Erratum
to
ASME B94.9-1999
Taps: Ground and Cut Threads
(Inch and Metric Sizes)

On page 15, term no. 023, replace "*gun point:* see no. 060, *spiral point,* which is the preferred term" with "INTENTIONALLY LEFT BLANK."

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Three Park Avenue, New York, NY 10016-5990

October 2001

K4399E

ASME B94.9-1999

(Revision of ASME/ANSI B94.9-1987)

TAPS: GROUND AND CUT THREADS (INCH AND METRIC SIZES)

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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ASME B94.9-1999
(Revision of ASME/ANSI B94.9-1987)

Date of Issuance: January 21, 2000

This Standard will be revised when the Society approves the issuance of a new edition. There will be no addenda or written interpretations of the requirements of this Standard issued to this edition.

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FOREWORD

A subcommittee of the National Screw Thread Commission began standardizing certain dimensions of cut and ground thread taps in 1926. The subcommittee prepared a report that was finally referred to the sectional committee on Small Tools and Machine Tool Elements (B5) organized under the procedure of the American Standards Association (ASA). The original proposal passed through the regular procedure and was designated as an American Standard by ASA in April 1930.

Following the publication of the standard in 1930, Technical Committee 12 on Cut and Ground Thread Taps decided to include in the next edition additional types and sizes, a glossary of terms and definitions, and certain commercial standards issued by the tap and die manufacturers that were reproduced from their publications. Following approval from the sectional committee and the sponsors, the proposal was approved by ASA in November 1939.

In 1962 a new sectional committee, B94, was formed for the standardization of cutting tools. Technical Committee 12 on Cut and Ground Thread Taps now operates within this framework.

In 1967 the revised Standard proposed by Technical Committee 12 was approved and designated B94.9-1967.

In 1971 the revised Standard proposed by Technical Committee 12 was approved and designated B94.9-1971.

In 1979 the revised Standard proposed by Technical Committee 12 was approved and designated B94.9-1979.

In 1987 the revised Standard proposed by Technical Committee 12 was approved following all the procedures of the American National Standards Institute (ANSI) and designated ASME/ANSI B94.9-1987.

In 1999 the revised Standard proposed by Technical Committee 12 was approved and designated ASME B94.9-1999. The American National Standards Institute designated this Standard an American National Standard on February 9, 1999. Major changes included are

(a) a complete updating of text and tables to conform to current practice

(b) the elimination of nut taps (fractional sizes)

(c) the addition of screw thread insert (STI) taps in machine screw, fractional, and metric sizes

(d) the combining of M14 and M18 spark plug taps into the standard corresponding metric tap tables

(e) the addition of tables for optional necks and optional shortened thread length tap dimension for cut and ground thread taps

(f) the addition of general dimension and standard fluting tables for machine screw, fractional, metric, and STI sizes, in addition to a general dimension table for tapered and straight pipe sizes. This addition eliminated the need for repetitive information in 26 existing tables.

(g) change in letter symbols for general dimensions to conform to those in ISO-5967

(h) redefinition of "types and styles" to conform to the SAE 2123 numbering systems for taps

(i) redefinition of "tap blank styles 1, 2, and 3" as "blank design 1, 2, and 3," which eliminates "style" being used to describe two different tap attributes

ASME B94 STANDARDS COMMITTEE
Cutting Tools, Holders, Drivers, and Bushings

(The following is the roster of the Committee at the time of approval of this Standard.)

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General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by requesting interpretations, proposing revisions, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B94 Main Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Attending Committee Meetings. The B94 Main Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B94 Main Committee.

CONTENTS

TAPS: GROUND AND CUT THREADS (INCH AND METRIC SIZES)

1 GENERAL

1.1 Scope

This Standard covers various designs of standard taps, nomenclature, and definitions; the standard system of marking; and dimensions and tolerance tables for the following types and styles of taps:

Type	Style	Applicable Section(s)
Standard straight thread, general purpose; Tables 2 and 2A	Straight fluted	3.1
	Spiral fluted	3.4 and 3.5
	Spiral point, with straight flutes	3.2
	Spiral point only, no straight flutes	3.3
Pipe, taper thread; Table 7	Straight fluted	3.8
Pipe, straight thread; Table 8	Straight fluted	3.8
Pulley; Table 5	Straight fluted	3.7
Screw thread insert; Table 2B	Straight fluted	3.1
Thread forming; Tables 2 and 2A	Straight lobes	3.6
	Spiral lobes	3.6

1.2 Reference Standards for Screw Thread Nomenclature and Forms of Thread

The following is a list of publications referenced in this Standard.

ANSI B1.18M, Metric Screw Threads for Commercial Mechanical Fasteners — Boundary Profile Defined[1]

ANSI B1.20.3, Dryseal Pipe Threads (Inch)[1]

ANSI/ASME B1.7M, Nomenclature, Definitions, and Letter Symbols for Screw Threads[1]

ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch)[1]

ASME B1.1, Unified Inch Screw Threads (UN and UNR Thread Form)[1]

ASME B1.12, Class 5 Interference-Fit Thread[1]

ASME B1.13M, Metric Screw Threads — M Profile[1]

ASME B1.15, Unified Inch Screw Threads (UNJ Thread Form)[1]

ASME B1.20.7, Hose Coupling Screw Threads (Inch)[1]

ASME B1.21M, Metric Screw Threads: MJ Profile[1]

ASME B1.30, Standard Practice for Calculating and Rounding Dimensions[1]

ASME B18.29.1, Helical Coil Screw Thread Inserts — Free Running and Screw Locking (Inch)[1]

Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990

MIL-P-7105B, General Requirements for Pipe Threads, Taper, Aeronautical National Form, Symbol ANPT

MIL-S-8879C, General Specification for Screw Threads, Controlled Radius Root With Increased Minor Diameter

MIL-T-21309E, Tools for Inserting and Extracting Helical Coil Wire Screw Thread Inserts

Publisher: National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161

1.3 Basic Form of Thread

The basic angle of thread between the flanks of thread measured in an axial plane is 60 deg. The line bisecting this 60-deg angle is perpendicular to the axis of the screw thread (Fig. 1).

The symmetrical height of the thread form, h, is found as follows:

$$h = 0.64951905P = \frac{0.64951905}{n}$$

The basic pitch diameter (PD) is obtained by subtracting the symmetrical single thread height, h, from the basic major diameter as follows:

$$\text{Basic pitch diameter} = D_{bsc} - h$$

where

D_{bsc} = basic major diameter

[1] May also be obtained from American National Standards Institute (ANSI), 11 West 42nd Street, New York, NY 10036.

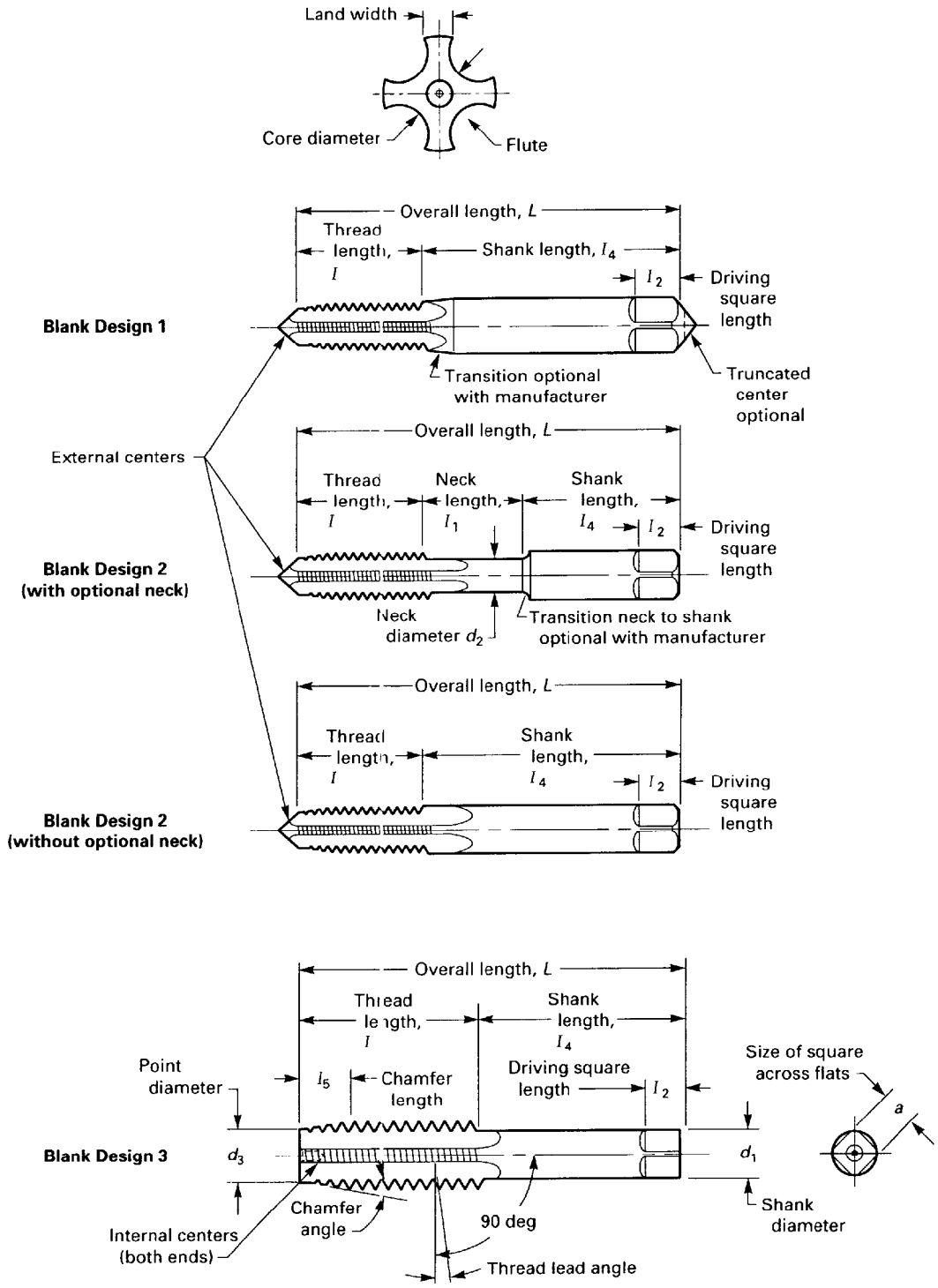


FIG. 1 ILLUSTRATIONS OF TERMS APPLYING TO TAPS

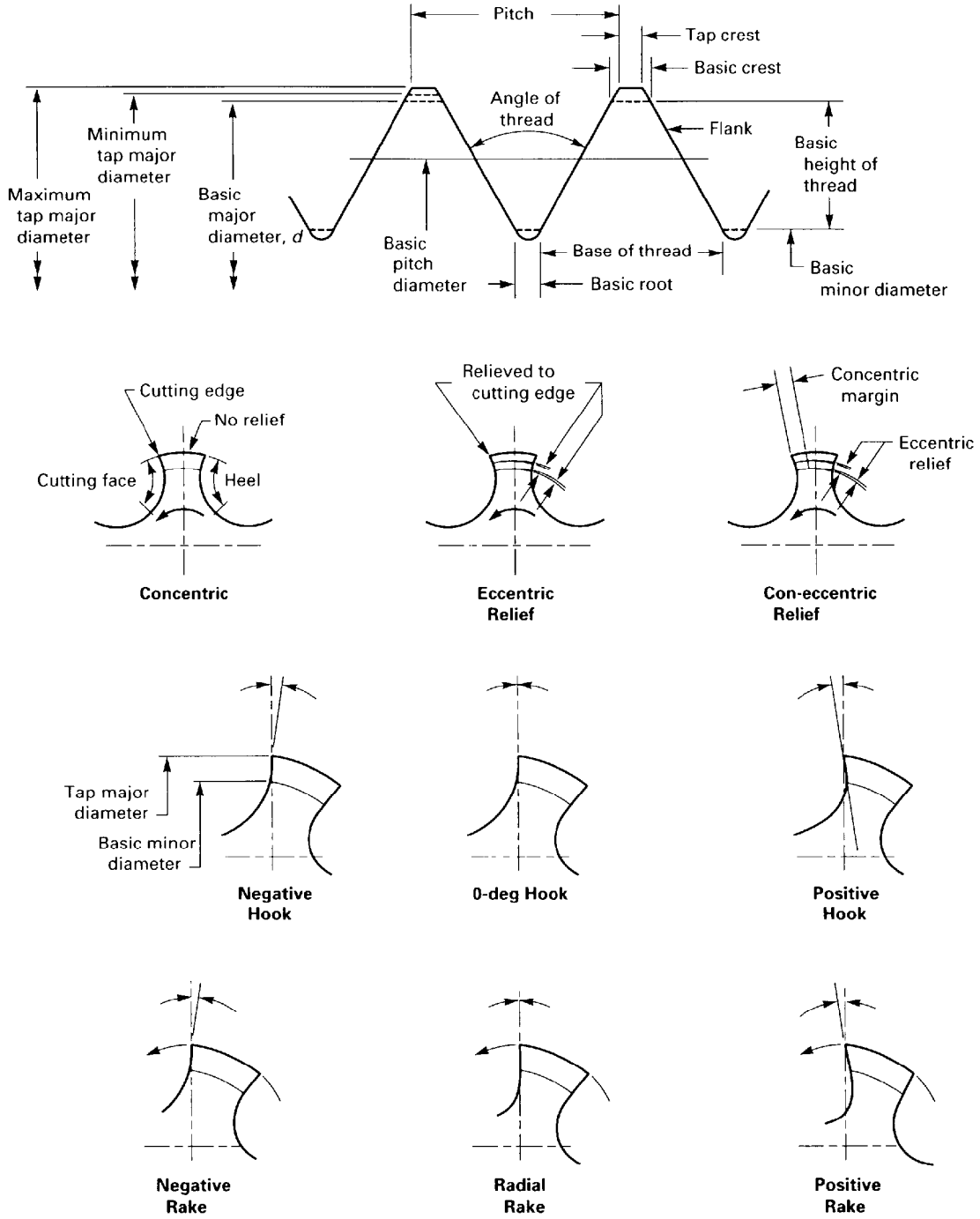


FIG. 1 ILLUSTRATIONS OF TERMS APPLYING TO TAPS (CONT'D)

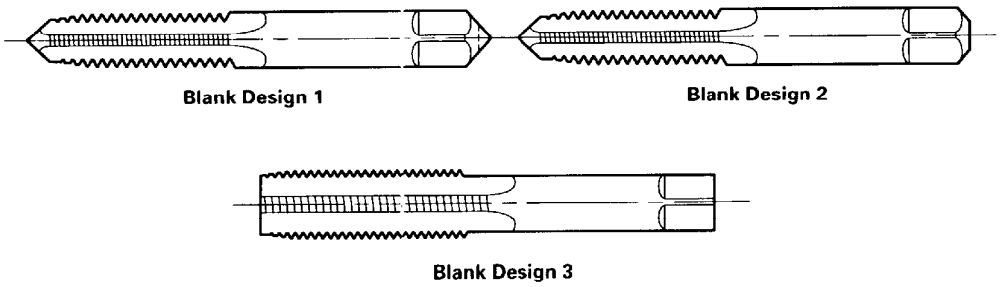


FIG. 2 STRAIGHT FLUTE STYLE TAPS

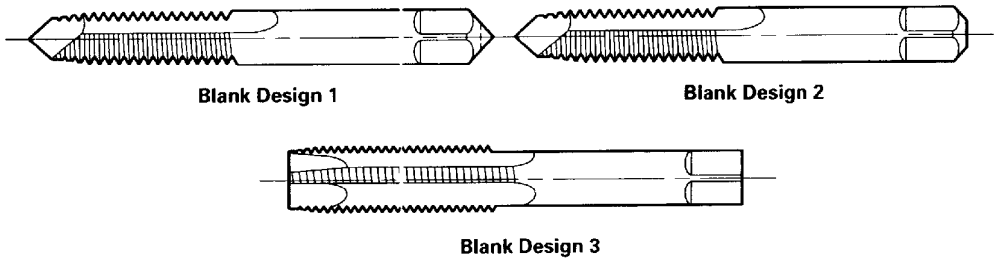


FIG. 3 SPIRAL POINTED STYLE TAPS

P = pitch of thread
h = symmetrical height of thread
n = number of threads per inch

1.4 Tap PD Size

A range of tap PD limits from which the user may select to suit local conditions is available. Tables A1 and A2 in Appendix A list tap PD limits that produce common classes of thread when used with reasonable care in average materials. Factors beyond the tap "H" limit affect final part size.

2 TAP CATEGORIZATION

Taps included in this standard are categorized according to type, style, size and chamfer, and blank design, which are explained further in the following paragraphs.

2.1 Type

Tap type is based on such general dimensions as standard straight thread, taper and straight pipe, pulley, etc., or is based on purpose, such as thread forming and screw thread insert (STI). See Fig. 1 and para. 1.1.

2.2 Style

Tap style is based on flute construction for cutting taps, such as straight, spiral, or spiral point, and on lobe style and construction for forming taps, such as straight or spiral. See Fig. 1 and para. 1.1.

2.3 Size and Chamfer

The thread size specifications for a type or style of tap may be fractional, machine screw, or metric. The thread form may be ground or cut (unground) as further defined in each table. Additionally, the cutting chamfer may be bottom, semibottom, plug, or taper, and the entry taper of form taps may be bottom or plug. Both cutting and entry tapers are defined in Tables 16 and 16A.

2.4 Blank Design

Blank design (formerly referred to as "style") further categorizes how a tap's overall length is measured, the type of centers (external or internal) it has, and whether the external center is required to be truncated.

Blank design 1 has an overall length measured from the intersection of the external center and the point diameter at the front end to the intersection of the

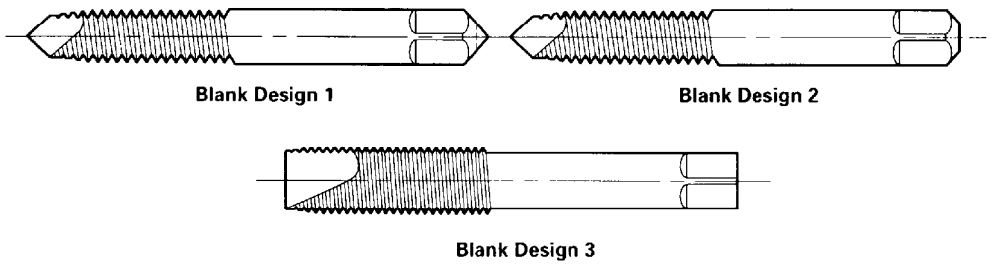


FIG. 4 SPIRAL POINTED ONLY STYLE TAPS

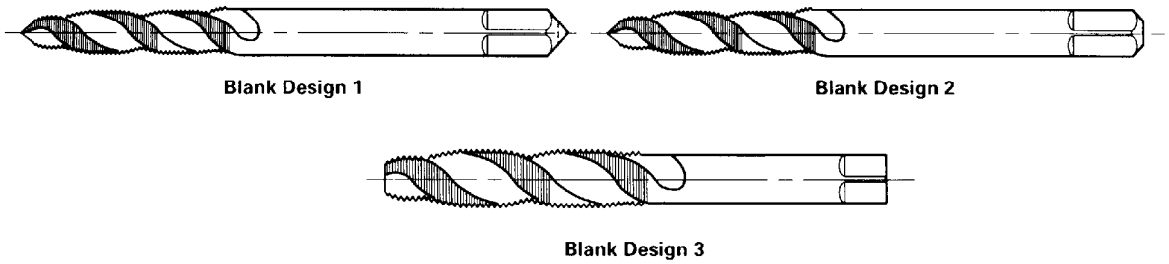


FIG. 5 REGULAR SPIRAL FLUTED STYLE TAPS

external and the shank diameter (corner of the square) at the back end. The external center on the square end can be full (to a point) or truncated.

Blank design 2 has a truncated external center on the square end, and the overall length is measured from that truncation to the intersection of the external center and the point diameter at the front end.

Blank design 3 has internal centers on both ends, and its overall length is measured from end to end.

3 TAP STYLES

3.1 Straight Flute Style Taps

Straight flute style taps, illustrated in Fig. 2, have straight flutes and are for general-purpose applications. This Standard applies to machine screw, fractional, metric, and STI sizes in high-speed, steel-ground thread and to machine screw and fractional sizes in high-speed and carbon steel cut thread, with taper, plug, semibottom, and bottom chamfer.

For general dimensions, optional necks, shortened thread length, and tolerance see Tables 2, 2A, 2B, and 2C. For number of flutes see Table 3. For standard ground thread limits see Tables 10, 10A, and 11. For standard cut thread limits see Tables 12 and 12A. For chamfer designations, including taper, plug, semibottom, and bottom, see Table 16. For runout tolerance see Table 6.

3.2 Spiral Pointed Style Taps

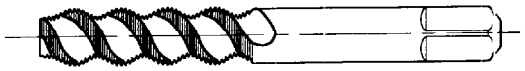
Spiral pointed style taps, illustrated in Fig. 3, are straight fluted. They have the cutting face of the first few threads ground at an angle to the axis of the tap to force the chips ahead to prevent clogging in the flutes. This Standard applies to machine screw, fractional, metric, and STI sizes; ground thread in machine screw, fractional, metric, and STI in high-speed steel; and cut thread in machine screw and fractional size with plug, semibottom, and bottom chamfer.

For general dimensions, optional necks, shortened thread length, and tolerance see Tables 2, 2A, 2B, and 2C. For number of flutes see Table 3. For standard ground thread limits see Tables 10, 10A, and 11. For standard cut thread limits see Tables 12 and 12A. For chamfer designations, including taper, plug, semibottom, and bottom see Table 16. For runout tolerance see Table 6.

3.3 Spiral Pointed Only Style Taps

Spiral pointed only style taps, illustrated in Fig. 4, are made with the spiral point feature only and do not have longitudinal flutes. They are especially suitable

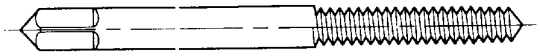
Blank Design 1



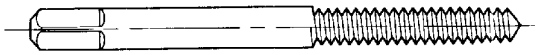
Blank Design 2

Blank Design 3

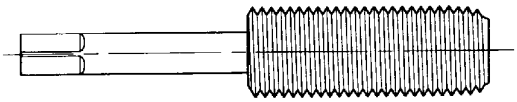
FIG. 6 FAST SPIRAL FLUTED STYLE TAPS



Blank Design 1



Blank Design 2



Blank Design 3

FIG. 7 THREAD FORMING TYPE TAPS

for tapping thin-walled materials. This Standard applies to machine screw and fractional size in high-speed steel, ground thread, with plug chamfer.

For general dimensions, optional necks, shortened thread length, and tolerance see Tables 2, 2A, 2B, and 2C. For number of flutes see Table 3. For standard ground thread limits see Tables 10, 10A, and 11. For standard cut thread limits see Tables 12 and 12A. For chamfer designations, including taper, plug, semibottom, and bottom see Table 16. For runout tolerance see Table 6.

3.4 Regular Spiral Fluted Style Taps

Regular spiral fluted style taps, illustrated in Fig. 5, have right-hand spiral flutes with a helix angle of 25 deg to 35 deg. They are designed to help extract the chips from the hole and/or to bridge a keyway. This Standard applies to machine screw, fractional, metric, and STI sizes in high-speed steel and to ground thread with plug, semibottom, and bottom chamfer.

For general dimensions, optional necks, shortened thread length, and tolerance see Tables 2, 2A, 2B, and 2C. For number of flutes see Table 3. For standard ground thread limits see Tables 10, 10A, and 11. For standard cut thread limits see Tables 12 and 12A. For chamfer designations, including taper, plug, semibottom, and bottom, see Table 16. For runout tolerance see Table 6.

3.5 Fast Spiral Fluted Style Taps

Fast spiral fluted style taps, illustrated in Fig. 6, have right-hand spiral flutes with a helix angle of 45 deg to 60 deg. They are designed to extract the chips from a hole and are normally used in low-tensile strength materials. This Standard applies to machine screw, fractional, metric, and STI sizes and to high-speed steel with plug, semibottom, and bottom chamfer.

For general dimensions, optional necks, shortened thread length, and tolerance see Tables 2, 2A, 2B, and 2C. For number of flutes see Table 3. For standard ground thread limits see Tables 10, 10A, and 11. For standard cut thread limits see Tables 12 and 12A. For chamfer designations, including taper, plug, semibottom, and bottom see Table 16. For runout tolerance see Table 6.

3.6 Thread Forming Type Taps

Thread forming type taps, illustrated in Fig. 7, are fluteless except as optionally designed with one or

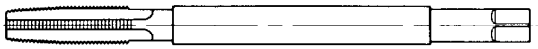


FIG. 8 PULLEY TYPE TAP

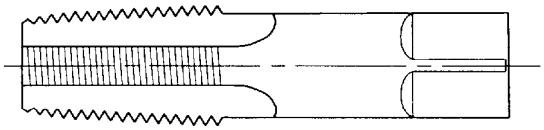


FIG. 9 PIPE TAP TYPE

more lubricating grooves. The thread form on the tap is lobed, so that there is a finite number of high points contacting the work thread form. The forming lobe may be either straight or spiral to conform to the manufacturer's standards. The tap forms the thread by extrusion and does not cut. This Standard applies to machine screw, fractional, and metric sizes, in high-speed steel, ground thread form, with plug, semibottom, and bottom entry taper.

For general dimensions, optional necks, shortened thread length, and tolerance see Tables 2, 2A, 2B, and 2C. For standard ground thread limits see Tables 10, 10A, and 11. For entry taper designations, including plug and bottom, see Table 16A. For runout tolerance see Table 6.

