stress area based on the mean of the minimum minor and pitch diameters of the external thread. See formulas for shear area and stress area on page 1827.

**Table 4. American National Standard General Purpose Acme Single-Start Screw Threads — Pitch Diameter Allowances ASME/ANSI B1.5-1988**

Nominal Size Range <sup>a</sup>		Allowances on External Threads <sup>b</sup>			Nominal Size Range <sup>a</sup>		Allowances on External Threads <sup>b</sup>		
Above	To and Including	Class 2G, 0.008 $\sqrt{D}$	Class 3G, 0.006 $\sqrt{D}$	Class 4G, 0.004 $\sqrt{D}$	Above	To and Including	Class 2G, 0.008 $\sqrt{D}$	Class 3G, 0.006 $\sqrt{D}$	Class 4G, 0.004 $\sqrt{D}$
0	$\frac{3}{16}$	0.0024	0.0018	0.0012	$1\frac{7}{16}$	$1\frac{9}{16}$	0.0098	0.0073	0.0049
$\frac{3}{16}$	$\frac{5}{16}$	0.0040	0.0030	0.0020	$1\frac{1}{8}$	$1\frac{7}{8}$	0.0105	0.0079	0.0052
$\frac{5}{16}$	$\frac{7}{16}$	0.0049	0.0037	0.0024	$1\frac{3}{8}$	$2\frac{1}{8}$	0.0113	0.0085	0.0057
$\frac{7}{16}$	$\frac{9}{16}$	0.0057	0.0042	0.0028	$2\frac{1}{8}$	$2\frac{3}{8}$	0.0120	0.0090	0.0060
$\frac{9}{16}$	$1\frac{1}{16}$	0.0063	0.0047	0.0032	$2\frac{3}{8}$	$2\frac{5}{8}$	0.0126	0.0095	0.0063
$1\frac{1}{16}$	$1\frac{3}{16}$	0.0069	0.0052	0.0035	$2\frac{5}{8}$	$2\frac{7}{8}$	0.0133	0.0099	0.0066
$1\frac{3}{16}$	$1\frac{5}{16}$	0.0075	0.0056	0.0037	$2\frac{7}{8}$	$3\frac{1}{4}$	0.0140	0.0105	0.0070
$1\frac{5}{16}$	$1\frac{7}{16}$	0.0080	0.0060	0.0040	$3\frac{1}{4}$	$3\frac{3}{4}$	0.0150	0.0112	0.0075
$1\frac{7}{16}$	$1\frac{9}{16}$	0.0085	0.0064	0.0042	$3\frac{3}{4}$	$4\frac{1}{4}$	0.0160	0.0120	0.0080
$1\frac{9}{16}$	$1\frac{11}{16}$	0.0089	0.0067	0.0045	$4\frac{1}{4}$	$4\frac{3}{4}$	0.0170	0.0127	0.0085
$1\frac{11}{16}$	$1\frac{13}{16}$	0.0094	0.0070	0.0047	$4\frac{3}{4}$	$5\frac{1}{2}$	0.0181	0.0136	0.0091

All dimensions in inches. It is recommended that the sizes given in Table 3 be used whenever possible.

<sup>a</sup> The values in columns for Classes 2G, 3G, and 4G are to be used for any size within the nominal size range shown. These values are calculated from the mean of the range.

<sup>b</sup> An increase of 10 per cent in the allowance is recommended for each inch, or fraction thereof, that the length of engagement exceeds two diameters.

<sup>c</sup> Allowances for the 2G Class of thread in this table also apply to American National Standard Stub Acme threads ASME/ANSI B 1.8-1988.

three-start threads, 75 per cent of these allowances; and for four-start threads, 100 per cent of these same values.

These values will provide for a 0.25-16 ACME-2G thread size, 0.002, 0.003, and 0.004 inch additional clearance for 2-, 3-, and 4-start threads, respectively. For a 5-2 ACME-3G thread size the additional clearances would be 0.0091, 0.0136, and 0.0181 inch, respectively. GO thread plug gages and taps would be increased by these same values. To maintain the same working tolerances on multi-start threads, the pitch diameter of the NOT GO thread plug gage would also be increased by these same values.

For multi-start threads with more than four starts, it is believed that the 100 per cent allowance provided by the above procedures would be adequate as index spacing variables would generally be no greater than on a four-start thread.

In general, for multi-start threads of Classes 2G, 3G, and 4G the percentages would be applied, usually, to allowances for the same class, respectively. However, where exceptionally good control over lead, angle, and spacing variables would produce close to theoretical values in the product, it is conceivable that these percentages could be applied to Class 3G or Class 4G allowances used on Class 2G internally threaded product. Also, these percentages could be applied to Class 4G allowances used on Class 3G internally threaded product. It is not advocated that any change be made in externally threaded products.

Designations for gages or tools for internal threads could cover allowance requirements as follows:

GO and NOT GO thread plug gages for: 2.875-0.4P-0.8L-ACME-2G with 50 per cent of the 4G internal thread allowance.

**Centralizing Acme Threads.**—The three classes of Centralizing Acme threads in American National Standard ASME/ANSI B1.5-1988, designated as 2C, 3C, and 4C, have limited clearance at the major diameters of internal and external threads so that a bearing at the major diameters maintains approximate alignment of the thread axis and prevents wedging



**Table 5. American National Standard General Purpose Acme Single-Start Screw Threads — Pitch Diameter Tolerances ASME/ANSI B1.5-1988**

Nom. Dia., <sup>a</sup> <i>D</i>	Class of Thread			Nom. Dia., <sup>a</sup> <i>D</i>	Class of Thread		
	2G <sup>b</sup>	3G	4G		2G <sup>b</sup>	3G	4G
	Diameter Increment				Diameter Increment		
	$0.006\sqrt{D}$	$0.0028\sqrt{D}$	$0.002\sqrt{D}$		$0.006\sqrt{D}$	$0.0028\sqrt{D}$	$0.002\sqrt{D}$
¼	.00300	.00140	.00100	½	.00735	.00343	.00245
⅜	.00335	.00157	.00112	¾	.00794	.00370	.00265
½	.00367	.00171	.00122	2	.00849	.00396	.00283
⅝	.00397	.00185	.00132	2¼	.00900	.00420	.00300
¾	.00424	.00198	.00141	2½	.00949	.00443	.00316
⅞	.00474	.00221	.00158	2¾	.00995	.00464	.00332
1	.00520	.00242	.00173	3	.01039	.00485	.00346
1¼	.00561	.00262	.00187	3½	.01122	.00524	.00374
1½	.00600	.00280	.00200	4	.01200	.00560	.00400
1⅝	.00636	.00297	.00212	4½	.01273	.00594	.00424
1¾	.00671	.00313	.00224	5	.01342	.00626	.00447
1⅞	.00704	.00328	.00235	...	...	...	...
Thds. per Inch <sup>c</sup> , <i>n</i>	Class of Thread			Thds. per Inch <sup>c</sup> , <i>n</i>	Class of Thread		
	2G <sup>b</sup>	3G	4G		2G <sup>b</sup>	3G	4G
	Pitch Increment				Pitch Increment		
	$0.030\sqrt{1/n}$	$0.014\sqrt{1/n}$	$0.010\sqrt{1/n}$		$0.030\sqrt{1/n}$	$0.014\sqrt{1/n}$	$0.010\sqrt{1/n}$
16	.00750	.00350	.00250	4	.01500	.00700	.00500
14	.00802	.00374	.00267	3	.01732	.00808	.00577
12	.00866	.00404	.00289	2½	.01897	.00885	.00632
10	.00949	.00443	.00316	2	.02121	.00990	.00707
8	.01061	.00495	.00354	1½	.02449	.01143	.00816
6	.01225	.00572	.00408	1⅓	.02598	.01212	.00866
5	.01342	.00626	.00447	1	.03000	.01400	.01000

For any particular size of thread, the pitch diameter tolerance is obtained by adding the *diameter increment* from the upper half of the table to the *pitch increment* from the lower half of the table. *Example:* A ¼-16 Acme-2G thread has a pitch diameter tolerance of  $0.00300 + 0.00750 = 0.0105$  inch.

The equivalent tolerance on thread thickness is 0.259 times the pitch diameter tolerance.

<sup>a</sup> For a nominal diameter between any two tabulated nominal diameters, use the diameter increment for the larger of the two tabulated nominal diameters.

<sup>b</sup> Columns for the 2G Class of thread in this table also apply to American National Standard Stub Acme threads, ASME/ANSI B1.8-1988 (R2001).

<sup>c</sup> All other dimensions are given in inches.

on the flanks of the thread. An alternative series having centralizing control on the *minor* diameter is described on page 1843. For any combination of the three classes of threads covered in this standard some end play or backlash will result. Classes 5C and 6C are not recommended for new designs.

*Application:* These three classes together with the accompanying specifications are for the purpose of ensuring the interchangeable manufacture of Centralizing Acme threaded parts. Each user is free to select the classes best adapted to his particular needs. It is suggested that external and internal threads of the same class be used together for centralizing assemblies, Class 2C providing the maximum end play or backlash. If less backlash or end play is desired, Classes 3C and 4C are provided. The requirement for a centralizing fit is that the sum of the major diameter tolerance plus the major diameter allowance on the internal thread, and the major diameter tolerance on the external thread shall equal or be less than the pitch diameter allowance on the external thread. A Class 2C external thread, which has a larger pitch diameter allowance than either a Class 3C or 4C, can be used inter-

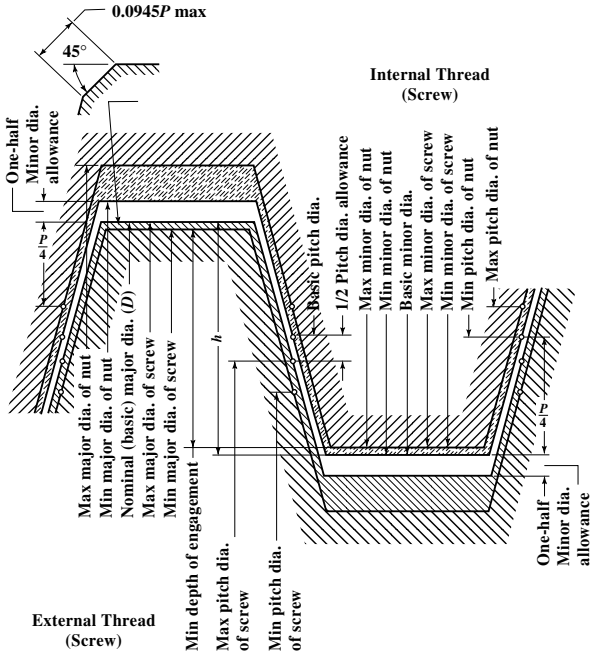


Fig. 2. Disposition of Allowances, Tolerances, and Crest Clearances for General Purpose Single-start Acme Threads (All Classes)

changeably with a Class 2C, 3C, or 4C internal thread and fulfill this requirement. Similarly, a Class 3C external thread can be used interchangeably with a Class 3C or 4C internal thread, but only a Class 4C internal thread can be used with a Class 4C external thread.

**Thread Form:** The thread form is the same as the General Purpose Acme Thread and is shown in Fig. 3. The formulas in Table 7 determine the basic dimensions, which are given in Table 6 for the most generally used pitches.

**Angle of Thread:** The angle between the sides of the thread measured in an axial plane is 29 degrees. The line bisecting this 29-degree angle shall be perpendicular to the axis of the thread.

**Chamfers and Fillets:** External threads have the crest corners chamfered at an angle of 45 degrees with the axis to a minimum depth of  $P/20$  and a maximum depth of  $P/15$ . These modifications correspond to a minimum width of chamfer flat of  $0.0707P$  and a maximum width of  $0.0945P$  (see Table 6, columns 6 and 7).

External threads for Classes 2C, 3C, and 4C may have a fillet at the minor diameter not greater than  $0.1P$

**Thread Series:** A series of diameters and pitches is recommended in the Standard as preferred. These diameters and pitches have been chosen to meet present needs with the few-

**Table 6. American National Standard Centralizing Acme Screw Thread Form — Basic Dimensions ASME/ANSI B1.5-1988**

Thds per Inch, $n$	Pitch, $P$	Height of Thread (Basic), $h = P/2$	Total Height of Thread (All External Threads) $h_t = h + \frac{1}{2}$ allowance <sup>a</sup>	Thread Thickness (Basic), $t = P/2$	45-Deg Chamfer Crest of External Threads		Max Fillet Radius, Root of Tapped Hole, $0.06P$	Fillet Radius at Min or Diameter of Screws Max (All) $0.10P$
					Min Depth, $0.05P$	Min Width of Chamfer Flat, $0.0707P$		
16	0.06250	0.03125	0.0362	0.03125	0.0031	0.0044	0.0038	0.0062
14	0.07143	0.03571	0.0407	0.03571	0.0036	0.0050	0.0038	0.0071
12	0.08333	0.04167	0.0467	0.04167	0.0042	0.0059	0.0050	0.0083
10	0.10000	0.05000	0.0600	0.05000	0.0050	0.0071	0.0060	0.0100
8	0.12500	0.06250	0.0725	0.06250	0.0062	0.0088	0.0075	0.0125
6	0.16667	0.08333	0.0933	0.08333	0.0083	0.0119	0.0100	0.0167
5	0.20000	0.10000	0.1100	0.10000	0.0100	0.0141	0.0120	0.0200
4	0.25000	0.12500	0.1350	0.12500	0.0125	0.0177	0.0150	0.0250
3	0.33333	0.16667	0.1767	0.16667	0.0167	0.0236	0.0200	0.0333
2½	0.40000	0.20000	0.2100	0.20000	0.0200	0.0283	0.0240	0.0400
2	0.50000	0.25000	0.2600	0.25000	0.0250	0.0354	0.0300	0.0500
1½	0.66667	0.33333	0.3433	0.33333	0.0330	0.0471	0.0400	0.0667
1⅓	0.75000	0.37500	0.3850	0.37500	0.0380	0.0530	0.0450	0.0750
1	1.00000	0.50000	0.5100	0.50000	0.0500	0.0707	0.0600	0.1000

All dimensions in inches. See Fig. 3.

<sup>a</sup> Allowance is 0.020 inch for 10 or less threads per inch and 0.010 inch for more than 10 threads per inch.

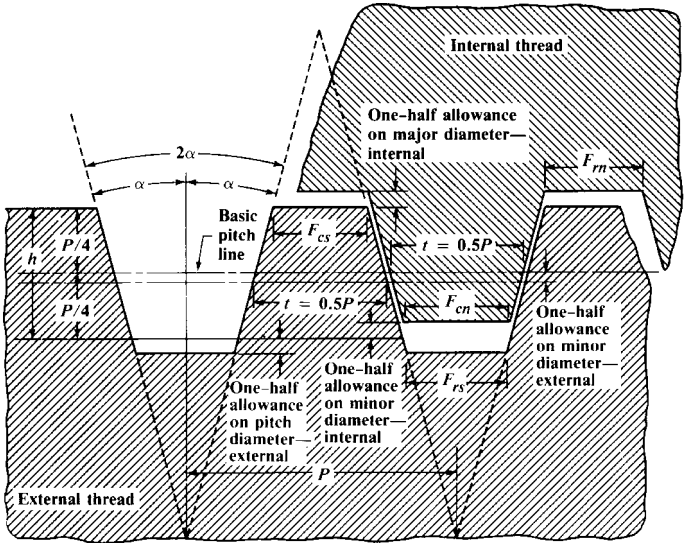


Fig. 3. Centralizing Acme Screw Thread Form

**Table 7. Formulas for Finding Basic Dimensions of Centralizing Acme Screw Threads**

Pitch = $P = 1 \div \text{No. threads per inch, } n$ :	Basic thread height $h = 0.5P$
Basic thread thickness $t = 0.5P$	
Basic flat at crest $F_{cn} = 0.3707P + 0.259 \times (\text{minor diameter allowance on internal threads})$ (internal thread)	
Basic flat at crest $F_{cs} = 0.3707P - 0.259 \times (\text{pitch diameter allowance on external thread})$ (external thread)	
$F_m = 0.3707P - 0.259 \times (\text{major dia. allowance on internal thread})$	
$F_{rs} = 0.3707P - 0.259 \times (\text{minor dia. allowance on external thread} - \text{pitch dia. allowance on external thread})$	

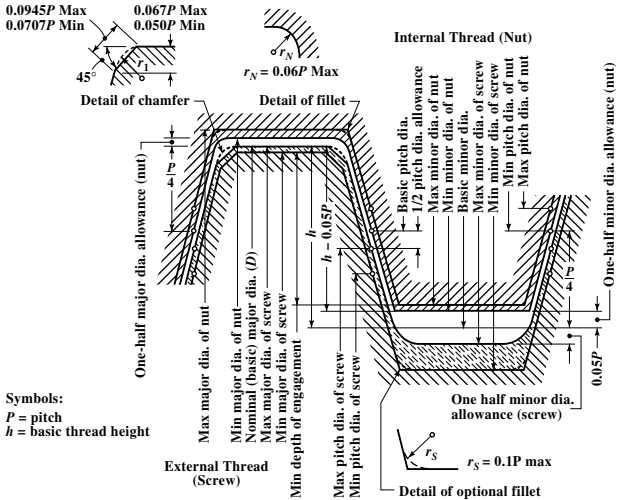


Fig. 4. Disposition of Allowances, Tolerances, and Crest Clearances for Centralizing Single-Start Acme Threads—Classes 2C, 3C, and 4C

est number of items in order to reduce to a minimum the inventory of both tools and gages. This series of diameters and associated pitches is given in [Table 9](#).

**Basic Diameters:** The maximum major diameter of the external thread is basic and is the nominal major diameter for all classes.

The minimum pitch diameter of the internal thread is basic for all classes and is equal to the basic major diameter  $D$  minus the basic height of thread,  $h$ . The minimum minor diameter of the internal thread for all classes is  $0.1P$  above basic.

**Length of Engagement:** The tolerances specified in this Standard are applicable to lengths of engagement not exceeding twice the nominal major diameter.

**Pitch Diameter Allowances:** Allowances applied to the pitch diameter of the external thread for all classes are given in [Table 10](#).

**Major and Minor Diameter Allowances:** A minimum diametral clearance is provided at the minor diameter of all external threads by establishing the maximum minor diameter  $0.020$  inch below the basic minor diameter for 10 threads per inch and coarser, and  $0.010$  inch for finer pitches and by establishing the minimum minor diameter of the internal thread  $0.1P$  greater than the basic minor diameter.

**Table 8a. American National Standard Centralizing Acme Single-Start Screw Threads — Formulas for Determining Diameters ASME/ANSI B1.5-1988**

$D$ = Nominal Size or Diameter in Inches $P$ = Pitch = $1 \div$ Number of Threads per Inch	
No.	Classes 2C, 3C, and 4C External Threads (Screws)
1	Major Dia., Max = $D$ (Basic).
2	Major Dia., Min = $D$ minus tolerance from Table 12, columns 7, 8, or 10.
3	Pitch Dia., Max = Int. Pitch Dia., Min (Formula 9) minus allowance from the appropriate Class 2C, 3C, or 4C column of Table 10.
4	Pitch Dia., Min = Ext. Pitch Dia., Max (Formula 3) minus tolerance from Table 11.
5	Minor Dia., Max = $D$ minus $P$ minus allowance from Table 12, column 3.
6	Minor Dia., Min = Ext. Minor Dia., Max (Formula 5) minus $1.5 \times$ Pitch Dia. tolerance from Table 11.
Classes 2C, 3C, and 4C Internal Threads (Nuts)	
7	Major Dia., Min = $D$ plus allowance from Table 12, column 4.
8	Major Dia., Max = Int. Major Dia., Min (Formula 7) plus tolerance from Table 12, columns 7, 9, or 11.
9	Pitch Dia., Min = $D$ minus $P/2$ (Basic).
10	Pitch Dia., Max = Int. Pitch Dia., Min (Formula 9) plus tolerance from Table 11.
11	Minor Dia., Min = $D$ minus $0.9P$ .
12	Minor Dia., Max = Int. Minor Dia., Min (Formula 11) plus tolerance from Table 12, column 6.

A minimum diametral clearance at the major diameter is obtained by establishing the minimum major diameter of the internal thread  $0.001\sqrt{D}$  above the basic major diameter. These allowances are shown in Table 12.

**Major and Minor Diameter Tolerances:** The tolerances on the major and minor diameters of the external and internal threads are listed in Table 12 and are based upon the formulas given in the column headings.

An increase of 10 per cent in the allowance is recommended for each inch or fraction thereof that the length of engagement exceeds two diameters.

For information on gages for Centralizing Acme threads the Standard ASME/ANSI B1.5 should be consulted.

**Pitch Diameter Tolerances:** Pitch diameter tolerances for Classes 2C, 3C and 4C for various practicable combinations of diameter and pitch are given in Table 11. The ratios of the pitch diameter tolerances of Classes 2C, 3C, and 4C are 3.0, 1.4, and 1, respectively.

**Application of Tolerances:** The tolerances specified are such as to insure interchangeability and maintain a high grade of product. The tolerances on the diameters of internal threads are plus, being applied from the minimum sizes to above the minimum sizes. The tolerances on the diameters of external threads are minus, being applied from the maximum sizes to below the maximum sizes. The pitch diameter tolerances for an external or internal thread of a given class are the same.

**Limiting Dimensions:** Limiting dimensions for Centralizing Acme threads in the preferred series of diameters and pitches are given in Tables 8b and 8c. These limits are based on the formulas in Table 8a.

For combinations of pitch and diameter other than those in the preferred series the formulas in Tables 8b and 8c and the data in the tables referred to therein make it possible to readily determine the limiting dimension required.