3.7 Pulley Type Taps

Pulley type taps, illustrated in Fig. 8, were originally designed for tapping line shaft pulleys by hand. Today, the pulley tap, which is used where extended reach is required, is commonly driven by machine. Because shank diameter is the same as the nominal diameter, the shank diameter and square size are different from those listed in Table 2. Accordingly, sizes $^{7}/_{16}$ and larger require special tap holders/drivers. This Standard applies to fractional size and ground thread with plug and bottom chamfer.

For general dimensions, optional necks, thread length, and tolerance see Table 4. For number of flutes see Table 4. For standard ground thread limits see Tables 10, 10A, and 11. For chamfer designations see Table 16. For runout tolerance see Table 6.

3.8 Pipe Tap Types

Pipe tap types, illustrated in Fig. 9, are designed for producing standard straight or taper pipe threads. This Standard applies to fractional size in high-speed, steel-ground thread, to high-speed steel and carbon steel in cut thread, and to straight-pipe taps having plug chamfers and taper pipe taps having 2 to $3^{1}/_{2}$ threads chamfered.

For general dimensions, optional necks, and tolerance and for number of flutes see Table 5. For taper thread ground thread limits see Table 13. For taper thread cut thread limits see Table 13. For straight thread ground thread limits see Tables 14 and 14A. For straight thread cut thread limits see Table 15. For chamfer designations see Table 16. For runout tolerance see Table 6.

4 STANDARD SYSTEM OF TAP MARKING

4.1 Ground Thread Taps, Inch Screw Threads

Ground thread taps specified in the U.S. customary system are marked with the nominal size, number of threads per inch, the proper symbol to identify the thread form ("HS" for high-speed steel and "G" for ground thread), designators for tap PD, and special features, such as left-hand and multi-start threads. Tap PD designators, system of limits, and special features are specified in section 5. Thread symbol designators are specified in Table 1.

4.2 Ground Thread Taps, Metric Screw Threads: M Profile

Ground thread taps made with metric screw threads (M profile) are marked with an "M," followed by the nominal size in millimeters and the pitch in millimeters, separated by the sign "X." Also included in the marking is "HS" for high-speed steel, "G" for ground thread, designators for tap PD, and special features, such as left-hand and multi-start threads. Tap PD designators, system of limits, and special features are specified in section 5.

4.3 Cut Thread Taps, Inch Screw Threads

Cut thread taps specified in the U.S. customary system are marked with the nominal size, number of threads per inch, and the proper symbol to identify thread form. High-speed steel taps are marked "HS," whereas carbon steel taps need not be marked with the steel designation. Thread symbol designators are specified in Table 1.

5 STANDARD SYSTEM OF TAP THREAD LIMITS AND IDENTIFICATION, GROUND THREAD

5.1 Unified Inch Screw Threads

5.1.1 H or L Limits. When the maximum tap PD limit is over basic PD by an even multiple of 0.0005, or the minimum tap PD limit is under basic PD by an even multiple of 0.0005, the taps are marked with "H" or "L," respectively, followed by a limit number. The limit numbers are determined as follows:

$$\text{H limit number} = \frac{\text{Amount maximum tap PD limit is over basic PD}}{0.0005}$$

$$\text{L limit number} = \frac{\text{Amount minimum tap PD limit is under basic PD}}{0.005}$$

For tap PD tolerances, see Table 7, column D. For standard taps, PD limits for various H limit numbers are shown in Tables 10 and 10A.

When unified inch screw thread taps are ordered without a PD for an H or L limit number, the tap PD is normally determined from Table 7 and is marked with the appropriate H limit number.

EXAMPLES: Tap marking with H or L limit numbers.

(1) 1/8 – 16 NC HS G H1
Maximum tap PD = Basic PD + 0.0005 in. (a)
Minimum tap PD = Maximum tap PD – 0.0005 in. (b)

(2) 1/4 – 7 NC HS G H4
Maximum tap PD = Basic PD + 0.0020 in. (a)
Minimum tap PD = Maximum tap PD – 0.0010 in. (b)

(3) 2 – 16 NEF HS G H8
Maximum tap PD = Basic PD + 0.0040 in. (a)
Minimum tap PD = Maximum tap PD – 0.0015 in. (b)

(4) 1/8 – 16 NC HS GL 2
Minimum tap PD = Basic PD – 0.0010 in. (a)
Maximum tap PD = Minimum tap PD + 0.0005 in. (b)

5.1.2 Oversize or Undersize. When the maximum tap PD over basic PD or the minimum tap PD under basic PD is not an even multiple of 0.0005, the tap PD is normally designated as an amount oversize or undersize. The amount oversize is added to the basic PD to establish the *minimum* tap PD. The amount undersize is subtracted from the basic PD to establish the *minimum* tap PD. The PD tolerance from Table 7, column D, is added to the minimum tap PD to establish the maximum tap PD in both cases.

EXAMPLE: 7/16 – 14 NC plus 0.0017 HS G
(1) Minimum tap PD = Basic PD + 0.0017 in.
(2) Maximum tap PD = Minimum Tap PD + 0.0005 in.

Whenever possible in the case of oversize or other special tap PD requirements, the maximum and minimum tap PD requirements should be specified.

5.1.3 Special Tap Pitch Diameter. Taps not made to H or L limit numbers, to the specifications in Table 7, or to the formula for oversize or undersize taps may be marked with "S" enclosed by a circle or another special identifier.

EXAMPLE: 1/2 – 16 NC HS G Ⓢ

5.1.4 Left-Hand Taps. Taps with left-hand threads are marked "LEFT HAND" or "LH."

EXAMPLE: 3/8 – 16 NC LH HS G H3

NOTE: In general, metal cutting tools must be marked with the country of origin. Reference should be made to part 134, Customs Regulations (19 CFR Part 134) to determine the specific requirements as to the permanent marking of imported tools.

5.2 Metric Screw Threads: M Profile

All calculations for metric taps are done using millimeter values. When U.S. customary values are needed, they are translated from the three-place millimeter tap diameters, only after calculations are complete.

5.2.1 D or DU Limits. When the maximum tap PD limit is over basic PD by an even multiple of 0.013 mm (0.000512 in. reference), or the minimum tap PD limit is under basic PD by an even multiple of 0.013 mm, the taps are marked with "D" or "DU," respectively, followed by a limit number. The limit number is determined as follows:

$$\text{D limit number} = \frac{\text{Amount maximum tap PD limit is over basic PD}}{0.013}$$

$$\text{DU limit number} = \frac{\text{Amount minimum tap PD limit is under basic PD}}{0.013}$$

For D limit increments that are based on 0.013 mm, see Table 8, column Y. For tap PD tolerances, see Table 8, column Z. For standard taps, PD limits for various D limit numbers are shown in Table 11.

When metric screw thread (M profile) ground thread taps are ordered without a PD or a D or DU limit number, the tap PD will normally be determined from

Table 8, and the tap will be marked with the appropriate D limit number.

EXAMPLES: Tap marking with D or DU limit numbers.

(1) M1.6 x 0.35 HS G D3
Maximum tap PD = Basic PD + 0.039 mm (a)
Minimum tap PD = Maximum tap PD − 0.015 mm (b)

(1) M12 x 1.75 HS G D6
Maximum tap PD = Basic PD + 0.078 mm (a)
Minimum tap PD = Maximum tap PD − 0.031 mm (b)

(3) M39 x 4 HS G D10
Maximum tap PD = Basic PD + 0.130 mm (a)
Minimum tap PD = Maximum tap PD − 0.052 mm (b)

(4) M6 x 1 HS G DU4
Minimum tap PD = Basic PD − 0.052 mm (a)
Maximum tap PD = Minimum tap PD + 0.025 mm (b)

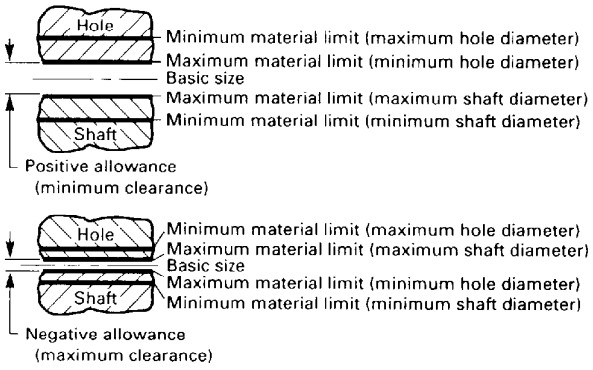
5.2.2 Metric oversize or undersize taps, taps with special PD, and left-hand taps follow the marking system given above for inch taps.

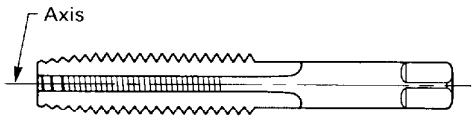
EXAMPLES:

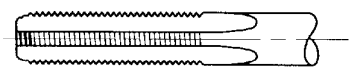
(1) M12 x 1.75 + 0.044 HS G
(2) M10 x 1.5 HS G (S)
(3) M10 x 1.5 LH HS G D6

6 GLOSSARY OF TAP ELEMENTS AND OTHER TERMS RELATED TO SCREW THREADS

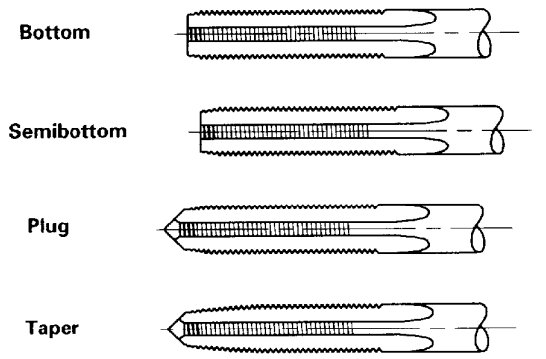
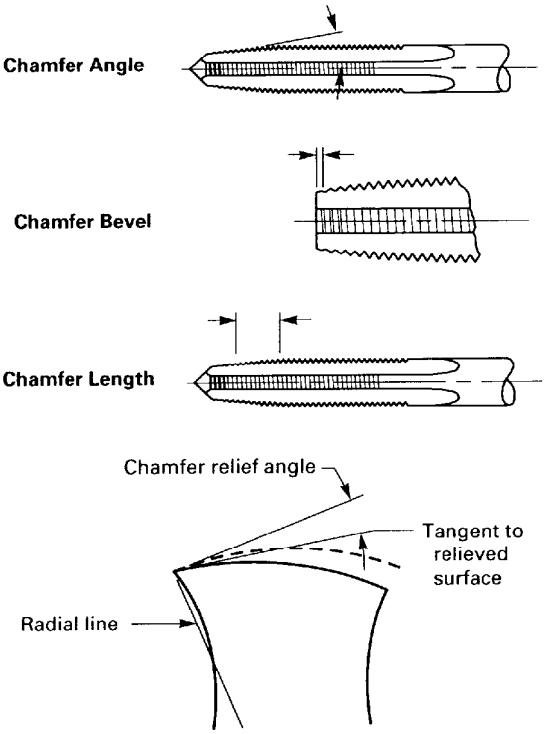
No.	Term	Illustration
001	*actual size*: the measured size of an element on an individual part.	
002	*allowance*: a prescribed difference between the maximum material limits of mating parts. It is the minimum clearance (positive allowance) or maximum interference (negative allowance) between such parts.	
003	*axis*: the imaginary straight line that forms the longitudinal centerline of the tool or threaded part.	
004	*basic size*: the size from which the limits are derived by application of allowance and tolerance.	
005	*bottom tap*: a tap having a chamfer length of 1 to 2 pitches.	

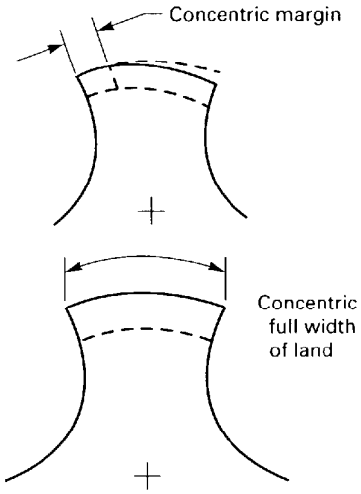
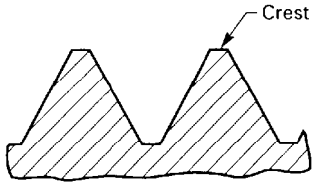
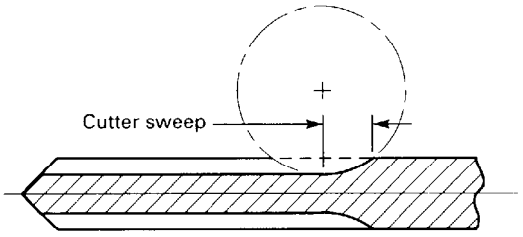
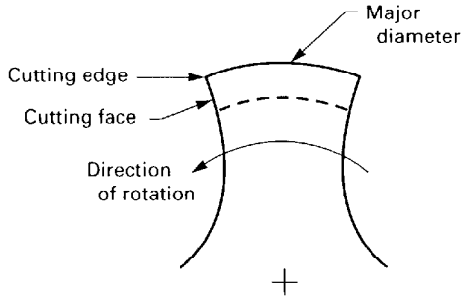
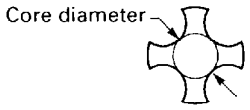


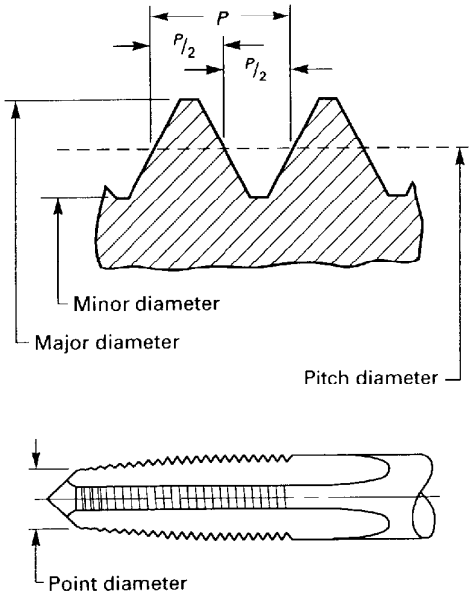
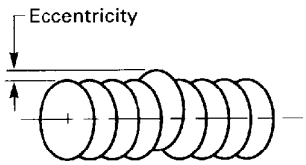


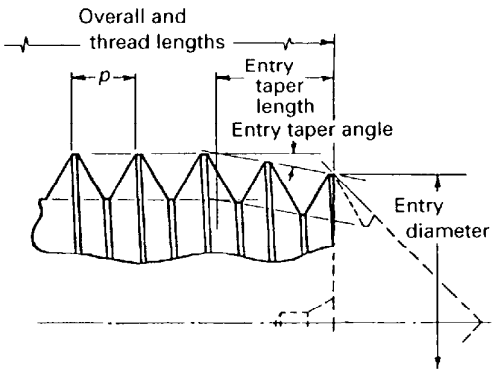
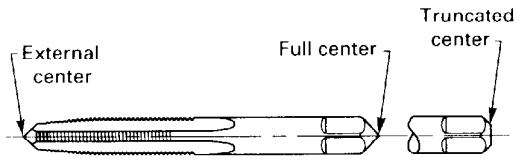
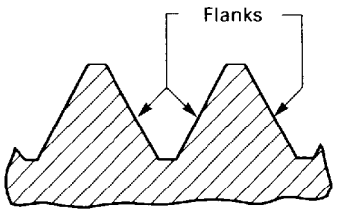
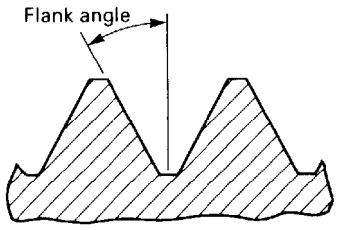


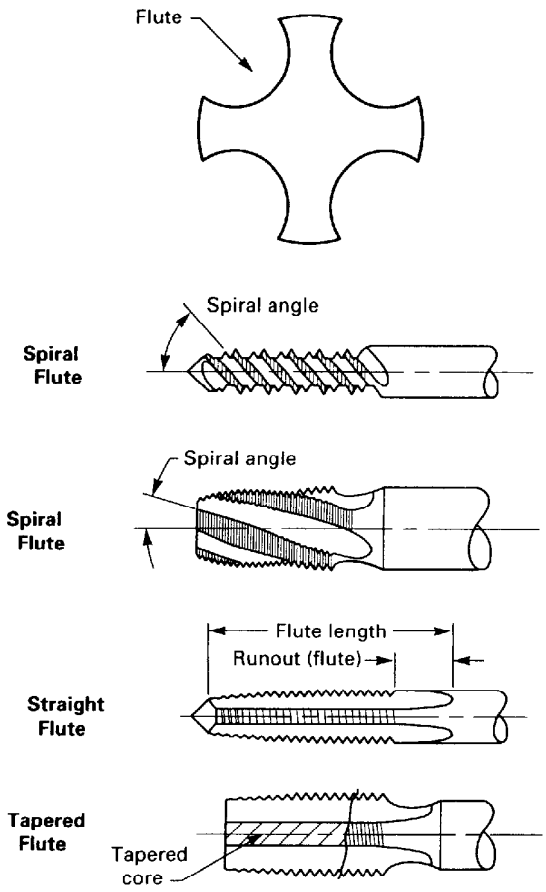
Bottom Tap

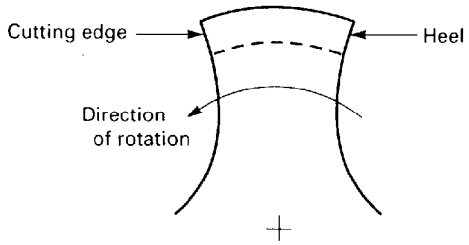
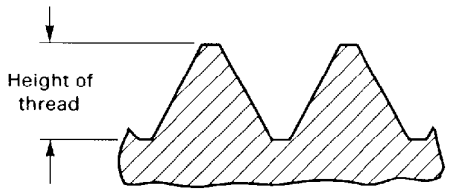
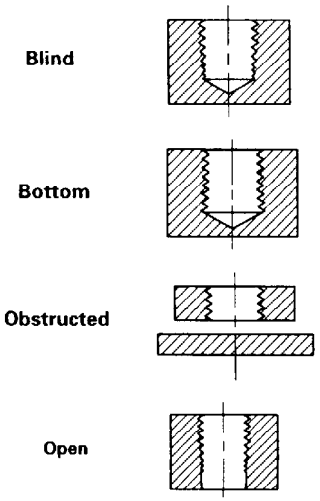
No.	Term	Illustration
006	*chamfer*: the tapering of the threads at the front end of each land of a tap by cutting away and relieving the crest of the first few teeth to distribute the cutting action over several teeth. *(a) bottom taps*: chamfered 1 to 2 pitches. *(b) semibottom taps*: chamfered 2 to 3 pitches. *(c) plug taps*: chamfered 3 to 5 pitches. *(d) taper taps*: chamfered 7 to 10 pitches.	
	chamfer angle: the angle formed between the chamfer and the axis of the tap measured in an axial plane at the cutting edge *chamfer bevel*: an angular surface of revolution (which may or may not be relieved) preceding the point diameter on a tap. *chamfer length*: the length of the chamfer measured parallel to the axis at the cutting edge. *chamfer point diameter*: see no. 012, *diameter, point.* *chamfer relief*: the gradual decrease in land height from cutting edge to heel on the chamfered portion of the land to provide radial clearance for the cutting edge. *chamfer relief angle*: the complement of the angle formed between a line tangent to the relieved surface at the cutting edge and a radial line to the same point.	
007	*classes of threads*: distinguished by the amounts of tolerance or tolerances and all allowance specified. Both inch and metric screw threads have alphanumeric class designations. Class designations do not apply to the tap.	

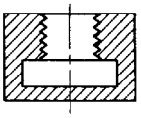
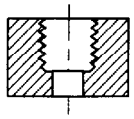
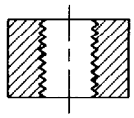
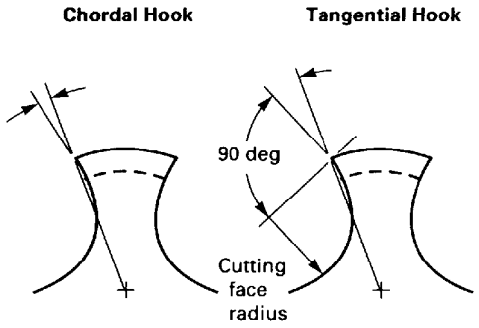
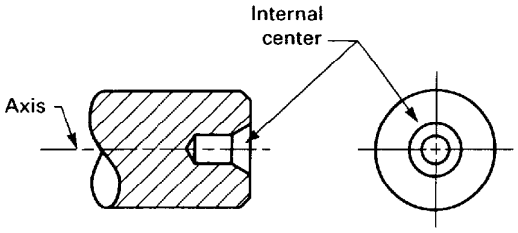
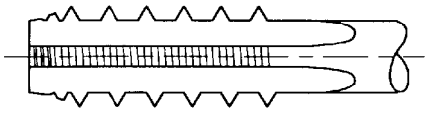
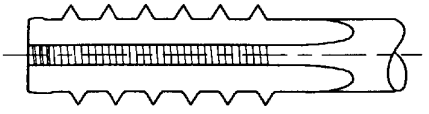
No.	Term	Illustration
008	*concentric*: having a common center. *concentric margin*: a portion of the threaded land, adjacent to the cutting edge that has concentric threads (tap outside diameter only). *concentric thread*: threads that are substantially circular for the full land width with a center coincident with the tool axis; that is, having no relief in the thread form except for that slight amount produced by back taper.	
009	*crest*: the surface of the thread that joins the flanks of the thread and is farthest from the cylinder or cone from which the thread projects.	
010	*cutter sweep*: the section removed by the milling cutter or the grinding wheel in entering or leaving a flute.	
011	*cutting edge*: the intersection of the cutting face and major diameter in the direction of rotation for cutting and which does the actual cutting. *cutting face*: the leading side of the land in the direction of rotation for cutting on which the chip impinges.	
012	*diameter*: *core*: the diameter of a circle that is tangent to the bottom of the flutes at a given point on the axis.	

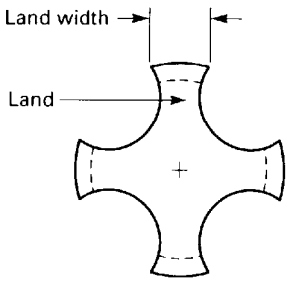
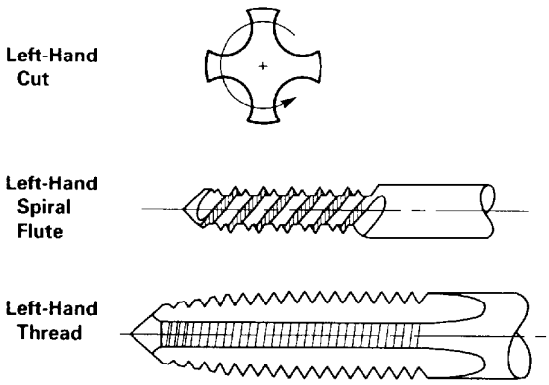
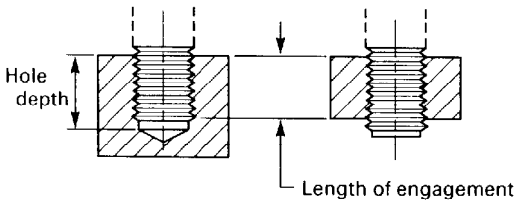
No.	Term	Illustration
012 (Cont'd)	*major*: on a straight thread, the major diameter is that of the major cylinder. On a taper thread, the major diameter at a given position on the thread axis is that of the major cone at that position. *minor*: on a straight thread, the minor diameter is that of the 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. *pitch*: on a straight thread, the diameter of the imaginary coaxial cylinder, the surface of which would pass through the thread profiles at such points as to make the width of the thread groove and ridge equal. On a theoretically perfect thread, these widths are equal to one half the pitch. On taper thread, the PD at a given position on the thread axis is the diameter of the pitch cone at that position. *point*: the diameter at the cutting edge of the leading end of the chamfered section. The diameter is approximately the same as the basic minor diameter and varies with manufacturers.	
013	*dryseal*: a thread system used for both external and internal pipe threads applications designed for use where the assembled product must withstand high fluid or gas pressure without the use of a sealing compound or where a sealer is functionally objectionable.	
014	*eccentric*: not having a common center.	
015	*eccentricity (with respect to the tool axis)*: one-half of the total indicator variation (TIV). (See also no. 050, *relative eccentricity*, and no. 054, *runout*, which is the preferred term.)	
016	*entry taper*: the portion of a thread-forming tap where the thread form is tapered toward the front to allow entry into the hole to be tapped. These tapered threads produce contact points that perform the forming or extrusion process.	

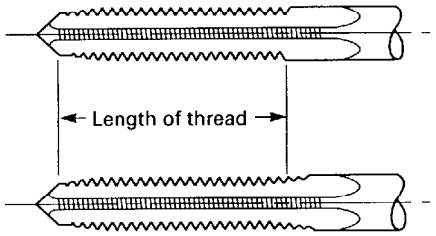
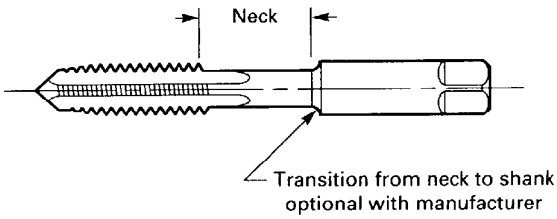
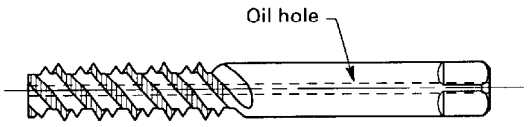
No.	Term	Illustration
016 (Cont'd)	*entry taper length*: the length, measured on the full diameter of the thread forming lobe, from the entry diameter position on the theoretical intersection to the tap major diameter and entry taper angle. *(a) bottom length*: 1 to $2\frac{1}{2}$ pitches. *(b) plug length*: 3 to 5 pitches. *entry taper angle*: the angle at which the thread form is tapered from the major diameter to the entry diameter portion. *entry taper diameter*: the diameter measured at the full thread crest nearest the front of the tap. This diameter must be an appropriate amount smaller than the diameter of the hole produced for tapping.	
017	*external center, full or truncated*: the pointed end on a tap. Its included angle varies with manufacturing practice. It must not be confused with a tap chamfer or a chamfer bevel. On bottoming chamfered taps the point on the front end may be removed, which is optional with manufacturer.	
018	*female center*: see no. 029, *internal center*, which is the preferred term.	
019	*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. *(a) leading*: *(1)* the flank of a thread facing toward the chamfered end of a threading tool. *(2)* the flank of a thread that, when the thread is about to be assembled with a mating thread, faces the mating thread. *(b) trailing*: the flank of a thread that is opposite to the leading flank. *flank angle*: the angle between the individual flank and the perpendicular plane 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 angle variation*: the deviation from the basic (nominal) flank angle.	 