**Table 8b. Limiting Dimensions of American National Standard Centralizing Acme Single-Start Screw Threads, Classes 2C, 3C, and 4C ASME/ANSI B1.5-1988**

Nominal Diameter, $D$ Threads per Inch <sup>a</sup>		$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{1}{2}$
		10	8	6	6	5	5	5	4	4
Limiting Dimensions		<b>External Threads</b>								
Classes 2C, 3C, and 4C, Major Diameter	Max	0.5000	0.6250	0.7500	0.8750	1.0000	1.1250	1.2500	1.3750	1.5000
Class 2C, Major Diameter	Min	0.4975	0.6222	0.7470	0.8717	0.9965	1.1213	1.2461	1.3709	1.4957
Class 3C, Major Diameter	Min	0.4989	0.6238	0.7487	0.8736	0.9985	1.1234	1.2483	1.3732	1.4982
Class 4C, Major Diameter	Min	0.4993	0.6242	0.7491	0.8741	0.9990	1.1239	1.2489	1.3738	1.4988
Classes 2C, 3C, and 4C, Minor Diameter	Max	0.3800	0.4800	0.5633	0.6883	0.7800	0.9050	1.0300	1.1050	1.2300
Class 2C, Minor Diameter	Min	0.3594	0.4570	0.5371	0.6615	0.7509	0.8753	0.9998	1.0719	1.1965
Class 3C, Minor Diameter	Min	0.3704	0.4693	0.5511	0.6758	0.7664	0.8912	1.0159	1.0896	1.2144
Class 4C, Minor Diameter	Min	0.3731	0.4723	0.5546	0.6794	0.7703	0.8951	1.0199	1.0940	1.2188
Class 2C, Pitch Diameter	Max	0.4443	0.5562	0.6598	0.7842	0.8920	1.0165	1.1411	1.2406	1.3652
	Min	0.4306	0.5408	0.6424	0.7663	0.8726	0.9967	1.1210	1.2186	1.3429
Class 3C, Pitch Diameter	Max	0.4458	0.5578	0.6615	0.7861	0.8940	1.0186	1.1433	1.2430	1.3677
	Min	0.4394	0.5506	0.6534	0.7778	0.8849	1.0094	1.1339	1.2327	1.3573
Class 4C, Pitch Diameter	Max	0.4472	0.5593	0.6632	0.7880	0.8960	1.0208	1.1455	1.2453	1.3701
	Min	0.4426	0.5542	0.6574	0.7820	0.8895	1.0142	1.1388	1.2380	1.3627
		<b>Internal Threads</b>								
Classes 2C, 3C, and 4C, Major Diameter	Min	0.5007	0.6258	0.7509	0.8759	1.0010	1.1261	1.2511	1.3762	1.5012
Classes 2C and 3C, Major Diameter	Max	0.5032	0.6286	0.7539	0.8792	1.0045	1.1298	1.2550	1.3803	1.5055
Class 4C, Major Diameter	Max	0.5021	0.6274	0.7526	0.8778	1.0030	0.1282	1.2533	1.3785	1.5036
Classes 2C, 3C, and 4C, Minor Diameter	Min	0.4100	0.5125	0.6000	0.7250	0.8200	0.9450	0.0700	1.1500	1.2750
	Max	0.04150	0.5187	0.6083	0.7333	0.8300	0.9550	1.0800	1.1625	1.2875
Class 2C, Pitch Diameter	Min	0.4500	0.5625	0.6667	0.7917	0.9000	1.0250	1.1500	1.2500	1.3750
	Max	0.4637	0.5779	0.6841	0.8096	0.9194	1.0448	1.1701	1.2720	1.3973
Class 3C, Pitch Diameter	Min	0.4500	0.5625	0.6667	0.7917	0.9000	1.0250	1.1500	1.2500	1.3750
	Max	0.4564	0.5697	0.6748	0.8000	0.9091	1.0342	1.1594	1.2603	1.3854
Class 4C, Pitch Diameter	Min	0.4500	0.5625	0.6667	0.7917	0.9000	1.0250	1.1500	1.2500	1.3750
	Max	0.4546	0.5676	0.6725	0.7977	0.9065	1.0316	1.1567	1.2573	1.3824

**Table 8c. Limiting Dimensions of American National Standard Centralizing Acme Single-Start Screw Threads, Classes 2C, 3C, and 4C ASME/ANSI B1.5-1988**

Nominal Diameter, $D$		$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3	$3\frac{1}{2}$ <sub>212</sub>	4	$4\frac{1}{2}$	5
Threads per Inch <sup>a</sup>		4	4	3	3	3	2	2	2	2	2
Limiting Dimensions		External Threads									
Classes 2C, 3C, and 4C, Major Diameter	Max	1.7500	2.0000	2.2500	2.5000	2.7500	3.0000	3.5000	4.0000	4.5000	5.0000
Class 2C, Major Diameter	Min	1.7454	1.9951	2.2448	2.4945	2.7442	2.9939	3.4935	3.9930	4.4926	4.9922
Class 3C, Major Diameter	Min	1.7480	1.9979	2.2478	2.4976	2.7475	2.9974	3.4972	3.9970	4.4968	4.9966
Class 4C, Major Diameter	Min	1.7487	1.9986	2.2485	2.4984	2.7483	2.9983	3.4981	3.9980	4.4979	4.9978
Classes 2C, 3C, and 4C, Minor Diameter	Max	1.4800	1.7300	1.8967	2.1467	2.3967	2.4800	2.9800	3.4800	3.9800	4.4800
Class 2C, Minor Diameter	Min	1.4456	1.6948	1.8572	2.1065	2.3558	2.4326	2.9314	3.4302	3.9291	4.4281
Class 3C, Minor Diameter	Min	1.4640	1.7136	1.8783	2.1279	2.3776	2.4579	2.9574	3.4568	3.9563	4.4558
Class 4C, Minor Diameter	Min	1.4685	1.7183	1.8835	2.1333	2.3831	2.4642	2.9638	3.4634	3.9631	4.4627
Class 2C, Pitch Diameter	Max	1.6145	1.8637	2.0713	2.3207	2.5700	2.7360	3.2350	3.7340	4.2330	4.7319
	Min	1.5916	1.8402	2.0450	2.2939	2.5427	2.7044	3.2026	3.7008	4.1991	4.6973
Class 3C, Pitch Diameter	Max	1.6171	1.8665	2.0743	2.3238	2.5734	2.7395	3.2388	3.7380	4.2373	4.7364
	Min	1.6064	1.8555	2.0620	2.3113	2.5607	2.7248	3.2237	3.7225	4.2215	4.7202
Class 4C, Pitch Diameter	Max	1.6198	1.8693	2.0773	2.3270	2.5767	2.7430	3.2425	3.7420	4.2415	4.7409
	Min	1.6122	1.8615	2.0685	2.3181	2.5676	2.7325	3.2317	3.7309	4.2302	4.7294
		Internal Threads									
Classes 2C, 3C, and 4C, Major Diameter	Min	1.7513	2.0014	2.2515	2.5016	2.7517	3.0017	3.5019	4.0020	4.5021	5.0022
Classes 2C and 3C, Major Diameter	Max	1.7559	2.0063	2.2567	2.5071	2.7575	3.0078	3.5084	4.0090	4.5095	5.0100
Class 4C, Major Diameter	Max	1.7539	2.0042	2.2545	2.5048	2.7550	3.0052	3.5056	4.0060	4.5063	5.0067
Classes 2C, 3C, and 4C, Minor Diameter	Min	1.5250	1.7750	1.9500	2.2000	2.4500	2.5500	3.0500	3.5500	4.0500	4.5500
	Max	1.5375	1.7875	1.9667	2.2167	2.4667	2.5750	3.0750	3.5750	4.0750	4.5750
Class 2C, Pitch Diameter	Min	1.6250	1.8750	2.0833	2.3333	2.5833	2.7500	3.2500	3.7500	4.2500	4.7500
	Max	1.6479	1.8985	2.1096	2.3601	2.6106	2.7816	3.2824	3.7832	4.2839	4.7846
Class 3C, Pitch Diameter	Min	1.6250	1.8750	2.0833	2.3333	2.5833	2.7500	3.2500	3.7500	4.2500	4.7500
	Max	1.6357	1.8860	2.0956	2.3458	2.5960	2.7647	3.2651	3.7655	4.2658	4.7662
Class 4C Pitch Diameter	Min	1.6250	1.8750	2.0833	2.3333	2.5833	2.7500	3.2500	3.7500	4.2500	4.7500
	Max	1.6326	1.8828	2.0921	2.3422	2.5924	2.7605	3.2608	3.7611	4.2613	4.7615

<sup>a</sup>All other dimensions are in inches. The selection of threads per inch is arbitrary and for the purpose of establishing a standard.

**Table 9. American National Standard Centralizing Acme Single-Start Screw Thread Data ASME/ANSI B1.5-1988**

Identification		Diameters			Thread Data					
Nominal Sizes (All Classes)	Threads per Inch, <sup>a</sup> <i>n</i>	Centralizing, Classes 2C, 3C, and 4C			Pitch, <i>P</i>	Thickness at Pitch Line, <i>t = P/2</i>	Basic Height of Thread, <i>h = P/2</i>	Basic Width of Flat, <i>F = 0.3707P</i>	Lead Angle $\lambda$ at Basic Pitch Diameter <sup>a</sup>	
		Basic Major Diameter, <i>D</i>	Pitch Diameter, <i>D<sub>2</sub> = (D - h)</i>	Minor Diameter, <i>D<sub>1</sub> = (D - 2h)</i>					Centralizing Classes 2C, 3C, and 4C,	
									Deg	Min
1/4	16	0.2500	0.2188	0.1875	0.06250	0.03125	0.03125	0.0232	5	12
5/16	14	0.3125	0.2768	0.2411	0.07143	0.03571	0.03571	0.0265	4	42
3/8	12	0.3750	0.3333	0.2917	0.08333	0.04167	0.04167	0.0309	4	33
7/16	12	0.4375	0.3958	0.3542	0.08333	0.04167	0.04167	0.0309	3	50
1/2	10	0.5000	0.4500	0.4000	0.10000	0.05000	0.05000	0.0371	4	3
5/8	8	0.6250	0.5625	0.5000	0.12500	0.06250	0.06250	0.0463	4	3
3/4	6	0.7500	0.6667	0.5833	0.16667	0.08333	0.08333	0.0618	4	33
7/8	6	0.8750	0.7917	0.7083	0.16667	0.08333	0.08333	0.0618	3	50
1	5	1.0000	0.9000	0.8000	0.20000	0.10000	0.10000	0.0741	4	3
1 1/8	5	1.1250	1.0250	0.9250	0.20000	0.10000	0.10000	0.0741	3	33
1 1/4	5	1.2500	1.1500	1.0500	0.20000	0.10000	0.10000	0.0741	3	10
1 3/8	4	1.3750	1.2500	1.1250	0.25000	0.12500	0.12500	0.0927	3	39
1 1/2	4	1.5000	1.3750	1.2500	0.25000	0.12500	0.12500	0.0927	3	19
1 3/4	4	1.7500	1.6250	1.5000	0.25000	0.12500	0.12500	0.0927	2	48
2	4	2.0000	1.8750	1.7500	0.25000	0.12500	0.12500	0.0927	2	26
2 1/4	3	2.2500	2.0833	1.9167	0.33333	0.16667	0.16667	0.1236	2	55
2 1/2	3	2.5000	2.3333	2.1667	0.33333	0.16667	0.16667	0.1236	2	36
2 3/4	3	2.7500	2.5833	2.4167	0.33333	0.16667	0.16667	0.1236	2	21
3	2	3.0000	2.7500	2.5000	0.50000	0.25000	0.25000	0.1853	3	19
3 1/2	2	3.5000	3.2500	3.0000	0.50000	0.25000	0.25000	0.1853	2	48
4	2	4.0000	3.7500	3.5000	0.50000	0.25000	0.25000	0.1853	2	26
4 1/2	2	4.5000	4.2500	4.0000	0.50000	0.25000	0.25000	0.1853	2	9
5	2	5.0000	4.7500	4.5000	0.50000	0.25000	0.25000	0.1853	1	55

<sup>a</sup>All other dimensions are given in inches.



**Table 10. American National Standard Centralizing Acme Single-Start Screw Threads — Pitch Diameter Allowances ASME/ANSI B1.5-1988**

Nominal Size Range <sup>a</sup>		Allowances on External Threads <sup>b</sup>			Nominal Size Range <sup>a</sup>		Allowances on External Threads <sup>b</sup>		
Above	To and Including	Centralizing			Above	To and Including	Centralizing		
		Class 2C, 0.008 $\sqrt{D}$	Class 3C, 0.006 $\sqrt{D}$	Class 4C, 0.004 $\sqrt{D}$			Class 2C, 0.008 $\sqrt{D}$	Class 3C, 0.006 $\sqrt{D}$	Class 4C, 0.004 $\sqrt{D}$
0	$\frac{3}{16}$	0.0024	0.0018	0.0012	$\frac{1}{16}$	$\frac{1}{16}$	0.0098	0.0073	0.0049
$\frac{3}{16}$	$\frac{5}{16}$	0.0040	0.0030	0.0020	$\frac{1}{16}$	$\frac{1}{8}$	0.0105	0.0079	0.0052
$\frac{5}{16}$	$\frac{7}{16}$	0.0049	0.0037	0.0024	$\frac{1}{8}$	$\frac{2}{16}$	0.0113	0.0085	0.0057
$\frac{7}{16}$	$\frac{9}{16}$	0.0057	0.0042	0.0028	$\frac{2}{16}$	$\frac{3}{8}$	0.0120	0.0090	0.0060
$\frac{9}{16}$	$\frac{11}{16}$	0.0063	0.0047	0.0032	$\frac{3}{8}$	$\frac{2}{8}$	0.0126	0.0095	0.0063
$\frac{11}{16}$	$\frac{13}{16}$	0.0069	0.0052	0.0035	$\frac{2}{8}$	$\frac{2}{8}$	0.0133	0.0099	0.0066
$\frac{13}{16}$	$\frac{15}{16}$	0.0075	0.0056	0.0037	$\frac{2}{8}$	$\frac{3}{4}$	0.0140	0.0105	0.0070
$\frac{15}{16}$	$1\frac{1}{16}$	0.0080	0.0060	0.0040	$\frac{3}{4}$	$\frac{3}{4}$	0.0150	0.0110	0.0075
$1\frac{1}{16}$	$1\frac{3}{16}$	0.0085	0.0064	0.0042	$\frac{3}{4}$	$\frac{4}{4}$	0.0160	0.0120	0.0080
$1\frac{3}{16}$	$1\frac{5}{16}$	0.0089	0.0067	0.0045	$\frac{4}{4}$	$\frac{4}{4}$	0.0170	0.0127	0.0085
$1\frac{5}{16}$	$1\frac{7}{16}$	0.0094	0.0070	0.0047	$\frac{4}{4}$	$\frac{5}{2}$	0.0181	0.0136	0.0091

All dimensions are given in inches.

It is recommended that the sizes given in Table 9 be used whenever possible.

<sup>a</sup>The values in columns for Classes 2C, 3C, and 4C are to be used for any size within the nominal size range columns. These values are calculated from the mean of the range.

<sup>b</sup>An increase of 10 per cent in the allowance is recommended for each inch, or fraction thereof, that the length of engagement exceeds two diameters.

**Table 11. American National Standard Centralizing Acme Single-Start Screw Threads — Pitch Diameter Tolerances ASME/ANSI B1.5-1988**

Nom. Dia., <sup>a</sup> D	Class of Thread and Diameter Increment			Nom. Dia., <sup>a</sup> D	Class of Thread and Diameter Increment		
	2C	3C	4C		2C	3C	4C
	0.006 $\sqrt{D}$	0.0028 $\sqrt{D}$	0.002 $\sqrt{D}$		0.006 $\sqrt{D}$	0.0028 $\sqrt{D}$	0.002 $\sqrt{D}$
$\frac{1}{4}$	.00300	.00140	.00100	$1\frac{1}{2}$	.00735	.00343	.00245
$\frac{5}{16}$	.00335	.00157	.00112	$1\frac{3}{4}$	.00794	.00370	.00265
$\frac{3}{8}$	.00367	.00171	.00122	2	.00849	.00396	.00283
$\frac{7}{16}$	.00397	.00185	.00132	$2\frac{1}{4}$	.00900	.00420	.00300
$\frac{1}{2}$	.00424	.00198	.00141	$2\frac{1}{2}$	.00949	.00443	.00316
$\frac{5}{8}$	.00474	.00221	.00158	$2\frac{3}{4}$	.00995	.00464	.00332
$\frac{3}{4}$	.00520	.00242	.00173	3	.01039	.00485	.00346
$\frac{7}{8}$	.00561	.00262	.00187	$3\frac{1}{2}$	.01122	.00524	.00374
1	.00600	.00280	.00200	4	.01200	.00560	.00400
$1\frac{1}{8}$	.00636	.00297	.00212	$4\frac{1}{2}$	.01273	.00594	.00424
$1\frac{1}{4}$	.00671	.00313	.00224	5	.01342	.00626	.00447
$1\frac{3}{8}$	.00704	.00328	.00235	...	...	...	...
Thds. per Inch, n	Class of Thread and Pitch Increment			Thds. per Inch, n	Class of Thread and Pitch Increment		
	2C	3C	4C		2C	3C	4C
	0.030 $\sqrt{1/n}$	0.014 $\sqrt{1/n}$	0.010 $\sqrt{1/n}$		0.030 $\sqrt{1/n}$	0.014 $\sqrt{1/n}$	0.010 $\sqrt{1/n}$
16	.00750	.00350	.00250	4	.01500	.00700	.00500
14	.00802	.00374	.00267	3	.01732	.00808	.00577
12	.00866	.00404	.00289	$2\frac{1}{2}$	.01897	.00885	.00632
10	.00949	.00443	.00316	2	.02121	.00990	.00707
8	.01061	.00495	.00354	$1\frac{1}{2}$	.02449	.01143	.00816
6	.01225	.00572	.00408	$1\frac{1}{3}$	.02598	.01212	.00866
5	.01342	.00626	.00447	1	.03000	.01400	.01000

All dimensions are given in inches.

For any particular size of thread, the pitch diameter tolerance is obtained by adding the diameter increment from the upper half of the table to the pitch increment from the lower half of the table. Example: A 0.250-16-ACME-2C thread has a pitch diameter tolerance of 0.00300 + 0.00750 = 0.0105 inch.

The equivalent tolerance on thread thickness is 0.259 times the pitch diameter tolerance.

<sup>a</sup>For a nominal diameter between any two tabulated nominal diameters, use the diameter increment for the larger of the two tabulated nominal diameters.

**Table 12. American National Standard Centralizing Acme Single-Start Screw Threads — Tolerances and Allowances for Major and Minor Diameters ASME/ANSI B1.5-1988**

Size (Nom.)	Thds <sup>a</sup> per Inch	Allowance From Basic Major and Minor Diameters (All Classes)			Tolerance on Minor Diam., <sup>b,c</sup> All Internal Threads, (Plus 0.05P)	Tolerance on Major Diameter Plus on Internal, Minus on External Threads				
		Minor Diam., <sup>d</sup> All External Threads (Minus)	Internal Thread			Class 2C External and Internal Threads, $0.0035\sqrt{D}$	Class 3C		Class 4C	
			Major Diam., <sup>e</sup> (Plus $0.0010\sqrt{D}$ )	Minor Diam., <sup>d</sup> (Plus 0.1P)			External Thread, $0.0015\sqrt{D}$	Internal Thread, $0.0035\sqrt{D}$	External Thread, $0.0010\sqrt{D}$	Internal Thread, $0.0020\sqrt{D}$
1/4	16	0.010	0.0005	0.0062	0.0050	0.0017	0.0007	0.0017	0.0005	0.0010
5/16	14	0.010	0.0006	0.0071	0.0050	0.0020	0.0008	0.0020	0.0006	0.0011
3/8	12	0.010	0.0006	0.0083	0.0050	0.0021	0.0009	0.0021	0.0006	0.0012
7/16	12	0.010	0.0007	0.0083	0.0050	0.0023	0.0010	0.0023	0.0007	0.0013
1/2	10	0.020	0.0007	0.0100	0.0050	0.0025	0.0011	0.0025	0.0007	0.0014
5/8	8	0.020	0.0008	0.0125	0.0062	0.0028	0.0012	0.0028	0.0008	0.0016
3/4	6	0.020	0.0009	0.0167	0.0083	0.0030	0.0013	0.0030	0.0009	0.0017
7/8	6	0.020	0.0009	0.0167	0.0083	0.0033	0.0014	0.0033	0.0009	0.0019
1	5	0.020	0.0010	0.0200	0.0100	0.0035	0.0015	0.0035	0.0010	0.0020
1 1/8	5	0.020	0.0011	0.0200	0.0100	0.0037	0.0016	0.0037	0.0011	0.0021
1 1/4	5	0.020	0.0011	0.0200	0.0100	0.0039	0.0017	0.0039	0.0011	0.0022
1 3/8	4	0.020	0.0012	0.0250	0.0125	0.0041	0.0018	0.0041	0.0012	0.0023
1 1/2	4	0.020	0.0012	0.0250	0.0125	0.0043	0.0018	0.0043	0.0012	0.0024
1 3/4	4	0.020	0.0013	0.0250	0.0125	0.0046	0.0020	0.0046	0.0013	0.0026
2	4	0.020	0.0014	0.0250	0.0125	0.0049	0.0021	0.0049	0.0014	0.0028
2 1/4	3	0.020	0.0015	0.0333	0.0167	0.0052	0.0022	0.0052	0.0015	0.0030
2 1/2	3	0.020	0.0016	0.0333	0.0167	0.0055	0.0024	0.0055	0.0016	0.0032
2 3/4	3	0.020	0.0017	0.0333	0.0167	0.0058	0.0025	0.0058	0.0017	0.0033
3	2	0.020	0.0017	0.0500	0.0250	0.0061	0.0026	0.0061	0.0017	0.0035
3 1/2	2	0.020	0.0019	0.0500	0.0250	0.0065	0.0028	0.0065	0.0019	0.0037
4	2	0.020	0.0020	0.0500	0.0250	0.0070	0.0030	0.0070	0.0020	0.0040
4 1/2	2	0.020	0.0021	0.0500	0.0250	0.0074	0.0032	0.0074	0.0021	0.0042
5	2	0.020	0.0022	0.0500	0.0250	0.0078	0.0034	0.0078	0.0022	0.0045

<sup>a</sup> All other dimensions are given in inches. Intermediate pitches take the values of the next coarser pitch listed. Values for intermediate diameters should be calculated from the formulas in column headings, but ordinarily may be interpolated.

<sup>b</sup> To avoid a complicated formula and still provide an adequate tolerance, the pitch factor is used as a basis, with the minimum tolerance set at 0.005 in.

<sup>c</sup> Tolerance on minor diameter of all external threads is  $1.5 \times$  pitch diameter tolerance.

<sup>d</sup> The minimum clearance at the minor diameter between the internal and external thread is the sum of the values in columns 3 and 5.

<sup>e</sup> The minimum clearance at the major diameter between the internal and external thread is equal to column 4.

**Designation of Centralizing Acme Threads.**—The following examples are given to show how these Acme threads are designated on drawings, in specifications, and on tools and gages:

*Example, 1.750-6-ACME-4C:* Indicates a Centralizing Class 4C Acme thread of 1.750-inch major diameter, 0.1667-inch pitch, single thread, right-hand.

*Example, 1.750-6-ACME-4C-LH:* Indicates the same thread left-hand.

*Example, 2.875-0.4P-0.8L-ACME-3C (Two Start):* Indicates a Centralizing Class 3C Acme thread with 2.875-inch major diameter, 0.4-inch pitch, 0.8-inch lead, double thread, right-hand.