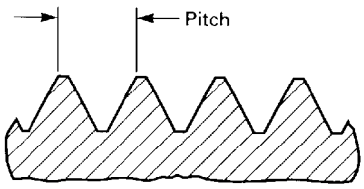
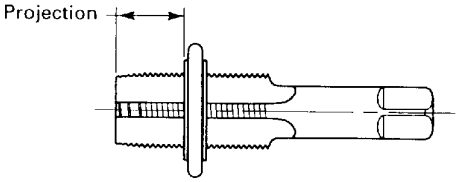
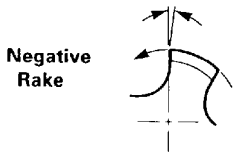
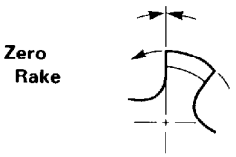
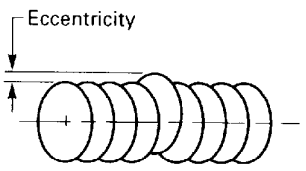
No.	Term	Illustration
020	*flutes*: the longitudinal channels formed in a tap to create cutting edges on the thread profile and to provide chip spaces and cutting fluid passages. On a parallel or straight thread tap they may be straight, angular, or spiral, and on a taper thread tap they may be straight, tapered, or spiral. *lead angle*: the angle that a helical or spiral cutting edge at a given point makes with an axial plane through the same point. *length*: as applied to taps, the full axial length of a flute including the cutter sweep. *runout*: see no. 010, *cutter sweep*. *spiral*: a flute with axial lead and helix in a helical path around the axis of a cylindrical tap. A regular spiral angle is 25–35 deg, and a fast spiral angle is 45–60 deg. On taper pipe taps the spiral angle is usually less than that described above. *straight*: a flute that forms a cutting edge lying in an axial plane. *tapered*: a flute lying in a plane intersecting the tool axis at an angle.	
021	*full indicator movement (FIM)*: the total movement of an indicator where appropriately applied to a surface to measure its variations.	
022	*functional size*: the functional diameter of an external or internal thread is the PD of the enveloping thread of perfect pitch, lead, and flank angles, having full depth of engagement but clear at crests and roots, and of a specified length of engagement. It may be derived by adding to the PD in the case of an external thread, or subtracting from the PD in the case of an internal thread, the cumulative effects of deviations from specified profile, including variations in lead and flank angle over a specified length of engagement. The effects of taper, out of roundness, and surface defects may be positive or negative on either external or internal threads.	

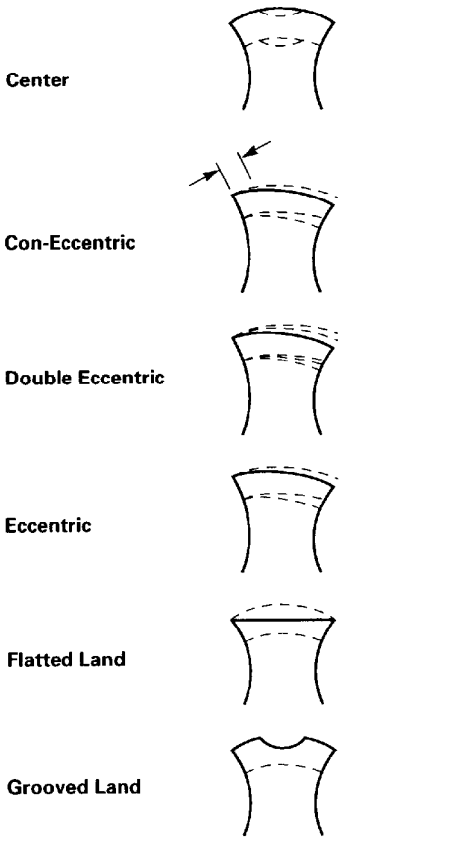
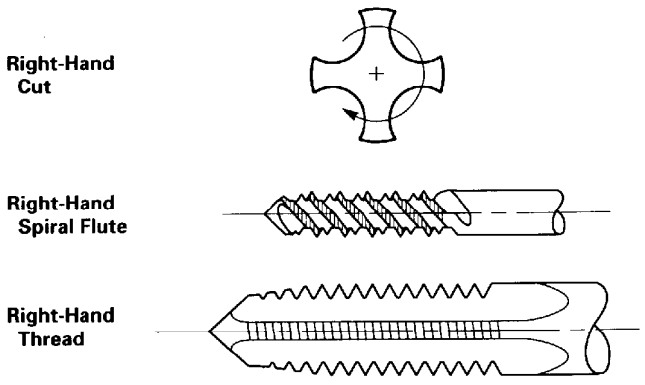
No.	Term	Illustration
023	*gun point*: see no. 060, *spiral point*, which is the preferred term.	
024	*heel*: the edge of the land opposite the cutting edge.	
025	*height of thread*: the height of a thread is the distance, measured radially between the major and minor cylinders or cones, respectively.	
026	*helix angle*: see no. 20, *flute, lead angle* and no. 64, *thread lead angle*. *helix variation*: helix variation of a thread is an undulate aberration from true helical advancement. The "helical path" includes the helix with its superimposed variation and is measured either as the maximum deviation from the true helix or as the "cumulative pitch." The cumulative pitch is the distance measured parallel to the axis of the thread between corresponding points on any two thread forms whether or not they are in the same axial plane.	
027	*holes*: *blind*: a hole that does not pass through the work piece and is not threaded to its full depth.	
	bottom: a blind hole that is threaded close to the bottom.	
	obstructed: a through hole that has some obstruction beyond the hole limiting the travel of the tap.	
	open: a hole that passes through the work piece but is not threaded its full depth.	

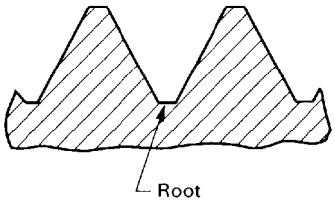
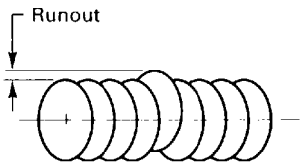
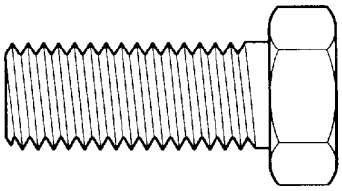
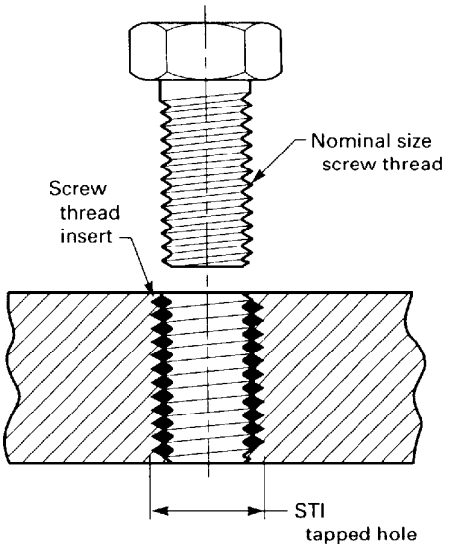
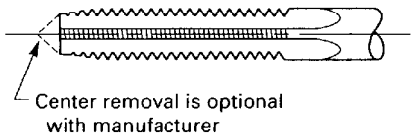
No.	Term	Illustration
027 (Cont'd)	*recessed*: a blind hole with a recess larger than the tap major diameter and beyond the depth of full thread, limiting the travel of the tap.	
	stepped: a blind or open hole with a change in diameter that limits the thread depth.	
	through: a hole that passes through the work piece and is threaded to its full depth.	
028	*hook angle*: the inclination of a concave cutting face, usually specified as either chordal hook or tangential hook. *chordal*: the angle between the chord passing through the basic minor diameter and the tap crest at the cutting face and a radial line through the tap crest at the cutting edge. *tangential*: the angle between a line tangent to the radius of the cutting face at the major diameter and a radial line to the same point.	
029	*internal center*: a countersink with clearance at the bottom, in one or both ends of a tool, which establishes the tool axis.	
030	*interrupted thread tap*: a tap having an odd number of lands with alternate teeth in the thread helix removed. Alternate teeth are generally removed only for a portion of the thread length beyond the chamfer (semi-interrupted thread), or in some cases on the full thread length including the chamfer (full-interrupted thread).	 

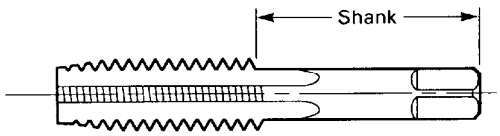
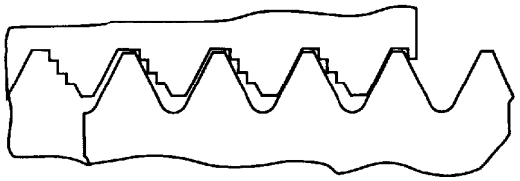
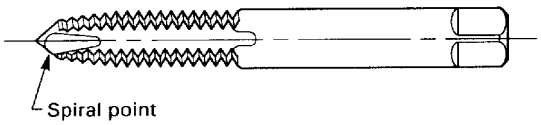
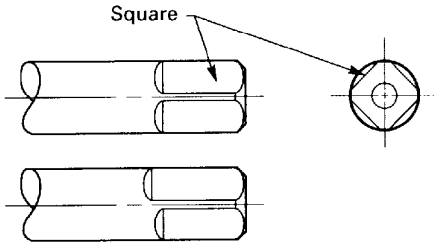
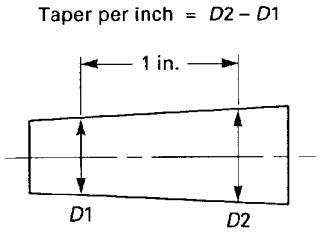
No.	Term	Illustration
031	*land*: one of the threaded sections between the flutes of a tap. *land width*: the chordal width of the land between the cutting edge and the heel measured normal to the cutting edge.	
032	*lead*: the distance a screw thread advances axially in one complete turn. *lead deviation*: the deviation from the basic nominal thread. *lead error*: the deviation from prescribed limits. *progressive*: *(a)* on the straight thread the deviation from a true helix where the thread helix advances uniformly, or *(b)* on a taper thread the deviation from a true spiral where the thread spiral advances uniformly.	
033	*left-hand cut*: rotation in a counterclockwise direction for cutting when viewed from the chamfered end of a tap. *left-hand spiral flute*: flutes that twist in a counterclockwise direction when viewed axially. *left-hand thread*: a thread is a left-hand thread if, when viewed axially, it winds in a counterclockwise and receding direction. All left-handed threads are designated LH.	
034	*length of engagement*: the length of engagement of two mating threads is the axial distance over which two mating threads are designed to contact.	

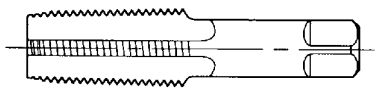
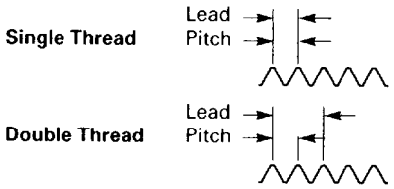
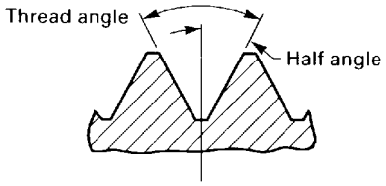
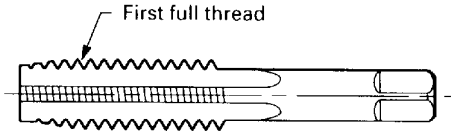
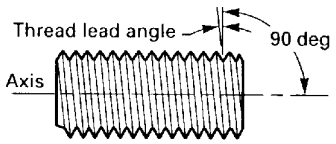
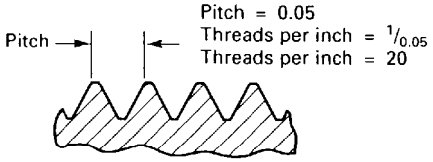
No.	Term	Illustration
035	*length of thread*: the length of the thread includes the chamfered threads and the full threads but does not include an external center or incomplete threads due to multiple rib grinding.	
036	*limits*: the limits of size are the applicable maximum and minimal sizes.	
037	*male center*: see no. 017, *external center*, which is the preferred term.	
038	*margin*: see no. 008, *concentric margin*.	
039	*neck*: a section of reduced diameter between two adjacent portions of a tool.	
040	*nominal size*: a designation consisting of basic specified size before any allowance or tolerance is applied, used for general identification.	
041	*number of threads*: see no. 064, *threads per inch*, which is the preferred term.	
042	*oil holes*: holes through which a cutting fluid is fed to the cutting edges of a tool.	
043	*optional number of flutes*: taps with more or less flutes than standard.	
044	*overall length*: see Fig. 1.	
045	*percent of thread*: one half the difference between the basic major diameter and the actual minor diameter of an internal thread, divided by the basic thread height, expressed as a percentage.	

No.	Term	Illustration
046	*pitch*: the distance from any point on a screw thread to a corresponding point on the next thread, measured parallel to the axis and on the same side of the axis. In the unified inch screw thread system, the pitch equals one divided by the number of threads per inch. *pitch error*: the deviation from the true basic pitch measured between adjacent teeth on a land.	**Examples:** $^1/_4$–20 UNC Pitch = $^1/_{20}$ Pitch = 0.05 in. M6 x 1 Pitch = 1 mm 
047	*plug tap*: a tap having a chamfer length of 3 to 5 pitches.	
048	*projection*: the distance the small end of a taper thread projects through a taper thread ring gage.	
049	*rake*: the angular relationship of the straight cutting face of a tooth with respect to the radial line through the crest of the tooth at the cutting edge. *negative*: the crest of the cutting face is angularly behind the balance of the cutting face of the tooth. *positive*: the crest of the cutting face is angularly ahead of the balance of the cutting face of the tooth. *zero*: the cutting face is directly on a radial line.	  
050	*relative eccentricity*: the distance between the geometric centerline of one portion of a tool and geometric centerline of some other portion.	

No.	Term	Illustration
051	*relief*: the removal of metal behind the cutting edge to provide clearance between the part being threaded and the threaded land. *center*: clearance produced on a portion of the land by reducing the diameter of the entire thread form between cutting edge and heel. *con-eccentric*: radial relief in the thread form starting back of a concentric margin. *double eccentric*: the combination of a slight radial relief in the thread form starting at the cutting edge and continuing for a portion of the land width, and a greater radial relief for the balance of the land. *eccentric*: radial relief in the thread form starting at the cutting edge and continuing to the heel. *flatted land*: clearance produced on a portion of the tap land by truncating the thread between the cutting edge and heel. *grooved land*: clearance produced on a tap land by forming a longitudinal groove in the center of the land. *radial*: the clearance produced by removal of metal from behind the cutting edge. Taps should have the chamfer relieved and should have back taper, but may or may not have relief in the angle and on the major diameter of the threads. When the thread angle is relieved, starting at the cutting edge and continuing to the heel, the tap is said to have "eccentric" relief. If the thread angle is relieved back of a concentric margin (usually one third of land width), the tap is said to have "con-eccentric" relief.	
052	*right-hand cut*: rotation in a clockwise direction for cutting when viewed from the chamfered end of a tap or die. *right-hand flutes*: flutes that twist in a clockwise direction when viewed axially. *right-hand thread*: a thread is a right hand thread if, when viewed axially, it winds in a clockwise and receding direction.	

No.	Term	Illustration
053	*root*: the surface of the thread that joins the flanks of adjacent thread forms and is identical to or immediately adjacent to the cylinder or cone from which the thread projects.	
054	*runout*: the radial variation from a true circle that lies in a diametral plane and is concentric with the tool axis. (See also no. 021, *full indicator movement [FIM].*)	
055	*screw thread*: a ridge, usually of uniform section and produced by forming a groove in the form of a helix on the external or internal surface of a cylinder, or in the form of a conical spiral on the external or internal surface of a cone or frustum of a cone. A screw thread formed on a cylinder is known as a straight or parallel thread, to distinguish it from a taper screw thread that is formed on a cone of frustum of a cone or frustum.	 **Example of Straight Screw Thread**
056	*screw thread insert (STI)*: screw thread bushing coiled from diamond-shaped cross-section wire. They are screwed into oversized tapped holes to form nominal size internal threads. Commonly referred to as "helical coil insert." *screw thread insert (STI) tap*: these taps are over the nominal size to the extent that the internal thread they produce will accommodate a helical coil screw insert, which at final assembly will accept a screw thread of the nominal size and pitch.	
057	*semibottom tap*: a tap having 2 to 3 pitches in chamfer length.	**Semibottom** 

No.	Term	Illustration
058	*shank*: the portion of the tool body by which it is held and driven.	
059	*shaving*: the excessive removal of material from the product thread profile by the tool thread flanks caused by an axial advance per revolution less than or more than the actual lead on the tool. In tapping, this results in an increase in product PD without an increase in product major diameter.	
060	*spiral point*: the angular fluting in the cutting face of the land at the chamfered end. It is formed at an angle with respect to the tap axis of opposite hand to that of rotation. Its length is usually greater than the chamfer length, and its angle with respect to the tap axis is usually made great enough to direct the chips ahead of the tap. The tap may or may not have longitudinal flutes. *spiral point angle*: the angle made by the projection of the spiral point flute into an axial plane parallel to the tap axis.	
061	*square*: four driving flats parallel to the axis on a tap shank forming a square with round corners. For location purposes, one of the flats can be longer than the three others.	
062	*taper*: *back*: a gradual decrease in the diameter of the thread form on a tap from the chamfered end of the land towards the back, which creates a slight radial relief in the threads. *front*: opposite of the back taper. *taper per inch:* *(a)* on a taper threaded part or on a taper shank, the difference in diameter in one inch measured parallel to the axis. *(b)* on a taper tap, the difference in diameter in one inch measured parallel to the axis at the cutting face. *taper tap*: a tap having a chamfer length of 7 to 10 pitches.	 

No.	Term	Illustration
062 (Cont'd)	*taper thread tap*: a tap with tapered threads for producing a tapered internal thread.	 Taper Thread Tap
063	*thread*: *angle of*: also known as included angle of a thread. The angle between the flanks of the thread measured in an axial plane. *base of*: that which coincides with the cylindrical or conical surface from which the thread projects. *class of*: the designation of the class that determines the specification of the size allowance, and tolerance to which a given threaded product is to be manufactured. It is not applicable to the tools for threading. *first full*: the first thread on the cutting edge back of the chamfer. It is at this point that rake, hook, and thread elements are measured. *half angle*: the angle formed by one thread flank top or line perpendicular to the axial plane. *height*: see no. 025, *height of thread.* *interrupted*: see no. 030, *interrupted thread tap.* *length*: see no. 035, *length of thread.* *multiple*: a thread of which the lead is an integral multiple of the pitch. On a double thread, the lead is equal to twice the pitch. On a triple thread, the lead is equal to three times the pitch, etc. *screw*: see no. 055, *screw thread.* *single*: a thread having a lead equal to the pitch.	  
064	*thread lead angle*: on a straight thread, 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 helix of the thread, with the plane perpendicular to the axis, at the pitch line diameter at that point. *threads per inch (TPI)*: the number of thread pitches in one inch of thread length.	 **Example:** Pitch = 0.05 Threads per inch = $^{1}/_{0.05}$ Threads per inch = 20 

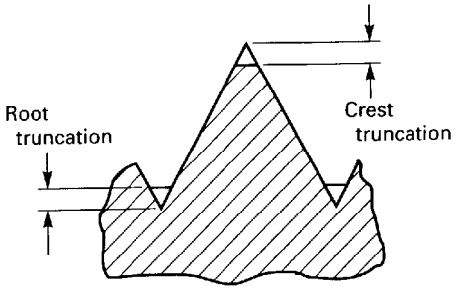
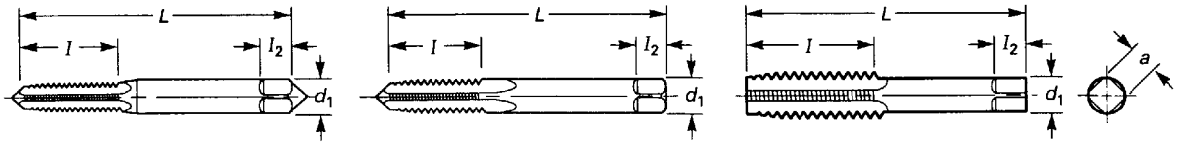
No.	Term	Illustration
065	*tolerance* *(a)* the total permissible variation of size *(b)* the difference between the limits of size	
066	*total indicator variation (TIV)*: the difference between maximum and minimum indicator readings during a checking cycle. (See also no. 021, *full indicator movement [FIM]*, which is the preferred term.)	
067	*truncation*: *crest*: the crest truncation of a thread is the radial distance between the sharp crest and the cylinder or cone that binds the crest. *root*: the root truncation of a thread is the radial distance between the sharp root and the cylinder or cone that binds the root.	