*Example, 2.500-0.3333P-0.6667L-ACME-4C (Two Start):* Indicates a Centralizing Class 4C Acme thread with 2.500-inch nominal major diameter (basic major diameter 2.500 inches), 0.3333-inch pitch, 0.6667-inch lead, double thread, right-hand. The same thread left-hand would have LH at the end of the designation.

**Acme Centralizing Threads—Alternative Series with Minor Diameter Centralizing Control.**—When Acme centralizing threads are produced in single units or in very small quantities (and principally in sizes larger than the range of commercial taps and dies) where the manufacturing process employs cutting tools (such as lathe cutting), it may be economically advantageous and therefore desirable to have the centralizing control of the mating threads located at the *minor diameters*.

Particularly under the above-mentioned type of manufacturing, the two advantages cited for minor diameter centralizing control over centralizing control at the major diameters of the mating threads are: 1) Greater ease and faster checking of machined thread dimensions. It is much easier to measure the minor diameter (root) of the external thread and the mating minor diameter (crest or bore) of the internal thread than it is to determine the major diameter (root) of the internal thread and the major diameter (crest or turn) of the external thread; and 2) better manufacturing control of the machined size due to greater ease of checking.

In the event that minor diameter centralizing is necessary, recalculate all thread dimensions, reversing major and minor diameter allowances, tolerances, radii, and chamfer.

**American National Standard Stub Acme Threads.**—This American National Standard ASME/ANSI B1.8-1988 (R2001) provides a Stub Acme screw thread for those unusual applications where, due to mechanical or metallurgical considerations, a coarse-pitch thread of shallow depth is required. The fit of Stub Acme threads corresponds to the Class 2G General Purpose Acme thread in American National Standard ANSI B1.5-1988. For a fit having less backlash, the tolerances and allowances for Classes 3G or 4G General Purpose Acme threads may be used.

*Thread Form:* The thread form and basic formulas for Stub Acme threads are given on page 1826 and the basic dimensions in Table 13.

*Allowances and Tolerances:* The major and minor diameter allowances for Stub Acme threads are the same as those given for General Purpose Acme threads on page 1825.

Pitch diameter allowances for Stub Acme threads are the same as for Class 2G General Purpose Acme threads and are given in Table 4. Pitch diameter tolerances for Stub Acme threads are the same as for Class 2G General Purpose Acme threads given in Table 5.

*Limiting Dimensions:* Limiting dimensions of American Standard Stub Acme threads may be determined by using the formulas given in Table 14a, or directly from Table 14b. The diagram below shows the limits of size for Stub Acme threads.

*Thread Series:* A preferred series of diameters and pitches for General Purpose Acme threads (Table 15) is recommended for Stub Acme threads.

**Table 13. American National Standard Stub Acme Screw Thread Form — Basic Dimensions ASME/ANSI B1.8-1988 (R2001)**

Thds. per Inch <sup>a</sup> <i>n</i>	Pitch, $P = 1/n$	Height of Thread (Basic), $0.3P$	Total Height of Thread, $0.3P + \frac{1}{2}$ allowance <sup>b</sup>	Thread Thickness (Basic), $P/2$	Width of Flat	
					Crest of Internal Thread (Basic), $0.4224P$	Root of Internal Thread, $0.4224P - 0.259 \times \text{allowance}^b$
16	0.06250	0.01875	0.0238	0.03125	0.0264	0.0238
14	0.07143	0.02143	0.0264	0.03571	0.0302	0.0276
12	0.08333	0.02500	0.0300	0.04167	0.0352	0.0326
10	0.10000	0.03000	0.0400	0.05000	0.0422	0.0370
9	0.11111	0.03333	0.0433	0.05556	0.0469	0.0417
8	0.12500	0.03750	0.0475	0.06250	0.0528	0.0476
7	0.14286	0.04285	0.0529	0.07143	0.0603	0.0551
6	0.16667	0.05000	0.0600	0.08333	0.0704	0.0652
5	0.20000	0.06000	0.0700	0.10000	0.0845	0.0793
4	0.25000	0.07500	0.0850	0.12500	0.1056	0.1004
3½	0.28571	0.08571	0.0957	0.14286	0.1207	0.1155
3	0.33333	0.10000	0.1100	0.16667	0.1408	0.1356
2½	0.40000	0.12000	0.1300	0.20000	0.1690	0.1638
2	0.50000	0.15000	0.1600	0.25000	0.2112	0.2060
1½	0.66667	0.20000	0.2100	0.33333	0.2816	0.2764
1¼	0.75000	0.22500	0.2350	0.37500	0.3168	0.3116
1	1.00000	0.30000	0.3100	0.50000	0.4224	0.4172

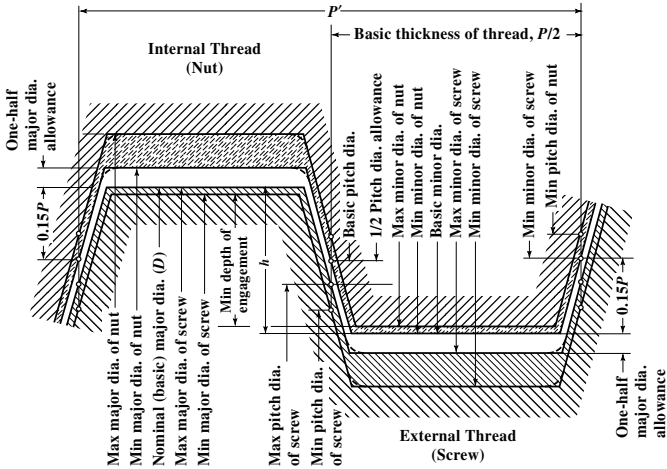
<sup>a</sup> All other dimensions in inches. See Fig. 1, page 1826.<sup>b</sup> Allowance is 0.020 inch for 10 or less threads per inch and 0.010 inch for more than 10 threads per inch.**Table 14a. American National Standard Stub Acme Single-Start Screw Threads — Formulas for Determining Diameters ASME/ANSI B1.8-1988 (R2001)**

$D$ = Basic Major Diameter and Nominal Size in Inches	
$D_2$ = Basic Pitch Diameter = $D - 0.3P$	
$D_1$ = Basic Minor Diameter = $D - 0.6P$	
No.	External Threads (Screws)
1	Major Dia., Max = $D$ .
2	Major Dia., Min. = $D$ minus $0.05P$ .
3	Pitch Dia., Max. = $D_2$ minus allowance from the appropriate Class 2G column, Table 4.
4	Pitch Dia., Min. = Pitch Dia., Max. (Formula 3) minus Class 2G tolerance from Table 5.
5	Minor Dia., Max. = $D_1$ minus 0.020 for 10 threads per inch and coarser and 0.010 for finer pitches.
6	Minor Dia., Min. = Minor Dia., Max. (Formula 5) minus Class 2G pitch diameter tolerance from Table 5.
Internal Threads (Nuts)	
7	Major Dia., Min. = $D$ plus 0.020 for 10 threads per inch and coarser and 0.010 for finer pitches.
8	Major Dia., Max. = Major Dia., Min. (Formula 7) plus Class 2G pitch diameter tolerance from Table 5.
9	Pitch Dia., Min. = $D_2 = D - 0.3P$
10	Pitch Dia., Max. = Pitch Dia., Min. (Formula 9) plus Class 2G tolerance from Table 5.
11	Minor Dia., Min. = $D_1 = D - 0.6P$
12	Minor Dia., Max. = Minor Dia., Min. (Formula 11) plus $0.05P$ .

**Table 14b. Limiting Dimensions for American National Standard Stub Acme Single-Start Screw Threads ASME/ANSI B1.8-1988 (R2001)**

Nominal Diameter, $D$ Threads per Inch <sup>a</sup>		$\frac{1}{4}$	$\frac{3}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	
		16	14	12	12	10	8	6	6	5	5	5	4	
Limiting Dimensions		<b>External Threads</b>												
Major Dia.	{	Max ( $D$ )	0.2500	0.3125	0.3750	0.4375	0.5000	0.6250	0.7500	0.8750	1.0000	1.1250	1.2500	1.3750
		Min	0.2469	0.3089	0.3708	0.4333	0.4950	0.6188	0.7417	0.8667	0.9900	1.1150	1.2400	1.3625
Pitch Dia.	{	Max	0.2272	0.2871	0.3451	0.4076	0.4643	0.5812	0.6931	0.8175	0.9320	1.0565	1.1811	1.2906
		Min	0.2167	0.2757	0.3328	0.3950	0.4506	0.5658	0.6757	0.7996	0.9126	1.0367	1.1610	1.2686
Minor Dia.	{	Max	0.2024	0.2597	0.3150	0.3775	0.4200	0.5300	0.6300	0.7550	0.8600	0.9850	1.1100	1.2050
		Min	0.1919	0.2483	0.3027	0.3649	0.4063	0.5146	0.6126	0.7371	0.8406	0.9652	1.0899	1.1830
		<b>Internal Threads</b>												
Major Dia.	{	Min	0.2600	0.3225	0.3850	0.4475	0.5200	0.6450	0.7700	0.8950	1.0200	1.1450	1.2700	1.3950
		Max	0.2705	0.3339	0.3973	0.4601	0.5337	0.6604	0.7874	0.9129	1.0394	1.1648	1.2901	1.4170
Pitch Dia.	{	Min	0.2312	0.2911	0.3500	0.4125	0.4700	0.5875	0.7000	0.8250	0.9400	1.0650	1.1900	1.3000
		Max	0.2417	0.3025	0.3623	0.4251	0.4837	0.6029	0.7174	0.8429	0.9594	1.0848	1.2101	1.3220
Minor Dia.	{	Min	0.2125	0.2696	0.3250	0.3875	0.4400	0.5500	0.6500	0.7750	0.8800	1.0050	1.1300	1.2250
		Max	0.2156	0.2732	0.3292	0.3917	0.4450	0.5562	0.6583	0.7833	0.8900	1.0150	1.1400	1.2375
Nominal Diameter, $D$ Threads per Inch <sup>a</sup>		$1\frac{1}{2}$	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5		
		4	4	4	3	3	3	2	2	2	2	2		
Limiting Dimensions		<b>External Threads</b>												
Major Dia.	{	Max ( $D$ )	1.5000	1.7500	2.0000	2.2500	2.5000	2.7500	3.0000	3.5000	4.0000	4.5000	5.0000	
		Min	1.4875	1.7375	1.9875	2.2333	2.4833	2.7333	2.9750	3.4750	3.9750	4.4750	4.9750	
Pitch Dia.	{	Max	1.4152	1.6645	1.9137	2.1380	2.3874	2.6367	2.8360	3.3350	3.8340	4.3330	4.8319	
		Min	1.3929	1.6416	1.8902	2.1117	2.3606	2.6094	2.8044	3.3026	3.8008	4.2991	4.7973	
Minor Dia.	{	Max	1.3300	1.5800	1.8300	2.0300	2.2800	2.5300	2.6800	3.1800	3.6800	4.1800	4.6800	
		Min	1.3077	1.5571	1.8065	2.0037	2.2532	2.5027	2.6484	3.1476	3.6468	4.1461	4.6454	
		<b>Internal Threads</b>												
Major Dia.	{	Min	1.5200	1.7700	2.0200	2.2700	2.5200	2.7700	3.0200	3.5200	4.0200	4.5200	5.0200	
		Max	1.5423	1.7929	2.0435	2.2963	2.5468	2.7973	3.0516	3.5524	4.0532	4.5539	5.0546	
Pitch Dia.	{	Min	1.4250	1.6750	1.9250	2.1500	2.4000	2.6500	2.8500	3.3500	3.8500	4.3500	4.8500	
		Max	1.4473	1.6979	1.9485	2.1763	2.4268	2.6773	2.8816	3.3824	3.8832	4.3839	4.8846	
Minor Dia.	{	Min	1.3500	1.6000	1.8500	2.0500	2.3000	2.5500	2.7000	3.2000	3.7000	4.2000	4.7000	
		Max	1.3625	1.6125	1.8625	2.0667	2.3167	2.5667	2.7250	3.2250	3.7250	4.2250	4.7250	

<sup>a</sup> All other dimensions are given in inches.



Limits of Size, Allowances, Tolerances, and Crest Clearances for American National Standard Stub Acme Threads

**Stub Acme Thread Designations.**—The method of designation for Standard Stub Acme threads is illustrated in the following examples: 0.500-20 Stub Acme indicates a  $\frac{1}{2}$ -inch major diameter, 20 threads per inch, right hand, single thread, Standard Stub Acme thread. The designation 0.500-20 Stub Acme-LH indicates the same thread except that it is left hand.

**Alternative Stub Acme Threads.**—Since one Stub Acme thread form may not meet the requirements of all applications, basic data for two of the other commonly used forms are included in the appendix of the American Standard for Stub Acme Threads. These so-called Modified Form 1 and Modified Form 2 threads utilize the same tolerances and allowances as Standard Stub Acme threads and have the same major diameter and basic thread thickness at the pitchline ( $0.5P$ ). The basic height of Form 1 threads,  $h$ , is  $0.375P$ ; for Form 2 it is  $0.250P$ . The basic width of flat at the crest of the internal thread is  $0.4030P$  for Form 1 and  $0.4353P$  for Form 2.

The pitch diameter and minor diameter for Form 1 threads will be smaller than similar values for the Standard Stub Acme Form and for Form 2 they will be larger owing to the differences in basic thread height  $h$ . Therefore, in calculating the dimensions of Form 1 and Form 2 threads using Formulas 1 through 12 in Table 14a, it is only necessary to substitute the following values in applying the formulas: For Form 1,  $D_2 = D - 0.375P$ ,  $D_1 = D - 0.75P$ ; for Form 2,  $D_2 = D - 0.25P$ ,  $D_1 = D - 0.5P$ .

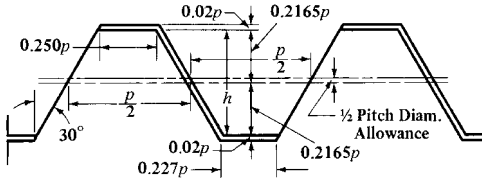
**Thread Designation:** These threads are designated in the same manner as Standard Stub Acme threads except for the insertion of either M1 or M2 after "Acme." Thus, 0.500-20 Stub Acme M1 for a Form 1 thread; and 0.500-20 Stub Acme M2 for a Form 2 thread.

**Former 60-Degree Stub Thread.**—Former American Standard B1.3-1941 included a 60-degree stub thread for use where design or operating conditions could be better satisfied by the use of this thread, or other modified threads, than by Acme threads. Data for 60-Degree Stub thread form are given in the accompanying diagram.

Table 15. Stub Acme Screw Thread Data ASME/ANSI B1.8-1988 (R2001)

Identification		Basic Diameters			Thread Data					
Nominal Sizes	Threads per Inch, <sup>a</sup> <i>n</i>	Major Diameter, <i>D</i>	Pitch Diameter, <i>D</i> <sub>2</sub> = <i>D</i> - <i>h</i>	Minor Diameter, <i>D</i> <sub>1</sub> = <i>D</i> - 2 <i>h</i>	Pitch, <i>P</i>	Thread Thickness at Pitch Line, <i>t</i> = <i>P</i> /2	Basic Thread Height, <i>h</i> = 0.3 <i>P</i>	Basic Width of Flat, 0.4224 <i>P</i>	Lead Anglet Basic Pitch Diameter	
									Deg	Min
1/4	16	0.2500	0.2312	0.2125	0.06250	0.03125	0.01875	0.0264	4	54
5/16	14	0.3125	0.2911	0.2696	0.07143	0.03572	0.02143	0.0302	4	28
3/8	12	0.3750	0.3500	0.3250	0.08333	0.04167	0.02500	0.0352	4	20
7/16	12	0.4375	0.4125	0.3875	0.08333	0.04167	0.02500	0.0352	3	41
1/2	10	0.5000	0.4700	0.4400	0.10000	0.05000	0.03000	0.0422	3	52
5/8	8	0.6250	0.5875	0.5500	0.12500	0.06250	0.03750	0.0528	3	52
3/4	6	0.7500	0.7000	0.6500	0.16667	0.08333	0.05000	0.0704	4	20
7/8	6	0.8750	0.8250	0.7750	0.16667	0.08333	0.05000	0.0704	3	41
1	5	1.0000	0.9400	0.8800	0.20000	0.10000	0.06000	0.0845	3	52
1 1/8	5	1.1250	1.0650	1.0050	0.20000	0.10000	0.06000	0.0845	3	25
1 1/4	5	1.2500	1.1900	1.1300	0.20000	0.10000	0.06000	0.0845	3	4
1 3/8	4	1.3750	1.3000	1.2250	0.25000	0.12500	0.07500	0.1056	3	30
1 1/2	4	1.5000	1.4250	1.3500	0.25000	0.12500	0.07500	0.1056	3	12
1 3/4	4	1.7500	1.6750	1.6000	0.25000	0.12500	0.07500	0.1056	2	43
2	4	2.0000	1.9250	1.8500	0.25000	0.12500	0.07500	0.1056	2	22
2 1/4	3	2.2500	2.1500	2.0500	0.33333	0.16667	0.10000	0.1408	2	50
2 1/2	3	2.5000	2.4000	2.3000	0.33333	0.16667	0.10000	0.1408	2	32
2 3/4	3	2.7500	2.6500	2.5500	0.33333	0.16667	0.10000	0.1408	2	18
3	2	3.0000	2.8500	2.7000	0.50000	0.25000	0.15000	0.2112	3	12
3 1/2	2	3.5000	3.3500	3.2000	0.50000	0.25000	0.15000	0.2112	2	43
4	2	4.0000	3.8500	3.7000	0.50000	0.25000	0.15000	0.2112	2	22
4 1/2	2	4.5000	4.3500	4.2000	0.50000	0.25000	0.15000	0.2112	2	6
5	2	5.0000	4.8500	4.7000	0.50000	0.25000	0.15000	0.2112	1	53

<sup>a</sup> All other dimensions are given in inches.



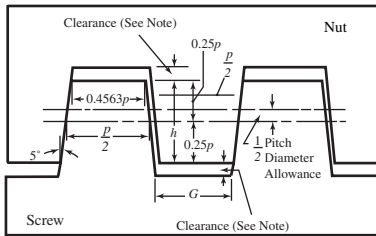
60-Degree Stub Thread

A clearance of at least  $0.02 \times \text{pitch}$  is added to depth  $h$  to produce extra depth, thus avoiding interference with threads of mating part at minor or major diameters.

Basic thread thickness at pitch line =  $0.5 \times \text{pitch } p$ ; basic depth  $h = 0.433 \times \text{pitch}$ ; basic width of flat at crest =  $0.25 \times \text{pitch}$ ; width of flat at root of screw thread =  $0.227 \times \text{pitch}$ ; basic pitch diameter = basic major diameter -  $0.433 \times \text{pitch}$ ; basic minor diameter = basic major diameter -  $0.866 \times \text{pitch}$ .

**Square Thread.**—The square thread is so named because the section is square, the depth, in the case of a screw, being equal to the width or one-half the pitch. The thread groove in a square-threaded nut is made a little greater than one-half the pitch in order to provide a slight clearance for the screw; hence, the tools used for threading square-threaded taps are a little less in width at the point than one-half the pitch. The pitch of a square thread is usually twice the pitch of an American Standard thread of corresponding diameter. The square thread has been superseded quite largely by the Acme form which has several advantages. See *ACME SCREW THREADS*.

**10-Degree Modified Square Thread:** The included angle between the sides of the thread is 10 degrees (see accompanying diagram). The angle of 10 degrees results in a thread which is the practical equivalent of a "square thread," and yet is capable of economical production. Multiple thread milling cutters and ground thread taps should not be specified for modified square threads of the larger lead angles without consulting the cutting tool manufacturer.



In the following formulas,  $D$  = basic major diameter;  $E$  = basic pitch diameter;  $K$  = basic minor diameter;  $p$  = pitch;  $h$  = basic depth of thread on screw depth when there is no clearance between root of screw and crest of thread on nut;  $t$  = basic thickness of thread at pitch line;  $F$  = basic width of flat at crest of screw thread;  $G$  = basic width of flat at root of screw thread;  $C$  = clearance between root of screw and crest of thread on nut:  $E = D - 0.5p$ ;  $K = D - p$ ;  $h = 0.5p$  (see Note);  $t = 0.5p$ ;  $F = 0.4563p$ ;  $G = 0.4563p - (0.17 \times C)$ .

*Note:* A clearance should be added to depth  $h$  to avoid interference with threads of mating parts at minor or major diameters.



## BUTTRESS THREADS

## Threads of Buttress Form

The buttress form of thread has certain advantages in applications involving exceptionally high stresses along the thread axis in one direction only. The contacting flank of the thread, which takes the thrust, is referred to as the *pressure flank* and is so nearly perpendicular to the thread axis that the radial component of the thrust is reduced to a minimum. Because of the small radial thrust, this form of thread is particularly applicable where tubular members are screwed together, as in the case of breech mechanisms of large guns and airplane propeller hubs.

Fig. 1a shows a common form. The front or load-resisting face is perpendicular to the axis of the screw and the thread angle is 45 degrees. According to one rule, the pitch  $P = 2 \times$  screw diameter  $\div 15$ . The thread depth  $d$  may equal  $\frac{3}{4} \times$  pitch, making the flat  $f = \frac{1}{8} \times$  pitch. Sometimes depth  $d$  is reduced to  $\frac{2}{3} \times$  pitch, making  $f = \frac{1}{6} \times$  pitch.

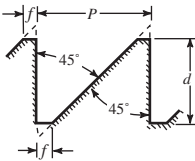


Fig. 1a.

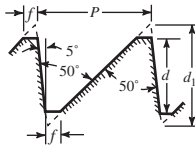


Fig. 1b.

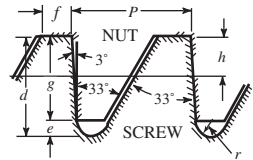


Fig. 1c.

The load-resisting side or flank may be inclined an amount (Fig. 1b) ranging usually from 1 to 5 degrees to avoid cutter interference in milling the thread. With an angle of 5 degrees and an included thread angle of 50 degrees, if the width of the flat  $f$  at both crest and root equals  $\frac{1}{8} \times$  pitch, then the thread depth equals  $0.69 \times$  pitch or  $\frac{3}{4} d_1$ .

The saw-tooth form of thread illustrated by Fig. 1c is known in Germany as the "Sägewinde" and in Italy as the "Filettatura a dente di Sega." Pitches are standardized from 2 millimeters up to 48 millimeters in the German and Italian specifications. The front face inclines 3 degrees from the perpendicular and the included angle is 33 degrees.

The thread depth  $d$  for the screw =  $0.86777 \times$  pitch  $P$ . The thread depth  $g$  for the nut =  $0.75 \times$  pitch. Dimension  $h = 0.341 \times P$ . The width  $f$  of flat at the crest of the thread on the screw =  $0.26384 \times$  pitch. Radius  $r$  at the root =  $0.12427 \times$  pitch. The clearance space  $e = 0.11777 \times$  pitch.

**British Standard Buttress Threads BS 1657: 1950.**—Specifications for buttress threads in this standard are similar to those in the American Standard (see page 1850) except: 1) A basic depth of thread of  $0.4p$  is used instead of  $0.6p$ ; 2) Sizes below 1 inch are not included; 3) Tolerances on major and minor diameters are the same as the pitch diameter tolerances, whereas in the American Standard separate tolerances are provided; however, provision is made for smaller major and minor diameter tolerances when crest surfaces of screws or nuts are used as datum surfaces, or when the resulting reduction in depth of engagement must be limited; and 4) Certain combinations of large diameters with fine pitches are provided that are not encouraged in the American Standard.

**Lowenherz or Löwenherz Thread.**—The Lowenherz thread is intended for the fine screws of instruments and is based on the metric system. The Löwenherz thread has flats at the top and bottom the same as the U.S. standard buttress form, but the angle is 53 degrees 8 minutes. The depth equals  $0.75 \times$  the pitch, and the width of the flats at the top and bottom is equal to  $0.125 \times$  the pitch. This screw thread used for measuring instruments, optical apparatus, etc., especially in Germany.

## Löwenherz Thread

Diameter		Pitch, Millimeters	Approximate No. of Threads per Inch	Diameter		Pitch, Millimeters	Approximate No. of Threads per Inch
Millimeters	Inches			Millimeters	Inches		
1.0	0.0394	0.25	101.6	9.0	0.3543	1.30	19.5
1.2	0.0472	0.25	101.6	10.0	0.3937	1.40	18.1
1.4	0.0551	0.30	84.7	12.0	0.4724	1.60	15.9
1.7	0.0669	0.35	72.6	14.0	0.5512	1.80	14.1
2.0	0.0787	0.40	63.5	16.0	0.6299	2.00	12.7
2.3	0.0905	0.40	63.5	18.0	0.7087	2.20	11.5
2.6	0.1024	0.45	56.4	20.0	0.7874	2.40	10.6
3.0	0.1181	0.50	50.8	22.0	0.8661	2.80	9.1
3.5	0.1378	0.60	42.3	24.0	0.9450	2.80	9.1
4.0	0.1575	0.70	36.3	26.0	1.0236	3.20	7.9
4.5	0.1772	0.75	33.9	28.0	1.1024	3.20	7.9
5.0	0.1968	0.80	31.7	30.0	1.1811	3.60	7.1
5.5	0.2165	0.90	28.2	32.0	1.2599	3.60	7.1
6.0	0.2362	1.00	25.4	36.0	1.4173	4.00	6.4
7.0	0.2756	1.10	23.1	40.0	1.5748	4.40	5.7
8.0	0.3150	1.20	21.1	...	...	...	...

## American National Standard Buttress Inch Screw Threads

The buttress form of thread has certain advantages in applications involving exceptionally high stresses along the thread axis in one direction only. As the thrust side (load flank) of the standard buttress thread is made very nearly perpendicular to the thread axis, the radial component of the thrust is reduced to a minimum. On account of the small radial thrust, the buttress form of thread is particularly applicable when tubular members are screwed together. Examples of actual applications are the breech assemblies of large guns, airplane propeller hubs, and columns for hydraulic presses.

**7°/45° Buttress Thread Form.**—In selecting the form of thread recommended as standard, ANSI B1.9-1973 (R1992), manufacture by milling, grinding, rolling, or other suitable means, has been taken into consideration. All dimensions are in inches.

*Form of Thread:* The form of the buttress thread is shown in the accompanying Figs. 2a and 2b, and has the following characteristics:

- A load flank angle, measured in an axial plane, of 7 degrees from the normal to the axis.
- A clearance flank angle, measured in an axial plane, of 45 degrees from the normal to the axis.
- Equal truncations at the crests of the external and internal threads such that the basic height of thread engagement (assuming no allowance) is equal to 0.6 of the pitch
- Equal radii, at the roots of the external and internal basic thread forms tangential to the load flank and the clearance flank. (There is, in practice, almost no chance that the thread forms will be achieved strictly as basically specified, that is, as true radii.) When specified, equal flat roots of the external and internal thread may be supplied.

**Table 1. American National Standard Diameter—Pitch Combinations for 7°/45° Buttress Threads ANSI B1.9-1973 (R1992)**

Preferred Nominal Major Diameters, Inches	Threads per Inch <sup>a</sup>	Preferred Nominal Major Diameters, Inches	Threads per Inch <sup>a</sup>
0.5, 0.625, 0.75	(20, 16, 12)	4.5, 5, 5.5, 6	12, 10, 8, (6, 5, 4), 3
0.875, 1.0	(16, 12, 10)	7, 8, 9, 10	10, 8, 6, (5, 4, 3), 2.5, 2
1.25, 1.375, 1.5	16, (12, 10, 8), 6	11, 12, 14, 16	10, 8, 6, 5, (4, 3, 2.5), 2, 1.5, 1.25
1.75, 2, 2.25, 2.5	16, 12, (10, 8, 6), 5, 4	18, 20, 22, 24	8, 6, 5, 4, (3, 2.5, 2), 1.5, 1.25, 1
2.75, 3, 3.5, 4	16, 12, 10, (8, 6, 5), 4		

<sup>a</sup> Preferred threads per inch are in parentheses.

**Table 2. American National Standard Inch Buttress Screw Threads—  
Basic Dimensions ANSI B1.9-1973 (R1992)**

Thds. <sup>a</sup> per Inch	Pitch, $p$	Basic Height of Thread, $h = 0.6p$	Height of Sharp-V Thread, $H =$ $0.89064p$	Crest Truncation, $f =$ $0.14532p$	Height of Thread, $h_s$ or $h_n =$ $0.66271p$	Max. Root Trunca- tion, <sup>b</sup> $s =$ $0.0826p$	Max. Root Radius, <sup>c</sup> $r =$ $0.0714p$	Width of Flat at Crest, $F =$ $0.16316p$
20	0.0500	0.0300	0.0445	0.0073	0.0331	0.0041	0.0036	0.0082
16	0.0625	0.0375	0.0557	0.0091	0.0414	0.0052	0.0045	0.0102
12	0.0833	0.0500	0.0742	0.0121	0.0552	0.0069	0.0059	0.0136
10	0.1000	0.0600	0.0891	0.0145	0.0663	0.0083	0.0071	0.0163
8	0.1250	0.0750	0.1113	0.0182	0.0828	0.0103	0.0089	0.0204
6	0.1667	0.1000	0.1484	0.0242	0.1105	0.0138	0.0119	0.0271
5	0.2000	0.1200	0.1781	0.0291	0.1325	0.0165	0.0143	0.0326
4	0.2500	0.1500	0.2227	0.0363	0.1657	0.0207	0.0179	0.0408
3	0.3333	0.2000	0.2969	0.0484	0.2209	0.0275	0.0238	0.0543
2½	0.4000	0.2400	0.3563	0.0581	0.2651	0.0330	0.0286	0.0653
2	0.5000	0.3000	0.4453	0.0727	0.3314	0.0413	0.0357	0.0816
1½	0.6667	0.4000	0.5938	0.0969	0.4418	0.0551	0.0476	0.1088
1¼	0.8000	0.4800	0.7125	0.1163	0.5302	0.0661	0.0572	0.1305
1	1.0000	0.6000	0.8906	0.1453	0.6627	0.0826	0.0714	0.1632

<sup>a</sup> All other dimensions are in inches.

<sup>b</sup> Minimum root truncation is one-half of maximum.

<sup>c</sup> Minimum root radius is one-half of maximum.

**Buttress Thread Tolerances.**—Tolerances from basic size on external threads are applied in a minus direction and on internal threads in a plus direction.

**Pitch Diameter Tolerances:** The following formula is used for determining the pitch diameter product tolerance for Class 2 (standard grade) external or internal threads:

$$\text{PD tolerance} = 0.002 \sqrt[3]{D} + 0.00278 \sqrt{L_e} + 0.00854 \sqrt{p}$$

where  $D$  = basic major diameter of external thread (assuming no allowance)

$L_e$  = length of engagement

$p$  = pitch of thread

When the length of engagement is taken as  $10p$ , the formula reduces to

$$0.002 \sqrt[3]{D} + 0.0173 \sqrt{p}$$

It is to be noted that this formula relates specifically to Class 2 (standard grade) PD tolerances. Class 3 (precision grade) PD tolerances are two-thirds of Class 2 PD tolerances. Pitch diameter tolerances based on this latter formula, for various diameter pitch combinations, are given in [Table 4](#).

**Functional Size:** Deviations in lead and flank angle of product threads increase the functional size of an external thread and decrease the functional size of an internal thread by the cumulative effect of the diameter equivalents of these deviations. The functional size of all buttress product threads shall not exceed the maximum-material limit.

**Tolerances on Major Diameter of External Thread and Minor Diameter of Internal Thread:** Unless otherwise specified, these tolerances should be the same as the pitch diameter tolerance for the class used.

**Tolerances on Minor Diameter of External Thread and Major Diameter of Internal Thread:** It will be sufficient in most instances to state only the maximum minor diameter of the external thread and the minimum major diameter of the internal thread without any tol-

Form of American National Standard 7°/45° Buttress Thread with 0.6p Basic Height of Thread Engagement

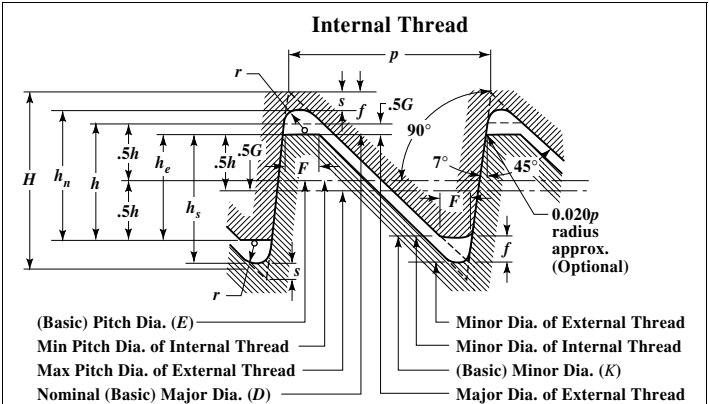


Fig. 2a. Round Root External Thread

Heavy Line Indicates Basic Form

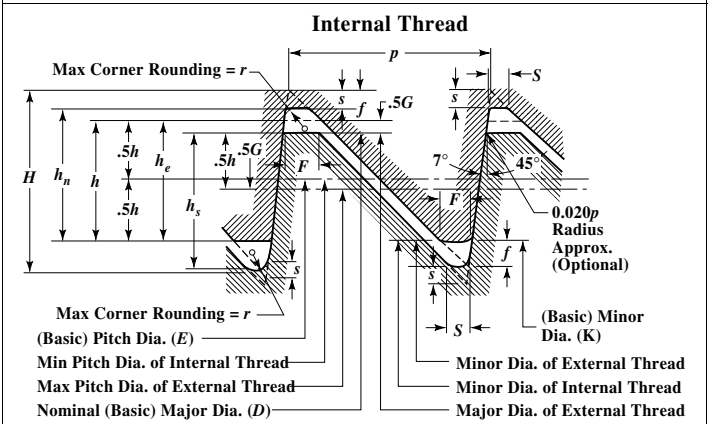


Fig. 2b. Flat Root External Thread

Heavy Line Indicates Basic Form

erance. However, the root truncation from a sharp V should not be greater than  $0.0826p$  nor less than  $0.0413p$ .

*Lead and Flank Angle Deviations for Class 2:* The deviations in lead and flank angles may consume the entire tolerance zone between maximum and minimum material product limits given in Table 4.

*Diameter Equivalents for Variations in Lead and Flank Angles for Class 3:* The combined diameter equivalents of variations in lead (including helix deviations), and flank

**Table 3. American National Standard Buttress Inch Screw Thread Symbols and Form**

Thread Element	Max. Material (Basic)	Min. Material
Pitch	$p$	
Height of sharp-V thread	$H = 0.89064p$	
Basic height of thread engagement	$h = 0.6p$	
Root radius (theoretical)(see footnote <sup>a</sup> )	$r = 0.07141p$	Min. $r = 0.0357p$
Root truncation	$s = 0.0826p$	Min. $s = 0.5$ ; Max. $s = 0.0413p$
Root truncation for flat root form	$s = 0.0826p$	Min. $s = 0.5$ ; Max. $s = 0.0413p$
Flat width for flat root form	$S = 0.0928p$	Min. $S = 0.0464p$
Allowance	$G$ (see text)	
Height of thread engagement	$h_e = h - 0.5G$	Min. $h_e = \text{Max. } h_e - [0.5 \text{ tol. on major dia. external thread} + 0.5 \text{ tol. on minor dia. internal thread}]$
Crest truncation	$f = 0.14532p$	
Crest width	$F = 0.16316p$	
Major diameter	$D$	
Major diameter of internal thread	$D_n = D + 0.12542p$	Max. $D_n = \text{Max. pitch dia. of internal thread} + 0.80803p$
Major diameter of external thread	$D_s = D - G$	Min. $D_s = D - G - D \text{ tol.}$
Pitch diameter	$E$	
Pitch diameter of internal thread (see footnote <sup>b</sup> )	$E_n = D - h$	Max. $E_n = D - h + PD \text{ tol.}$
Pitch diameter of external thread (see footnote <sup>c</sup> )	$E_s = D - h - G$	Min. $E_s = D - h - G - PD \text{ tol.}$
Minor diameter	$K$	
Minor diameter of external thread	$K_s = D - 1.32542p - G$	Min. $K_s = \text{Min. pitch dia. of external thread} - 0.80803p$
Minor diameter of internal thread	$K_n = D - 2h$	Min. $K_n = D - 2h + K \text{ tol.}$
Height of thread of internal thread	$h_n = 0.66271p$	
Height of thread of external thread	$h_s = 0.66271p$	
Pitch diameter increment for lead	$\Delta EI$	
Pitch diameter increment for 45° clearance flank angle	$\Delta E\alpha_1$	
Pitch diameter increment for 7° load flank angle	$\Delta E\alpha_2$	
Length of engagement	$L_e$	

<sup>a</sup>Unless the flat root form is specified, the rounded root form of the external and internal thread shall be a continuous, smoothly blended curve within the zone defined by 0.07141*p* maximum to 0.0357*p* minimum radius. The resulting curve shall have no reversals or sudden angular variations, and shall be tangent to the flanks of the thread. There is, in practice, almost no chance that the rounded thread form will be achieved strictly as basically specified, that is, as a true radius.

<sup>b</sup>The pitch diameter *X* tolerances for GO and NOT GO threaded plug gages are applied to the internal product limits for  $E_n$  and Max.  $E_n$ .

<sup>c</sup>The pitch diameter *W* tolerances for GO and NOT GO threaded setting plug gages are applied to the external product limits for  $E_s$  and Min.  $E_s$ .

**Table 4. American National Standard Buttress Inch Screw Threads Tolerances Class 2 (Standard Grade) and Class 3 (Precision Grade) ANSI B1.9-1973 (R1992)**

Thds. per Inch	Pitch, <sup>a</sup> <i>p</i> Inch	Basic Major Diameter, Inch									Pitch <sup>b</sup> Increment, $0.0173\sqrt{p}$ Inch
		From 0.5 thru 0.7	Over 0.7 thru 1.0	Over 1.0 thru 1.5	Over 1.5 thru 2.5	Over 2.5 thru 4	Over 4 thru 6	Over 6 thru 10	Over 10 thru 16	Over 16 thru 24	
		Tolerance on Major Diameter of External Thread, Pitch Diameter of External and Internal Threads, and Minor Diameter of Internal Thread, Inch									
<b>Class 2, Standard Grade</b>											
20	0.0500	.0056	....	....	....	....	....	....	....	....	.00387
16	0.0625	.0060	.0062	.0065	.0068	.0073	....	....	....	....	.00432
12	0.0833	.0067	.0069	.0071	.0075	.0080	.0084	....	....	....	.00499
10	0.1000	....	.0074	.0076	.0080	.0084	.0089	.0095	.0102	....	.00547
8	0.1250	....	....	.0083	.0086	.0091	.0095	.0101	.0108	.0115	.00612
6	0.1667	....	....	.0092	.0096	.0100	.0105	.0111	.0118	.0125	.00706
5	0.2000	....	....	....	.0103	.0107	.0112	.0117	.0124	.0132	.00774
4	0.2500	....	....	....	.0112	.0116	.0121	.0127	.0134	.0141	.00865
3	0.3333	....	....	....	....	....	.0134	.0140	.0147	.0154	.00999
2.5	0.4000	....	....	....	....	....	....	.0149	.0156	.0164	.01094
2.0	0.5000	....	....	....	....	....	....	.0162	.0169	.0177	.01223
1.5	0.6667	....	....	....	....	....	....	....	.0188	.0196	.01413
1.25	0.8000	....	....	....	....	....	....	....	.0202	.0209	.01547
1.0	1.0000	....	....	....	....	....	....	....	....	.0227	.01730
Diameter Increment, <sup>c</sup> $0.002\sqrt[3]{D}$		.00169	.00189	.00215	.00252	.00296	.00342	.00400	.00470	.00543	
<b>Class 3, Precision Grade</b>											
20	0.0500	.0037	....	....	....	....	....	....	....	....	
16	0.0625	.0040	.0042	.0043	.0046	.0049	....	....	....	....	
12	0.0833	.0044	.0046	.0048	.0050	.0053	.0056	....	....	....	
10	0.1000	....	.0049	.0051	.0053	.0056	.0059	.0063	.0068	....	
8	0.1250	....	....	.0055	.0058	.0061	.0064	.0067	.0072	.0077	
6	0.1667	....	....	.0061	.0064	.0067	.0070	.0074	.0078	.0083	
5	.02000	....	....	....	.0068	.0071	.0074	.0078	.0083	.0088	
4	0.2500	....	....	....	.0074	.0077	.0080	.0084	.0089	.0094	
3	.03333	....	....	....	....	....	.0089	.0093	.0098	.0103	
2.5	0.4000	....	....	....	....	....	....	.0100	.0104	.0109	
2.0	0.5000	....	....	....	....	....	....	.0108	.0113	.0118	
1.5	0.6667	....	....	....	....	....	....	....	.0126	.0130	
1.25	0.8000	....	....	....	....	....	....	....	.0135	.0139	
1.0	1.0000	....	....	....	....	....	....	....	....	.0152	

<sup>a</sup> For threads with pitches not shown in this table, pitch increment to be used in tolerance formula is to be determined by use of formula  $PD \text{ Tolerance} = 0.002\sqrt[3]{D} + 0.00278\sqrt{L_e} + 0.00854\sqrt{p}$ , where:  $D$  = basic major diameter of external thread (assuming no allowance),  $L_e$  = length of engagement, and  $p$  = pitch of thread. This formula relates specifically to Class 2 (standard grade) PD tolerances. Class 3 (precision grade) PD tolerances are two-thirds of Class 2 PD tolerances. See text

<sup>b</sup> When the length of engagement is taken as  $10p$ , the formula reduces to:  $0.002\sqrt[3]{D} + 0.0173\sqrt{p}$

<sup>c</sup> Diameter  $D$ , used in diameter increment formula, is based on the average of the range.

angle for Class 3, shall not exceed 50 percent of the Class 2 pitch diameter tolerances given in Table 4.

*Tolerances on Taper and Roundness:* There are no requirements for taper and roundness for Class 2 buttress screw threads.

The major and minor diameters of Class 3 buttress threads shall not taper nor be out of round to the extent that specified limits for major and minor diameter are exceeded. The taper and out-of-roundness of the pitch diameter for Class 3 buttress threads shall not exceed 50 per cent of the pitch-diameter tolerances.

**Allowances for Easy Assembly.**—An allowance (clearance) should be provided on all external threads to secure easy assembly of parts. The amount of the allowance is deducted from the nominal major, pitch, and minor diameters of the external thread when the maximum material condition of the external thread is to be determined.

The minimum internal thread is basic.

The amount of the allowance is the same for both classes and is equal to the Class 3 pitch-diameter tolerance as calculated by the formulas previously given. The allowances for various diameter-pitch combinations are given in [Table 5](#).

**Table 5. American National Standard External Thread Allowances for Classes 2 and 3 Buttress Inch Screw Threads ANSI B1.9-1973 (R1992)**

Threads per Inch	Pitch, $p$ Inch	Basic Major Diameter, Inch								
		From 0.5 thru 0.7	Over 0.7 thru 1.0	Over 1.0 thru 1.5	Over 1.5 thru 2.5	Over 2.5 thru 4	Over 4 thru 6	Over 6 thru 10	Over 10 thru 16	Over 16 thru 24
		Allowance on Major, Minor and Pitch Diameters of External Thread, Inch								
20	0.0500	.0037	....	....	....	....	....	....	....	....
16	0.0625	.0040	.0042	.0043	.0046	.0049	....	....	....	....
12	0.0833	.0044	.0046	.0048	.0050	.0053	.0056	....	....	....
10	0.1000	....	.0049	.0051	.0053	.0056	.0059	.0063	.0068	....
8	0.1250	....	....	.0055	.0058	.0061	.0064	.0067	.0072	.0077
6	0.1667	....	....	.0061	.0064	.0067	.0070	.0074	.0078	.0083
5	0.2000	....	....	....	.0068	.0071	.0074	.0078	.0083	.0088
4	0.2500	....	....	....	.0074	.0077	.0080	.0084	.0089	.0094
3	0.3333	....	....	....	....	....	.0089	.0093	.0098	.0103
2.5	0.4000	....	....	....	....	....	....	.0100	.0104	.0109
2.0	0.5000	....	....	....	....	....	....	.0108	.0113	.0118
1.5	0.6667	....	....	....	....	....	....	....	.0126	.0130
1.25	0.8000	....	....	....	....	....	....	....	.0135	.0139
1.0	1.0000	....	....	....	....	....	....	....	....	.0152

**Example Showing Dimensions for a Typical Buttress Thread.**—The dimensions for a 2-inch diameter, 4 threads per inch, Class 2 buttress thread with flank angles of 7 degrees and 45 degrees are

$$h = \text{basic thread height} = 0.1500 \text{ (Table 2)}$$

$$h_s = h_n = \text{height of thread in external and internal threads} = 0.1657 \text{ (Table 2)}$$

$$G = \text{pitch-diameter allowance on external thread} = 0.0074 \text{ (Table 5)}$$

$$\text{Tolerance on PD of external and internal threads} = 0.0112 \text{ (Table 4)}$$

$$\text{Tolerance on major diameter of external thread and minor diameter of internal thread} = 0.0112 \text{ (Table 4)}$$

#### Internal Thread:

$$\text{Basic Major Diameter: } D = 2.0000$$

$$\text{Min. Major Diameter: } D - 2h + 2h_n = 2.0314 \text{ (see Table 2)}$$

$$\text{Min. Pitch Diameter: } D - h = 1.8500 \text{ (see Table 2)}$$

$$\text{Max. Pitch Diameter: } D - h + PD \text{ Tolerance} = 1.8612 \text{ (see Table 4)}$$

$$\text{Min. Minor Diameter: } D - 2h = 1.7000 \text{ (see Table 2)}$$

$$\text{Max. Minor Diameter: } D - 2h + \text{Minor Diameter Tolerance} = 1.7112 \text{ (see Table 4)}$$

**External Thread:**

Max. Major Diameter:  $D - G = 1.9926$  (see Table 5)

Min. Major Diameter:  $D - G - \text{Major Diameter Tolerance} = 1.9814$  (see Tables 4 and 5)

Max. Pitch Diameter:  $D - h - G = 1.8426$  (see Tables 2 and 5)

Min. Pitch Diameter:  $D - h - G - PD \text{ Tolerance} = 1.8314$  (see Table 4)

Max. Minor Diameter:  $D - G - 2h_s = 1.6612$  (see Tables 2 and 5)

**Buttress Thread Designations.**—When only the designation, BUTT is used, the thread is “pull” type buttress (external thread pulls) with the clearance flank leading and the 7-degree pressure flank following. When the designation, PUSH-BUTT is used, the thread is a push type buttress (external thread pushes) with the 7-degree load flank leading and the 45-degree clearance flank following. Whenever possible this description should be confirmed by a simplified view showing thread angles on the drawing of the product that has the buttress thread.