TABLE 1 THREAD SERIES DESIGNATIONS

Standard Tap Marking	Product Thread Designation	Thread Series	American National Standards References
M	M	Metric Screw Threads — M Profile, with basic ISO 68 profile	B1.13M, B1.18M
M	MJ	Metric Screw Threads: MJ Profile, with rounded root of radius 0.15011*P* to 0.18042*P* (external thread only)	B1.21M
		Class 5 Interference — Fit Thread	
NC	NC5IF	Entire ferrous material range	B1.12
NC	NC5INF	Entire nonferrous material range	B1.12
NPS	NPSC	American Standard straight pipe threads in pipe couplings	B1.20.1
NPSF	NPSF	Dryseal American Standard fuel internal straight pipe threads	B1.20.3
NPSH	NPSH	American Standard straight hose coupling threads for joining to American Standard taper pipe threads	B1.20.7
NPSI	NPSI	Dryseal American Standard intermediate internal straight pipe threads	B1.20.3
NPSL	NPSL	American Standard straight pipe threads for loose-fitting mechanical joints with locknuts	B1.20.1
NPS	NPSM	American Standard straight pipe threads for free-fitting mechanical joints for fixtures	B1.20.1
ANPT	ANPT	Pipe threads, taper, aeronautical, national form	MIL-P-7105
NPT	NPT	American Standard taper pipe threads for general use	B1.20.1
NPTF	NPTF	Dryseal American Standard taper pipe threads	B1.20.3
NPTR	NPTR	American Standard taper pipe threads for railing joints	B1.20.1
PTF	PTF	Dryseal American Standard pipe threads	B1.20.3
PTF-SPL	PTF-SPL	Dryseal American Standard pipe threads	B1.20.3
N	UN	Unified Inch Screw Thread, constant-pitch series	B1.1
NC	UNC	Unified Inch Screw Thread, coarse pitch series	B1.1
NF	UNF	Unified Inch Screw Thread, fine pitch series	B1.1
NEF	UNEF	Unified Inch Screw Thread, extra-fine pitch series	B1.1
N	UNJ	Unified Inch Screw Thread, constant-pitch series, with rounded root of radius 0.15011*P* to 0.18042*P* (external thread only)	MIL-S-8879
NC	UNJC	Unified Inch Screw Thread, coarse pitch series, with rounded root of radius 0.15011*P* to 0.18042*P* (external thread only)	B1.15 MIL-S-8879
NF	UNJF	Unified Inch Screw Thread, fine pitch series, with rounded root of radius 0.15011*P* to 0.18042*P* (external thread only)	B1.15 MIL-S-8879
NEF	UNJEF	Unified Inch Screw Thread, extra-fine pitch series, with rounded root of radius 0.15011*P* to 0.18042*P* (external thread only)	B1.15 MIL-S-8879
N	UNR	Unified Inch Screw Thread, constant-pitch series, with rounded root of radius not less than 0.108*P* (external thread only)	B1.1
NC	UNRC	Unified Inch Screw Thread, coarse thread series, with rounded root of radius not less than 0.108*P* (external thread only)	B1.1
NF	UNRF	Unified Inch Screw Thread, fine pitch series, with rounded root of radius not less than 0.108*P* (external thread only)	B1.1
NEF	UNREF	Unified Inch Screw Thread, extra-fine pitch series, with rounded root of radius not less than 0.108*P* (external thread only)	B1.1
NS	UNS	Unified Inch Screw Thread, special diameter pitch, or length of engagement	B1.1
STI	STI	Helical Coil Screw Thread Inserts — Freerunning and Screwlocking (Inch Series)	B18.29.1



Blank Design 1 Blank Design 2 Blank Design 3

TABLE 2 STANDARD TAP DIMENSIONS (GROUND AND CUT THREAD)

General Dimensions											
Nominal Diameter Range, in.		Machine Screw Size	Nominal Fractional Diameter (Decimal Equivalent),	Nominal Metric Diameter		Blank Design	Tap Dimensions, in.				
Over	To (Inclusive)	No.	in.	mm	in.	No.	Overall Length, *L*	Thread Length, *l*	Square Length, l_2	Shank Diameter, d_1	Size of Square, *a*
0.052	0.065	0 (0.0600)	...	M1.6	(0.0630)	1	1.63	0.31	0.19	0.1410	0.110
0.065	0.078	1 (0.0730)	...	M1.8	(0.0709)	1	1.69	0.38	0.19	0.1410	0.110
0.078	0.091	2 (0.0860)	...	M2	(0.0787)	1	1.75	0.44	0.19	0.1410	0.110
				M2.2	(0.0866)						
0.091	0.104	3 (0.0990)	...	M2.5	(0.0984)	1	1.81	0.50	0.19	0.1410	0.110
0.104	0.117	4 (0.1120)	...	...	...	1	1.88	0.56	0.19	0.1410	0.110
0.117	0.130	5 (0.1250)	...	M3	(0.1181)	1	1.94	0.63	0.19	0.1410	0.110
0.130	0.145	6 (0.1380)	...	M3.5	(0.1378)	1	2.00	0.69	0.19	0.1410	0.110
0.145	0.171	8 (0.1640)	...	M4	(0.1575)	1	2.13	0.75	0.25	0.1680	0.131
0.171	0.197	10 (0.1900)	...	M4.5	(0.1772)	1	2.38	0.88	0.25	0.1940	0.152
				M5	(0.1969)						
0.197	0.223	12 (0.2160)	...	...	...	1	2.38	0.94	0.28	0.2200	0.165
0.223	0.260	...	1/4 (0.2500)	M6	(0.2362)	2	2.50	1.00	0.31	0.2550	0.191
0.260	0.323	...	5/16 (0.3125)	M7	(0.2756)	2	2.72	1.13	0.38	0.3180	0.238
				M8	(0.3150)						
0.323	0.395	...	3/8 (0.3750)	M10	(0.3937)	2	2.94	1.25	0.44	0.3810	0.286
0.395	0.448	...	7/16 (0.4375)	...	...	3	3.16	1.44	0.41	0.3230	0.242
0.448	0.510	...	1/2 (0.5000)	M12	(0.4724)	3	3.38	1.66	0.44	0.3670	0.275

(continued)

TABLE 2 STANDARD TAP DIMENSIONS (GROUND AND CUT THREAD) (CONT'D)

General Dimensions											
Nominal Diameter Range, in.		Machine Screw Size No.	Nominal Fractional Diameter (Decimal Equivalent), in.	Nominal Metric Diameter		Blank Design No.	Tap Dimensions, in.				
							Overall Length, L	Thread Length, l	Square Length, l_2	Shank Diameter, d_1	Size of Square, a
Over	To (Inclusive)			mm	in.						
0.510	0.573	...	9/16 (0.5625)	M14	(0.5512)	3	3.59	1.66	0.50	0.4290	0.322
0.573	0.635	...	5/8 (0.6250)	M16	(0.6299)	3	3.81	1.81	0.56	0.4800	0.360
0.635	0.709	...	11/16 (0.6875)	M18	(0.7087)	3	4.03	1.81	0.63	0.5420	0.406
0.709	0.760	...	3/4 (0.7500)	...	...	3	4.25	2.00	0.69	0.5900	0.442
0.760	0.823	...	13/16 (0.8125)	M20	(0.7874)	3	4.47	2.00	0.69	0.6520	0.489
0.823	0.885	...	7/8 (0.8750)	M22	(0.8861)	3	4.69	2.22	0.75	0.6970	0.523
0.885	0.948	...	15/16 (0.9375)	M24	(0.9449)	3	4.91	2.22	0.75	0.7600	0.570
0.948	1.010	...	1 (1.0000)	M25	(0.9843)	3	5.13	2.50	0.81	0.8000	0.600
1.010	1.073	...	1 1/16 (1.0625)	M27	(1.0630)	3	5.13	2.50	0.88	0.8960	0.672
1.073	1.135	...	1 1/8 (1.1250)	...	...	3	5.44	2.56	0.88	0.8960	0.672
1.135	1.198	...	1 3/16 (1.1875)	M30	(1.1811)	3	5.44	2.56	1.00	1.0210	0.766
1.198	1.260	...	1 1/4 (1.2500)	...	...	3	5.75	2.56	1.00	1.0210	0.766
1.260	1.323	...	1 5/16 (1.3125)	M33	(1.2992)	3	5.75	2.56	1.06	1.1080	0.831
1.323	1.385	...	1 3/8 (1.3750)	...	...	3	6.06	3.00	1.06	1.1080	0.831
1.358	1.448	...	1 7/16 (1.4375)	M36	(1.4173)	3	6.06	3.00	1.13	1.2330	0.925
1.448	1.510	...	1 1/2 (1.5000)	...	...	3	6.38	3.00	1.13	1.2330	0.925
1.510	1.635	...	1 5/8 (1.6250)	M39	(1.5354)	3	6.69	3.19	1.13	1.3050	0.979
1.635	1.760	...	1 3/4 (1.7500)	M42	(1.6535)	3	7.00	3.19	1.25	1.4300	1.072
1.760	1.885	...	1 7/8 (1.8750)	...	...	3	7.31	3.56	1.25	1.5190	1.139
1.885	2.010	...	2 (2.0000)	M48	(1.8898)	3	7.63	3.56	1.38	1.6440	1.233

(continued)

TABLE 2 STANDARD TAP DIMENSIONS (GROUND AND CUT THREAD) (CONT'D)

Tolerances					
	Nominal Diameter Range, in.			Tolerance, in.	
Element	Over	To (Inclusive)	Direction	Ground Thread	Cut Thread
Length overall, *L*	0.0520	1.0100	Plus or minus	0.03	0.03
	1.0100	2.0000	Plus or minus	0.06	0.06
Length of thread, *l*	0.0520	0.2230	Plus or minus	0.05	0.05
	0.2230	0.5100	Plus or minus	0.06	0.06
	0.5100	1.5100	Plus or minus	0.09	0.09
	1.5100	2.0000	Plus or minus	0.13	0.13
Length of square, l_2	0.0520	1.0100	Plus or minus	0.03	0.03
	1.0100	2.0000	Plus or minus	0.06	0.06
Diameter of shank, d_1	0.0520	0.2230	Minus	0.0015	0.0040
	0.2230	0.6350	Minus	0.0015	0.0050
	0.6350	1.0100	Minus	0.0020	0.0050
	1.0100	1.5100	Minus	0.0020	0.0070
	1.5100	2.0000	Minus	0.0030	0.0070
Size of square, *a*	0.0520	0.5100	Minus	0.004	0.004
	0.5100	1.0100	Minus	0.006	0.006
	1.0100	2.0000	Minus	0.008	0.008

GENERAL NOTES:

(a) Special taps greater than 1.010 in. to 1.510 in. in diameter inclusive, having 14 or more threads per inch or 1.75-mm pitch and finer, and sizes over 1.510 in. in diameter with 10 or more threads per inch or 2.5-mm pitch and finer are made to general dimensions shown in Table A5 in Appendix A.

(b) For standard ground thread tap limits see Tables 10 and 10A for inch and Table 11 for metric.

(c) For cut thread tap limits see Tables 12 and 12A.

(d) Special ground thread tap limits are determined by using the formulas shown in Table 7 for unified inch screw threads and Table 8 for metric M profile screw threads.

(e) Tap sizes 0.395 in. and smaller have an external center on the thread end (may be removed on bottom taps). Sizes 0.223 in. and smaller have an external center on the shank end. Sizes 0.224 in. through 0.395 in. have truncated partial cone centers on the shank end (¼ of diameter of shank). Sizes greater than 0.395 in. have internal centers on both the thread and shank ends.

(f) For standard thread limits and tolerances see Table A1 in Appendix A for unified inch screw threads and Table A2 in Appendix A for metric threads.

(g) For runout tolerances of tap elements see Table 6.

(h) For number of flutes see Table 3.

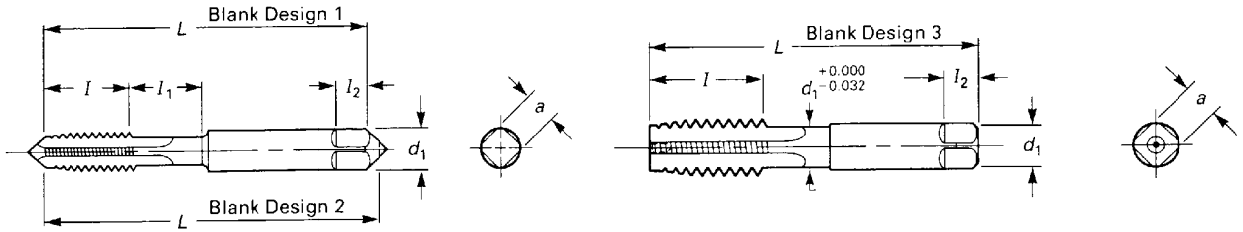
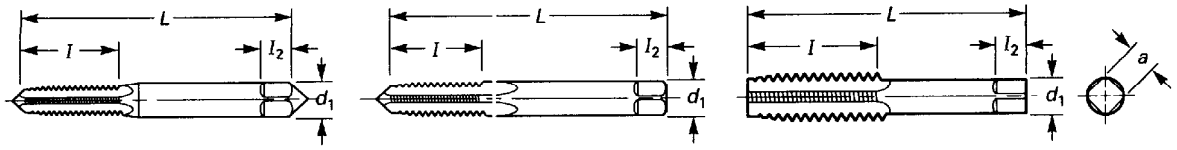


TABLE 2A OPTIONAL NECK AND OPTIONAL SHORTENED THREAD LENGTH (TAP DIMENSIONS, GROUND AND CUT THREAD)

General Dimensions												
Nominal Diameter		Machine Screw Size No.	Nominal Fractional Diameter (Decimal Equivalent), in.	Nominal Metric Diameter		Blank Design No.	Tap Dimensions, in.					
							Overall Length, L	Thread Length, l	Neck Length, l_1	Square Length, l_2	Shank Diameter, d_1	Size of Square, a
Over	To (Inclusive)			mm	in.							
0.104	0.117	4 (0.1120)	...	...	...	1	1.88	0.31	0.25	0.19	0.1410	0.110
0.117	0.130	5 (0.1250)	...	M3	(0.1181)	1	1.94	0.31	0.31	0.19	0.1410	0.110
0.130	0.145	6 (0.1380)	...	M3.5	(0.1378)	1	2.00	0.38	0.31	0.19	0.1410	0.110
0.145	0.171	8 (0.1640)	...	M4	(0.1575)	1	2.13	0.38	0.38	0.25	0.1680	0.131
0.171	0.197	10 (0.1900)	...	M4.5 M5	(0.1772) (0.1969)	1	2.38	0.50	0.38	0.25	0.1940	0.152
0.197	0.223	12 (0.2160)	...	...	...	1	2.38	0.50	0.44	0.28	0.2200	0.165
0.223	0.260	...	1/4 (0.2500)	M6	(0.2362)	2	2.50	0.63	0.38	0.31	0.2550	0.191
0.260	0.323	...	5/16 (0.3125)	M7 M8	(0.2756) (0.3150)	2	2.72	0.69	0.44	0.38	0.3180	0.238
0.323	0.395	...	3/8 (0.3750)	M10	(0.3937)	2	2.94	0.75	0.50	0.44	0.3810	0.286
0.395	0.448	...	7/16 (0.4375)	...	...	3	3.16	0.88	...	0.41	0.3230	0.242
0.448	0.510	...	1/2 (0.5000)	M12	(0.4724)	3	3.38	0.94	...	0.44	0.3670	0.275
0.510	0.573	...	9/16 (0.5625)	M14	(0.5512)	3	3.59	1.00	...	0.50	0.4290	0.322
0.573	0.635	...	5/8 (0.6250)	M16	(0.6299)	3	3.81	1.09	...	0.56	0.4800	0.360
0.635	0.709	...	11/16 (0.6875)	M18	(0.7087)	3	4.03	1.09	...	0.63	0.5420	0.406
0.709	0.760	...	3/4 (0.7500)	...	...	3	4.25	1.22	...	0.69	0.5900	0.442
0.760	0.823	...	13/16 (0.8125)	M20	(0.7874)	3	4.47	1.22	...	0.69	0.6520	0.489
0.823	0.885	...	7/8 (0.8750)	M22	(0.8661)	3	4.69	1.34	...	0.75	0.6970	0.523
0.885	0.948	...	15/16 (0.9375)	M24	(0.9449)	3	4.91	1.34	...	0.75	0.7600	0.570
0.948	1.010	...	1 (1.0000)	M25	(0.9843)	3	5.13	1.50	...	0.81	0.8000	0.600

GENERAL NOTES:
(a) Thread length, l, is based on a length of 12 pitches of the UNC thread series.
(b) Thread length, l, is a minimum value and has no tolerance.
(c) When thread length, l, is added to neck length, l_1, the total shall be no less than the minimum Table 2 thread length, l.
(d) Unless otherwise specified, all tolerances are in accordance with Table 2.
(e) For runout tolerances, see Table 6.
(f) For number of flutes see Table 3.



Blank Design 1 Blank Design 2 Blank Design 3

TABLE 2B STANDARD TAP DIMENSIONS (SCREW THREAD INSERTS [STI]: MACHINE SCREW AND FRACTIONAL SIZE, GROUND THREAD TAPS)

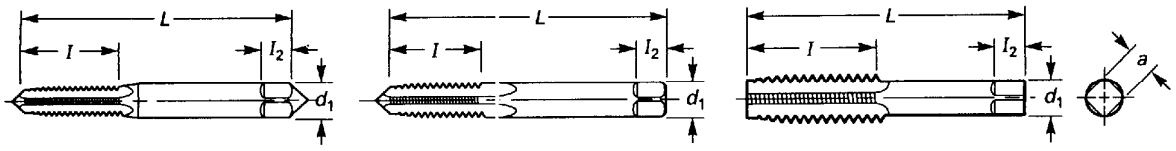
Nominal Size (STI)	Threads per Inch NC	Threads per Inch NF	Blank Design No.	Tap Dimensions, in. Overall Length, L	Thread Length, l	Square Length, l_2	Shank Diameter, d_1	Size of Square, a	Table 2 Blank Equivalent (Reference)
1	64	...	1	1.81	0.50	0.19	0.1410	0.110	No. 3
2	56	...	1	1.88	0.56	0.19	0.1410	0.110	No. 4
	...	64	1	1.88	0.56	0.19	0.1410	0.110	No. 4
3	48	...	1	1.94	0.63	0.19	0.1410	0.110	No. 5
	...	56	1	1.94	0.63	0.19	0.1410	0.110	No. 5
4	40	...	1	2.00	0.69	0.19	0.1410	0.110	No. 6
	...	48	1	2.00	0.69	0.19	0.1410	0.110	No. 6
5	40	...	1	2.13	0.75	0.25	0.1680	0.131	No. 8
6	32	...	1	2.38	0.88	0.25	0.1940	0.152	No. 10
	...	40	1	2.13	0.75	0.25	0.1680	0.131	No. 8
8	32	...	1	2.38	0.94	0.28	0.2200	0.165	No. 12
	...	36	1	2.38	0.94	0.28	0.2200	0.165	No. 12
10	24	...	2	2.50	1.00	0.31	0.2550	0.191	1/4
	...	32	2	2.50	1.00	0.31	0.2550	0.191	1/4
12	24	...	2	2.72	1.13	0.38	0.3180	0.238	5/16
1/4	20	...	2	2.72	1.13	0.38	0.3180	0.238	5/16
	...	28	2	2.72	1.13	0.38	0.3180	0.238	5/16
5/16	18	...	2	2.94	1.25	0.44	0.3810	0.286	3/8
	...	24	2	2.94	1.25	0.44	0.3810	0.286	3/8
3/8	16	...	3	3.38	1.66	0.44	0.3670	0.275	1/2
	...	24	3	3.16	1.44	0.41	0.3230	0.242	7/16
7/16	14	...	3	3.59	1.66	0.50	0.4290	0.322	9/16
	...	20	3	3.38	1.66	0.44	0.3670	0.275	1/2
1/2	13	...	3	3.81	1.81	0.56	0.4800	0.360	5/8
	...	20	3	3.59	1.66	0.50	0.4290	0.322	9/16
9/16	12	...	3	4.03	1.81	0.63	0.5420	0.406	11/16
	...	18	3	3.81	1.81	0.56	0.4800	0.360	5/8
5/8	11	...	3	4.25	2.00	0.69	0.5900	0.442	3/4
	...	18	3	4.03	1.81	0.63	0.5420	0.406	11/16
3/4	10	...	3	4.69	2.22	0.75	0.6970	0.523	7/8
	...	16	3	4.47	2.00	0.69	0.6520	0.489	13/16

(continued)

TABLE 2B STANDARD TAP DIMENSIONS (SCREW THREAD INSERTS [STI]: MACHINE SCREW AND FRACTIONAL SIZE, GROUND THREAD TAPS) (CONT'D)

Nominal Size (STI)	Threads per Inch		Blank Design No.	Tap Dimensions, in.					Table 2 Blank Equivalent (Reference)
	NC	NF		Overall Length, L	Thread Length, l	Square Length, l_2	Shank Diameter, d_1	Size of Square, a	
7/8	9	...	3	5.13	2.50	0.81	0.8000	0.600	1
	...	14	3	5.13	2.50	0.81	0.8000	0.600	1
1	8	...	3	5.75	2.56	1.00	1.0210	0.766	1 1/4
	...	12	3	5.44	2.56	0.88	0.8960	0.672	1 1/8
	...	14 NS	3	5.44	2.56	0.88	0.8960	0.672	1 1/8
1 1/8	7	...	3	6.06	3.00	1.06	1.1080	0.831	1 3/8
	...	12	3	5.75	2.56	1.00	1.0210	0.766	1 1/4
1 1/4	7	...	3	6.38	3.00	1.13	1.2330	0.925	1 1/2
	...	12	3	6.06	3.00	1.06	1.1080	0.831	1 3/8
1 3/8	6	...	3	6.69	3.19	1.13	1.3050	0.979	1 5/8
	...	12	3	6.38	3.00	1.13	1.2330	0.925	1 1/2
1 1/2	6	...	3	7.00	3.19	1.25	1.4300	1.072	1 3/4
	...	12	3	6.69	3.19	1.13	1.3050	0.979	1 5/8

GENERAL NOTES:
(a) These taps are larger than nominal size to the extent that the internal thread they produce will accommodate a helical coil screw insert, which at final assembly will accept a screw thread of the normal size and pitch.
(b) For optional necks, refer to Table 2A using dimensions for equivalent blank sizes.
(c) Ground thread taps, STI sizes 5/16 in. and smaller, have external center on thread end (may be removed on bottom taps).
(d) Ground thread taps, STI sizes no. 10 through 5/16 in., will have an external partial cone center on the shank end, with the length of the cone center approximately 1/4 of the diameter of shank.
(e) Ground thread taps, STI sizes larger than 5/16 in., may have internal centers in both the thread and shank ends.
(f) For runout tolerances of tap elements, refer to Table 6 using dimensions for equivalent blank sizes.
(g) For number of flutes, refer to Table 3 using dimensions for equivalent blank sizes.
(h) For general dimension tolerances, refer to Table 2 using Table 2 equivalent blank size.



Blank Design 1 Blank Design 2 Blank Design 3

TABLE 2C STANDARD TAP DIMENSIONS (SCREW THREAD INSERTS [STI], METRIC SIZE TAPS)

Nominal Size (STI)	Thread Pitch, mm		Blank Design No.	Tap Dimensions, in. Overall Length, L	Thread Length, l	Square Length, l_2	Shank Diameter, d_1	Size of Square, a	Table 2 Blank Equivalent (Reference)
M2.2	0.45	...	1	1.88	0.56	0.19	0.1410	0.110	No. 4
M2.5	0.45	...	1	1.94	0.63	0.19	0.1410	0.110	No. 5
M3	0.5	...	1	2.00	0.69	0.19	0.1410	0.110	No. 6
M3.5	0.6	...	1	2.13	0.75	0.25	0.1680	0.131	No. 8
M4	0.7	...	1	2.38	0.88	0.25	0.1940	0.152	No. 10
M5	0.8	...	2	2.50	1.00	0.31	0.2550	0.191	1/4
M6	1	...	2	2.72	1.13	0.38	0.3180	0.238	5/16
M7	1	...	2	2.94	1.25	0.44	0.3810	0.286	3/8
M8	1.25	...	2	2.94	1.25	0.44	0.3810	0.286	3/8
	...	1	2	2.94	1.25	0.44	0.3810	0.286	3/8
M10	1.5	...	3	3.38	1.66	0.44	0.3670	0.275	1/2
	1.5	1.25	3	3.38	1.66	0.44	0.3670	0.275	1/2
	...	1	3	3.16	1.44	0.41	0.3230	0.242	7/16
M12	1.75	...	3	3.59	1.66	0.50	0.4290	0.322	9/16
	...	1.5	3	3.59	1.66	0.50	0.4290	0.322	9/16
	...	1.25	3	3.59	1.66	0.50	0.4290	0.322	9/16
M14	2	...	3	4.03	1.81	0.63	0.5420	0.406	11/16
	...	1.5	3	3.81	1.81	0.56	0.4800	0.360	5/8
M16	2	...	3	4.25	2.00	0.69	0.5900	0.442	3/4
	...	1.5	3	4.03	1.81	0.63	0.5420	0.406	11/16
M18	2.5	...	3	4.69	2.22	0.75	0.6970	0.523	7/8
	...	2	3	4.47	2.00	0.69	0.6520	0.489	13/16
	...	1.5	3	4.47	2.00	0.69	0.6520	0.489	13/16
M20	2.5	...	3	4.91	2.22	0.75	0.7600	0.570	15/16
	...	2	3	4.91	2.22	0.75	0.7600	0.570	15/16
	...	1.5	3	4.69	2.22	0.75	0.6970	0.523	7/8
M22	2.5	...	3	5.13	2.50	0.81	0.8000	0.600	1
	...	2	3	5.13	2.50	0.81	0.8000	0.600	1
	...	1.5	3	4.91	2.22	0.75	0.7600	0.570	15/16
M24	3	...	3	5.44	2.56	0.88	0.8960	0.672	1 1/8
	...	2	3	5.13	2.50	0.88	0.8960	0.672	1 1/16
M27	3	...	3	5.75	2.56	1.00	1.0210	0.766	1 1/4
	...	2	3	5.44	2.56	0.88	0.8960	0.672	1 1/8

(continued)

TABLE 2C STANDARD TAP DIMENSIONS (SCREW THREAD INSERTS [STI], METRIC SIZE TAPS) (CONT'D)

Nominal Size (STI)	Thread Pitch, mm		Blank Design No.	Tap Dimensions, in. Overall Length, L	Thread Length, l	Square Length, l_2	Shank Diameter, d_1	Size of Square, a	Table 2 Blank Equivalent (Reference)
M30	3.5	...	3	6.06	3.00	1.06	1.1080	0.831	1 3/8
	...	2	3	5.75	2.56	1.00	1.0210	0.766	1 1/4
M33	3.5	...	3	6.38	3.00	1.13	1.2330	0.925	1 1/2
	...	2	3	6.06	3.00	1.06	1.1080	0.831	1 3/8
M36	4	...	3	6.69	3.19	1.13	1.3050	0.979	1 5/8
	...	3	3	6.69	3.19	1.13	1.3050	0.979	1 5/8
	...	2	3	6.69	3.19	1.13	1.3050	0.979	1 5/8
M39	4	...	3	7.00	3.19	1.25	1.4300	1.072	1 3/4
	...	3	3	7.00	3.19	1.25	1.4300	1.072	1 3/4
	...	2	3	7.00	3.19	1.25	1.4300	1.072	1 3/4

GENERAL NOTES:

(a) These taps are larger than nominal size to the extent that the internal thread they produce will accommodate a helical coil screw insert, which at final assembly will accept a screw thread of the normal size and pitch.
(b) For optional necks, refer to Table 2 using dimensions for equivalent blank sizes.
(c) Ground thread taps, STI sizes M8 and smaller, have external center on thread end may be removed on bottom taps.
(d) Ground thread taps, STI sizes no. M5 through M8, will have an external partial cone center on the shank end with the length of the cone center approximately 1/4 of the diameter of shank.
(e) Ground thread taps, STI sizes larger than M8, will have internal centers in both the thread and shank ends.
(f) For runout tolerances of tap elements, refer to Table 6 using dimensions for equivalent blank sizes.
(g) For number of flutes, refer to Table 3 using dimensions for equivalent blank sizes.
(h) For general dimension tolerances, refer to Table 2 using Table 2 equivalent blank size.