*Standard Buttress Threads:* A buttress thread is considered to be standard when: 1) opposite flank angles are 7-degrees and 45-degrees; 2) basic thread height is  $0.6p$ ; 3) tolerances and allowances are as shown in Tables 4 and 5; and 4) length of engagement is  $10p$  or less.

*Thread Designation Abbreviations:* In thread designations on drawings, tools, gages, and in specifications, the following abbreviations and letters are to be used:

BUTT	for buttress thread, pull type	
PUSH-BUTT	for buttress thread, push type	
LH	for left-hand thread (Absence of LH indicates that the thread is a right-hand thread.)	
P	for pitch	
L	for lead	
A	for external thread	<i>Note:</i> Absence of A or B after thread class indicates that designation covers both the external and internal threads.
B	for internal thread	
Le	for length of thread engagement	
SPL	for special	
FL	for flat root thread	
E	for pitch diameter	
TPI	for threads per inch	
THD	for thread	

**Designation Sequence for Buttress Inch Screw Threads.**—When designating single-start standard buttress threads the nominal size is given first, the threads per inch next, then PUSH if the internal member is to push, but nothing if it is to pull, then the class of thread (2 or 3), then whether external (A) or internal (B), then LH if left-hand, but nothing if right-hand, and finally FL if a flat root thread, but nothing if a radiused root thread; thus, 2.5-8 BUTT-2A indicates a 2.5 inch, 8 threads per inch buttress thread, Class 2 external, right-hand, internal member to pull, with radiused root of thread. The designation 2.5-8 PUSH-BUTT-2A-LH-FL signifies a 2.5 inch size, 8 threads per inch buttress thread with internal member to push, Class 2 external, left-hand, and flat root.

A multiple-start standard buttress thread is similarly designated but the pitch is given instead of the threads per inch, followed by the lead and the number of starts is indicated in parentheses after the class of thread. Thus, 10-0.25P-0.5L – BUTT-3B (2 start) indicates a 10-inch thread with 4 threads per inch, 0.5 inch lead, buttress form with internal member to pull, Class 3 internal, 2 starts, with radiused root of thread.



## WHITWORTH THREADS

**British Standard Whitworth (BSW) and British Standard Fine (BSF) Threads**

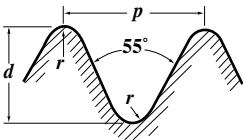
The BSW is the Coarse Thread series and the BSF is the Fine Thread series of British Standard 84:1956—Parallel Screw Threads of Whitworth Form. The dimensions given in the tables on the following pages for the major, effective, and minor diameters are, respectively, the maximum limits of these diameters for bolts and the minimum limits for nuts. Formulas for the tolerances on these diameters are given in the table below.

**Whitworth Standard Thread Form.**—This thread form is used for the British Standard Whitworth (BSW) and British Standard Fine (BSF) screw threads. More recently, both threads have been known as parallel screw threads of Whitworth form.

With standardization of the Unified thread, the Whitworth thread form is expected to be used only for replacements or spare parts. Tables of British Standard Parallel Screw Threads of Whitworth Form will be found on the following pages; tolerance formulas are given in the table below. The form of the thread is shown by the diagram. If  $p$  = pitch,  $d$  = depth of thread,  $r$  = radius at crest and root, and  $n$  = number of threads per inch, then

$$d = \frac{1}{2}p \times \cot 27^{\circ}30' = 0.640327p = 0.640327 \div n$$

$$r = 0.137329p = 0.137329 \div n$$



It is recommended that stainless steel bolts of nominal size  $\frac{3}{4}$  inch and below should not be made to Close Class limits but rather to Medium or Free Class limits. Nominal sizes above  $\frac{3}{4}$  inch should have maximum and minimum limits 0.001 inch smaller than the values obtained from the table.

**Tolerance Classes :** *Close Class bolts.* Applies to screw threads requiring a fine snug fit, and should be used only for special work where refined accuracy of pitch and thread form are particularly required. *Medium Class bolts and nuts.* Applies to the better class of ordinary interchangeable screw threads. *Free Class bolts.* Applies to the majority of bolts of ordinary commercial quality. *Normal Class nuts.* Applies to ordinary commercial quality nuts; this class is intended for use with Medium or Free Class bolts.

**Table 1. Tolerance Formulas for BSW and BSF Threads**

	Class or Fit	Tolerance in inches <sup>a</sup> (+ for nuts, - for bolts)		
		Major Dia.	Effective Dia.	Minor Dia.
Bolts	Close	$\frac{2}{3}T + 0.01\sqrt{p}$	$\frac{2}{3}T$	$\frac{2}{3}T + 0.013\sqrt{p}$
	Medium	$T + 0.01\sqrt{p}$	$T$	$T + 0.02\sqrt{p}$
	Free	$\frac{3}{2}T + 0.01\sqrt{p}$	$\frac{3}{2}T$	$\frac{3}{2}T + 0.02\sqrt{p}$
Nuts	Close	...	$\frac{2}{3}T$	} { 0.2p + 0.004 <sup>b</sup> 0.2p + 0.005 <sup>c</sup> 0.2p + 0.007 <sup>d</sup>
	Medium	...	$T$	
	Normal	...	$\frac{3}{2}T$	

<sup>a</sup> The symbol  $T = 0.002\sqrt[3]{D} + 0.003\sqrt{L} + 0.005\sqrt{p}$ , where  $D$  = major diameter of thread in inches;  $L$  = length of engagement in inches;  $p$  = pitch in inches. The symbol  $p$  signifies pitch.

<sup>b</sup> For 26 threads per inch and finer.

<sup>c</sup> For 24 and 22 threads per inch.

<sup>d</sup> For 20 threads per inch and coarser.

WHITWORTH THREADS

Table 2. Threads of Whitworth Form—Basic Dimensions

$p = 1 \div n$   
 $H = 0.960491p$   
 $H/6 = 0.160082p$   
 $h = 0.640327p$   
 $e = 0.0739176p$   
 $r = 0.137329p$

Threads per Inch	Pitch	Triangular Height	Shortening	Depth of Thread	Depth of Rounding	Radius
<i>n</i>	<i>p</i>	<i>H</i>	<i>H/6</i>	<i>h</i>	<i>e</i>	<i>r</i>
72	0.013889	0.013340	0.002223	0.008894	0.001027	0.001907
60	0.016667	0.016009	0.002668	0.010672	0.001232	0.002289
56	0.017857	0.017151	0.002859	0.011434	0.001320	0.002452
48	0.020833	0.020010	0.003335	0.013340	0.001540	0.002861
40	0.025000	0.024012	0.004002	0.016008	0.0011848	0.003433
36	0.027778	0.026680	0.004447	0.017787	0.002053	0.003815
32	0.031250	0.030015	0.005003	0.020010	0.002310	0.004292
28	0.035714	0.034303	0.005717	0.022869	0.002640	0.004905
26	0.038462	0.036942	0.006157	0.024628	0.002843	0.005282
24	0.041667	0.040020	0.006670	0.026680	0.003080	0.005722
22	0.045455	0.043659	0.007276	0.029106	0.003366	0.006242
20	0.050000	0.048025	0.008004	0.032016	0.003696	0.006866
19	0.052632	0.050553	0.008425	0.033702	0.003890	0.007228
18	0.055556	0.053361	0.008893	0.035574	0.004107	0.007629
16	0.062500	0.060031	0.010005	0.040020	0.004620	0.008583
14	0.071429	0.068607	0.011434	0.045738	0.005280	0.009809
12	0.083333	0.080041	0.013340	0.053361	0.006160	0.011444
11	0.090909	0.087317	0.014553	0.058212	0.006720	0.012484
10	0.100000	0.096049	0.016008	0.064033	0.007392	0.013733
9	0.111111	0.106721	0.017787	0.071147	0.008213	0.015259
8	0.125000	0.120061	0.020010	0.080041	0.009240	0.017166
7	0.142857	0.137213	0.022869	0.091475	0.010560	0.019618
6	0.166667	0.160082	0.026680	0.106721	0.012320	0.022888
5	0.200000	0.192098	0.032016	0.128065	0.014784	0.027466
4.5	0.222222	0.213442	0.035574	0.142295	0.016426	0.030518
4	0.250000	0.240123	0.040020	0.160082	0.018479	0.034332
3.5	0.285714	0.274426	0.045738	0.182951	0.021119	0.039237
3.25	0.307692	0.295536	0.049256	0.197024	0.022744	0.042255
3	0.333333	0.320164	0.053361	0.213442	0.024639	0.045776
2.875	0.347826	0.334084	0.055681	0.222722	0.025710	0.047767
2.75	0.363636	0.349269	0.058212	0.232846	0.026879	0.049938
2.625	0.380952	0.365901	0.060984	0.243934	0.028159	0.052316
2.5	0.400000	0.384196	0.064033	0.256131	0.029567	0.054932

Dimensions are in inches.

**Allowances:** Only Free Class and Medium Class bolts have an allowance. For nominal sizes of 3/4 inch down to 1/4 inch, the allowance is 30 per cent of the Medium Class bolt effective-diameter tolerance (0.3T); for sizes less than 1/4 inch, the allowance for the 1/4-inch size applies. Allowances are applied minus from the basic bolt dimensions; the tolerances are then applied to the reduced dimensions.

**Table 3. British Standard Whitworth (BSW) and British Standard Fine (BSF) Screw Thread Series—Basic Dimensions BS 84:1956 (obsolescent)**

Nominal Size, Inches	Threads per Inch	Pitch, Inches	Depth of Thread, Inches	Major Diameter, Inches	Effective Diameter, Inches	Minor Diameter, Inches	Area at Bottom of Thread, Sq. in.	Tap Drill Dia.
<b>Coarse Thread Series (BSW)</b>								
$\frac{1}{8}$ <sup>a</sup>	40	0.02500	0.0160	0.1250	0.1090	0.9030	0.0068	2.55 mm
$\frac{3}{16}$	24	0.04167	0.0267	0.1875	0.1608	0.1341	0.0141	3.70 mm
$\frac{1}{4}$	20	0.05000	0.0320	0.2500	0.2180	0.1860	0.0272	5.10 mm
$\frac{5}{16}$	18	0.05556	0.0356	0.3125	0.2769	0.2413	0.0457	6.50 mm
$\frac{3}{8}$	16	0.06250	0.0400	0.3750	0.3350	0.2950	0.0683	7.90 mm
$\frac{7}{16}$	14	0.07143	0.0457	0.4375	0.3918	0.3461	0.0941	9.30 mm
$\frac{1}{2}$	12	0.08333	0.0534	0.5000	0.4466	0.3932	0.1214	10.50 mm
$\frac{5}{16}$ <sup>a</sup>	12	0.08333	0.0534	0.5625	0.5091	0.4557	0.1631	12.10 mm
$\frac{5}{8}$	11	0.09091	0.0582	0.6250	0.5668	0.5086	0.2032	13.50 mm
$\frac{11}{16}$ <sup>a</sup>	11	0.09091	0.0582	0.6875	0.6293	0.5711	0.2562	15.00 mm
$\frac{3}{4}$	10	0.10000	0.0640	0.7500	0.6860	0.6220	0.3039	16.25 mm
$\frac{7}{8}$	9	0.11111	0.0711	0.8750	0.8039	0.7328	0.4218	19.25 mm
1	8	0.12500	0.0800	1.0000	0.9200	0.8400	0.5542	22.00 mm
$1\frac{1}{8}$	7	0.14286	0.0915	1.1250	1.0335	0.9420	0.6969	24.75 mm
$1\frac{1}{4}$	7	0.14286	0.0915	1.2500	1.1585	1.0670	0.8942	28.00 mm
$1\frac{1}{2}$	6	0.16667	0.1067	1.5000	1.3933	1.2866	1.3000	33.50 mm
$1\frac{3}{4}$	5	0.20000	0.1281	1.7500	1.6219	1.4938	1.7530	39.00 mm
2	4.5	0.22222	0.1423	2.0000	1.8577	1.7154	2.3110	44.50 mm
$2\frac{1}{4}$	4	0.25000	0.1601	2.2500	2.0899	1.9298	2.9250	
$2\frac{1}{2}$	4	0.25000	0.1601	2.5000	2.3399	2.1798	3.7320	
$2\frac{3}{4}$	3.5	0.28571	0.1830	2.7500	2.5670	2.3840	4.4640	Tap drill diameters shown in this column are recommended sizes listed in BS 1157:1975 and provide from 77 to 87% of full thread.
3	3.5	0.28571	0.1830	3.0000	2.8170	2.6340	5.4490	
$3\frac{1}{2}$ <sup>a</sup>	3.25	0.30769	0.1970	3.2500	3.0530	2.8560	6.4060	
$3\frac{1}{2}$	3.25	0.30769	0.1970	3.5000	3.3030	3.1060	7.5770	
$3\frac{3}{4}$ <sup>a</sup>	3	0.33333	0.2134	3.7500	3.5366	3.3232	8.6740	
4	3	0.33333	0.2134	4.0000	3.7866	3.5732	10.0300	
$4\frac{1}{2}$	2.875	0.34783	0.2227	4.5000	4.2773	4.0546	12.9100	
5	2.75	0.36364	0.2328	5.0000	4.7672	4.5344	16.1500	
$5\frac{1}{2}$	2.625	0.38095	0.2439	5.5000	5.2561	5.0122	19.7300	
6	2.5	0.40000	0.2561	6.0000	5.7439	5.4878	23.6500	
<b>Fine Thread Series (BSF)</b>								
$\frac{3}{16}$ <sup>a b</sup>	32	0.03125	0.0200	0.1875	0.1675	0.1475	0.0171	4.00 mm
$\frac{7}{32}$ <sup>a</sup>	28	0.03571	0.0229	0.2188	0.1959	0.1730	0.0235	4.60 mm
$\frac{1}{4}$	26	0.03846	0.0246	0.2500	0.2254	0.2008	0.0317	5.30 mm
$\frac{9}{32}$ <sup>a</sup>	26	0.03846	0.0246	0.2812	0.2566	0.2320	0.0423	6.10 mm
$\frac{5}{16}$	22	0.04545	0.0291	0.3125	0.2834	0.2543	0.0508	6.80 mm
$\frac{3}{8}$	20	0.05000	0.0320	0.3750	0.3430	0.3110	0.0760	8.30 mm
$\frac{7}{16}$	18	0.05556	0.0356	0.4375	0.4019	0.3363	0.1054	9.70 mm
$\frac{1}{2}$	16	0.06250	0.0400	0.5000	0.4600	0.4200	0.1385	11.10 mm
$\frac{9}{16}$	16	0.06250	0.0400	0.5625	0.5225	0.4825	0.1828	12.70 mm
$\frac{5}{8}$	14	0.07143	0.0457	0.6250	0.5793	0.5336	0.2236	14.00 mm
$\frac{11}{16}$ <sup>a</sup>	14	0.07143	0.0457	0.6875	0.6418	0.5961	0.2791	15.50 mm
$\frac{3}{4}$	12	0.08333	0.0534	0.7500	0.6966	0.6432	0.3249	16.75 mm
$\frac{7}{8}$	11	0.09091	0.0582	0.8750	0.8168	0.7586	0.4520	19.75 mm
1	10	0.10000	0.0640	1.0000	0.9360	0.8720	0.5972	22.75 mm
$1\frac{1}{8}$	9	0.11111	0.0711	1.1250	1.0539	0.9828	0.7586	25.50 mm
$1\frac{1}{4}$	9	0.11111	0.0711	1.2500	1.1789	1.1078	0.9639	28.50 mm
$1\frac{3}{8}$ <sup>a</sup>	8	0.12500	0.0800	1.3750	1.2950	1.2150	1.1590	31.50 mm
$1\frac{1}{2}$	8	0.12500	0.0800	1.5000	1.4200	1.3400	1.4100	34.50 mm
$1\frac{5}{8}$ <sup>a</sup>	8	0.12500	0.0800	1.6250	1.5450	1.4650	1.6860	
$1\frac{3}{4}$	7	0.14286	0.0915	1.7500	1.6585	1.5670	1.9280	
2	7	0.14286	0.0915	2.0000	1.9085	1.8170	2.5930	
$2\frac{1}{4}$	6	0.16667	0.1067	2.2500	2.1433	2.0366	3.2580	
$2\frac{1}{2}$	6	0.16667	0.1067	2.5000	2.3933	2.2866	4.1060	Tap drill sizes listed in this column are recommended sizes shown in BS 1157:1975 and provide from 78 to 88% of full thread.
$2\frac{3}{4}$	6	0.16667	0.1067	2.7500	2.6433	2.5366	5.0540	
3	5	0.20000	0.1281	3.0000	2.8719	2.7438	5.9130	
$3\frac{1}{4}$	5	0.20000	0.1281	3.2500	3.1219	2.9938	7.0390	
$3\frac{1}{2}$	4.5	0.22222	0.1423	3.5000	3.3577	3.2154	8.1200	
$3\frac{3}{4}$	4.5	0.22222	0.1423	3.7500	3.6077	3.4654	9.4320	
4	4.5	0.22222	0.1423	4.0000	3.8577	3.7154	10.8400	
$4\frac{1}{4}$	4	0.25000	0.1601	4.2500	4.0899	3.9298	12.1300	

<sup>a</sup>To be dispensed with wherever possible.<sup>b</sup>The use of number 2 BA threads is recommended in place of 3/16-inch BSF thread, see page 1885.

## PIPE AND HOSE THREADS

The types of threads used on pipe and pipe fittings may be classed according to their intended use: 1) threads that when assembled with a sealer will produce a pressure-tight joint; 2) threads that when assembled without a sealer will produce a pressure-tight joint; 3) threads that provide free- and loose-fitting mechanical joints without pressure tightness; and 4) threads that produce rigid mechanical joints without pressure tightness.

## American National Standard Pipe Threads

American National Standard pipe threads described in the following paragraphs provide taper and straight pipe threads for use in various combinations and with certain modifications to meet these specific needs.

**Thread Designation and Notation.**—American National Standard Pipe Threads are designated by specifying in sequence the nominal size, number of threads per inch, and the symbols for the thread series and form, as:  $\frac{3}{8}$ —18 NPT. The symbol designations are as follows: NPT—American National Standard Taper Pipe Thread; NPTR—American National Standard Taper Pipe Thread for Railing Joints; NPSC—American National Standard Straight Pipe Thread for Couplings; NPSM—American National Standard Straight Pipe Thread for Free-fitting Mechanical Joints; NPSL—American National Standard Straight Pipe Thread for Loose-fitting Mechanical Joints with Locknuts; and NPSH—American National Standard Straight Pipe Thread for Hose Couplings.

**American National Standard Taper Pipe Threads.**—The basic dimensions of the ANSI Standard taper pipe thread are given in [Table 1a](#).

*Form of Thread:* The angle between the sides of the thread is 60 degrees when measured in an axial plane, and the line bisecting this angle is perpendicular to the axis. The depth of the truncated thread is based on factors entering into the manufacture of cutting tools and the making of tight joints and is given by the formulas in [Table 1a](#) or the data in [Table 2](#) obtained from these formulas. Although the standard shows flat surfaces at the crest and root of the thread, some rounding may occur in commercial practice, and it is intended that the pipe threads of product shall be acceptable when crest and root of the tools or chasers lie within the limits shown in [Table 2](#).

*Pitch Diameter Formulas:* In the following formulas, which apply to the ANSI Standard taper pipe thread,  $E_0$  = pitch diameter at end of pipe;  $E_1$  = pitch diameter at the large end of the internal thread and at the gaging notch;  $D$  = outside diameter of pipe;  $L_1$  = length of hand-tight or normal engagement between external and internal threads;  $L_2$  = basic length of effective external taper thread; and  $p$  = pitch =  $1 \div$  number of threads per inch.

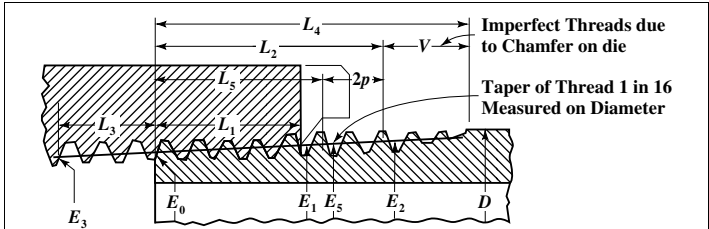
$$E_0 = D - (0.05D + 1.1)p$$

$$E_1 = E_0 + 0.0625L_1$$

*Thread Length:* The formula for  $L_2$  determines the length of the effective thread and includes approximately two usable threads that are slightly imperfect at the crest. The normal length of engagement,  $L_1$ , between external and internal taper threads, when assembled by hand, is controlled by the use of the gages.

$$L_2 = (0.80D + 6.8)p$$

*Taper:* The taper of the thread is 1 in 16, or 0.75 inch per foot, measured on the diameter and along the axis. The corresponding half-angle of taper or angle with the center line is 1 degree, 47 minutes.

**Table 1a. Basic Dimensions, American National Standard Taper Pipe Threads, NPT  
ANSI/ASME B1.20.1-1983 (R2001)**

For all dimensions, see corresponding reference letter in table.

Angle between sides of thread is 60 degrees. Taper of thread, on diameter, is  $\frac{3}{4}$  inch per foot. Angle of taper with center line is  $1^{\circ}47'$ .