TABLE 3 STANDARD NUMBER OF FLUTES (GROUND AND CUT THREAD)

Nominal Size							Number of Flutes						
		Metric		TPI/Pitch			Straight Flutes		Spiral Point				
Machine Screw	Fractional	mm	in.	UNC NC	UNF NF	mm	Standard	Optional	Standard	Optional	Spiral Point Only (Standard)	Reg. Spiral Flute (Standard)	Fast Spiral Flute (Standard)
0 (0.0600)	...	M1.6	(0.0630)	...	80	0.35	2	...	2	...	...	...	...
1 (0.0730)	...	...	...	64	72	...	2	...	2	...	...	...	...
2 (0.0860)	...	M2	(0.0787)	56	64	0.4	3	2	2	...	...	...	...
3 (0.0990)	...	M2.5	(0.0984)	48	56	0.45	3	2	2	...	...	...	2
4 (0.1120)	...	...	...	40	48	...	3	2	2	...	2	2	2
5 (0.1250)	...	M3	(0.1181)	40	44	0.5	3	2	2		2	2	2
6 (0.1380)	...	M3.5	(0.1378)	32	40	0.6	3	2	2	...	2	2	2
8 (0.1640)	...	M4	(0.1575)	32	36	0.7	4	2/3	2	...	2	2	3
10 (0.1900)	...	M4.5	(0.1772)	24	32	0.75	4	2/3	2	...	2	2	3
...	...	M5	(0.1969)	...	...	0.8	4	2/3	2	...	2	2	3
12 (0.2160)	...	...	...	24	28	...	4	2/3	2	...	2	2	3
...	1/4 (0.2500)	M6	(0.2362)	20	28	1.0	4	2/3	2	3	2	(3 optional)	3
...	...	M7	(0.2756)	18	24	1.0	4	2/2	2	3	2	3	3
...	5/16 (0.3125)	M8	(0.3150)	18	24	1.25	4	2/3	2	3	2	3	3
...	3/8 (0.3750)	M10	(0.3937)	16	24	1.5	4	3	3	...	3	3	3
...	7/16 (0.4375)	...	...	14	20	...	4	3	3	...	3	3	3
...	1/2 (0.5000)	M12	(0.4724)	13	20	1.75	4	3	3	...	...	...	3
...	9/16 (0.5625)	M14	(0.5512)	12	18	2.0	4	...	3	...	...	...	...
...	5/8 (0.6250)	M16	(0.6299)	11	18	2.0	4	...	3	...	...	...	...
...	3/4 (0.7500)	...	...	10	16	...	4	...	3	...	...	...	...
...	...	M20	(0.7874)	...	...	2.5	4	...	...	...	...	...	...
...	7/8 (0.8750)	...	...	9	14	...	4	...	...	...	...	...	...
...	...	M24	(0.9449)	...	...	3.0	4	...	...	...	...	...	...
...	1 (1.0000)	...	...	8	12	...	4	...	...	...	...	...	...
...	1 1/8 (1.1250)	...	...	7	12	...	4	...	...	...	...	...	...
...	...	M30	(1.1811)	...	...	3.5	4	...	...	...	...	...	...
...	1 1/4 (1.2500)	...	...	7	...	...	4	...	...	...	...	...	...
...	...	...	...	...	12	...	6	...	...	...	...	...	...
...	1 3/8 (1.3750)	...	...	6	...	...	4	...	...	...	...	...	...
...	...	...	...	...	12	...	6	...	...	...	...	...	...

(continued)

TABLE 3 STANDARD NUMBER OF FLUTES (GROUND AND CUT THREAD) (CONT'D)

Nominal Size							Number of Flutes						
		Metric		TPI/Pitch			Straight Flutes		Spiral Point				
Machine Screw	Fractional	mm	in.	UNC NC	UNF NF	mm	Standard	Optional	Standard	Optional	Spiral Point Only (Standard)	Reg. Spiral Flute (Standard)	Fast Spiral Flute (Standard)
...	...	M36	(1.4173)	...	...	4.0	4	...	...	...	...	...	...
...	1½ (1.5000)	...	...	6	...	...	4	...	...	...	...	...	...
...	...	...	...	...	12	...	6	...	...	...	...	...	...
...	1¾ (1.7500)	...	...	5	...	...	6	...	...	...	...	...	...
...	2 (2.0000)	...	...	4½	...	...	6	...	...	...	...	...	...

GENERAL NOTES:
(a) For pulley taps see Table 4.
(b) For taper pipe see Table 5.
(c) For straight pipe taps see Table 5.
(d) For STI taps, use number of flutes for blank size equivalent on Table 2.
(e) For optional flutes see section 5, no. 043.

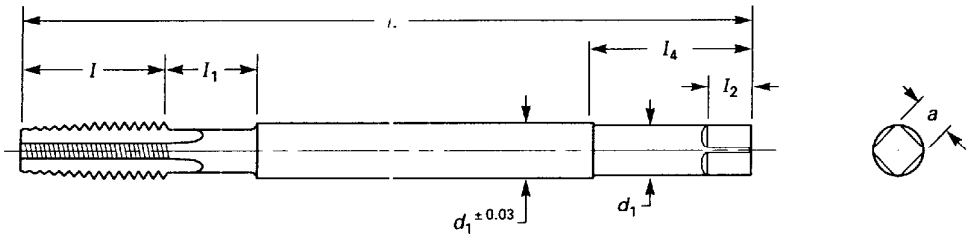


TABLE 4 PULLEY TAPS, FRACTIONAL SIZE (HIGH-SPEED STEEL, GROUND THREAD)

General Dimensions									
			Tap Dimensions, in.						
Nominal Fractional Diameter, in.	Threads per Inch (NC, UNC)	Number of Flutes	Overall Length, L	Thread Length, l	Neck Length, l_1	Square Length, l_2	Length of Shank Close Tolerance Section, l_4 [Note (1)]	Shank Diameter, d_1	Size of Square, a [Note (2)]
1/4 (0.2500)	20	4	6, 8	1.00	0.38	0.31	1.50	0.2550	0.191
5/16 (0.3125)	18	4	6, 8	1.13	0.38	0.38	1.56	0.3180	0.238
3/8 (0.3750)	16	4	6, 8, 10	1.25	0.38	0.44	1.63	0.3810	0.286
7/16 (0.4375)	14	4	6, 8	1.44	0.44	0.50	1.69	0.4440	0.333
1/2 (0.5000)	13	4	6, 8, 10, 12	1.66	0.50	0.56	1.69	0.5070	0.380
5/8 (0.6250)	11	4	6, 8, 10, 12	1.81	0.63	0.69	2.00	0.6330	0.475
3/4 (0.7500)	10	4	10, 12	2.00	0.75	0.75	2.25	0.7590	0.569

Tolerances			
Element	Size Range	Direction	Tolerance
Overall length, L	1/4 to 3/4 (0.25 to 0.75) inclusive	Plus or minus	0.06
Thread length, l	1/4 to 3/4 (0.25 to 0.75) inclusive	Plus or minus	0.06
Neck length, l_1	1/4 to 3/4 (0.25 to 0.75) inclusive	[Note (4)]	[Note (4)]
Square length, l_2	1/4 to 3/4 (0.25 to 0.75) inclusive	Plus or minus	0.03
Length of close tolerance shank, l_4	1/4 to 3/4 (0.25 to 0.75) inclusive	[Note (1)]	[Note (1)]
Shank diameter, d_1 [Note (3)]	1/4 to 3/4 (0.25 to 0.75) inclusive	Minus	0.0050
Size of square, a [Note (2)]	1/4 to 1/2 (0.25 to 0.50) inclusive	Minus	0.004
	5/8 to 3/4 (0.625 to 0.75) inclusive	Minus	0.006

GENERAL NOTES:
(a) These taps are standard with plug chamfer in H3 limit only.
(b) All dimensions are given in inches.
(c) These taps have internal center in the thread end.
(d) For standard thread limits see Table 10A.
(e) For runout tolerances of tap elements see Table 6.
(f) For chamfer dimensions, see Table 16.

NOTES:
(1) Length of close tolerance shank, l_4, is a minimum length that is held to runout tolerances per Table 6.
(2) Size of square, a, is equal to $0.75d_1$ to the nearest 0.001 in.
(3) Shank diameter, d_1, is approximately the same as the maximum major diameter for that size.
(4) Neck length, l_1, is optional with manufacturer.

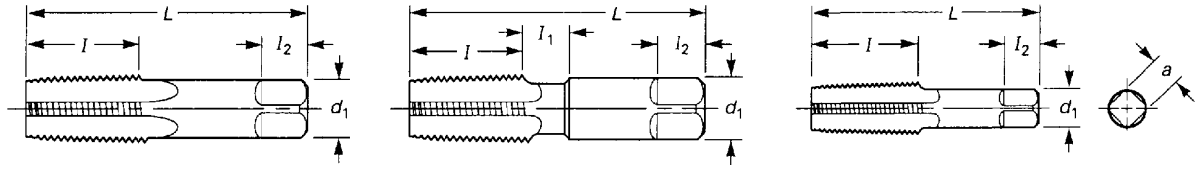


TABLE 5 STRAIGHT AND TAPER PIPE TAPS (GROUND AND CUT THREAD)

Standard Tap Dimensions

Nominal Size, in. [Note (1)]	Threads per Inch	Number of Flutes: Regular Thread	Number of Flutes: Interrupted Thread	Length Overall, L	Length of Thread, l	Length of Square, l_2	Diameter of Shank, d_1	Size of Square, a	Length Optional Neck, l_1	Ground Thread: NPT NPTF ANPT	Ground Thread: NPSC NPSM NPSF	Cut Thread Only: NPT	Cut Thread Only: NPSC NPSM
1/16	27	4	...	2.13	0.69	0.38	0.3125	0.234	0.375	[Note (2)]	...	...	...
1/8	27	4	5	2.13	0.75	0.38	0.3125	0.234	...	[Notes (2), (3)]	[Notes (5), (6)]	[Notes (7)–(9)]	...
1/8	27	4	5	2.13	0.75	0.38	0.4375	0.328	0.375	[Notes (2), (3)]	[Notes (5), (6)]	[Notes (7)–(9)]	[Note (1)]
1/4	18	4	5	2.44	1.06	0.44	0.5625	0.421	0.375	[Notes (2), (3)]	[Notes (5), (6)]	[Notes (7)–(9)]	[Note (1)]
3/8	18	4	5	2.56	1.06	0.50	0.7000	0.531	0.375	[Notes (2), (3)]	[Notes (5), (6)]	[Notes (7)–(9)]	[Note (1)]
1/2	14	4	5	3.13	1.38	0.63	0.6875	0.515	...	[Notes (2), (3)]	[Notes (5), (6)]	[Notes (7)–(9)]	[Note (1)]
3/4	14	5	5	3.25	1.38	0.69	0.9063	0.679	...	[Notes (2), (3)]	[Notes (5), (6)]	[Notes (7)–(9)]	[Note (1)]
1	11 1/2	5	5	3.75	1.75	0.81	1.1250	0.843	...	[Notes (2), (3)]	[Note (5)]	[Notes (7)–(9)]	[Note (1)]
1 1/4	11 1/2	5	5	4.00	1.75	0.94	1.3125	0.984	...	[Notes (2), (3)]	...	[Notes (7)–(9)]	...
1 1/2	11 1/2	7	7	4.25	1.75	1.00	1.5000	1.125	...	[Notes (2), (4)]	...	[Notes (7), (9)]	...
2	11 1/2	7	7	4.25	1.75	1.13	1.8750	1.406	...	[Notes (2), (4)]	...	[Notes (7), (9)]	...
2 1/2	8	8	...	5.50	2.56	1.25	2.2500	1.687	...	...	...	[Note (9)]	...
3	8	8	...	6.00	2.63	1.38	2.6250	1.968	...	...	...	[Note (9)]	...

Tolerances

Element	Ground Thread: Size Range	Ground Thread: Direction	Ground Thread: Tolerance	Cut Thread: Size Range	Cut Thread: Direction	Cut Thread: Tolerance
Length overall	1/16 to 3/4 inclusive	Plus or minus	0.031	1/8 to 3/4 inclusive	Plus or minus	0.031
	1 to 2 inclusive	Plus or minus	0.063	1 to 3 inclusive	Plus or minus	0.063
Length of thread	1/16 to 3/4 inclusive	Plus or minus	0.063	1/8 to 3/4 inclusive	Plus or minus	0.063
	1 to 1 1/4 inclusive	Plus or minus	0.094	1 to 1 1/4 inclusive	Plus or minus	0.094
	1 1/2 to 2 inclusive	Plus or minus	0.125	1 1/2 to 3 inclusive	Plus or minus	0.125
Length of square	1/16 to 3/4 inclusive	Plus or minus	0.031	1/8 to 3/4 inclusive	Plus or minus	0.031
	1 to 2 inclusive	Plus or minus	0.063	1 to 3 inclusive	Plus or minus	0.063

(continued)

TABLE 5 STRAIGHT AND TAPER PIPE TAPS (GROUND AND CUT THREAD) (CONT'D)

	Tolerances					
	Ground Thread			Cut Thread		
Element	Size Range	Direction	Tolerance	Size Range	Direction	Tolerance
Diameter of shank	1/16 and 1/8	Minus	0.002	1/8 to 1/2 inclusive	Minus	0.007
	1/4 to 1 inclusive	Minus	0.002	3/4 to 3 inclusive	Minus	0.009
	1 1/4 to 2 inclusive	Minus	0.003	...	...	...
Size of square	1/16 and 1/8	Minus	0.004	1/8	Minus	0.004
	1/4 to 3/4 inclusive	Minus	0.006	1/4 to 3/4 inclusive	Minus	0.006
	1 to 2 inclusive	Minus	0.008	1 to 3 inclusive	Minus	0.008

GENERAL NOTES:
(a) All dimensions are given in inches.
(b) The first few threads on interrupted thread pipe taps are left full.
(c) These taps have internal centers.
(d) For runout tolerances of tap elements see Table 6.
(e) Taps marked NPS are suitable for NPSC and NPSM.
(f) These taps have 2 to 3 1/2 threads chamfer. See Table 2.
(g) Optional neck is for manufacturing use only.
(h) For taper pipe thread limits see Table 13.
(i) For straight pipe thread limits see Tables 14, 14A, and 15.

NOTES:
The following styles and sizes are considered standard.
(1) Pipe taps 1/8 in. are furnished with large size shanks unless the small shank is specified.
(2) High-speed ground thread 1/16 to 2 in. including noninterrupted (NPT, NPTF, and ANPT).
(3) High-speed ground thread 1/8 to 1 1/4 in. including interrupted (NPT, NPTF, and ANPT).
(4) High-speed ground thread 1 1/2 and 2 in. including interrupted (NPT).
(5) High-speed ground thread 1/8 to 1 in. including noninterrupted (NPSC and NPSM).
(6) High-speed cut thread 1/8 to 1 in. including noninterrupted (NPSC and NPSM).
(7) High-speed cut thread 1/8 to 2 in. including noninterrupted (NPT).
(8) High-speed cut thread 1/8 to 1 1/4 in. including interrupted (NPT).
(9) Carbon cut thread 1/8 to 3 in. including noninterrupted (NPT).

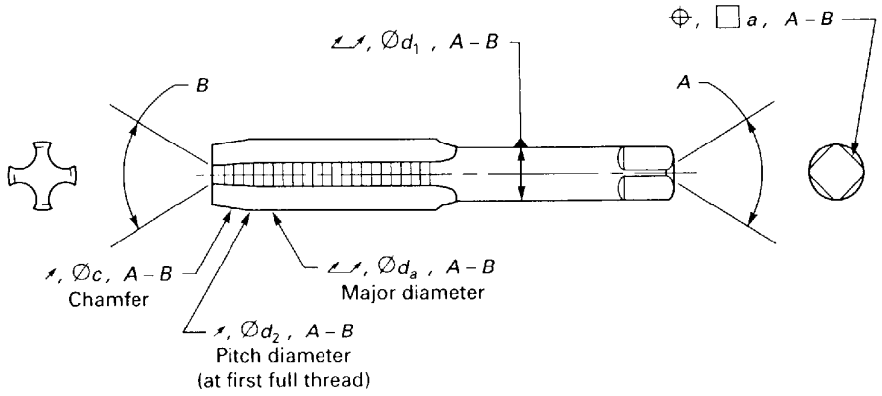


TABLE 6 RUNOUT AND LOCATION TOLERANCE OF TAP ELEMENTS

	Range Sizes (Inclusive)			Total Runout, FIM, in.		
	Fractional Machine Screw	Metric	Pipe, in.	Cut Thread	Ground Thread	Location, in.
Shank, d_1	# 0–5/16	M1.6–M8	1/16	0.0060	0.0010	. . .
	11/32–4	M10–M100	1/8–4	0.0080	0.0016	
Major diameter, d_a	# 0–5/16	M1.6–M8	1/16	0.0050	0.0010	. . .
	11/32–4	M10–M100	1/8–4	0.0080	0.0016	
Pitch diameter, d_2 (at first full thread)	# 0–5/16	M1.6–M8	1/16	0.0050	0.0010	. . .
	11/32–4	M10–M100	1/8–4	0.0080	0.0016	
Chamfer, c [Note (1)]	# 0–1/2	M1.6–M12	1/16–1/8	0.0040	0.0020	. . .
	17/32–4	M14–M100	1/4–4	0.0060	0.0030	
Square, a (at central point)	# 0–1/2	M1.6—M12	1/16–1/8	. . .	. . .	0.0060
	17/32–4	M14–M100	1/4–4	. . .	. . .	0.0080

NOTE:
(1) Chamfer should preferably be inspected by light projection to avoid errors due to indicator contact points dropping into the thread groove.

TABLE 7 TAP THREAD LIMITS AND TOLERANCES, FORMULAS FOR UNIFIED INCH SCREW THREADS (GROUND THREAD)

Formulas

Max. major diameter = Basic plus A
Min. major diameter = Max. minus B
Max. pitch diameter = Min. plus D
Min. pitch diameter = Basic plus C

In the above formulas:

A = Constant to add = $0.130P$ for all pitches
B = Major diameter tolerance = $0.087P$ for 48 through 80 TPI
= $0.076P$ for 36 through 47 TPI
= $0.065P$ for 4 through 35 TPI
C = Amount over basic for minimum pitch diameter
D = Pitch diameter tolerance

			C			*D*			
Threads per Inch	*A*	*B*	To $^5/_8$ in., Inclusive	Over $^5/_8$ in. to $2^1/_2$ in., Inclusive	Over $2^1/_2$ in.	To 1 in., Inclusive	Over 1 in. to $1^1/_2$ in., Inclusive	Over $1^1/_2$ in. to $2^1/_2$ in., Inclusive	Over $2^1/_2$ in.
80	0.0016	0.0011	0.0005	0.0010	0.0015	0.0005	0.0010	0.0010	0.0015
72	0.0018	0.0012	0.0005	0.0010	0.0015	0.0005	0.0010	0.0010	0.0015
64	0.0020	0.0014	0.0005	0.0010	0.0015	0.0005	0.0010	0.0010	0.0015
56	0.0023	0.0016	0.0005	0.0010	0.0015	0.0005	0.0010	0.0010	0.0015
48	0.0027	0.0018	0.0005	0.0010	0.0015	0.0005	0.0010	0.0010	0.0015
44	0.0030	0.0017	0.0005	0.0010	0.0015	0.0005	0.0010	0.0010	0.0015
40	0.0032	0.0019	0.0005	0.0010	0.0015	0.0005	0.0010	0.0010	0.0015
36	0.0036	0.0021	0.0005	0.0010	0.0015	0.0005	0.0010	0.0010	0.0015
32	0.0041	0.0020	0.0010	0.0010	0.0015	0.0005	0.0010	0.0010	0.0015
28	0.0046	0.0023	0.0010	0.0010	0.0015	0.0005	0.0010	0.0010	0.0015
24	0.0054	0.0027	0.0010	0.0010	0.0015	0.0005	0.0010	0.0015	0.0015
20	0.0065	0.0032	0.0010	0.0010	0.0015	0.0005	0.0010	0.0015	0.0015
18	0.0072	0.0036	0.0010	0.0010	0.0015	0.0005	0.0010	0.0015	0.0015
16	0.0081	0.0041	0.0010	0.0010	0.0015	0.0005	0.0010	0.0015	0.0020
14	0.0093	0.0046	0.0010	0.0015	0.0015	0.0005	0.0010	0.0015	0.0020
13	0.0100	0.0050	0.0010	0.0015	0.0015	0.0005	0.0010	0.0015	0.0020
12	0.0108	0.0054	0.0010	0.0015	0.0015	0.0005	0.0010	0.0015	0.0020
11	0.0118	0.0059	0.0010	0.0015	0.0020	0.0005	0.0010	0.0015	0.0020
10	0.0130	0.0065	...	0.0015	0.0020	0.0005	0.0010	0.0015	0.0020
9	0.0144	0.0072	...	0.0015	0.0020	0.0005	0.0010	0.0015	0.0020
8	0.0162	0.0081	...	0.0015	0.0020	0.0005	0.0010	0.0015	0.0020
7	0.0186	0.0093	...	0.0015	0.0020	0.0010	0.0010	0.0020	0.0025
6	0.0217	0.0108	...	0.0015	0.0020	0.0010	0.0010	0.0020	0.0025
$5^1/_2$	0.0236	0.0118	...	0.0015	0.0020	0.0010	0.0015	0.0020	0.0025
5	0.0260	0.0130	...	0.0015	0.0020	0.0010	0.0015	0.0020	0.0025
$4^1/_2$	0.0289	0.0144	...	0.0015	0.0020	0.0010	0.0015	0.0020	0.0025
4	0.0325	0.0162	...	0.0015	0.0020	0.0010	0.0015	0.0020	0.0025

(continued)

TABLE 7 TAP THREAD LIMITS AND TOLERANCES, FORMULAS FOR UNIFIED INCH SCREW THREADS (GROUND THREAD) (CONT'D)

GENERAL NOTES:
(a) Dimensions are given in inches.
(b) The tables and formulas are used in determining the limits and tolerances for ground thread taps having a thread lead angle not in excess of 5 deg, unless otherwise specified.
(c) When the tap major diameter must be determined from a specified tap pitch diameter, the maximum major diameter equals the minimum specified pitch diameter minus Constant *C*, plus 0.04951904*P* Constant *A*.
(d) For intermediate pitches use value for next coarser pitch for *C* and *D*, but use formulas for *A* and *B*.

Lead Tolerance

A maximum lead deviation of ±0.0005 in. within any two threads not farther apart than 1 in. is permitted.

Angle Tolerance

Threads per Inch	Deviation in Half Angle
4 to 5½, inclusive	±0 deg 20 min
6 to 9, inclusive	±0 deg 25 min
10 to 80, inclusive	±0 deg 30 min

TABLE 8 TAP THREAD LIMITS AND TOLERANCES, FORMULAS FOR METRIC THREADS (GROUND THREAD)

Formulas

Min. major diameter = Basic plus W
Max. major diameter = Min. plus X
Max. pitch diameter = Basic plus Y
Min. pitch diameter = Max. minus Z

W = Constant to add to basic major diameter ($W = 0.080P$)
X = Major diameter tolerance
Y = Amount over basic for maximum pitch diameter
Z = Pitch diameter

P			Y				Z			
Pitch, mm	W (0.08P)	X	M1.6 to M6.3, Inclusive	Over M6.3 to M25, Inclusive	Over M25 to M90, Inclusive	Over M90	M1.6 to M6.3, Inclusive	Over M6.3 to M25, Inclusive	Over M25 to M90, Inclusive	Over M90
0.3	0.024	0.025	0.039	0.039	0.052	0.052	0.015	0.015	0.020	0.020
0.35	0.028	0.025	0.039	0.039	0.052	0.052	0.015	0.015	0.020	0.020
0.4	0.032	0.025	0.039	0.052	0.052	0.052	0.015	0.015	0.020	0.025
0.45	0.036	0.025	0.039	0.052	0.052	0.052	0.015	0.020	0.020	0.025
0.5	0.040	0.025	0.039	0.052	0.052	0.065	0.015	0.020	0.025	0.025
0.6	0.048	0.025	0.052	0.052	0.065	0.065	0.020	0.020	0.025	0.025
0.7	0.056	0.041	0.052	0.052	0.065	0.065	0.020	0.020	0.025	0.025
0.75	0.060	0.041	0.052	0.065	0.065	0.078	0.020	0.025	0.025	0.031
0.8	0.064	0.041	0.052	0.065	0.065	0.078	0.020	0.025	0.025	0.031
0.9	0.072	0.041	0.052	0.065	0.065	0.078	0.020	0.025	0.025	0.031
1	0.080	0.041	0.065	0.065	0.078	0.025	0.025	0.025	0.031	0.031
1.25	0.100	0.064	0.065	0.065	0.078	0.091	0.025	0.031	0.031	0.041
1.5	0.120	0.064	0.065	0.078	0.078	0.091	0.025	0.031	0.031	0.041
1.75	0.140	0.064	...	0.078	0.091	0.104	...	0.031	0.041	0.041
2	0.160	0.064	...	0.091	0.091	0.104	...	0.041	0.041	0.041
2.5	0.200	0.063	...	0.091	0.104	0.117	...	0.041	0.041	0.052
3	0.240	0.100	...	0.104	0.104	0.130	...	0.041	0.052	0.052
3.5	0.280	0.100	...	0.104	0.117	0.130	...	0.041	0.052	0.052
4	0.320	0.100	...	0.104	0.117	0.143	...	0.052	0.052	0.064
4.5	0.360	0.100	...	...	0.130	0.143	...	0.052	0.052	0.064
5	0.400	0.100	...	...	0.130	0.156	...	...	0.064	0.064
5.5	0.440	0.100	...	...	0.143	0.156	...	...	0.064	0.064
6	0.480	0.100	...	...	0.143	0.156	...	...	0.064	0.064

GENERAL NOTES:
(a) Dimensions are given in millimeters.
(b) The tables and formulas are used in determining the limits and tolerances for ground thread metric taps having a thread lead angle not in excess of 5 deg, unless otherwise specified. They apply only to metric threads having a 60-deg form with a $^{P}/_{8}$ flat at the major diameter of the basic thread form. All calculations for metric taps are done using millimeter values as shown. When inch values are needed, they are translated from the three-place millimeter tap diameters only after calculations are complete.
(c) When the tap major diameter must be determined from a specified tap pitch diameter, the minimum major diameter equals the maximum specified tap pitch diameter minus Constant Y, plus $0.64951904P$ plus Constant W.
(d) For intermediate pitches use value for next coarser pitch.

Lead Tolerance

A maximum lead deviation of ±0.013 mm within any two threads not farther apart than 25 mm is permitted.

Angle Tolerance	
Pitch, mm	Deviation in Half Angles
Over 0.25 to 2.5, inclusive	±0 deg 30 min
Over 2.5 to 4, inclusive	±0 deg 25 min
Over 4 to 6, inclusive	±0 deg 20 min

TABLE 9 TAP THREAD LIMITS AND TOLERANCES, FORMULAS FOR UNIFIED INCH SCREW THREADS (CUT THREAD)

Formulas

Min. major diameter = Basic plus ($B + C$)
Max. major diameter = Min. plus A

Min. pitch diameter = Basic plus B
Max. pitch diameter = Min. plus D

A = Major diameter tolerance
B = Amount minimum pitch diameter is over basic
C = A constant to add:
20% of the theoretical truncation for 2 to 5½ threads per inch
25% for 6 to 80 threads per inch
D = Pitch diameter tolerance

Values for *A*, *B*, and *D*

Diameter of Tap, in.	*A*	*B*		*D*	
		36 or More Threads per Inch	34 or Less Threads per Inch	Coarser than N.F.	N.F. and Finer [Note (1)]
0 to 0.099, inclusive	0.0015	0.0002	0.0005	0.0010	0.0010
0.100 to 0.249, inclusive	0.0020	0.0002	0.0005	0.0015	0.0015
¼ to ⅜, inclusive	0.0025	0.0005	0.0005	0.0020	0.0015
Over ⅜ to ⅝, inclusive	0.0030	0.0005	0.0005	0.0025	0.0020
Over ⅝ to ¾, inclusive	0.0040	0.0005	0.0005	0.0030	0.0025
Over ¾ to 1, inclusive	0.0040	0.0010	0.0010	0.0030	0.0025
Over 1 to 1½, inclusive	0.0045	0.0010	0.0010	0.0035	0.0030
Over 1½ to 2, inclusive	0.0055	0.0015	0.0015	0.0040	0.0030
Over 2 to 2¼, inclusive	0.0060	0.0015	0.0015	0.0045	0.0035
Over 2¼ to 2½, inclusive	0.0060	0.0020	0.0020	0.0045	0.0035
Over 2½ to 3, inclusive	0.0070	0.0020	0.0020	0.0050	0.0035
Over 3	0.0070	0.0025	0.0025	0.0055	0.0045

Values for *C*

Threads per Inch	Constant	Threads per Inch	Constant	Threads per Inch	Constant	Threads per Inch	Constant
2	0.0217	7	0.0077	18	0.0030	36	0.0015
2½	0.0173	8	0.0068	20	0.0027	40	0.0014
3	0.0144	9	0.0060	22	0.0025	48	0.0011
3½	0.0124	10	0.0054	24	0.0023	50	0.0011
4	0.0108	11	0.0049	26	0.0021	56	0.0010
4½	0.0096	12	0.0045	27	0.0020	60	0.0009
5	0.0087	13	0.0042	28	0.0019	64	0.0008
5½	0.0079	14	0.0039	30	0.0018	72	0.0008
6	0.0090	16	0.0034	32	0.0017	80	0.007

(continued)

TABLE 9 TAP THREAD LIMITS AND TOLERANCES, FORMULAS FOR UNIFIED INCH SCREW THREADS (CUT THREAD) (CONT'D)

GENERAL NOTES:
(a) Dimensions are given in inches.
(b) The tables and formulas are used in determining the limits and tolerances for cut thread taps having special diameter, special pitch, or both.
(c) For intermediate pitches use constant for next coarser pitch.

NOTE:
(1) Taps over 1½ in. with 10 or more threads per inch have tolerances for N.F. and finer.

Lead Tolerance

A maximum lead deviation of ±0.003 in. in 1 in. of thread is permitted.

	Angle Tolerance	
Threads per Inch	**Deviation in Half Angle**	**Deviation in Full Angle**
4 and coarser	±0 deg 30 min	0 deg 45 min
4½ to 5½, inclusive	±0 deg 35 min	0 deg 53 min
6 to 9, inclusive	±0 deg 40 min	0 deg 60 min
10 to 28, inclusive	±0 deg 45 min	0 deg 68 min
30 and finer	±0 deg 60 min	0 deg 90 min

TABLE 10 TAP THREAD LIMITS: MACHINE SCREW SIZES, GROUND THREAD (UNIFIED AND AMERICAN NATIONAL THREAD FORMS, STANDARD THREAD LIMITS)

Size, in.	Threads per Inch NC UNC	Threads per Inch NF UNF	NS	Major Diameter Basic	Major Diameter Min.	Major Diameter Max.	Pitch Diameter Basic	H1 Limit Min.	H1 Limit Max.	H2 Limit Min.	H2 Limit Max.	H3 Limit Min.	H3 Limit Max.	H4 Limit Min.	H4 Limit Max.	H5 Limit Min.	H5 Limit Max.	H6 Limit [Note (1)] Min.	H6 Limit [Note (1)] Max.	H7 Limit [Note (2)] Min.	H7 Limit [Note (2)] Max.	H10 Limit [Note (3)] Min.	H10 Limit [Note (3)] Max.
0	...	80	...	0.0600	0.0605	0.0616	0.0519	0.0519	0.0524	0.0524	0.0529	...	...	...	...	...	...	...	...	...	...	...	...
1	64	...	...	0.0730	0.0736	0.0750	0.0629	0.0629	0.0634	0.0634	0.0639	...	...	...	...	...	...	...	...	...	...	...	...
1	...	72	...	0.0730	0.0736	0.0748	0.0640	0.0640	0.0645	0.0645	0.0650	...	...	...	...	...	...	...	...	...	...	...	...
2	56	...	...	0.0860	0.0867	0.0883	0.0744	0.0744	0.0749	0.0749	0.0754	...	...	...	...	...	...	...	...	...	...	...	...
2	...	64	...	0.0860	0.0866	0.0880	0.0759	...	...	0.0764	0.0769	...	...	...	...	...	...	...	...	...	...	...	...
3	48	...	...	0.0990	0.0999	0.1017	0.0855	...	...	0.0860	0.0865	...	...	...	...	...	...	...	...	...	...	...	...
3	...	56	...	0.0990	0.0997	0.1013	0.0874	0.0874	0.0879	0.0879	0.0884	...	...	...	...	...	...	...	...	...	...	...	...
4	40	...	...	...	0.1134	0.1153	0.0958	0.0958	0.0963	0.0963	0.0968	...	...	...	...	0.0978 (4)	0.0983 (4)	...	...	...	...	...	...
4	...	...	36	0.1120	0.1135	0.1156	0.0940	0.0940	0.0945	0.0945	0.0950	...	...	...	...	0.0960 (4)	0.0965 (4)	...	...	...	...	...	...
4	...	48	...	0.1120	0.1129	0.1147	0.0985	0.0985	0.0990	0.0990	0.0995	...	...	...	...	0.1005 (4)	0.1010 (4)	...	...	...	...	...	...
5	40	...	...	0.1250	0.1264	0.1283	0.1088	0.1088	0.1093	0.1093	0.1098	...	...	...	...	0.1108 (4)	0.1113 (4)	...	...	...	...	...	...
5	...	44	...	0.1250	0.1263	0.1280	0.1102	...	...	0.1107	0.1112	...	...	...	...	0.1122 (4)	0.1127 (4)	...	...	...	...	...	...
6	32	...	...	0.1380	0.1401	0.1421	0.1177	0.1177	0.1182	0.1182	0.1187	0.1187	0.1192	...	...	0.1197 (1)	0.1202 (1)	...	...	0.1207	0.1212	0.1222	0.1227
6	...	40	...	0.1380	0.1394	0.1413	0.1218	0.1218	0.1223	0.1223	0.1228	...	...	...	...	0.1238 (1)	0.1243 (1)	...	...	...	...	...	...
8	32	...	...	0.1640	0.1661	0.1681	0.1437	0.1437	0.1442	0.1442	0.1447	0.1447	0.1452	...	...	0.1457 (1)	0.1462 (1)	...	...	0.1467	0.1472	0.1482	0.1487
8	...	36	...	0.1640	0.1655	0.1676	0.1460	...	...	0.1465	0.1470	...	...	...	...	0.1480 (1)	0.1485 (1)	...	...	...	...	...	...
10	24	...	...	0.1900	0.1927	0.1954	0.1629	0.1629	0.1634	0.1634	0.1639	0.1639	0.1644	0.1644	0.1649	...	...	0.1654	0.1659	0.1659	0.1664	...	...
10	...	32	...	0.1900	0.1921	0.1941	0.1697	0.1697	0.1702	0.1702	0.1707	0.1707	0.1712	0.1712	0.1717	...	...	0.1722	0.1727	0.1727	0.1732	0.1742	0.1747
12	24	...	...	0.2160	0.2187	0.2214	0.1889	...	...	...	...	0.1899	0.1904	0.1904	0.1909	...	...	0.1914	0.1919	...	...	...	...
12	...	28	...	0.2160	0.2183	0.2206	0.1928	...	...	...	...	0.1938	0.1943	0.1943	0.1948	...	...	0.1953	0.1958	...	...	...	...

GENERAL NOTES:
(a) Limits listed in above table are the most commonly used in industry.
(b) Not all styles of taps are available with all limits listed.
(c) For calculation of limits other than those listed, see formulas and Table 7.

NOTES:
(1) Minimum and maximum major diameters are 0.0010 larger than shown.
(2) Minimum and maximum major diameters are 0.0020 larger than shown.
(3) Minimum and maximum major diameters are 0.0035 larger than shown.
(4) Minimum and maximum major diameters are 0.0015 larger than shown.

TABLE 10A TAP THREAD LIMITS: FRACTIONAL SIZES, GROUND THREAD (UNIFIED AND AMERICAN NATIONAL THREAD FORMS, STANDARD THREAD LIMITS)

Size, in.	Threads per Inch			Major Diameter			Pitch Diameter															
								H1 Limit		H2 Limit		H3 Limit		H4 Limit		H5 Limit		H6 Limit [Note (1)]		H7 Limit		H8 Limit [Note (2)]	
	NC UNC	NF UNF	NS	Basic	Min.	Max.	Basic	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1/4	20	...	...	0.2500	0.2532	0.2565	0.2175	0.2175	0.2180	0.2180	0.2185	0.2185	0.2190	...	...	0.2195 (1)	0.2200 (1)	...	...	...	...	...	...
1/4	...	28	...	0.2500	0.2523	0.2546	0.2268	0.2268	0.2273	0.2273	0.2278	0.2278	0.2283	0.2283	0.2288	...	...	...	...	...	...	...	...
5/16	18	...	...	0.3125	0.3161	0.3197	0.2764	0.2764	0.2769	0.2769	0.2774	0.2774	0.2779	...	...	0.2784 (1)	0.2789 (1)	...	...	0.2794 (3)	0.2799 (3)	...	...
5/16	...	24	...	0.3125	0.3152	0.3179	0.2854	0.2854	0.2859	0.2859	0.2864	0.2864	0.2869	0.2869	0.2874	...	...	...	...	0.2884 (3)	0.2889 (3)	...	...
3/8	16	...	...	0.3750	0.3790	0.3831	0.3344	0.3344	0.3349	0.3349	0.3354	0.3354	0.3359	...	...	0.3364 (1)	0.3369 (1)	...	...	0.3374 (3)	0.3379 (3)	...	...
3/8	...	24	...	0.3750	0.3777	0.3804	0.3479	0.3479	0.3484	0.3484	0.3489	0.3489	0.3494	0.3494	0.3499	...	...	...	...	0.3509 (3)	0.3514 (3)	...	...
7/16	14	...	...	0.4375	0.4422	0.4468	0.3911	...	...	0.3916	0.3921	0.3921	0.3926	...	...	0.3931 (1)	0.3936 (1)	...	...	...	...	0.3946	0.3951
7/16	...	20	...	0.4375	0.4407	0.4440	0.4050	...	...	...	...	0.4060	0.4065	...	...	0.4070 (1)	0.4075 (1)	...	...	...	...	0.4085	0.4090
1/2	13	...	...	0.5000	0.5050	0.5100	0.4500	0.4500	0.4505	0.4505	0.4510	0.4510	0.4515	...	...	0.4520 (1)	0.4525 (1)	...	...	...	...	0.4535	0.4540
1/2	...	20	...	0.5000	0.5032	0.5065	0.4675	0.4675	0.4680	0.4680	0.4685	0.4685	0.4690	...	...	0.4695 (1)	0.4700 (1)	...	...	...	...	0.4710	0.4715
9/16	12	...	...	0.5625	0.5679	0.5733	0.5084	...	...	...	...	0.5094	0.5099	...	...	0.5104 (1)	0.5109 (1)	...	...	0.5114 (3)	0.5119 (3)	...	...
9/16	...	18	...	0.5625	0.5661	0.5697	0.5264	...	...	0.5269	0.5274	0.5274	0.5279	...	...	0.5284 (1)	0.5289 (1)	...	...	0.5294 (3)	0.5299 (3)	...	...
5/8	11	...	...	0.6250	0.6309	0.6368	0.5660	...	...	0.5665	0.5670	0.5670	0.5675	...	...	0.5680 (1)	0.5685 (1)	...	...	0.5690 (3)	0.5695 (3)	...	...
5/8	...	18	...	0.6250	0.6286	0.6322	0.5889	...	...	0.5894	0.5899	0.5899	0.5904	...	...	0.5909 (1)	0.5914 (1)	...	...	0.5919 (3)	0.5924 (3)	...	...
11/16	...	...	11	0.6875	0.6934	0.6993	0.6285	...	...	...	...	0.6295	0.6300	...	...	...	...	...	...	...	...	...	...
11/16	...	...	16	0.6875	0.6915	0.6956	0.6469	...	...	...	...	0.6479	0.6484	...	...	...	...	...	...	...	...	...	...
3/4	10	...	...	0.7500	0.7565	0.7630	0.6850	...	...	0.6855	0.6860	0.6860	0.6865	...	...	0.6870	0.6875	...	...	0.6880 (4)	0.6885 (4)	...	...
3/4	...	16	...	0.7500	0.7540	0.7581	0.7094	0.7094	0.7099	0.7099	0.7104	0.7104	0.7109	...	...	0.7114 (1)	0.7119 (1)	...	...	0.7124 (4)	0.7129 (4)	...	...
7/8	9	...	...	0.8750	0.8822	0.8894	0.8028	...	...	...	...	...	...	0.8043	0.8048	...	...	0.8053	0.8058	...	...	...	...
7/8	...	14	...	0.8750	0.8797	0.8843	0.8286	...	...	0.8291	0.8296	...	...	0.8301	0.8306	...	...	...	...	...	...	...	...
1	8	...	...	1.0000	1.0082	1.0163	0.9188	...	...	...	...	...	...	0.9203	0.9208	...	...	0.9213	0.9218	...	...	...	...
1	...	12	...	1.0000	1.0054	1.0108	0.9459	...	...	...	...	...	...	0.9474	0.9479	...	...	...	...	...	...	...	...
1	...	...	14	1.0000	1.0047	1.0093	0.9536	...	...	...	...	...	...	0.9551	0.9556	...	...	...	...	...	...	...	...
1 1/8	7	...	...	1.1250	1.1343	1.1436	1.0322	...	...	...	...	...	...	1.0337	1.0342	...	...	...	...	...	...	...	...
1 1/8	...	12	...	1.1250	1.1304	1.1358	1.0709	...	...	...	...	...	...	1.0724	1.0729	...	...	...	...	...	...	...	...
1 1/4	7	...	...	1.2500	1.2593	1.2686	1.1572	...	...	...	...	...	...	1.1587	1.1592	...	...	...	...	...	...	...	...
1 1/4	...	12	...	1.2500	1.2554	1.2608	1.1959	...	...	...	...	...	...	1.1974	1.1979	...	...	...	...	...	...	...	...

(continued)

TABLE 10A TAP THREAD LIMITS: FRACTIONAL SIZES, GROUND THREAD (UNIFIED AND AMERICAN NATIONAL THREAD FORMS, STANDARD THREAD LIMITS) (CONT'D)

Size, in.	Threads per Inch			Major Diameter			Pitch Diameter															
								H1 Limit		H2 Limit		H3 Limit		H4 Limit		H5 Limit		H6 Limit [Note (1)]		H7 Limit		H8 Limit [Note (2)]	
	NC UNC	NF UNF	NS	Basic	Min.	Max.	Basic	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1 3/8	6	...	...	1.3750	1.3859	1.3967	1.2667	...	...	...	...	...	...	1.2682	1.2687	...	...	...	...	...	...	...	...
1 3/8	...	12	...	1.3750	1.3804	1.3858	1.3209	...	...	...	...	...	...	1.3224	1.3229	...	...	...	...	...	...	...	...
1 1/2	6	...	...	1.5000	1.5109	1.5217	1.3917	...	...	...	...	...	...	1.3932	1.3937	...	...	...	...	...	...	...	...
1 1/2	...	12	...	1.5000	1.5054	1.5108	1.4459	...	...	...	...	...	...	1.4474	1.4479	...	...	...	...	...	...	...	...
1 3/4	...	5	...	1.7500	1.7630	1.7760	1.6201	...	...	...	...	...	...	1.6216	1.6221	...	...	...	...	...	...	...	...
2	...	4.5	...	2.0000	2.0145	2.0289	1.8557	...	...	...	...	...	...	1.8572	1.8577	...	...	...	...	...	...	...	...

GENERAL NOTES:
(a) Limits listed in above table are the most commonly used in industry.
(b) Not all styles of taps are available with all limits listed.
(c) For calculation of limits other than those listed, see formulas and Table 7.

NOTES:
(1) Minimum and maximum major diameters are 0.0010 larger than shown.
(2) Minimum and maximum major diameters are 0.0035 larger than shown.
(3) Minimum and maximum major diameters are 0.0020 larger than shown.
(4) Minimum and maximum major diameters are 0.0015 larger than shown.

TABLE 11 TAP THREAD LIMITS: METRIC SIZES, GROUND THREAD (M PROFILE: STANDARD THREAD LIMITS IN MILLIMETERS)

Nominal Diameter, mm	Pitch, mm	Major Diameter			Pitch Diameter						
						D3		D4		D5	
		Basic	Min.	Max.	Basic	Min.	Max.	Min.	Max.	Min.	Max.
1.6	0.35	1.600	1.628	1.653	1.373	1.397	1.412	...	...	...	...
2	0.4	2.000	2.032	2.057	1.740	1.764	1.779	...	...	...	...
2.5	0.45	2.500	2.536	2.561	2.208	2.232	2.247	...	...	...	...
3	0.5	3.000	3.040	3.065	2.675	2.699	2.714	...	...	2.725 (2),(3)	2.740 (2),(3)
3.5	0.6	3.500	3.548	3.573	3.110	...	...	3.142	3.162	...	...
4	0.7	4.000	4.056	4.097	3.545	...	...	3.577	3.597	...	...
4.5	0.75	4.500	4.560	4.601	4.013	...	...	4.045	4.065	...	...
5	0.8	5.000	5.064	5.105	4.480	...	...	4.512	4.532	...	...
6	1	6.000	6.080	6.121	5.350	...	...	...	...	5.390	5.415
7	1	7.000	7.080	7.121	6.350	...	...	...	...	6.390	6.415
8	1.25	8.000	8.100	8.164	7.188	...	...	...	...	7.222	7.253
10	1.5	10.000	10.120	10.184	9.026	...	...	...	...	...	...
12	1.75	12.000	12.140	12.204	10.863	...	...	...	...	...	...
14	1.25	14.000	14.097	14.122	13.188	...	...	13.225 (1)	13.238 (1)	...	...
14	2	14.000	14.160	14.224	12.701	...	...	...	...	...	...
16	2	16.000	16.160	16.224	14.701	...	...	...	...	...	...
18	1.5	18.000	18.123	18.148	17.026	...	...	17.063 (1)	17.076 (1)	...	...
20	2.5	20.000	20.200	20.264	18.376	...	...	...	...	...	...
24	3	24.000	24.240	24.340	22.051	...	...	...	...	...	...
30	3.5	30.000	30.280	30.380	27.727	...	...	...	...	...	...
36	4	36.000	36.320	36.420	33.402	...	...	...	...	...	...
42	4.5	42.000	42.360	43.460	39.077	...	...	...	...	...	...
48	5	48.000	48.400	50.500	44.752	...	...	...	...	...	...

GENERAL NOTES:
(a) Inch translations are listed in Table A3 in Appendix A.
(b) Limits listed in above table are the most commonly used in industry.
(c) Not all styles of taps are available with all limits listed.
(d) For calculation of limits other than those listed, see formulas and Table 8.

NOTES:
(1) These sizes are intended for spark plug applications; use the pitch diameter tolerances from Table 8, column Z.
(2) Minimum and maximum major diameters are 0.026 larger than shown.
(3) Standard D limit for thread forming taps.
(4) Minimum and maximum major diameters are 0.039 larger than shown.
(5) Minimum and maximum major diameters are 0.052 larger than shown.
(6) Minimum and maximum major diameters are 0.065 larger than shown.

TABLE 11 TAP THREAD LIMITS: METRIC SIZES, GROUND THREAD (M PROFILE: STANDARD THREAD LIMITS IN MILLIMETERS)

Pitch Diameter											
D6		D7		D8		D9		D10		D11	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...
3.603 (2),(3)	3.623 (2),(3)	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...
...	...	4.551 (3),(4)	4.571 (3),(4)	...	...	...	...	...	...	...	...
...	...	...	...	5.429 (3),(4)	5.454 (3),(4)	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	7.274 (3),(5)	7.305 (3),(5)	...	...	...	...
9.073	9.104	...	...	...	...	...	...	9.125 (3),(5)	9.156 (3),(5)	...	...
10.910	10.941	...	...	...	...	...	...	...	...	10.975 (3),(6)	11.006 (3),(6)
...	...	...	...	...	...	...	...	...	...	...	...
...	...	12.751	12.792	...	...	...	...	...	...	...	...
...	...	14.751	14.792	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...
...	...	18.426	18.467	...	...	...	...	...	...	...	...
...	...	...	...	22.114	22.155	...	...	...	...	...	...
...	...	...	...	...	...	27.792	27.844	...	...	...	...
...	...	...	...	...	...	33.467	33.519	...	...	...	...
...	...	...	...	...	...	...	...	39.155	39.207	...	...
...	...	...	...	...	...	...	...	44.830	44.882	...	...

TABLE 12 TAP THREAD LIMITS: MACHINE SCREW SIZES, CUT THREAD (UNIFIED AND AMERICAN NATIONAL THREAD FORMS)

Sizes and Standards									
	Threads per Inch			Major Diameter			Pitch Diameter		
Size	NC UNC	NF UNF	NS UNS	Basic	Min.	Max.	Basic	Min.	Max.
0	...	80	...	0.0600	0.0609	0.0624	0.0519	0.0521	0.0531
1	64	...	...	0.0730	0.0740	0.0755	0.0629	0.0631	0.0641
1	...	72	...	0.0730	0.0740	0.0755	0.0640	0.0642	0.0652
2	56	...	...	0.0860	0.0872	0.0887	0.0744	0.0746	0.0756
2	...	64	...	0.0860	0.0870	0.0885	0.0759	0.0761	0.0771
3	48	...	...	0.0990	0.1003	0.1018	0.0855	0.0857	0.0867
3	...	56	...	0.0990	0.1002	0.1017	0.0874	0.0876	0.0886
4	...	...	36	0.1120	0.1137	0.1157	0.0940	0.0942	0.0957
4	40	...	...	0.1120	0.1136	0.1156	0.0958	0.0960	0.0975
4	...	48	...	0.1120	0.1133	0.1153	0.0985	0.0987	0.1002
5	40	...	...	0.1250	0.1266	0.1286	0.1088	0.1090	0.1105
6	32	...	...	0.1380	0.1402	0.1422	0.1177	0.1182	0.1197
6	...	...	36	0.1380	0.1397	0.1417	0.1200	0.1202	0.1217
6	...	40	...	0.1380	0.1396	0.1416	0.1218	0.1220	0.1235
8	32	...	...	0.1640	0.1662	0.1682	0.1437	0.1442	0.1457
8	...	36	...	0.1640	0.1657	0.1677	0.1460	0.1462	0.1477
8	...	...	40	0.1640	0.1656	0.1676	0.1478	0.1480	0.1495
10	24	...	...	0.1900	0.1928	0.1948	0.1629	0.1634	0.1649
10	...	32	...	0.1900	0.1922	0.1942	0.1697	0.1702	0.1717
12	24	...	...	0.2160	0.2188	0.2208	0.1889	0.1894	0.1909
12	...	28	...	0.2160	0.2184	0.2204	0.1928	0.1933	0.1948
14	...	...	24	0.2420	0.2448	0.2473	0.2149	0.2154	0.2174

Lead Tolerance

A maximum lead error of ±0.003 in. in 1 in. of thread is permitted.

Angle Tolerance		
Threads per Inch	Half Angle	Full Angle
20 to 28, inclusive	±0 deg 45 min	0 deg 65 min
30 and finer	±0 deg 60 min	0 deg 90 min

GENERAL NOTES:
(a) All dimensions are given in inches.
(b) Thread limits are computed from Table 9.