The basic maximum thread height,  $h$ , of the truncated thread is  $0.8 \times$  pitch of thread. The crest and root are truncated a minimum of  $0.033 \times$  pitch for all pitches. For maximum depth of truncation, see Table 2.

Nominal Pipe Size	Outside Dia. of Pipe, $D$	Threads per Inch, $n$	Pitch of Thread, $p$	Pitch Diameter at Beginning of External Thread, $E_0$	Handtight Engagement		Effective Thread, External	
					Length, <sup>a</sup> $L_1$	Dia., <sup>b</sup> $E_1$	Length, <sup>c</sup> $L_2$	Dia., $E_2$
					Inch		Inch	
$\frac{1}{16}$	0.3125	27	0.03704	0.27118	0.160	0.28118	0.2611	0.28750
$\frac{1}{8}$	0.405	27	0.03704	0.36351	0.1615	0.37360	0.2639	0.38000
$\frac{1}{4}$	0.540	18	0.05556	0.47739	0.2278	0.49163	0.4018	0.50250
$\frac{3}{8}$	0.675	18	0.05556	0.61201	0.240	0.62701	0.4078	0.63750
$\frac{1}{2}$	0.840	14	0.07143	0.75843	0.320	0.77843	0.5337	0.79179
$\frac{3}{4}$	1.050	14	0.07143	0.96768	0.339	0.98887	0.5457	1.00179
1	1.315	$11\frac{1}{2}$	0.08696	1.21363	0.400	1.23863	0.6828	1.25630
$1\frac{1}{4}$	1.660	$11\frac{1}{2}$	0.08696	1.55713	0.420	1.58338	0.7068	1.60130
$1\frac{1}{2}$	1.900	$11\frac{1}{2}$	0.08696	1.79609	0.420	1.82234	0.7235	1.84130
2	2.375	$11\frac{1}{2}$	0.08696	2.26902	0.436	2.29627	0.7565	2.31630
$2\frac{1}{2}$	2.875	8	0.12500	2.71953	0.682	2.76216	1.1375	2.79062
3	3.500	8	0.12500	3.34062	0.766	3.38850	1.2000	3.41562
$3\frac{1}{2}$	4.000	8	0.12500	3.83750	0.821	3.88881	1.2500	3.91562
4	4.500	8	0.12500	4.33438	0.844	4.38712	1.3000	4.41562
5	5.563	8	0.12500	5.39073	0.937	5.44929	1.4063	5.47862
6	6.625	8	0.12500	6.44609	0.958	6.50597	1.5125	6.54062
8	8.625	8	0.12500	8.43359	1.063	8.50003	1.7125	8.54062
10	10.750	8	0.12500	10.54531	1.210	10.62094	1.9250	10.66562
12	12.750	8	0.12500	12.53281	1.360	12.61781	2.1250	12.66562
14 OD	14.000	8	0.12500	13.77500	1.562	13.87262	2.2500	13.91562
16 OD	16.000	8	0.12500	15.76250	1.812	15.87575	2.4500	15.91562
18 OD	18.000	8	0.12500	17.75000	2.000	17.87500	2.6500	17.91562
20 OD	20.000	8	0.12500	19.73750	2.125	19.87031	2.8500	19.91562
24 OD	24.000	8	0.12500	23.71250	2.375	23.86094	3.2500	23.91562

<sup>a</sup> Also length of thin ring gage and length from gaging notch to small end of plug gage.

<sup>b</sup> Also pitch diameter at gaging notch (handtight plane).

<sup>c</sup> Also length of plug gage.

**Table 1b. Basic Dimensions, American National Standard Taper Pipe Threads, NPT  
ANSI/ASME B1.20.1-1983 (R2001)**

Nominal Pipe Size	Wrench Makeup Length for Internal Thread		Vanish Thread, (3.47 thds.), $V$	Overall Length External Thread, $L_4$	Nominal Perfect External Threads <sup>a</sup>		Height of Thread, $h$	Basic Minor Dia. at Small End of Pipe, <sup>b</sup> $K_0$
	Length, <sup>c</sup> $L_3$	Dia., $E_3$			Length, $L_5$	Dia., $E_5$		
1/16	0.1111	0.26424	0.1285	0.3896	0.1870	0.28287	0.02963	0.2416
1/8	0.1111	0.35656	0.1285	0.3924	0.1898	0.37537	0.02963	0.3339
1/4	0.1667	0.46697	0.1928	0.5946	0.2907	0.49556	0.04444	0.4329
3/8	0.1667	0.60160	0.1928	0.6006	0.2967	0.63056	0.04444	0.5676
1/2	0.2143	0.74504	0.2478	0.7815	0.3909	0.78286	0.05714	0.7013
3/4	0.2143	0.95429	0.2478	0.7935	0.4029	0.99286	0.05714	0.9105
1	0.2609	1.19733	0.3017	0.9845	0.5089	1.24543	0.06957	1.1441
1 1/4	0.2609	1.54083	0.3017	1.0085	0.5329	1.59043	0.06957	1.4876
1 1/2	0.2609	1.77978	0.3017	1.0252	0.5496	1.83043	0.06957	1.7265
2	0.2609	2.25272	0.3017	1.0582	0.5826	2.30543	0.06957	2.1995
2 1/2	0.2500 <sup>d</sup>	2.70391	0.4337	1.5712	0.8875	2.77500	0.100000	2.6195
3	0.2500 <sup>d</sup>	3.32500	0.4337	1.6337	0.9500	3.40000	0.100000	3.2406
3 1/2	0.2500	3.82188	0.4337	1.6837	1.0000	3.90000	0.100000	3.7375
4	0.2500	4.31875	0.4337	1.7337	1.0500	4.40000	0.100000	4.2344
5	0.2500	5.37511	0.4337	1.8400	1.1563	5.46300	0.100000	5.2907
6	0.2500	6.43047	0.4337	1.9462	1.2625	6.52500	0.100000	6.3461
8	0.2500	8.41797	0.4337	2.1462	1.4625	8.52500	0.100000	8.3336
10	0.2500	10.52969	0.4337	2.3587	1.6750	10.65000	0.100000	10.4453
12	0.2500	12.51719	0.4337	2.5587	1.8750	12.65000	0.100000	12.4328
14 OD	0.2500	13.75938	0.4337	2.6837	2.0000	13.90000	0.100000	13.6750
16 OD	0.2500	15.74688	0.4337	2.8837	2.2000	15.90000	0.100000	15.6625
18 OD	0.2500	17.73438	0.4337	3.0837	2.4000	17.90000	0.100000	17.6500
20 OD	0.2500	19.72188	0.4337	3.2837	2.6000	19.90000	0.100000	19.6375
24 OD	0.2500	23.69688	0.4337	3.6837	3.0000	23.90000	0.100000	23.6125

<sup>a</sup>The length  $L_5$  from the end of the pipe determines the plane beyond which the thread form is imperfect at the crest. The next two threads are perfect at the root. At this plane the cone formed by the crests of the thread intersects the cylinder forming the external surface of the pipe.  $L_5 = L_2 - 2p$ .

<sup>b</sup>Given as information for use in selecting tap drills.

<sup>c</sup>Three threads for 2-inch size and smaller; two threads for larger sizes.

<sup>d</sup>Military Specification MIL—P—7105 gives the wrench makeup as three threads for 3 in. and smaller. The  $E_3$  dimensions are then as follows: Size 2 1/2 in., 2.69609 and size 3 in., 3.31719.

All dimensions given in inches.

Increase in diameter per thread is equal to  $0.0625/n$ .

The basic dimensions of the ANSI Standard Taper Pipe Thread are given in inches to four or five decimal places. While this implies a greater degree of precision than is ordinarily attained, these dimensions are the basis of gage dimensions and are so expressed for the purpose of eliminating errors in computations.

**Engagement Between External and Internal Taper Threads.**—The normal length of engagement between external and internal taper threads when screwed together handtight is shown as  $L_1$  in Table 1a. This length is controlled by the construction and use of the pipe thread gages. It is recognized that in special applications, such as flanges for high-pressure work, longer thread engagement is used, in which case the pitch diameter  $E_1$  (Table 1a) is maintained and the pitch diameter  $E_0$  at the end of the pipe is proportionately smaller.

**Tolerances on Thread Elements.**—The maximum allowable variation in the commercial product (manufacturing tolerance) is one turn large or small from the basic dimensions.

The permissible variations in thread elements on steel products and all pipe made of steel, wrought iron, or brass, exclusive of butt-weld pipe, are given in Table 3. This table is a

guide for establishing the limits of the thread elements of taps, dies, and thread chasers. These limits may be required on product threads.

On pipe fittings and valves (not steel) for steam pressures 300 pounds and below, it is intended that plug and ring gage practice as set up in the Standard ANSI/ASME B1.20.1 will provide for a satisfactory check of accumulated variations of taper, lead, and angle in such product. Therefore, no tolerances on thread elements have been established for this class.

For service conditions where a more exact check is required, procedures have been developed by industry to supplement the regulation plug and ring method of gaging.

**Table 2. Limits on Crest and Root of American National Standard External and Internal Taper Pipe Threads, NPT ANSI/ASME B1.20.1-1983 (R2001)**

INTERNAL THREAD							
EXTERNAL THREAD							
Threads per Inch	Height of Sharp V Thread, $H$	Height of Pipe Thread, $h$		Truncation, $f$		Width of Flat, $F$ , Equivalent to Truncation	
		Max.	Min.	Min.	Max.	Min.	Max.
27	0.03208	0.02963	0.02496	0.0012	0.0036	0.0014	0.0041
18	0.04811	0.04444	0.03833	0.0018	0.0049	0.0021	0.0057
14	0.06186	0.05714	0.05071	0.0024	0.0056	0.0027	0.0064
11½	0.07531	0.06957	0.06261	0.0029	0.0063	0.0033	0.0073
8	0.10825	0.10000	0.09275	0.0041	0.0078	0.0048	0.0090

All dimensions are in inches and are given to four or five decimal places only to avoid errors in computations, not to indicate required precision.

**Table 3. Tolerances on Taper, Lead, and Angle of Pipe Threads of Steel Products and All Pipe of Steel, Wrought Iron, or Brass ANSI/ASME B1.20.1-1983 (R2001) (Exclusive of Butt-Weld Pipe)**

Nominal Pipe Size	Threads per Inch	Taper on Pitch Line ( $\frac{1}{4}$ in./ft)		Lead in Length of Effective Threads	60 Degree Angle of Threads, Degrees
		Max.	Min.		
$\frac{1}{16}$ $\frac{1}{8}$	27	$+\frac{1}{8}$	$-\frac{1}{16}$	$\pm 0.003$	$\pm 2\frac{1}{2}$
$\frac{1}{4}$ $\frac{3}{8}$	18	$+\frac{1}{8}$	$-\frac{1}{16}$	$\pm 0.003$	$\pm 2$
$\frac{1}{2}$ $\frac{3}{4}$	14	$+\frac{1}{8}$	$-\frac{1}{16}$	$\pm 0.003^a$	$\pm 2$
1, 1¼, 1½, 2	11½	$+\frac{1}{8}$	$-\frac{1}{16}$	$\pm 0.003^a$	$\pm 1\frac{1}{2}$
2½ and larger	8	$+\frac{1}{8}$	$-\frac{1}{16}$	$\pm 0.003^a$	$\pm 1\frac{1}{2}$

<sup>a</sup>The tolerance on lead shall be  $\pm 0.003$  in. per inch on any size threaded to an effective thread length greater than 1 in.

For tolerances on height of thread, see Table 2.

The limits specified in this table are intended to serve as a guide for establishing limits of the thread elements of taps, dies, and thread chasers. These limits may be required on product threads.

**Table 4. Internal Threads in Pipe Couplings, NPSC for Pressure-tight Joints with Lubricant or Sealer ANSI/ASME B1.20.1-1983 (R2001)**

Nom. Pipe-Size	Thds. per Inch	Minor <sup>a</sup> Dia.	Pitch Diameter <sup>b</sup>		Nom. Pipe	Thds. per Inch	Minor <sup>a</sup> Dia.	Pitch Diameter <sup>b</sup>	
			Min.	Max.				Min.	Max.
1/8	27	0.340	0.3701	0.3771	1 1/2	11 1/2	1.745	1.8142	1.8305
1/4	18	0.442	0.4864	0.4968	2	11 1/2	2.219	2.2881	2.3044
3/8	18	0.577	0.6218	0.6322	2 1/2	8	2.650	2.7504	2.7739
1/2	14	0.715	0.7717	0.7851	3	8	3.277	3.3768	3.4002
3/4	14	0.925	0.9822	0.9956	3 1/2	8	3.777	3.8771	3.9005
1	11 1/2	1.161	1.2305	1.2468	4	8	4.275	4.3754	4.3988
1 1/4	11 1/2	1.506	1.5752	1.5915	...	...	...	...	...

<sup>a</sup> As the ANSI Standard Pipe Thread form is maintained, the major and minor diameters of the internal thread vary with the pitch diameter. All dimensions are given in inches.

<sup>b</sup> The actual pitch diameter of the straight tapped hole will be slightly smaller than the value given when gaged with a taper plug gage as called for in ANSI/ASME B1.20.1.

**Railing Joint Taper Pipe Threads, NPTR.**—Railing joints require a rigid mechanical thread joint with external and internal taper threads. The external thread is basically the same as the ANSI Standard Taper Pipe Thread, except that sizes 1/2 through 2 inches are shortened by 3 threads and sizes 2 1/2 through 4 inches are shortened by 4 threads to permit the use of the larger end of the pipe thread. A recess in the fitting covers the last scratch or imperfect threads on the pipe.

**Straight Pipe Threads in Pipe Couplings, NPSC.**—Threads in pipe couplings made in accordance with the ANSI/ASME B1.20.1 specifications are straight (parallel) threads of the same thread form as the ANSI Standard Taper Pipe Thread. They are used to form pressure-tight joints when assembled with an ANSI Standard external taper pipe thread and made up with lubricant or sealant. These joints are recommended for comparatively low pressures only.

**Straight Pipe Threads for Mechanical Joints, NPSM, NPSL, and NPSH.**—While external and internal taper pipe threads are recommended for pipe joints in practically every service, there are mechanical joints where straight pipe threads are used to advantage. Three types covered by ANSI/ASME B1.20.1 are:

*Loose-fitting Mechanical Joints With Locknuts (External and Internal), NPSL:* This thread is designed to produce a pipe thread having the largest diameter that it is possible to cut on standard pipe. The dimensions of these threads are given in Table 5. It will be noted that the maximum major diameter of the external thread is slightly greater than the nominal outside diameter of the pipe. The normal manufacturer's variation in pipe diameter provides for this increase.

*Loose-fitting Mechanical Joints for Hose Couplings (External and Internal), NPSH:*

Hose coupling joints are ordinarily made with straight internal and external loose-fitting threads. There are several standards of hose threads having various diameters and pitches. One of these is based on the ANSI Standard pipe thread and by the use of this thread series, it is possible to join small hose couplings in sizes 1/2 to 4 inches, inclusive, to ends of standard pipe having ANSI Standard External Pipe Threads, using a gasket to seal the joints. For the hose coupling thread dimensions see *ANSI Standard Hose Coupling Screw Threads* starting on page 1872.

*Free-fitting Mechanical Joints for Fixtures (External and Internal), NPSM:* Standard iron, steel, and brass pipe are often used for special applications where there are no internal pressures. Where straight thread joints are required for mechanical assemblies, straight pipe threads are often found more suitable or convenient. Dimensions of these threads are given in Table 5.



**Table 5. American National Standard Straight Pipe Threads for Mechanical Joints, NPSM and NPSL ANSI/ASME B1.20.1-1983 (R2001)**

Nominal Pipe Size	Threads per Inch	Allowance	External Thread				Internal Thread			
			Major Diameter		Pitch Diameter		Minor Diameter		Pitch Diameter	
			Max. <sup>a</sup>	Min.	Max.	Min.	Min. <sup>a</sup>	Max.	Min. <sup>b</sup>	Max.
Free-fitting Mechanical Joints for Fixtures—NPSM										
1/8	27	0.0011	0.397	0.390	0.3725	0.3689	0.358	0.364	0.3736	0.3783
1/4	18	0.0013	0.526	0.517	0.4903	0.4859	0.468	0.481	0.4916	0.4974
3/8	18	0.0014	0.662	0.653	0.6256	0.6211	0.603	0.612	0.6270	0.6329
1/2	14	0.0015	0.823	0.813	0.7769	0.7718	0.747	0.759	0.7784	0.7851
3/4	14	0.0016	1.034	1.024	0.9873	0.9820	0.958	0.970	0.9889	0.9958
1	11 1/2	0.0017	1.293	1.281	1.2369	1.2311	1.201	1.211	1.2386	1.2462
1 1/4	11 1/2	0.0018	1.638	1.626	1.5816	1.5756	1.546	1.555	1.5834	1.5912
1 1/2	11 1/2	0.0018	1.877	1.865	1.8205	1.8144	1.785	1.794	1.8223	1.8302
2	11 1/2	0.0019	2.351	2.339	2.2944	2.2882	2.259	2.268	2.2963	2.3044
2 1/2	8	0.0022	2.841	2.826	2.7600	2.7526	2.708	2.727	2.7622	2.7720
3	8	0.0023	3.467	3.452	3.3862	3.3786	3.334	3.353	3.3885	3.3984
3 1/2	8	0.0023	3.968	3.953	3.8865	3.8788	3.835	3.848	3.8888	3.8988
4	8	0.0023	4.466	4.451	4.3848	4.3771	4.333	4.346	4.3871	4.3971
5	8	0.0024	5.528	5.513	5.4469	5.4390	5.395	5.408	5.4493	5.4598
6	8	0.0024	6.585	6.570	6.5036	6.4955	6.452	6.464	6.5060	6.5165
Loose-fitting Mechanical Joints for Locknut Connections—NPSL										
1/8	27	...	0.409	...	0.3840	0.3805	0.362	...	0.3863	0.3898
1/4	18	...	0.541	...	0.5038	0.4986	0.470	...	0.5073	0.5125
3/8	18	...	0.678	...	0.6409	0.6357	0.607	...	0.6444	0.6496
1/2	14	...	0.844	...	0.7963	0.7896	0.753	...	0.8008	0.8075
3/4	14	...	1.054	...	1.0067	1.0000	0.964	...	1.0112	1.0179
1	11 1/2	...	1.318	...	1.2604	1.2523	1.208	...	1.2658	1.2739
1 1/4	11 1/2	...	1.663	...	1.6051	1.5970	1.553	...	1.6106	1.6187
1 1/2	11 1/2	...	1.902	...	1.8441	1.8360	1.792	...	1.8495	1.8576
2	11 1/2	...	2.376	...	2.3180	2.3099	2.265	...	2.3234	2.3315
2 1/2	8	...	2.877	...	2.7934	2.7817	2.718	...	2.8012	2.8129
3	8	...	3.503	...	3.4198	3.4081	3.344	...	3.4276	3.4393
3 1/2	8	...	4.003	...	3.9201	3.9084	3.845	...	3.9279	3.9396
4	8	...	4.502	...	4.4184	4.4067	4.343	...	4.4262	4.4379
5	8	...	5.564	...	5.4805	5.4688	5.405	...	5.4884	5.5001
6	8	...	6.620	...	6.5372	6.5255	6.462	...	6.5450	6.5567
8	8	...	8.615	...	8.5313	8.5196	8.456	...	8.5391	8.5508
10	8	...	10.735	...	10.6522	10.6405	10.577	...	10.6600	10.6717
12	8	...	12.732	...	12.6491	12.6374	12.574	...	12.6569	12.6686

<sup>a</sup> As the ANSI Standard Straight Pipe Thread form of thread is maintained, the major and the minor diameters of the internal thread and the minor diameter of the external thread vary with the pitch diameter. The major diameter of the external thread is usually determined by the diameter of the pipe. These theoretical diameters result from adding the depth of the truncated thread ( $0.666025 \times p$ ) to the maximum pitch diameters, and it should be understood that commercial pipe will not always have these maximum major diameters.

<sup>b</sup> This is the same as the pitch diameter at end of internal thread,  $E_1$  Basic. (See Table 1a.)

All dimensions are given in inches.

*Notes for Free-fitting Fixture Threads:* The minor diameters of external threads and major diameters of internal threads are those as produced by commercial straight pipe dies and commercial ground straight pipe taps.

The major diameter of the external thread has been calculated on the basis of a truncation of  $0.10825p$ , and the minor diameter of the internal thread has been calculated on the basis of a truncation of  $0.21651p$ , to provide no interference at crest and root when product is gaged with gages made in accordance with the Standard.

*Notes for Loose-fitting Locknut Threads:* The locknut thread is established on the basis of retaining the greatest possible amount of metal thickness between the bottom of the thread and the inside of the pipe. In order that a locknut may fit loosely on the externally threaded part, an allowance equal to the "increase in pitch diameter per turn" is provided, with a tolerance of  $1\frac{1}{2}$  turns for both external and internal threads.

**American National Standard Dryseal Pipe Threads for Pressure-Tight Joints.—**

Dryseal pipe threads are based on the USA (American) pipe thread; however, they differ in that they are designed to seal pressure-tight joints without the necessity of using sealing compounds. To accomplish this, some modification of thread form and greater accuracy in manufacture is required. The roots of both the external and internal threads are truncated slightly more than the crests, i.e., roots have wider flats than crests so that metal-to-metal contact occurs at the crests and roots coincident with, or prior to, flank contact. Thus, as the threads are assembled by wrenching, the roots of the threads crush the sharper crests of the mating threads. This sealing action at both major and minor diameters tends to prevent spiral leakage and makes the joints pressure-tight without the necessity of using sealing compounds, provided that the threads are in accordance with standard specifications and tolerances and are not damaged by galling in assembly. The control of crest and root truncation is simplified by the use of properly designed threading tools. Also, it is desirable that both external and internal threads have full thread height for the length of hand engagement. Where not functionally objectionable, the use of a compatible lubricant or sealant is permissible to minimize the possibility of galling. This is desirable in assembling Dryseal pipe threads in refrigeration and other systems to effect a pressure-tight seal. The crest and root of Dryseal pipe threads may be slightly rounded, but are acceptable if they lie within the truncation limits given in Table 6.

**Table 6. American National Standard Dryseal Pipe Threads—Limits on Crest and Root Truncation ANSI B1.20.3-1976 (R1998)**

Threads Per Inch	Height of Sharp V Thread ( $H$ )	Truncation							
		Minimum				Maximum			
		At Crest		At Root		At Crest		At Root	
		Formula	Inch	Formula	Inch	Formula	Inch	Formula	Inch
27	0.03208	0.047 $p$	0.0017	0.094 $p$	0.0035	0.094 $p$	0.0035	0.140 $p$	0.0052
18	0.04811	0.047 $p$	0.0026	0.078 $p$	0.0043	0.078 $p$	0.0043	0.109 $p$	0.0061
14	0.06180	0.036 $p$	0.0026	0.060 $p$	0.0043	0.060 $p$	0.0043	0.085 $p$	0.0061
11½	0.07531	0.040 $p$	0.0035	0.060 $p$	0.0052	0.060 $p$	0.0052	0.090 $p$	0.0078
8	0.10825	0.042 $p$	0.0052	0.055 $p$	0.0069	0.055 $p$	0.0069	0.076 $p$	0.0095

All dimensions are given in inches. In the formulas,  $p$  = pitch.

**Types of Dryseal Pipe Thread.—**American National Standard ANSI B1.20.3-1976 (R1998) covers four types of standard Dryseal pipe threads:

NPTF, Dryseal USA (American) Standard Taper Pipe Thread

PTF-SAE SHORT, Dryseal SAE Short Taper Pipe Thread

NPSF, Dryseal USA (American) Standard Fuel Internal Straight Pipe Thread

NPSI, Dryseal USA (American) Standard Intermediate Internal Straight Pipe Thread

**Table 7. Recommended Limitation of Assembly among the Various Types of Dryseal Threads**

External Dryseal Thread		For Assembly with Internal Dryseal Thread	
Type	Description	Type	Description
1	NPTF (tapered), ext thd	1	NPTF (tapered), int thd
		2 <sup>a,b</sup>	PTF-SAE SHORT (tapered), int thd
		3 <sup>a,c</sup>	NPSF (straight), int thd
		4 <sup>a,c,d</sup>	NPSI (straight), int thd
2 <sup>a,c</sup>	PTF-SAE SHORT (tapered) ext thd	4	NPSI (straight), int thd
		1	NPTF (tapered), int thd

<sup>a</sup> Pressure-tight joints without the use of a sealant can best be ensured where both components are threaded with NPTF (full length threads), since theoretically interference (sealing) occurs at all threads, but there are two less threads engaged than for NPTF assemblies. When straight internal threads are used, there is interference only at one thread depending on ductility of materials.

<sup>b</sup>PTF-SAE SHORT internal threads are primarily intended for assembly with type 1-NPTF external threads. They are not designed for, and at extreme tolerance limits may not assemble with, type 2-PTF-SAE SHORT external threads.

<sup>c</sup>There is no external straight Dryseal thread.

<sup>d</sup>NPSI internal threads are primarily intended for assembly with type 2-PTF-SAE SHORT external threads but will also assemble with full length type 1 NPTF external threads.

<sup>e</sup>PTF-SAE SHORT external threads are primarily intended for assembly with type 4-NPSI internal threads but can also be used with type 1-NPTF internal threads. They are not designed for, and at extreme tolerance limits may not assemble with, type 2-PTF-SAE SHORT internal threads or type 3-NPSF internal threads.

An assembly with straight internal pipe threads and taper external pipe threads is frequently more advantageous than an all taper thread assembly, particularly in automotive and other allied industries where economy and rapid production are major considerations. Dryseal threads are not used in assemblies in which both components have straight pipe threads.

*NPTF Threads:* This type applies to both external and internal threads and is suitable for pipe joints in practically every type of service. Of all Dryseal pipe threads, NPTF external and internal threads mated are generally conceded to be superior for strength and seal since they have the longest length of thread and, theoretically, interference (sealing) occurs at every engaged thread root and crest. Use of tapered internal threads, such as NPTF or PTF-SAE SHORT in hard or brittle materials having thin sections will minimize the possibility of fracture.

There are two classes of NPTF threads. Class 1 threads are made to interfere (seal) at root and crest when mated, but inspection of crest and root truncation is not required. Consequently, Class 1 threads are intended for applications where close control of tooling is required for conformance of truncation or where sealing is accomplished by means of a sealant applied to the threads.

Class 2 threads are theoretically identical to those made to Class 1, however, inspection of root and crest truncation is required. Consequently, where a sealant is not used, there is more assurance of a pressure-tight seal for Class 2 threads than for Class 1 threads.

*PTF-SAE SHORT Threads:* External threads of this type conform in all respects with NPTF threads except that the thread length has been shortened by eliminating one thread from the small (entering) end. These threads are designed for applications where clearance is not sufficient for the full length of the NPTF threads or for economy of material where the full thread length is not necessary.

Internal threads of this type conform in all respects with NPTF threads, except that the thread length has been shortened by eliminating one thread from the large (entry) end. These threads are designed for thin materials where thickness is not sufficient for the full thread length of the NPTF threads or for economy in tapping where the full thread length is not necessary.

Pressure-tight joints without the use of lubricant or sealer can best be ensured where mating components are both threaded with NPTF threads. This should be considered before specifying PTF-SAE SHORT external or internal threads.

*NPSF Threads:* Threads of this type are straight (cylindrical) instead of tapered and are internal only. They are more economical to produce than tapered internal threads, but when assembled do not offer as strong a guarantee of sealing since root and crest interference will not occur for all threads. NPSF threads are generally used with soft or ductile materials which will tend to adjust at assembly to the taper of external threads, but may be used in hard or brittle materials where the section is thick.

*NPSI Threads:* Threads of this type are straight (cylindrical) instead of tapered, are internal only and are slightly larger in diameter than NPSF threads but have the same tolerance and thread length. They are more economical to produce than tapered threads and may be used in hard or brittle materials where the section is thick or where there is little expansion at assembly with external taper threads. As with NPSF threads, NPSI threads when assembled do not offer as strong a guarantee of sealing as do tapered internal threads.

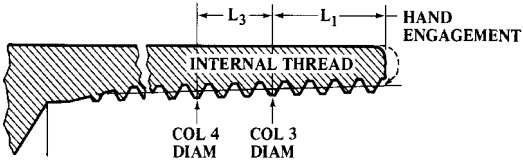
DRYSEAL PIPE THREADS

For more complete specifications for production and acceptance of Dryseal pipe threads, see ANSI B1.20.3 (Inch) and ANSI B1.20.4 (Metric Translation), and for gaging and inspection, see ANSI B1.20.5 (Inch) and ANSI B1.20.6M (Metric Translation).

*Designation of Dryseal Pipe Threads:* The standard Dryseal pipe threads are designated by specifying in sequence nominal size, thread series symbol, and class:

*Examples:* 1/8-27 NPTF-1; 1/8-27 PTF-SAE SHORT; and 3/8-18 NPTF-1 AFTER PLATING.

**Table 8. Suggested Tap Drill Sizes for Internal Dryseal Pipe Threads**



Size	Probable Drill Oversize Cut (Mean)	Taper Pipe Thread				Straight Pipe Thread		
		Minor Diameter At Distance		Drill Size <sup>a</sup>		Minor Diameter		Drill Size <sup>a</sup>
		L <sub>1</sub> From Large End	L <sub>1</sub> + L <sub>3</sub> From Large End	Without Reamer	With Reamer	NPSF	NPSI	
1/16-27	0.0038	0.2443	0.2374	"C" (0.242)	"A" (0.234)	0.2482	0.2505	"D" (0.246)
1/8-27	0.0044	0.3367	0.3298	"Q" (0.332)	21/64 (0.328)	0.3406	0.3429	"R" (0.339)
1/4-18	0.0047	0.4362	0.4258	7/16 (0.438)	27/64 (0.422)	0.4422	0.4457	7/16 (0.438)
3/8-18	0.0049	0.5708	0.5604	9/16 (0.562)	9/16 (0.563)	0.5776	0.5811	37/64 (0.578)
1/2-14	0.0051	0.7034	0.6901	45/64 (0.703)	11/16 (0.688)	0.7133	0.7180	45/64 (0.703)
3/4-14	0.0060	0.9127	0.8993	29/32 (0.906)	57/64 (0.891)	0.9238	0.9283	59/64 (0.922)
1-11 1/2	0.0080	1.1470	1.1307	1 1/64 (1.141)	1 1/8 (1.125)	1.1600	1.1655	1 5/32 (1.156)
1 1/4-11 1/2	0.0100	1.4905	1.4742	1 31/64 (1.484)	1 15/32 (1.469)	...	...	...
1 1/2-11 1/2	0.0120	1.7295	1.7132	1 23/32 (1.719)	1 45/64 (1.703)	...	...	...
2-11 1/2	0.0160	2.2024	2.1861	2 3/16 (2.188)	2 11/64 (2.172)	...	...	...
2 1/2-8	0.0180	2.6234	2.6000	2 39/64 (2.609)	2 27/64 (2.578)	...	...	...
3-8	0.0200	3.2445	3.2211	3 15/64 (3.234)	3 13/64 (3.203)	...	...	...

<sup>a</sup> Some drill sizes listed may not be standard drills.

All dimensions are given in inches.

**Special Dryseal Threads.**—Where design limitations, economy of material, permanent installation, or other limiting conditions prevail, consideration may be given to using a special Dryseal thread series.

*Dryseal Special Short Taper Pipe Thread, PTF-SPL SHORT:* Threads of this series conform in all respects to PTF-SAE SHORT threads except that the full thread length has been further shortened by eliminating one thread at the small end of internal threads or one thread at the large end of external threads.

*Dryseal Special Extra Short Taper Pipe Thread, PTF-SPL EXTRA SHORT:* Threads of this series conform in all respects to PTF-SAE SHORT threads except that the full thread length has been further shortened by eliminating two threads at the small end of internal threads or two threads at the large end of external threads.

*Limitations of Assembly:* Table 9 applies where Dryseal Special Short or Extra Short Taper Pipe Threads are to be assembled as special combinations.

**Table 9. Assembly Limitations for Special Combinations of Dryseal Threads**

Thread	May Assemble with <sup>a</sup>	May Assemble with <sup>b</sup>
PTF SPL SHORT EXTERNAL PTF SPL EXTRA SHORT EXTERNAL	PTF-SAE SHORT INTERNAL NPSF INTERNAL PTF SPL SHORT INTERNAL PTF SPL EXTRA SHORT INTERNAL	NPTF or NPSI INTERNAL
PTF SPL SHORT INTERNAL PTF SPL EXTRA SHORT INTERNAL	PTF-SAE SHORT EXTERNAL	NPTF EXTERNAL

<sup>a</sup> Only when the external thread or the internal thread or both are held closer than the standard tolerance, the external thread toward the minimum and the internal thread toward the maximum pitch diameter to provide a minimum of one turn hand engagement. At extreme tolerance limits the shortened full-thread lengths reduce hand engagement and the threads may not start to assemble.

<sup>b</sup> Only when the internal thread or the external thread or both are held closer than the standard tolerance, the internal thread toward the minimum and the external thread toward the maximum pitch diameter to provide a minimum of two turns for wrench make-up and sealing. At extreme tolerance limits the shortened full-thread lengths reduce wrench make-up and the threads may not seal.

*Dryseal Fine Taper Thread Series, F-PTF:* The need for finer pitches for nominal pipe sizes has brought into use applications of 27 threads per inch to  $\frac{1}{4}$ - and  $\frac{3}{8}$ -inch pipe sizes. There may be other needs that require finer pitches for larger pipe sizes. It is recommended that the existing threads per inch be applied to the next larger pipe size for a fine thread series, thus:  $\frac{1}{4}$ -27,  $\frac{3}{8}$ -27,  $\frac{1}{2}$ -18,  $\frac{3}{4}$ -18, 1-14,  $1\frac{1}{4}$ -14,  $1\frac{1}{2}$ -14, and 2-14. This series applies to external and internal threads of full length and is suitable for applications where threads finer than NPTF are required.

*Dryseal Special Diameter-Pitch Combination Series, SPL-PTF:* Other applications of diameter-pitch combinations have come into use where taper pipe threads are applied to nominal size thin wall tubing. These combinations are:  $\frac{1}{2}$ -27,  $\frac{5}{8}$ -27,  $\frac{3}{4}$ -27,  $\frac{7}{8}$ -27, and 1-27. This series applies to external and internal threads of full length and is applicable to thin wall nominal diameter outside tubing.

*Designation of Special Dryseal Pipe Threads:* The designations used for these special dryseal pipe threads are as follows:

$\frac{1}{8}$ -27 PTF-SPL SHORT

$\frac{1}{8}$ -27 PTF-SPL EXTRA SHORT

$\frac{1}{2}$ -27 SPL PTF, OD 0.500

Note that in the last designation the OD of tubing is given.

### British Standard Pipe Threads

**British Standard Pipe Threads for Non-pressure-tight Joints.**—The threads in BS 2779:1973, “Specifications for Pipe Threads where Pressure-tight Joints are not Made on the Threads”, are Whitworth form parallel fastening threads that are generally used for fastening purposes such as the mechanical assembly of component parts of fittings, cocks and valves. They are not suitable where pressure-tight joints are made on the threads.

The crests of the basic Whitworth thread form may be truncated to certain limits of size given in the Standard except on internal threads, when they are likely to be assembled with external threads conforming to the requirements of BS 21 “British Standard Pipe Threads for Pressure-tight Joints” (see page 1870).

For external threads two classes of tolerance are provided and for internal, one class. The two classes of tolerance for external threads are Class A and Class B. For economy of manufacture the class B fit should be chosen whenever possible. The class A is reserved for those applications where the closer tolerance is essential. Class A tolerance is an entirely negative value, equivalent to the internal thread tolerance. Class B tolerance is an entirely negative value twice that of class A tolerance. Tables showing limits and dimensions are given in the Standard.

The thread series specified in this Standard shall be designated by the letter "G". A typical reference on a drawing might be "G $\frac{1}{2}$ ", for internal thread; "G $\frac{1}{2}$ A", for external thread, class A; and "G  $\frac{1}{2}$  B", for external thread, class B. Where no class reference is stated for external threads, that of class B will be assumed. The designation of truncated threads shall have the addition of the letter "T" to the designation, i.e., G  $\frac{1}{2}$ T and G  $\frac{1}{2}$ BT.

**British Standard Pipe Threads (Non-pressure-tight Joints)  
Metric and Inch Basic Sizes BS 2779:1973**

Nominal Size, Inches	Threads per Inch <sup>a</sup>	Depth of Thread	Major Diameter	Pitch Diameter	Minor Diameter	Nominal Size, Inches	Threads per Inch <sup>a</sup>	Depth of Thread	Major Diameter	Pitch Diameter	Minor Diameter
$\frac{1}{16}$	28 {	0.581	7.723	7.142	6.561	$1\frac{3}{4}$	11 {	1.479	53.746	52.267	50.788
		<i>0.0229</i>	<i>0.3041</i>	<i>0.2812</i>	<i>0.2583</i>			<i>0.0582</i>	<i>2.1160</i>	<i>2.0578</i>	<i>1.9996</i>
$\frac{1}{8}$	28 {	0.581	9.728	9.147	8.566	2	11 {	1.479	59.614	58.135	56.656
		<i>0.0229</i>	<i>0.3830</i>	<i>0.3601</i>	<i>0.3372</i>			<i>0.0582</i>	<i>2.3470</i>	<i>2.2888</i>	<i>2.2306</i>
$\frac{1}{4}$	19 {	0.856	13.157	12.301	11.445	$2\frac{1}{4}$	11 {	1.479	65.710	64.231	62.752
		<i>0.0337</i>	<i>0.5180</i>	<i>0.4843</i>	<i>0.4506</i>			<i>0.0582</i>	<i>2.5870</i>	<i>2.5288</i>	<i>2.4706</i>
$\frac{3}{8}$	19 {	0.856	16.662	15.806	14.950	$2\frac{1}{2}$	11 {	1.479	75.184	73.705	72.226
		<i>0.0337</i>	<i>0.6560</i>	<i>0.6223</i>	<i>0.5886</i>			<i>0.0582</i>	<i>2.9600</i>	<i>2.9018</i>	<i>2.8436</i>
$\frac{1}{2}$	14 {	1.162	20.955	19.793	18.631	$2\frac{3}{4}$	11 {	1.479	81.534	80.055	78.576
		<i>0.0457</i>	<i>0.8250</i>	<i>0.7793</i>	<i>0.7336</i>			<i>0.0582</i>	<i>3.2100</i>	<i>3.1518</i>	<i>3.0936</i>
$\frac{3}{4}$	14 {	1.162	22.911	21.749	20.587	3	11 {	1.479	87.884	86.405	84.926
		<i>0.0457</i>	<i>0.9020</i>	<i>0.8563</i>	<i>0.8106</i>			<i>0.0582</i>	<i>3.4600</i>	<i>3.4018</i>	<i>3.3436</i>
$\frac{7}{8}$	14 {	1.162	26.441	25.279	24.117	$3\frac{1}{2}$	11 {	1.479	100.330	98.851	97.372
		<i>0.0457</i>	<i>1.0410</i>	<i>0.9953</i>	<i>0.9496</i>			<i>0.0582</i>	<i>3.9500</i>	<i>3.8918</i>	<i>3.8336</i>
$\frac{1}{8}$	14 {	1.162	30.201	29.039	27.877	4	11 {	1.479	113.030	111.551	110.072
		<i>0.0457</i>	<i>1.1890</i>	<i>1.1433</i>	<i>1.0976</i>			<i>0.0582</i>	<i>4.4500</i>	<i>4.3918</i>	<i>4.3336</i>
1	11 {	1.479	33.249	31.770	30.291	$4\frac{1}{2}$	11 {	1.479	125.730	124.251	122.772
		<i>0.0582</i>	<i>1.3090</i>	<i>1.2508</i>	<i>1.1926</i>			<i>0.0582</i>	<i>4.9500</i>	<i>4.8918</i>	<i>4.8336</i>
$1\frac{1}{8}$	11 {	1.479	37.897	36.418	34.939	5	11 {	1.479	138.430	136.951	135.472
		<i>0.0582</i>	<i>1.4920</i>	<i>1.4338</i>	<i>1.3756</i>			<i>0.0582</i>	<i>5.4500</i>	<i>5.3918</i>	<i>5.3336</i>
$1\frac{1}{4}$	11 {	1.479	41.910	40.431	38.952	$5\frac{1}{2}$	11 {	1.479	151.130	149.651	148.172
		<i>0.0582</i>	<i>1.6500</i>	<i>1.5918</i>	<i>1.5336</i>			<i>0.0582</i>	<i>5.9500</i>	<i>5.8918</i>	<i>5.8336</i>
$1\frac{1}{2}$	11 {	1.479	47.803	46.324	44.845	6	11 {	1.479	163.830	162.351	160.872
		<i>0.0582</i>	<i>1.8820</i>	<i>1.8238</i>	<i>1.7656</i>			<i>0.0582</i>	<i>6.4500</i>	<i>6.3918</i>	<i>6.3336</i>

<sup>a</sup>The thread pitches in millimeters are as follows: 0.907 for 28 threads per inch. 1.337 for 19 threads per inch, 1.814 for 14 threads per inch, and 2.309 for 11 threads per inch.

Each basic metric dimension is given in roman figures (nominal sizes excepted) and each basic inch dimension is shown in italics directly beneath it.

**British Standard Pipe Threads for Pressure-tight Joints.**—The threads in BS 21:1973, "Specification for Pipe Threads where Pressure-tight Joints are Made on the Threads", are based on the Whitworth thread form and are specified as:

1) *Jointing threads:* These relate to pipe threads for joints made pressure-tight by the mating of the threads; they include taper external threads for assembly with either taper or parallel internal threads (parallel external pipe threads are not suitable as jointing threads)

2) *Longscrew threads:* These relate to parallel external pipe threads used for longscrews (connectors) specified in BS 1387 where a pressure-tight joint is achieved by the compression of a soft material onto the surface of the external thread by tightening a back nut against a socket

**British Standard External and Internal Pipe Threads (Pressure-tight Joints)  
Metric and Inch Dimensions and Limits of Size BS 21:1973**

Nominal Size	No. of Threads per Inch <sup>a</sup>		Basic Diameters at Gage Plane			Gage Length		Number of Useful Threads on Pipe for Basic Gage Length <sup>b</sup>	Tolerance + and -	
			Major	Pitch	Minor	Basic	Tolerance (+ and -)		Gage Plane to Face of Int. Taper Thread	On Diameter of Parallel Int. Threads
1/16	28	{	7.723	7.142	6.561	(4 3/8)	(1)	(7 1/8)	(1 1/4)	0.071
			<i>0.304</i>	<i>0.2812</i>	<i>0.2583</i>	4.0	0.9	6.5	1.1	<i>0.0028</i>
1/8	28	{	9.728	9.147	8.566	(4 3/8)	(1)	(7 1/8)	(1 1/4)	0.071
			<i>0.383</i>	<i>0.3601</i>	<i>0.3372</i>	4.0	0.9	6.5	1.1	<i>0.0028</i>
1/4	19	{	13.157	12.301	11.445	(4 1/2)	(1)	(7 1/4)	(1 1/4)	0.104
			<i>0.518</i>	<i>0.4843</i>	<i>0.4506</i>	6.0	1.3	9.7	1.7	<i>0.0041</i>
3/8	19	{	16.662	15.806	14.950	(4 3/4)	(1)	(7 1/2)	(1 1/4)	0.104
			<i>0.656</i>	<i>0.6223</i>	<i>0.5886</i>	6.4	1.3	10.1	1.7	<i>0.0041</i>
1/2	14	{	20.955	19.793	18.631	(4 1/2)	(1)	(7 1/4)	(1 1/4)	0.142
			<i>0.825</i>	<i>0.7793</i>	<i>0.7336</i>	8.2	1.8	13.2	2.3	<i>0.0056</i>
3/4	14	{	26.441	25.279	24.117	(5 1/4)	(1)	(8)	(1 1/4)	0.142
			<i>1.041</i>	<i>0.9953</i>	<i>0.9496</i>	9.5	1.8	14.5	2.3	<i>0.0056</i>
1	11	{	33.249	31.770	30.291	(4 1/2)	(1)	(7 1/4)	(1 1/4)	0.180
			<i>1.309</i>	<i>1.2508</i>	<i>1.1926</i>	10.4	2.3	16.8	2.9	<i>0.0071</i>
1 1/4	11	{	41.910	40.431	38.952	(5 1/2)	(1)	(8 1/4)	(1 1/4)	0.180
			<i>1.650</i>	<i>1.5918</i>	<i>1.5336</i>	12.7	2.3	19.1	2.9	<i>0.0071</i>
1 1/2	11	{	47.803	46.324	44.845	(5 1/2)	(1)	(8 1/4)	(1 1/4)	0.180
			<i>1.882</i>	<i>1.8238</i>	<i>1.7656</i>	12.7	2.3	19.1	2.9	<i>0.0071</i>
2	11	{	59.614	58.135	56.656	(6 3/8)	(1)	(10 1/8)	(1 1/4)	0.180
			<i>2.347</i>	<i>2.2888</i>	<i>2.2306</i>	15.9	2.3	23.4	2.9	<i>0.0071</i>
2 1/2	11	{	75.184	73.705	72.226	(7 9/16)	(1 1/2)	(11 9/16)	(1 1/2)	0.216
			<i>2.960</i>	<i>2.9018</i>	<i>2.8436</i>	17.5	3.5	26.7	3.5	<i>0.0085</i>
3	11	{	87.884	86.405	84.926	(8 15/16)	(1 1/2)	(12 15/16)	(1 1/2)	0.216
			<i>3.460</i>	<i>3.4018</i>	<i>3.3436</i>	20.6	3.5	29.8	3.5	<i>0.0085</i>
4	11	{	113.030	111.551	110.072	(11)	(1 1/2)	(15 1/2)	(1 1/2)	0.216
			<i>4.450</i>	<i>4.3918</i>	<i>4.3336</i>	25.4	3.5	35.8	3.5	<i>0.0085</i>
5	11	{	138.430	136.951	135.472	(12 3/8)	(1 1/2)	(17 3/8)	(1 1/2)	0.216
			<i>5.450</i>	<i>5.3918</i>	<i>5.3336</i>	28.6	3.5	40.1	3.5	<i>0.0085</i>
6	11	{	163.830	162.351	160.872	(12 3/8)	(1 1/2)	(17 3/8)	(1 1/2)	0.216
			<i>6.450</i>	<i>6.3918</i>	<i>6.3336</i>	28.6	3.5	40.1	3.5	<i>0.0085</i>

<sup>a</sup>In the Standard BS 21:1973 the thread pitches in millimeters are as follows: 0.907 for 28 threads per inch, 1.337 for 19 threads per inch, 1.814 for 14 threads per inch, and 2.309 for 11 threads per inch.