TABLE 12A TAP THREAD LIMITS: FRACTIONAL SIZES, CUT THREAD (UNIFIED AND AMERICAN NATIONAL THREAD FORMS)

	Standard Thread Limits								
	Threads per Inch			Major Diameter			Pitch Diameter		
Size	NC UNC	NF UNF	NS UNS	Basic	Min.	Max.	Basic	Min.	Max.
1/8	...	...	40	0.1250	0.1266	0.1286	0.1088	0.1090	0.1105
5/32	...	...	32	0.1563	0.1585	0.1605	0.1360	0.1365	0.1380
3/16	...	...	24	0.1875	0.1903	0.1923	0.1604	0.1609	0.1624
3/16	...	...	32	0.1875	0.1897	0.1917	0.1672	0.1677	0.1692
1/4	20	...	...	0.2500	0.2532	0.2557	0.2175	0.2180	0.2200
1/4	...	28	...	0.2500	0.2524	0.2549	0.2268	0.2273	0.2288
5/16	18	...	...	0.3125	0.3160	0.3185	0.2764	0.2769	0.2789
5/16	...	24	...	0.3125	0.3153	0.3178	0.2854	0.2859	0.2874
3/8	16	...	...	0.3750	0.3789	0.3814	0.3344	0.3349	0.3369
3/8	...	24	...	0.3750	0.3778	0.3803	0.3479	0.3484	0.3499
7/16	14	...	...	0.4375	0.4419	0.4449	0.3911	0.3916	0.3941
7/16	...	20	...	0.4375	0.4407	0.4437	0.4050	0.4055	0.4075
1/2	13	...	...	0.5000	0.5047	0.5077	0.4500	0.4505	0.4530
1/2	...	20	...	0.5000	0.5032	0.5062	0.4675	0.4680	0.4700
9/16	12	...	...	0.5625	0.5675	0.5705	0.5084	0.5089	0.5114
9/16	...	18	...	0.5625	0.5660	0.5690	0.5264	0.5269	0.5289
5/8	11	...	...	0.6250	0.6304	0.6334	0.5660	0.5665	0.5690
5/8	...	18	...	0.6250	0.6285	0.6315	0.5889	0.5894	0.5914
3/4	10	...	...	0.7500	0.7559	0.7599	0.6850	0.6855	0.6885
3/4	...	16	...	0.7500	0.7539	0.7579	0.7094	0.7099	0.7124
7/8	9	...	...	0.8750	0.8820	0.8860	0.8028	0.8038	0.8068
7/8	...	14	...	0.8750	0.8799	0.8839	0.8286	0.8296	0.8321
1	8	...	...	1.0000	1.0078	1.0118	0.9188	0.9198	0.9228
1	...	12	...	1.0000	1.0055	1.0095	0.9459	0.9469	0.9494
1	...	...	14	1.0000	1.0049	1.0089	0.9536	0.9546	0.9571
1 1/8	7	...	...	1.1250	1.1337	1.1382	1.0322	1.0332	1.0367
1 1/8	...	12	...	1.1250	1.1305	1.1350	1.0709	1.0719	1.0749
1 1/4	7	...	...	1.2500	1.2587	1.2632	1.1572	1.1582	1.1617
1 1/4	...	12	...	1.2500	1.2555	1.2600	1.1959	1.1969	1.1999
1 3/8	6	...	...	1.3750	1.3850	1.3895	1.2667	1.2677	1.2712
1 3/8	...	12	...	1.3750	1.3805	1.3850	1.3209	1.3219	1.3249
1 1/2	6	...	...	1.5000	1.5100	1.5145	1.3917	1.3927	1.3962
1 1/2	...	12	...	1.5000	1.5055	1.5100	1.4459	1.4469	1.4499
1 3/4	5	...	...	1.7500	1.7602	1.7657	1.6201	1.6216	1.6256
2	4 1/2	...	...	2.0000	2.0111	2.0166	1.8557	1.8572	1.8612

Lead Tolerance

A maximum lead error of ±0.003 in. in 1 in. of thread is permitted.

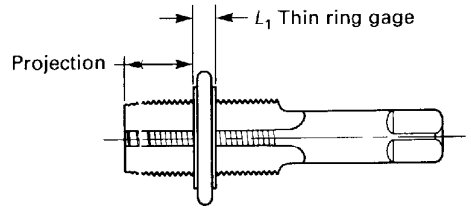
Angle Tolerance

Threads per Inch	Half Angle	Full Angle
4 1/2 to 5 1/2, inclusive	±0 deg 35 min	0 deg 53 min
6 to 9, inclusive	±0 deg 40 min	0 deg 60 min
10 to 28, inclusive	±0 deg 45 min	0 deg 68 min
30 to 64, inclusive	±0 deg 60 min	0 deg 90 min

GENERAL NOTES:
(a) All dimensions are given in inches.
(b) Thread limits are computed from Table 9.

TABLE 13 TAPER PIPE TAP THREAD LIMITS (GROUND AND CUT THREAD; GROUND THREAD FOR NPS, NPTF, AND ANPT; CUT THREAD FOR NPT ONLY)

Nominal Size, in.	Threads per Inch	Gage Measurement, in.			Taper per Inch on Diameter [Note (2)]				Reference Dimensions	
		Projection, in. [Note (1)]	Tolerance, Plus or Minus		Cut Thread		Ground Thread		L_1 Length [Note (3)]	Tap Drill Size NPT, ANPT, NPTF [Note (4)]
			Cut Thread	Ground Thread	Min.	Max.	Min.	Max.		
1/16	27	0.312	0.0625	0.0625	0.0599	0.0703	0.0599	0.0651	0.1600	C
1/8	27	0.312	0.0625	0.0625	0.0599	0.0703	0.0599	0.0651	0.1615	Q
1/4	18	0.459	0.0625	0.0625	0.0599	0.0703	0.0599	0.0651	0.2278	7/16
3/8	18	0.454	0.0625	0.0625	0.0599	0.0703	0.0599	0.0651	0.2400	9/16
1/2	14	0.579	0.0625	0.0625	0.0599	0.0677	0.0599	0.0651	0.3200	45/64
3/4	14	0.565	0.0625	0.0625	0.0599	0.0677	0.0599	0.0651	0.3390	29/32
1	11 1/2	0.678	0.0937	0.0937	0.0599	0.0677	0.0599	0.0651	0.4000	1 9/64
1 1/4	11 1/2	0.686	0.0937	0.0937	0.0599	0.0677	0.0599	0.0651	0.4200	1 31/64
1 1/2	11 1/2	0.699	0.0937	0.0937	0.0599	0.0677	0.0599	0.0651	0.4200	1 23/32
2	11 1/2	0.667	0.0937	0.0937	0.0599	0.0677	0.0599	0.0651	0.4360	2 3/16
2 1/2	8	0.925	0.0937	0.0937	0.0612	0.0664	0.0612	0.0651	0.6820	2 39/64
3	8	0.925	0.0937	0.0937	0.0612	0.0664	0.0612	0.0651	0.7660	3 15/16



Lead Tolerances

Cut Thread: A maximum lead deviation of ±0.003 in in 1 in. of thread is permitted.
Ground Thread: A maximum lead deviation of ±0.0005 in. within any two threads not farther apart than 1 in. is permitted.

Threads per Inch	Cut Thread		Ground Thread
	Half Angle	Full Angle	Half Angle
8	±0 deg 40 min	0 deg 60 min	±0 deg 25 min
11 1/2 to 27 Inclusive	±0 deg 45 min	0 deg 60 min	±0 deg 30 min

(continued)

TABLE 13 TAPER PIPE TAP THREAD LIMITS (GROUND AND CUT THREAD; GROUND THREAD FOR NPS, NPTF, AND ANPT; CUT THREAD FOR NPT ONLY) (CONT'D)

Widths of Flats at Tap Crests and Roots					
		Column I		Column II	
Threads per Inch	Tap Flat Width at	NPT: Cut and Ground Thread [Note (5)] ANPT: Ground Thread [Note (5)] Min. [Note (6)]	Max.	NPTF Min. [Note (6)]	Ground Thread [Note (5)] Max.
27	Major diameter	0.0014	0.0041	0.0040	0.0055
	Minor diameter	...	0.0041	...	0.0040
18	Major diameter	0.0021	0.0057	0.0050	0.0065
	Minor diameter	...	0.0057	...	0.0050
14	Major diameter	0.0027	0.0064	0.0050	0.0065
	Minor diameter	...	0.0064	...	0.0050
11½	Major diameter	0.0033	0.0073	0.0060	0.0083
	Minor diameter	...	0.0073	...	0.0060
8	Major diameter	0.0048	0.0090	0.0080	0.0103
	Minor diameter	...	0.0090	...	0.0080

GENERAL NOTE: All dimensions are given in inches.

NOTES:

(1) Distance small end of tap projects through L_1, taper ring gage.
(2) Taper is 0.0625 in. per 1.000 in. on diameter (1:16) (¾ in. per 12 in.).
(3) Dimension, L_1, thickness of thin ring gage; see ASME B1.20.1 and B1.20.5.
(4) Sizes given permit direct tapping without reaming the hole, but only give full threads for approximate L_1 distance.
(5) Cut thread taps made to Column I are marked NPT but are not recommended for ANPT applications.
Ground thread taps made to Column I are marked NPT and may be used for NPT and ANPT applications.
Ground thread taps made to Column II are marked NPTF and may be used for dryseal application.
(6) Minimum minor diameter flats are not specified and may be sharp as practicable.

TABLE 14 STRAIGHT PIPE TAP THREAD LIMITS: NPS, GROUND THREAD (AMERICAN NATIONAL STANDARD STRAIGHT PIPE THREAD FORM [NPSC, NPSM])

		Standard Thread Limits					
		Major Diameter			Pitch Diameter		
Nominal Size, in.	Threads per Inch	Plug at Gaging Notch	Min., *G*	Max., *H*	Plug at Gaging Notch, *E*	Min., *K*	Max., *L*
1/8	27	0.3983	0.4022	0.4032	0.3736	0.3746	0.3751
1/4	18	0.5286	0.5347	0.5357	0.4916	0.4933	0.4938
3/8	18	0.6640	0.6701	0.6711	0.6270	0.6287	0.6292
1/2	14	0.8260	0.8347	0.8357	0.7784	0.7806	0.7811
3/4	14	1.0364	1.0447	1.0457	0.9889	0.9906	0.9916
1	11 1/2	1.2966	1.3062	1.3077	1.2386	1.2402	1.2412

Formula for NPS Ground Thread Taps

The maximum pitch diameter of tap is based on an allowance deducted from the maximum product pitch diameter of NPSC or NPSM, whichever is smaller.

The minimum pitch diameter of tap is derived by subtracting the ground thread pitch diameter tolerance for actual equivalent size.

Nominal Size, in.	Major Diameter		Minor Diameter, Max.
	Min., *G*	Max., *H*	
1/8	*H* − 0.0010	*K* + *A* − 0.0010	*M* − *B*
1/4 to 3/4, inclusive	*H* − 0.0010	*K* + *A* − 0.0020	*M* − *B*
1	*H* − 0.0015	*K* + *A* − 0.0021	*M* − *B*

	Formula Values		
Threads per Inch	*A*	*B*	*M*
27	0.0296	0.0257	Actual measured pitch diameter
18	0.0444	0.0401	
14	0.0571	0.0525	
11 1/2	0.0696	0.0647	

Lead Tolerance

A maximum lead deviation of ±0.0005 in. within two threads not farther apart than 1 in. is permitted.

Angle Tolerance	
Threads per Inch	Half Angle
11 1/2 to 27, inclusive	±0 deg 30 min

GENERAL NOTES:
(a) Taps made to the specifications in this Table are marked NPS and are used for NPSC and NPSM.
(b) All dimensions are given in inches.

TABLE 14A STRAIGHT PIPE TAP THREAD LIMITS: NPSF, GROUND THREAD (DRYSEAL AMERICAN NATIONAL STANDARD STRAIGHT PIPE THREAD FORM [NPSF])

Standard Thread Limits

Nominal Size, in.	Threads per Inch	Major Diameter		Pitch Diameter			Minor [Note (1)] Flat Max.
		Min., *G*	Max., *H*	Plug at Gaging Notch, *E*	Min., *K*	Max., *L*	
1/16	27	0.3008	0.3018	0.2812	0.2772	0.2777	0.004
1/8	27	0.3932	0.3942	0.3736	0.3696	0.3701	0.004
1/4	18	0.5239	0.5249	0.4916	0.4859	0.4864	0.005
3/8	18	0.6593	0.6603	0.6270	0.6213	0.6218	0.005
1/2	14	0.8230	0.8240	0.7784	0.7712	0.7717	0.005
3/4	14	1.0335	1.0345	0.9889	0.9817	0.9822	0.005

Formula for NPSF Ground Thread Taps

Nominal Size, in.	Major Diameter		Pitch Diameter		Maximum Minor Diameter
	Min., *G*	Max., *H*	Min., *K*	Max., *L*	
1/16	*H* − 0.0010	*K* + *Q* − 0.0005	*L* − 0.0005	*E* − *F*	*M* − *Q*
1/8	*H* − 0.0010	*K* + *Q* − 0.0005	*L* − 0.0005	*E* − *F*	*M* − *Q*
1/4	*H* − 0.0010	*K* + *Q* − 0.0005	*L* − 0.0005	*E* − *F*	*M* − *Q*
3/8	*H* − 0.0010	*K* + *Q* − 0.0005	*L* − 0.0005	*E* − *F*	*M* − *Q*
1/2	*H* − 0.0010	*K* + *Q* − 0.0005	*L* − 0.0005	*E* − *F*	*M* − *Q*
3/4	*H* − 0.0010	*K* + *Q* − 0.0005	*L* − 0.0005	*E* − *F*	*M* − *Q*

Formula Values

Threads per Inch	*E*	*F*	*M*	*Q*
27	Pitch diameter	0.0035	Actual measured	0.0251
18	of plug at	0.0052	pitch	0.0395
14	gaging notch	0.0067	diameter	0.0533

Lead Tolerance

A maximum lead deviation of ±0.0005 in. within any two threads not farther apart than 1 in. is permitted.

Angle Tolerance	
Threads per Inch	**Half Angle**
14 to 27, inclusive	±0 deg 30 min

GENERAL NOTES:
(a) Ground thread shall be as specified or sharper.
(b) All dimensions are given in inches.

TABLE 15 STRAIGHT PIPE TAP THREAD LIMITS: NPS, CUT THREAD (AMERICAN NATIONAL STANDARD STRAIGHT PIPE THREAD FORM [NPSC])

Standard Thread Limits				
Nominal Size	Threads per Inch	Size at Gaging Notch	Pitch Diameter	
			Min.	Max.
1/8	27	0.3736	0.3721	0.3751
1/4	18	0.4916	0.4908	0.4938
3/8	18	0.6270	0.6257	0.6292
1/2	14	0.7784	0.7776	0.7811
3/4	14	0.9889	0.9876	0.9916
1	11 1/2	1.2386	1.2372	1.2412

Formula for NPS Cut Thread Taps (Approximate)

The maximum pitch diameter of tap is based on an allowance deducted from the maximum product pitch diameter of NPSC.

The minimum pitch diameter of tap equals maximum pitch diameter minus the tolerance.

Minimum major diameter = Measured pitch diameter plus "A"
Maximum major diameter = Measured pitch diameter plus "B"
Maximum minor diameter = Measured pitch diameter minus "C"

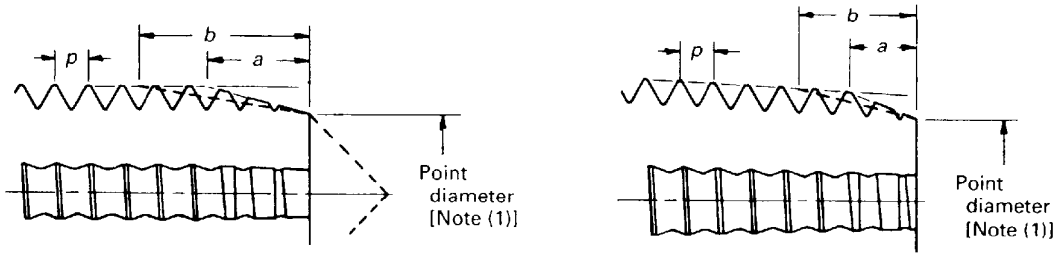
Formula Values			
Threads per Inch	*A*	*B*	*C*
27	0.0267	0.0296	0.0257
18	0.0408	0.0444	0.0401
14	0.0535	0.0571	0.0525
11 1/2	0.0658	0.0696	0.0647

Lead Tolerance

A value of ±0.003 in. per inch is permitted.

Angle Tolerance		
Threads per Inch	Half Angle	Full Angle
11 1/2 to 27, inclusive	±0 deg 45 min	0 deg 68 min

GENERAL NOTES:
(a) Taps made to the specifications in this Table are to be marked NPS and used for NPSC.
(b) All dimensions are given in inches.
(c) As the American national standard straight pipe thread form is to be maintained, the major and minor diameters vary with the pitch diameter. See formula above. Either a flat or a rounded form is allowable at both the crest and root.



Straight Thread Taps **Taper Pipe Taps**

TABLE 16 STANDARD CHAMFERS FOR THREAD CUTTING TAPS

The chamfer length is measured at the cutting edge and is the axial length from the point diameter to the theoretical intersection of the tap major diameter and the chamfer angle. Whenever chamfer length is specified in terms of number of threads, this length is measured in number of pitches as shown. The point diameter is approximately equal to the basic thread minor diameter. Standard types are illustrated above.

Type of Tap		Chamfer Length *a*	Chamfer Length *b*
Straight Threads Taps:	Bottom	1_p	2_p
	Semibottom	2_p	3_p
	Plug	3_p	5_p
	Taper	7_p	10_p
Taper Pipe Taps		2_p	$3\frac{1}{2}_p$

GENERAL NOTES:
(a) Refer to Table 6 for runout tolerances.
(b) a = minimum length of chamfer
b = maximum length of chamfer
p = pitch

NOTE:
(1) For point diameter see section 6, no. 012.

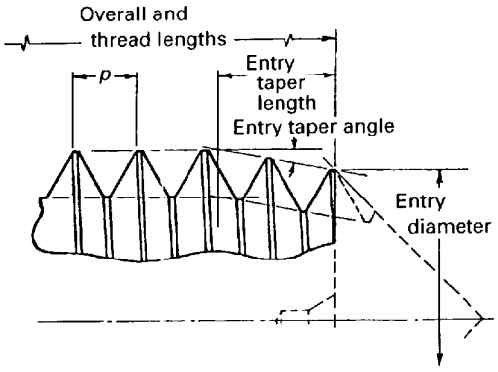


TABLE 16A STANDARD ENTRY TAPER LENGTHS FOR THREAD FORMING TAPS

Entry taper length is measured on the full diameter of the thread forming lobes and is the axial distance from the entry diameter position to the theoretical intersection of tap major diameter and entry taper angle.

Beveled end threads provided on taps having internal center or incomplete threads retained when external center is removed (not shown), optional with manufacturer.

Whenever entry taper length is specified in terms of number of threads, this length is measured in number of pitches, *p*.

Bottom length = 1 to $2^1/_2$ pitches.
Plug length = 3 to 5 pitches.

Entry diameter, measured at the thread crest nearest the front of the tap, is an appropriate amount smaller than the diameter of the hole drilled for tapping.

GENERAL NOTE: For entry taper diameter see section 6, no. 016.

TABLE 17 TAP THREAD LIMITS (SCREW THREAD INSERTS [STI], GROUND THREAD, MACHINE SCREW, AND FRACTIONAL SIZE)

Machine Screw Size, STI	Fractional Size, STI	Threads per Inch		Tap Major Diameter		Recommended Tap Pitch Diameter Limits					
						2B			3B		
		NC	NF	Min.	Max.	H Limit	Min.	Max.	H Limit	Min.	Max.
1	...	64	...	0.0948	0.0958	H2	0.0837	0.0842	H1	0.0832	0.0837
2	...	56	...	0.1107	0.1117	H2	0.0981	0.0986	H1	0.0976	0.0981
	...	...	64	0.1078	0.1088	H2	0.0967	0.0972	H1	0.0962	0.0967
3	...	48	...	0.1279	0.1289	H2	0.1131	0.1136	H1	0.1126	0.1131
	...	...	56	0.1237	0.1247	H2	0.1111	0.1116	H1	0.1106	0.1111
4	...	40	...	0.1463	0.1473	H2	0.1288	0.1293	H1	0.1283	0.1288
	...	...	48	0.1409	0.1419	H2	0.1261	0.1266	H1	0.1256	0.1261
5	...	40	...	0.1593	0.1603	H2	0.1418	0.1423	H1	0.1413	0.1418
6	...	32	...	0.1807	0.1817	H3	0.1593	0.1598	H2	0.1588	0.1593
	...	...	40	0.1723	0.1733	H2	0.1548	0.1553	H1	0.1543	0.1548
8	...	32	...	0.2067	0.2077	H3	0.1853	0.1858	H2	0.1848	0.1853
	...	...	36	0.2022	0.2032	H2	0.1826	0.1831	H1	0.1821	0.1826
10	...	24	...	0.2465	0.2475	H3	0.2180	0.2185	H2	0.2175	0.2180
	...	...	32	0.2327	0.2337	H3	0.2113	0.2118	H2	0.2108	0.2113
12	...	24	...	0.2725	0.2735	H3	0.2440	0.2445	H2	0.2435	0.2440
	1/4	20	...	0.3177	0.3187	H3	0.2835	0.2840	H2	0.2830	0.2835
	...	...	28	0.2985	0.2995	H3	0.2742	0.2747	H2	0.2737	0.2742
	5/16	18	...	0.3874	0.3884	H4	0.3501	0.3506	H3	0.3496	0.3501
	...	...	24	0.3690	0.3700	H3	0.3405	0.3410	H2	0.3400	0.3405
	3/8	16	...	0.4592	0.4602	H4	0.4171	0.4176	H3	0.4166	0.4171
	...	...	24	0.4315	0.4325	H3	0.4030	0.4035	H2	0.4025	0.4030

(continued)

TABLE 17 TAP THREAD LIMITS (SCREW THREAD INSERTS [STI], GROUND THREAD, MACHINE SCREW, AND FRACTIONAL SIZE) (CONT'D)

Fractional Size, STI	Threads per Inch		Tap Major Diameter		Recommended Tap Pitch Diameter Limits					
					2B			3B		
	NC	NF	Min.	Max.	H Limit	Min.	Max.	H Limit	Min.	Max.
7/16	14	...	0.5333	0.5343	H4	0.4854	0.4859	H3	0.4849	0.4854
	...	20	0.5052	0.5062	H4	0.4715	0.4720	H3	0.4710	0.4715
1/2	13	...	0.6032	0.6042	H4	0.5514	0.5519	H3	0.5509	0.5514
	...	20	0.5677	0.5687	H4	0.5340	0.5345	H3	0.5335	0.5340
9/16	12	...	0.6741	0.6751	H4	0.6182	0.6187	H3	0.6177	0.6182
	...	18	0.6374	0.6384	H4	0.6001	0.6006	H3	0.5996	0.6001
5/8	11	...	0.7467	0.7477	H4	0.6856	0.6861	H3	0.6851	0.6856
	...	18	0.6999	0.7009	H4	0.6626	0.6631	H3	0.6621	0.6626
3/4	10	...	0.8835	0.8850	H5	0.8169	0.8174	H3	0.8159	0.8164
	..	1	0.8342	0.8352	H4	0.7921	0.7926	H3	0.7916	0.7921
7/8	9	...	1.0232	1.0247	H5	0.9491	0.9496	H3	0.9481	0.9486
	...	14	0.9708	0.9718	H4	0.9234	0.9239	H3	0.9224	0.9229
1	8	...	1.1666	1.1681	H6	1.0832	1.0842	H4	1.0822	1.0832
	...	12	1.1116	1.1126	H6	1.0562	1.0572	H4	1.0552	1.0562
	...	14	1.0958	1.0968	H6	1.0484	1.0494	H4	1.0474	1.0484
		NS								
1 1/8	7	...	1.3151	1.3171	H6	1.2198	1.2208	H4	1.2188	1.2198
	...	12	1.2366	1.2376	H6	1.1812	1.1822	H4	1.1802	1.1812
1 1/4	7	...	1.4401	1.4421	H6	1.3448	1.3458	H4	1.3438	1.3448
	...	12	1.3616	1.3626	H6	1.3062	1.3072	H4	1.3052	1.3062
1 3/8	6	...	1.5962	1.5982	H8	1.4862	1.4872	H6	1.4852	1.4862
	...	12	1.4866	1.4876	H6	1.4312	1.4322	H4	1.4302	1.4312
1 1/2	6	...	1.7212	1.7232	H8	1.6112	1.6122	H6	1.6102	1.6112
	...	12	1.6116	1.6126	H6	1.5562	1.5572	H4	1.5552	1.5562

GENERAL NOTE:
These taps are over the nominal size to the extent that the internal thread they produce will accommodate a helical coil screw insert, which at final assembly will accept a screw thread of the normal size and pitch.