<sup>b</sup>This is the minimum number of useful threads on the pipe for the basic gage length; for the maximum and minimum gage lengths, the minimum numbers of useful threads are, respectively, greater and less by the amount of tolerance in the column to the left. The design of internally threaded parts shall make allowance for receiving pipe ends of up to the minimum number of useful threads corresponding to the maximum gage length; the minimum number of useful *internal* threads shall be no less than 80 per cent of the minimum number of useful external threads for the minimum gage length.

Each basic metric dimension is given in roman figures (nominal sizes excepted) and each basic inch dimension is shown in italics directly beneath it. Figures in ( ) are numbers of turns of thread with metric linear equivalents given beneath. Taper of taper thread is 1 in 16 on diameter.

## Hose Coupling Screw Threads

**ANSI Standard Hose Coupling Screw Threads.**—Threads for hose couplings, valves, and all other fittings used in direct connection with hose intended for domestic, industrial, and general service in sizes  $\frac{1}{2}$ ,  $\frac{5}{8}$ ,  $\frac{3}{4}$ , 1,  $1\frac{1}{4}$ ,  $1\frac{1}{2}$ , 2,  $2\frac{1}{2}$ , 3,  $3\frac{1}{2}$ , and 4 inches are covered by American National Standard ANSI/ASME B1.20.7-1991. These threads are designated as follows:

NH — Standard hose coupling threads of full form as produced by cutting or rolling.

NHR — Standard hose coupling threads for garden hose applications where the design utilizes thin walled material which is formed to the desired thread.

NPSH — Standard straight hose coupling thread series in sizes  $\frac{1}{2}$  to 4 inches for joining to American National Standard taper pipe threads using a gasket to seal the joint.

Thread dimensions are given in [Table 1](#) and thread lengths in [Table 2](#).

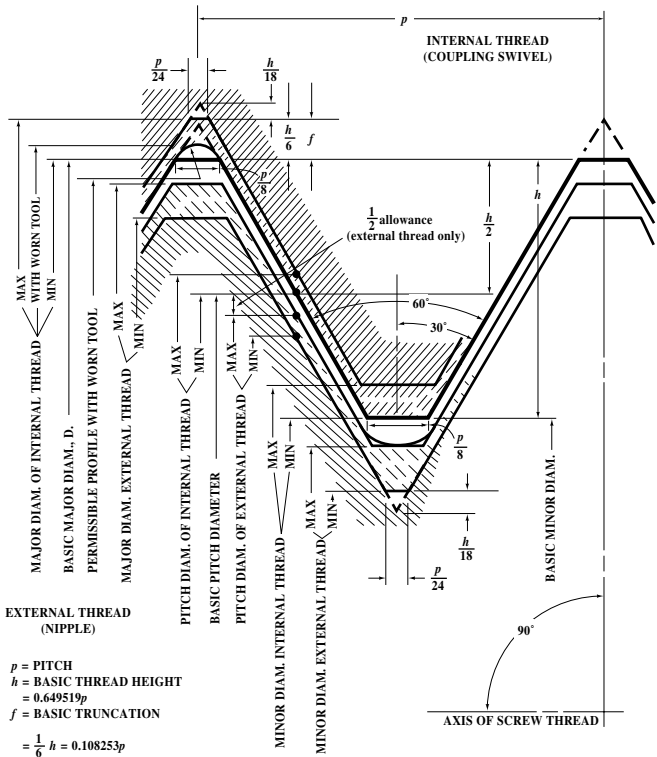


Fig. 1. Thread Form for ANSI Standard Hose Coupling Threads, NPSH, NH, and NHR. Heavy Line Shows Basic Size.



**Table 1. ANSI Standard Hose Coupling Threads for NPSH, NH, and NHR Nipples and Coupling Swivels ANSI/ASME B1.20.7-1991**

Nominal Size of Hose	Threads per Inch	Thread Designation	Pitch	Basic Height of Thread	Nipple (External) Thread					Coupling (Internal) Thread				
					Major Dia.		Pitch Dia.		Minor Dia.	Minor Dia.		Pitch Dia.		Major Dia.
					Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
$\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$	11.5	.75-11.5NH	.08696	.05648	1.0625	1.0455	1.0060	0.9975	0.9495	0.9595	0.9765	1.0160	1.0245	1.0725
$\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$	11.5	.75-11.5NHR	.08696	.05648	1.0520	1.0350	1.0100	0.9930	0.9495	0.9720	0.9930	1.0160	1.0280	1.0680
$\frac{1}{2}$	14	.5-14NPSH	.07143	.04639	0.8248	0.8108	0.7784	0.7714	0.7320	0.7395	0.7535	0.7859	0.7929	0.8323
$\frac{3}{4}$	14	.75-14NPSH	.07143	.04639	1.0353	1.0213	0.9889	0.9819	0.9425	0.9500	0.9640	0.9964	1.0034	1.0428
1	11.5	1-11.5NPSH	.08696	.05648	1.2951	1.2781	1.2396	1.2301	1.1821	1.1921	1.2091	1.2486	1.2571	1.3051
$1\frac{1}{4}$	11.5	1.25-11.5NPSH	.08696	.05648	1.6399	1.6229	1.5834	1.5749	1.5269	1.5369	1.5539	1.5934	1.6019	1.6499
$1\frac{1}{2}$	11.5	1.5-11.5 NPSH	.08696	.05648	1.8788	1.8618	1.8223	1.8138	1.7658	1.7758	1.7928	1.8323	1.8408	1.8888
2	11.5	2-11.5NPSH	.08696	.05648	2.3528	2.3358	2.2963	2.2878	2.2398	2.2498	2.2668	2.3063	2.3148	2.3628
$2\frac{1}{2}$	8	2.5-8NPSH	.12500	.08119	2.8434	2.8212	2.7622	2.7511	2.6810	2.6930	2.7152	2.7742	2.7853	2.8554
3	8	3-8NPSH	.12500	.08119	3.4697	3.4475	3.3885	3.3774	3.3073	3.3193	3.3415	3.4005	3.4116	3.4817
$3\frac{1}{2}$	8	3.5-8NPSH	.12500	.08119	3.9700	3.9478	3.8888	3.8777	3.8076	3.8196	3.8418	3.9008	3.9119	3.9820
4	8	4-8NPSH	.12500	.08119	4.4683	4.4461	4.3871	4.3760	4.3059	4.3179	4.3401	4.3991	4.4102	4.4803
4	6	4-6NH (SPL)	.16667	.10825	4.9082	4.8722	4.7999	4.7819	4.6916	4.7117	4.7477	4.8200	4.8380	4.9283

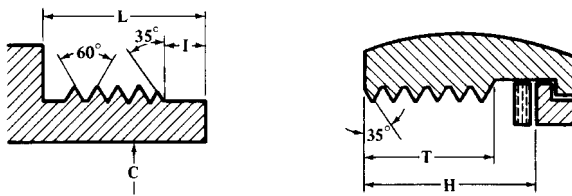
All dimensions are given in inches.

Dimensions given for the maximum minor diameter of the nipple are figured to the intersection of the worn tool arc with a centerline through crest and root. The minimum minor diameter of the nipple shall be that corresponding to a flat at the minor diameter of the minimum nipple equal to  $\frac{1}{2}p$ , and may be determined by subtracting  $0.7939p$  from the minimum pitch diameter of the nipple. (See Fig. 1)

Dimensions given for the minimum major diameter of the coupling correspond to the basic flat,  $\frac{1}{2}p$ , and the profile at the major diameter produced by a worn tool must not fall below the basic outline. The maximum major diameter of the coupling shall be that corresponding to a flat at the major diameter of the maximum coupling equal to  $\frac{1}{2}p$  and may be determined by adding  $0.7939p$  to the maximum pitch diameter of the coupling. (See Fig. 1)

NH and NHR threads are used for garden hose applications. NPSH threads are used for steam, air and all other hose connections to be made up with standard pipe threads. NH (SPL) threads are used for marine applications.

**Table 2. ANSI Standard Hose Coupling Screw Thread Lengths**  
ANSI/ASME B1.20.7-1991



Nominal Size of Hose	Threads per Inch	I.D. of Nipple, C	Approx. O.D. of Ext. Thd.	Length of Nipple, L	Length of Pilot, I	Depth of Coupl., H	Coupl. Thd. Length, T	Approx. No. Thds. in Length T
$\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$	11.5	$\frac{25}{32}$	$1\frac{1}{16}$	$\frac{9}{16}$	$\frac{1}{8}$	$\frac{17}{32}$	$\frac{3}{8}$	$4\frac{1}{4}$
$\frac{1}{2}$ , $\frac{5}{8}$ , $\frac{3}{4}$	11.5	$\frac{25}{32}$	$1\frac{1}{16}$	$\frac{9}{16}$	$\frac{1}{8}$	$\frac{17}{32}$	$\frac{3}{8}$	$4\frac{1}{4}$
$\frac{1}{2}$	14	$\frac{17}{32}$	$\frac{13}{16}$	$\frac{1}{2}$	$\frac{1}{8}$	$\frac{15}{32}$	$\frac{5}{16}$	$4\frac{1}{4}$
$\frac{3}{4}$	14	$\frac{25}{32}$	$1\frac{1}{32}$	$\frac{9}{16}$	$\frac{1}{8}$	$\frac{17}{32}$	$\frac{3}{8}$	$5\frac{1}{4}$
1	11.5	$1\frac{1}{32}$	$1\frac{9}{32}$	$\frac{9}{16}$	$\frac{5}{32}$	$\frac{17}{32}$	$\frac{3}{8}$	$4\frac{1}{4}$
$1\frac{1}{4}$	11.5	$1\frac{9}{32}$	$1\frac{5}{8}$	$\frac{5}{8}$	$\frac{5}{32}$	$\frac{19}{32}$	$\frac{15}{32}$	$5\frac{1}{2}$
$1\frac{1}{2}$	11.5	$1\frac{17}{32}$	$1\frac{7}{8}$	$\frac{5}{8}$	$\frac{5}{32}$	$\frac{19}{32}$	$\frac{15}{32}$	$5\frac{1}{2}$
2	11.5	$2\frac{1}{32}$	$2\frac{11}{32}$	$\frac{3}{4}$	$\frac{3}{16}$	$\frac{23}{32}$	$\frac{19}{32}$	$6\frac{3}{4}$
$2\frac{1}{2}$	8	$2\frac{17}{32}$	$2\frac{27}{32}$	1	$\frac{1}{4}$	$\frac{15}{16}$	$\frac{11}{16}$	$5\frac{1}{2}$
3	8	$3\frac{3}{32}$	$3\frac{15}{32}$	$1\frac{1}{8}$	$\frac{1}{4}$	$1\frac{1}{16}$	$\frac{13}{16}$	$6\frac{1}{2}$
$3\frac{1}{2}$	8	$3\frac{17}{32}$	$3\frac{31}{32}$	$1\frac{1}{8}$	$\frac{1}{4}$	$1\frac{1}{16}$	$\frac{13}{16}$	$6\frac{1}{2}$
4	8	$4\frac{3}{32}$	$4\frac{15}{32}$	$1\frac{1}{8}$	$\frac{1}{4}$	$1\frac{1}{16}$	$\frac{13}{16}$	$6\frac{1}{2}$
4	6	4	$4\frac{29}{32}$	$1\frac{1}{8}$	$\frac{5}{16}$	$1\frac{1}{16}$	$\frac{3}{4}$	$4\frac{1}{2}$

All dimensions are given in inches. For thread designation see Table 1.

**American National Fire Hose Connection Screw Thread.**—This thread is specified in the National Fire Protection Association's Standard NFPA No. 194-1974. It covers the dimensions for screw thread connections for fire hose couplings, suction hose couplings, relay supply hose couplings, fire pump suction, discharge valves, fire hydrants, nozzles, adaptors, reducers, caps, plugs, wyes, siamese connections, standpipe connections, and sprinkler connections.

**Form of Thread:** The basic form of thread is as shown in Fig. 1. It has an included angle of 60 degrees and is truncated top and bottom. The flat at the root and crest of the basic thread form is equal to  $\frac{1}{8}$  (0.125) times the pitch in inches. The height of the thread is equal to 0.649519 times the pitch. The outer ends of both external and internal threads are terminated by the blunt start or "Higbee Cut" on full thread to avoid crossing and mutilation of thread.

**Thread Designation:** The thread is designated by specifying in sequence the nominal size of the connection, number of threads per inch followed by the thread symbol NH.

Thus, .75-8NH indicates a nominal size connection of 0.75 inch diameter with 8 threads per inch.

*Basic Dimensions:* The basic dimensions of the thread are as given in [Table 1](#).

**Table 1. Basic Dimensions of NH Threads NFPA 1963–1993 Edition**

Nom. Size	Threads per Inch (tpi)	Thread Designation	Pitch, $p$	Basic Thread Height, $h$	Minimum Internal Thread Dimensions		
					Min. Minor Dia.	Basic Pitch Dia.	Basic Major Dia.
$\frac{3}{4}$	8	0.75-8 NH	0.12500	0.08119	1.2246	1.3058	1.3870
1	8	1-8 NH	0.12500	0.08119	1.2246	1.3058	1.3870
$1\frac{1}{2}$	9	1.5-9 NH	0.11111	0.07217	1.8577	1.9298	2.0020
$2\frac{1}{2}$	7.5	2.5-7.5 NH	0.13333	0.08660	2.9104	2.9970	3.0836
3	6	3-6 NH	0.16667	0.10825	3.4223	3.5306	3.6389
$3\frac{1}{2}$	6	3.5-6 NH	0.16667	0.10825	4.0473	4.1556	4.2639
4	4	4-4 NH	0.25000	0.16238	4.7111	4.8735	5.0359
$4\frac{1}{2}$	4	4.5-4 NH	0.25000	0.16238	5.4611	5.6235	5.7859
5	4	5-4 NH	0.25000	0.16238	5.9602	6.1226	6.2850
6	4	6-4 NH	0.25000	0.16238	6.7252	6.8876	7.0500
Nom. Size	Threads per Inch (tpi)	Thread Designation	Pitch, $p$	External Thread Dimensions (Nipple)			
				Allowance	Max. Major Dia.	Max. Pitch Dia.	Max. Minor Dia.
$\frac{3}{4}$	8	0.75-8 NH	0.12500	0.0120	1.3750	1.2938	1.2126
1	8	1-8 NH	0.12500	0.0120	1.3750	1.2938	1.2126
$1\frac{1}{2}$	9	1.5-9 NH	0.11111	0.0120	1.9900	1.9178	1.8457
$2\frac{1}{2}$	7.5	2.5-7.5 NH	0.13333	0.0150	3.0686	2.9820	2.8954
3	6	3-6 NH	0.16667	0.0150	3.6239	3.5156	3.4073
$3\frac{1}{2}$	6	3.5-6 NH	0.16667	0.0200	4.2439	4.1356	4.0273
4	4	4-4 NH	0.25000	0.0250	5.0109	4.8485	4.6861
$4\frac{1}{2}$	4	4.5-4 NH	0.25000	0.0250	5.7609	5.5985	5.4361
5	4	5-4 NH	0.25000	0.0250	6.2600	6.0976	5.9352
6	4	6-4 NH	0.25000	0.0250	7.0250	6.8626	6.7002

All dimensions are in inches.

*Thread Limits of Size:* Limits of size for NH external threads are given in [Table 2](#). Limits of size for NH internal threads are given in [Table 3](#).

*Tolerances:* The pitch-diameter tolerances for mating external and internal threads are the same. Pitch-diameter tolerances include lead and half-angle deviations. Lead deviations consuming one-half of the pitch-diameter tolerance are 0.0032 inch for  $\frac{3}{4}$ -, 1-, and  $1\frac{1}{2}$ -inch sizes; 0.0046 inch for  $2\frac{1}{2}$ -inch size; 0.0052 inch for 3-, and  $3\frac{1}{2}$ -inch sizes; and 0.0072 inch for 4-,  $4\frac{1}{2}$ -, 5-, and 6-inch sizes. Half-angle deviations consuming one-half of the pitch-diameter tolerance are 1 degree, 42 minutes for  $\frac{3}{4}$ - and 1-inch sizes; 1 degree, 54 minutes for  $1\frac{1}{2}$ -inch size; 2 degrees, 17 minutes for  $2\frac{1}{2}$ -inch size; 2 degrees, 4 minutes for 3- and  $3\frac{1}{2}$ -inch size; and 1 degree, 55 minutes for 4-,  $4\frac{1}{2}$ -, 5-, and 6-inch sizes.

Tolerances for the external threads are:

Major diameter tolerance =  $2 \times$  pitch-diameter tolerance

Minor diameter tolerance = pitch-diameter tolerance +  $2h/9$

The minimum minor diameter of the external thread is such as to result in a flat equal to one-third of the  $p/8$  basic flat, or  $p/24$ , at the root when the pitch diameter of the external thread is at its minimum value. The maximum minor diameter is basic, but may be such as results from the use of a worn or rounded threading tool. The maximum minor diameter is shown in [Fig. 1](#) and is the diameter upon which the minor diameter tolerance formula shown above is based.

Tolerances for the internal threads are:

Minor diameter tolerance =  $2 \times$  pitch-diameter tolerance

The minimum minor diameter of the internal thread is such as to result in a basic flat,  $p/8$ , at the crest when the pitch diameter of the thread is at its minimum value.

Major diameter tolerance = pitch-diameter tolerance -  $2h/9$

**Table 2. Limits of Size and Tolerances for NH External Threads (Nipples)**  
*NFPA 1963, 1993 Edition*

Nom. Size	Threads per Inch (tpi)	External Thread (Nipple)						
		Major Diameter			Pitch Diameter			Minor <sup>a</sup> Dia.
		Max.	Min.	Toler.	Max.	Min.	Toler.	Max.
$\frac{3}{4}$	8	1.3750	1.3528	0.0222	1.2938	1.2827	0.0111	1.2126
1	8	1.3750	1.3528	0.0222	1.2938	1.2827	0.0111	1.2126
$1\frac{1}{2}$	9	1.9900	1.9678	0.0222	1.9178	1.9067	0.0111	1.8457
$2\frac{1}{2}$	7.5	3.0686	3.0366	0.0320	2.9820	2.9660	0.0160	2.8954
3	6	3.6239	3.5879	0.0360	3.5156	3.4976	0.0180	3.4073
$3\frac{1}{2}$	6	4.2439	4.2079	0.0360	4.1356	4.1176	0.0180	4.0273
4	4	5.0109	4.9609	0.0500	4.8485	4.8235	0.0250	4.6861
$4\frac{1}{2}$	4	5.7609	5.7109	0.0500	5.5985	5.5735	0.0250	5.4361
5	4	6.2600	6.2100	0.0500	6.0976	6.0726	0.0250	5.9352
6	4	7.0250	6.9750	0.0500	6.8626	6.8376	0.0250	6.7002

<sup>a</sup>Dimensions given for the maximum minor diameter of the nipple are figured to the intersection of the worn tool arc with a center line through crest and root. The minimum minor diameter of the nipple shall be that corresponding to a flat at the minor diameter of the minimum nipple equal to  $p/24$  and may be determined by subtracting  $11h/9$  (or  $0.7939p$ ) from the minimum pitch diameter of the nipple.

All dimensions are in inches.

**Table 3. Limits of Size and Tolerances for NH Internal Threads (Couplings)**  
*NFPA 1963, 1993 Edition*

Nom. Size	Threads per Inch (tpi)	Internal Thread (Coupling)						
		Minor Diameter			Pitch Diameter			Major <sup>a</sup> Dia.
		Min.	Max.	Toler.	Min.	Max.	Toler.	Min.
$\frac{3}{4}$	8	1.2246	1.2468	0.0222	1.3058	1.3169	0.0111	1.3870
1	8	1.2246	1.2468	0.0222	1.3058	1.3169	0.0111	1.3870
$1\frac{1}{2}$	9	1.8577	1.8799	0.0222	1.9298	1.9409	0.0111	2.0020
$2\frac{1}{2}$	7.5	2.9104	2.9424	0.0320	2.9970	3.0130	0.0160	3.0836
3	6	3.4223	3.4583	0.0360	3.5306	3.5486	0.0180	3.6389
$3\frac{1}{2}$	6	4.0473	4.0833	0.0360	4.1556	4.1736	0.0180	4.2639
4	4	4.7111	4.7611	0.0500	4.8735	4.8985	0.0250	5.0359
$4\frac{1}{2}$	4	5.4611	5.5111	0.0500	5.6235	5.6485	0.0250	5.7859
5	4	5.9602	6.0102	0.0500	6.1226	6.1476	0.0250	6.2850
6	4	6.7252	6.7752	0.0500	6.8876	6.9126	0.0250	7.0500

<sup>a</sup>Dimensions for the minimum major diameter of the coupling correspond to the basic flat ( $p/8$ ), and the profile at the major diameter produced by a worn tool must not fall below the basic outline. The maximum major diameter of the coupling shall be that corresponding to a flat at the major diameter of the maximum coupling equal to  $p/24$  and may be determined by adding  $11h/9$  (or  $0.7939p$ ) to the maximum pitch diameter of the coupling.

All dimensions are in inches.

**Gages and Gaging:** Full information on gage dimensions and the use of gages in checking the NH thread are given in NFPA Standard No. 1963, 1993 Edition, published by the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

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