TABLE 17A TAP THREAD LIMITS (SCREW THREAD INSERTS [STI], GROUND THREAD, METRIC SIZE [INCH])

Metric Size (STI)	Pitch, mm	Tap Major Diameter, mm		Recommended Tap Pitch Diameter Limits, in.					
				Tolerance Class 4H			Tolerance Class 5H and 6H		
		Min.	Max.	H Limit	Max.	Min.	H Limit	Max.	Min.
M2.5	0.45	0.1239	0.1229	1	0.1105	0.1100	2	0.1110	0.1105
M3	0.5	0.1463	0.1453	1	0.1314	0.1309	2	0.1319	0.1314
M3.5	0.6	0.1714	0.1704	1	0.1537	0.1532	2	0.1542	0.1537
M4	0.7	0.1971	0.1955	2	0.1764	0.1759	3	0.1769	0.1764
M5	0.8	0.2418	0.2403	2	0.2184	0.2179	3	0.2187	0.2184
M6	1	0.2922	0.2906	2	0.2629	0.2624	3	0.2634	0.2629
M7	1	0.3316	0.3300	2	0.3022	0.3017	3	0.3027	0.3022
M8	1	0.3710	0.3694	2	0.3416	0.3411	3	0.3421	0.3416
	1.25	0.3853	0.3828	2	0.3480	0.3475	3	0.3485	0.3480
M10	1	0.4497	0.4481	2	0.4203	0.4198	3	0.4208	0.4203
	1.25	0.4641	0.4616	2	0.4267	0.4262	3	0.4272	0.4267
	1.5	0.4776	0.4751	3	0.4336	0.4331	4	0.4341	0.4336
M12	1.25	0.5428	0.5403	3	0.5059	0.5054	4	0.5064	0.5059
	1.5	0.5564	0.5539	3	0.5123	0.5118	4	0.5128	0.5123
	1.75	0.5700	0.5675	3	0.5187	0.5182	4	0.5192	0.5187
M14	1.5	0.6351	0.6326	3	0.5911	0.5906	4	0.5916	0.5911
	2	0.6623	0.6598	3	0.6039	0.6034	5	0.6049	0.6044
M16	1.5	0.7139	0.7114	3	0.6698	0.6693	4	0.6703	0.6698
	2	0.7410	0.7385	3	0.6826	0.6821	5	0.6836	0.6831
M18	1.5	0.7926	0.7901	3	0.7485	0.7480	4	0.7490	0.7485
	2	0.8198	0.8173	3	0.7613	0.7608	5	0.7623	0.7618
	2.5	0.8470	0.8445	3	0.7741	0.7736	5	0.7751	0.7746
M20	1.5	0.8713	0.8688	3	0.8273	0.8268	4	0.8278	0.8273
	2	0.8985	0.8960	3	0.8401	0.8396	5	0.8411	0.8406
	2.5	0.9257	0.9232	3	0.8529	0.8524	5	0.8539	0.8534
M22	1.5	0.9500	0.9475	3	0.9060	0.9055	4	0.9065	0.9060
	2	0.9773	0.9748	3	0.9188	0.9183	5	0.9198	0.9193
	2.5	1.0044	1.0019	3	0.9316	0.9311	5	0.9326	0.9321
M24	2	1.0559	1.0534	4	0.9981	0.9971	6	0.9991	0.9981
	3	1.1117	1.1078	4	1.0236	1.0226	6	1.0246	1.0236
M27	2	1.1741	1.1716	4	1.1162	1.1152	6	1.1172	1.1162
	3	1.2298	1.2259	4	1.1417	1.1407	6	1.1427	1.1417
M30	2	1.2922	1.2897	4	1.2343	1.2333	6	1.2353	1.2343
	3.5	1.3750	1.3711	4	1.2726	1.2716	6	1.2736	1.2726
M33	2	1.4103	1.4078	4	1.3525	1.3515	6	1.3535	1.3525
	3.5	1.4931	1.4892	4	1.3907	1.3897	6	1.3917	1.3907
M36	2	1.5284	1.5259	4	1.4706	1.4696	6	1.4716	1.4706
	3	1.5841	1.5802	6	1.4971	1.4961	8	1.4981	1.4971
	4	1.6384	1.6345	6	1.5226	1.5216	8	1.5236	1.5226
M39	2	1.6465	1.6440	4	1.5887	1.5877	6	1.5897	1.5887
	3	1.7022	1.6983	6	1.6152	1.6142	8	1.6162	1.6152
	4	1.7565	1.7526	6	1.6407	1.6397	8	1.6417	1.6407
M2.5	0.45	3.147	3.122	1	2.807	2.794	2	2.819	2.807
M3	0.5	3.716	3.691	1	3.338	3.325	2	3.350	3.338
M3.5	0.6	4.354	4.328	1	3.904	3.891	2	3.917	3.904

(continued)

TABLE 17A TAP THREAD LIMITS (SCREW THREAD INSERTS [STI], GROUND THREAD, METRIC SIZE [INCH]) (CONT'D)

Metric Size (STI)	Pitch, mm	Tap Major Diameter, in.		Recommended Tap Pitch Diameter Limits, mm					
				Tolerance Class 4H			Tolerance Class 5H and 6H		
		Min.	Max.	H Limit	Max.	Min.	H Limit	Max.	Min.
M4	0.7	5.006	4.966	2	4.481	4.468	3	4.493	4.481
M5	0.8	6.142	6.104	2	5.547	5.535	3	5.555	5.547
M6	1	7.422	7.381	2	6.678	6.665	3	6.690	6.678
M7	1	8.423	8.382	2	7.676	7.663	3	7.689	7.676
M8	1	9.423	9.383	2	8.677	8.664	3	8.689	8.677
	1.25	9.787	9.723	2	8.839	8.827	3	8.852	8.839
M10	1	11.422	11.382	2	10.676	10.663	3	10.688	10.676
	1.25	11.788	11.725	2	10.838	10.825	3	10.851	10.838
	1.5	12.131	12.068	3	11.013	11.001	4	11.026	11.013
M12	1.25	13.787	13.724	3	12.850	12.837	4	12.863	12.850
	1.5	14.133	14.069	3	13.012	13.000	4	13.025	13.012
	1.75	14.478	14.415	3	13.175	13.162	4	13.188	13.175
M14	1.5	16.132	16.068	3	15.014	15.001	4	15.027	15.014
	2	16.822	16.759	3	15.339	15.326	5	15.364	15.352
M16	1.5	18.133	18.070	3	17.013	17.000	4	17.026	17.013
	2	18.821	18.758	3	17.338	17.325	5	17.363	17.351
M18	1.5	20.132	20.069	3	19.012	18.999	4	19.025	19.012
	2	20.823	20.759	3	19.337	19.324	5	19.362	19.350
	2.5	21.514	21.450	3	19.662	19.649	5	19.688	19.675
M20	1.5	22.131	22.068	3	21.013	21.001	4	21.026	21.013
	2	22.822	22.758	3	21.339	21.326	5	21.364	21.351
	2.5	23.513	23.449	3	21.664	21.651	5	21.689	21.676
M22	1.5	24.130	24.067	3	23.012	23.000	4	23.025	23.012
	2	24.823	24.760	3	23.338	23.325	5	23.363	23.350
	2.5	25.512	25.448	3	23.663	23.650	5	23.688	23.675
M24	2	26.820	26.756	4	25.352	25.326	6	25.377	25.352
	3	28.237	28.138	4	25.999	25.974	6	26.025	25.999
M27	2	29.822	29.759	4	28.351	28.326	6	28.377	28.351
	3	31.237	31.138	4	28.999	28.974	6	29.025	28.999
M30	2	32.822	32.758	4	31.351	31.326	6	31.377	31.351
	3.5	34.925	34.826	4	32.324	32.299	6	32.349	32.324
M33	2	35.822	35.758	4	34.354	34.328	6	34.379	34.354
	3.5	37.925	37.826	4	35.324	35.298	6	35.349	35.324
M36	2	38.821	38.758	4	37.353	37.328	6	37.379	37.353
	3	40.236	40.137	6	38.026	38.001	8	38.052	38.026
	4	41.615	41.516	6	38.674	38.649	8	38.699	38.674
M39	2	41.821	41.758	4	40.353	40.328	6	40.378	40.353
	3	43.236	43.137	6	41.026	41.001	8	41.051	41.026
	4	44.615	44.516	6	41.674	41.648	8	41.699	41.674

GENERAL NOTES:

(a) These taps are over the nominal size to the extent that the internal thread they produce will accommodate a helical coil screw insert, which at final assembly will accept a screw thread of the normal size and pitch.

(b) STI basic thread dimensions are determined by adding twice the single thread height ($2 \times 0.64952P$) to the basic dimensions of the nominal thread size.

(c) Formulas for major and pitch diameters are presented in MIL-T-21309E.

NONMANDATORY APPENDIX A

TABLE A1 TAP SIZE RECOMMENDATIONS FOR CLASSES 2B AND 3B UNIFIED INCH SCREW THREADS (MACHINE SCREW AND FRACTIONAL SIZES)

Size	Threads per Inch		Recommended Tap for Class of Thread [Note (1)]		Pitch Diameter Limits for Class of Thread		
	NC UNC	NF UNF	Class 2B [Note (2)]	Class 3B [Note (3)]	Min. All Classes (Basic)	Max. Class 2B	Max. Class 3B
0	...	80	G H2	G H1	0.0519	0.0542	0.0536
1/4	20	...	G H5	G H3	0.2175	0.2224	0.2211
1/4	...	28	G H4	G H3	0.2268	0.2311	0.2300
5/16	18	...	G H5	G H3	0.2764	0.2817	0.2803
5/16	...	24	G H4	G H3	0.2854	0.2902	0.2890
3/8	16	...	G H5	G H3	0.3344	0.3401	0.3387
3/8	...	24	G H4	G H3	0.3479	0.3528	0.3516
7/16	14	...	G H5	G H3	0.3911	0.3972	0.3957
7/16	...	20	G H5	G H3	0.4050	0.4104	0.4091
1/2	13	...	G H5	G H3	0.4500	0.4565	0.4548
1/2	...	20	G H5	G H3	0.4675	0.4731	0.4717
9/16	12	...	G H5	G H3	0.5084	0.5152	0.5135
9/16	...	18	G H5	G H3	0.5264	0.5323	0.5308
5/8	11	...	G H5	G H3	0.5660	0.5732	0.5714
5/8	...	18	G H5	G H3	0.5889	0.5949	0.5934
3/4	10	...	G H5	G H5	0.6850	0.6927	0.6907
3/4	...	16	G H5	G H3	0.7094	0.7159	0.7143
7/8	9	...	G H6	G H4	0.8028	0.8110	0.8089
7/8	...	14	G H6	G H4	0.8286	0.8536	0.8339
1	8	...	G H6	G H4	0.9188	0.9276	0.9254
1	...	12	G H6	G H4	0.9459	0.9535	0.9516
1	14NS	14NS	G H6	G H4	0.9536	0.9609	0.9590
1	64	...	G H2	G H1	0.0629	0.0655	0.0648
1	...	72	G H2	G H1	0.0640	0.0665	0.0659
1 1/8	7	...	G H8	G H4	1.0322	1.0416	1.0393
1 1/8	...	12	G H6	G H4	1.0709	1.0787	1.0768

(continued)

TABLE A1 TAP SIZE RECOMMENDATIONS FOR CLASSES 2B AND 3B UNIFIED INCH SCREW THREADS (MACHINE SCREW AND FRACTIONAL SIZES) (CONT'D)

Size	Threads per Inch		Recommended Tap for Class of Thread [Note (1)]		Pitch Diameter Limits for Class of Thread		
	NC UNC	NF UNF	Class 2B [Note (2)]	Class 3B [Note (3)]	Min. All Classes (Basic)	Max. Class 2B	Max. Class 3B
1¼	7	...	G H8	G H4	1.1572	1.1668	1.1644
1¼	...	12	G H6	G H4	1.1959	1.2039	1.2019
1⅜	6	...	G H8	G H4	1.2667	1.2771	1.2745
1⅜	...	12	G H6	G H4	1.3209	1.3291	1.3270
1½	6	...	G H8	G H4	1.3917	1.4022	1.3996
1½	...	12	G H6	G H4	1.4459	1.4542	1.4522
2	56	...	G H2	G H1	0.0744	0.0772	0.0765
2	...	64	G H2	G H1	0.0759	0.0786	0.0779
3	48	...	G H2	G H1	0.0855	0.0855	0.0877
3	...	56	G H2	G H1	0.0874	0.0902	0.0895
4	40	...	G H2	G H2	0.0958	0.0991	0.0982
4	...	48	G H2	G H1	0.0985	0.1016	0.1008
5	40	...	G H2	G H2	0.1088	0.1121	0.1113
5	...	44	G H2	G H1	0.1102	0.1134	0.1126
6	32	...	G H3	G H2	0.1177	0.1214	0.1204
6	...	40	G H2	G H2	0.1218	0.1252	0.1243
8	32	...	G H3	G H2	0.1437	0.1475	0.1465
8	...	36	G H2	G H2	0.1460	0.1496	0.1487
10	24	...	G H3	G H3	0.1629	0.1672	0.1661
10	...	32	G H3	G H2	0.1697	0.1736	0.1726
12	24	...	G H3	G H3	0.1889	0.1933	0.1922
12	...	28	G H3	G H3	0.1928	0.1970	0.1959

GENERAL NOTES:
(a) All dimensions are given in inches.
(b) The above recommended taps normally produce the class of thread indicated in average materials when used with reasonable care; however, if the tap specified does not give a satisfactory gage fit in the work, a choice of some other limit tap will be necessary.

NOTES:
(1) Recommended taps are for cutting threads only and are not for roll-form threads.
(2) Cut thread taps in sizes #3 to 1½ in. NC and NF, inclusive, may be used under normal conditions and in average materials for producing Class 2B tapped holes.
(3) Taps suitable for Class 3B are satisfactory for Class 2B threads.

TABLE A2 TAP SIZE RECOMMENDATIONS FOR CLASS 6H METRIC SCREW THREADS

Thread Size		Recommended Tap Limit Number	Internal Thread: Product Limits, Class 6H			
			Pitch Diameter, mm		Pitch Diameter, in.	
Nominal Diameter, mm	Pitch, mm		Min.	Max.	Min.	Max.
1.6	0.35	D3	1.373	1.458	0.05406	0.05740
2	0.4	D3	1.740	1.830	0.06850	0.07205
2.5	0.45	D3	2.208	2.303	0.08693	0.09067
3	0.5	D3	2.675	2.775	0.10531	0.10925
3.5	0.6	D4	3.110	3.222	0.12244	0.12685
4	0.7	D4	3.545	3.663	0.13957	0.14421
4.5	0.75	D4	4.013	4.131	0.15789	0.16264
5	0.8	D4	4.480	4.605	0.17638	0.18130
6	1	D5	5.350	5.500	0.21063	0.21654
7	1	D5	6.350	6.500	0.25000	0.25591
8	1.25	D5	7.188	7.348	0.28299	0.28929
10	1.5	D6	9.206	9.206	0.35535	0.36244
12	1.75	D6	10.863	11.063	0.42768	0.43555
14	2	D7	12.701	12.913	0.50004	0.50839
16	2	D7	14.701	14.913	0.57878	0.58713
20	2.5	D7	18.376	18.600	0.72346	0.73228
24	3	D8	22.051	22.316	0.86815	0.87858
30	3.5	D9	27.727	28.007	1.09161	1.10264
36	4	D9	33.402	33.702	1.31504	1.32685

GENERAL NOTE:
The above recommended taps normally produce the class of thread indicated in average materials when used with reasonable care; however, if the tap specified does not give a satisfactory gage fit in the work, a choice of some other limit tap will be necessary.

TABLE A3 TAP THREAD LIMITS: METRIC SIZES, GROUND THREAD (M PROFILE: STANDARD THREAD LIMITS IN INCHES)

Nominal Diameter, mm	Pitch, mm	Major Diameter			Pitch Diameter									
						D3		D4		D5		D6	
		Basic	Min.	Max.	Basic	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1.6	0.35	0.06299	0.06409	0.06508	0.05406	0.05500	0.05559	...	...	...	...	...	...
2	0.4	0.07874	0.08000	0.08098	0.06850	0.06945	0.07004	...	...	...	...	...	...
2.5	0.45	0.09843	0.09984	0.10083	0.08693	0.08787	0.08846	...	...	...	...	...	...
3	0.5	0.11811	0.11969	0.12067	0.10531	0.10626	0.10685	...	...	0.10278 (2),(3)	0.10787 (2),(3)	...	...
3.5	0.6	0.13780	0.13969	0.14067	0.12244	...	...	0.12370	0.12449	...	...	...	...
4	0.7	0.15748	0.15969	0.16130	0.13957	...	...	0.14083	0.14161	...	...	0.14185 (2),(3)	0.14264 (2),(3)
4.5	0.75	0.17717	0.17953	0.18114	0.15799	...	...	0.15925	0.16004	...	...	...	...
5	0.8	0.19685	0.19937	0.20098	0.17638	...	...	0.17764	0.17843	...	...	...	...
6	1	0.23622	0.23937	0.24098	0.21063	...	...	...	...	0.21220	0.21319	...	...
7	1	0.27559	0.27874	0.28035	0.25000	...	...	...	...	0.25157	0.25256	...	...
8	1.25	0.31496	0.31890	0.32142	0.28299	...	...	...	...	0.28433	0.28555	...	...
10	1.5	0.39370	0.39843	0.40094	0.35535	...	...	...	...	...	...	0.35720	0.35843
12	1.75	0.47244	0.47795	0.48047	0.42768	...	...	...	...	...	...	0.42953	0.43075
14	2	0.55118	0.55748	0.56000	0.50004	...	...	...	...	...	...	...	...
14	1.25	0.55118	0.55500	0.55600	0.51920	...	...	0.52070 (1)	0.52120 (1)	...	...	...	...
16	2	0.62992	0.63622	0.63874	0.57878	...	...	...	...	...	...	...	...
18	1.5	0.70870	0.71350	0.71450	0.67030	...	...	0.67180 (1)	0.67230 (1)	...	...	...	...
20	2.5	0.78740	0.79528	0.79780	0.72346	...	...	...	...	...	...	...	...
24	3	0.94488	0.95433	0.95827	0.86815	...	...	...	...	...	...	...	...
30	3.5	1.18110	1.19213	1.19606	1.09161	...	...	...	...	...	...	...	...
36	4	1.41732	1.42992	1.43386	1.31504	...	...	...	...	...	...	...	...
42	4.5	1.65354	1.66772	1.71102	1.53846	...	...	...	...	...	...	...	...
48	5	1.88976	1.90551	1.98819	1.76189	...	...	...	...	...	...	...	...

GENERAL NOTES:
(a) Limits listed in above table are the most commonly used in industry.
(b) Not all styles of taps are available with all limits listed.
(c) For calculation of limits other than those listed, see formulas and Table 8.

NOTES:
(1) These sizes are intended for spark plug applications; use tolerances from Table 7, column D.
(2) Minimum and maximum major diameters are 0.00102 larger than shown.
(3) Standard D limit for thread forming taps.
(4) Minimum and maximum major diameters are 0.00154 larger than shown.
(5) Minimum and maximum major diameters are 0.00205 larger than shown.
(6) Minimum and maximum major diameters are 0.00256 larger than shown.

TABLE A3 TAP THREAD LIMITS: METRIC SIZES, GROUND THREAD (M PROFILE: STANDARD THREAD LIMITS IN INCHES)

Pitch Diameter									
D7		D8		D9		D10		D11	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
0.17917 (3),(4)	0.17996 (3),(4)	...	...	...	...	...	...	...	...
...	...	0.21374 (3),(4)	0.21472 (3),(4)	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	0.28638 (3),(5)	0.28760 (3),(5)	...	...	...	...
...	...	...	...	...	...	0.35925	0.36047	...	...
...	...	...	...	...	...	...	...	0.43209 (3),(6)	0.43331 (3),(6)
0.50201	0.50362	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
0.58075	0.58236	...	...	...	...	...	...	...	...
0.58075	0.58236	...	...	...	...	...	...	...	...
0.72543	0.72705	...	...	...	...	...	...	...	...
...	...	0.87063	0.87224	...	...	...	...	...	...
...	...	...	...	1.09417	1.09622	...	...	...	...
...	...	...	...	1.31760	1.31965	...	...	...	...
...	...	...	...	...	...	1.54154	1.54358	...	...
...	...	...	...	...	...	1.76496	1.76701	...	...

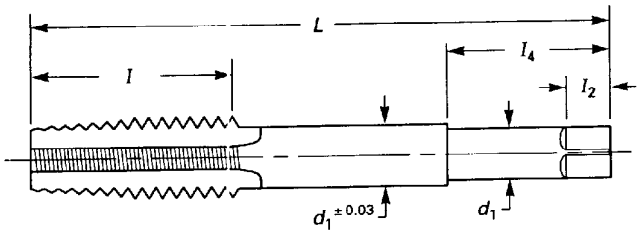


TABLE A4 SPECIAL EXTENSION TAPS (TAP DIMENSIONS, GROUND AND CUT THREADS)

General Dimensions				Tolerances				
Nominal Tap Size				For Shank Diameter, d_1 for l_4 Length				
				Size Range				
Fractional	Machine Screw	Pipe	Shank Length, l_4	Fractional, in.	Machine Screw	Pipe, in.	Direction	Tolerance
...	0–3	...	0.88	1/4 to 5/8 incl.	0 to 14 incl.	1/16 to 1/8 incl.	Minus	0.003
...	4	...	1.00					
...	5–6	...	1.13	11/16 to 1 1/2 incl.	...	1/4 to 1 incl.	Minus	0.004
...	8	...	1.25					
...	10–12	1/16 to 1/4 incl.	1.38	1 5/8 to 4 incl.	...	1 1/4 to 4 incl.	Minus	0.006
1/4	14	...	1.50					
5/16	...	...	1.56					
3/8	...	...	1.63					
7/16	...	3/8 to 1/2 incl.	1.69					
1/2	...	...	1.69					
9/16	...	3/4	1.88					
5/8	...	1	2.00					
11/16	...	...	2.13					
3/4	...	1 1/4	2.25					
13/16	...	1 1/2	2.38					
7/8	...	...	2.50					
15/16	...	...	2.63					
1	...	...	2.63					
1 1/8	...	2	2.75					
1 1/4	...	2 1/2	2.88					
1 3/8	...	...	3.00					
1 1/2	...	...	3.00					
1 5/8	...	3	3.13					
1 3/4	...	...	3.13					
1 7/8	...	...	3.25					
2	...	...	3.25					
2 1/8	...	...	3.38					
2 1/4	...	...	3.38					
2 3/8	...	...	3.50					
2 1/2	...	...	3.50					
2 5/8	...	3 1/2	3.63					
2 3/4	...	...	3.63					
2 7/8	...	...	3.75					
3	...	...	3.75					
3 1/8	...	...	3.88					
3 1/4	...	...	3.88					
3 3/8	...	4	4.00					
3 1/2	...	...	4.00					
3 5/8	...	...	4.13					
3 3/4	...	...	4.13					
3 7/8	...	...	4.25					
4	...	...	4.25					

GENERAL NOTE:
Unless otherwise specified, special extension taps will be furnished with dimensions and tolerances as shown for machine screw and fractional taps Tables 2 and 2A and for pipe taps in Table 5. Exceptions are as follows:
(a) Types of centers are optional with manufacturer.
(b) Tolerances on shank diameter d_1 for l_4 length as shown in the above table.
(c) Shank runout tolerance in Table 6 applies only to the l_4 length shown in the above table.

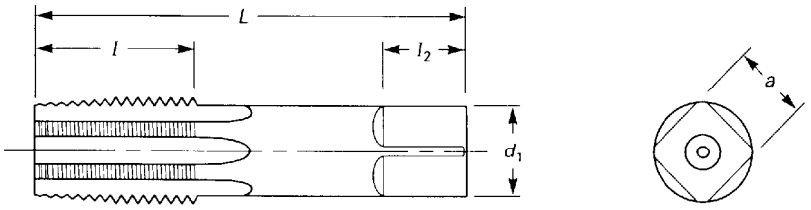


TABLE A5 SPECIAL FINE PITCH TAPS, SHORT SERIES (TAP DIMENSIONS, GROUND AND CUT THREAD)

General Dimensions								
Nominal Diameter Range, in.		Nominal Fractional Diameter, in.	Nominal Metric Diameter, mm	Tap Dimensions, in.				
Over	To (Inclusive)			Overall Length, *L*	Thread Length, *l*	Square Length, l_2	Shank Diameter, d_1	Size of Square, *a*
1.070	1.073	1 1/16	M27	4.00	1.50	0.88	0.8960	0.672
1.073	1.135	1 1/8	...	4.00	1.50	0.88	0.8960	0.672
1.135	1.198	1 3/16	M30	4.00	1.50	1.00	1.0210	0.766
1.198	1.260	1 1/4	...	4.00	1.50	1.00	1.0210	0.766
1.260	1.323	1 5/16	M33	4.00	1.50	1.00	1.1080	0.831
1.323	1.385	1 3/8	...	4.00	1.50	1.00	1.1080	0.831
1.385	1.448	1 7/16	M36	4.00	1.50	1.00	1.2330	0.925
1.448	1.510	1 1/2	...	4.00	1.50	1.00	1.2330	0.925
1.510	1.635	1 5/8	M39	5.00	2.00	1.13	1.3050	0.979
1.635	1.760	1 3/4	M42	5.00	2.00	1.25	1.4300	1.072
1.760	1.885	1 7/8	...	5.00	2.00	1.25	1.5190	1.139
1.885	2.010	2	M48	5.00	2.00	1.38	1.6440	1.233
2.010	2.135	2 1/8	...	5.25	2.00	1.38	1.7690	1.327
2.135	2.260	2 1/4	M56	5.25	2.00	1.44	1.8940	1.420
2.260	2.385	2 3/8	...	5.25	2.00	1.44	2.0190	1.514
2.385	2.510	2 1/2	...	5.25	2.00	1.50	2.1000	1.575
2.510	2.635	2 5/8	M64	5.50	2.00	1.50	2.1000	1.575
2.635	2.760	2 3/4	...	5.50	2.00	1.50	2.1000	1.575
2.760	2.885	2 7/8	M72	5.50	2.00	1.50	2.1000	1.575
2.885	3.010	3	...	5.50	2.00	1.50	2.1000	1.575
3.010	3.135	3 1/8	...	5.75	2.00	1.50	2.1000	1.575
3.135	3.260	3 1/4	M80	5.75	2.00	1.50	2.1000	1.575
3.260	3.385	3 3/8	...	5.75	2.00	1.50	2.1000	1.575
3.385	3.510	3 1/2	...	5.75	2.00	1.50	2.1000	1.575
3.510	3.635	3 5/8	M90	6.00	2.00	1.75	2.1000	1.575
3.635	3.760	3 3/8	...	6.00	2.00	1.75	2.1000	1.575
3.760	3.885	3 7/8	...	6.00	2.00	1.75	2.1000	1.575
3.885	4.010	4	M100	6.00	2.00	1.75	2.1000	1.575

GENERAL NOTES:

(a) Unless otherwise specified, special taps 1.010 in. to 1.510 in. in diameter, inclusive, have 14 or more threads per inch or 1.75-mm pitch and finer. Sizes greater than 1.510 in. in diameter with 10 or more threads per inch, or 2.5-mm pitch and finer will be made to the general dimensions shown above.

(b) For tolerances see Table 2.

(c) For runout tolerances of tap elements, see Table 6.