ASME B94.9-2008

(Revision of ASME B94.9-1999)

REAFFIRMED 2023

Taps: Ground Thread With Cut Thread Appendix (Inch and Metric Sizes)

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

ASME SETTING THE STANDARD

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Date of Issuance: June 30, 2009

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.

Periodically certain actions of the ASME B1 Committee will be published as Cases. Cases are published on the ASME Web site under the Committee Pages at http://cstools.asme.org as they are issued.

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

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Nonmandatory Appendices

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.

In 2005 the revised Standard proposed by Technical Committee 12 was approved and designated ASME B94.9-2008. The following major changes to the standard included are:

(a) ASME B94.9 is now under the B1 Standards Committee. This Standard will still have the B94.9 designation.

(b) All tables for cut thread taps have been moved to the Appendix section of this Standard.

(c) STI size taps have had blank sizes revised to be consistent with standard industry practice. The major diameter values on metric STI taps will follow established values, and pitch diameter values of metric STI taps will remain listed with "H" pitch diameter limits.

(d) The term "lead tolerance" has been changed to "cumulative pitch error," and formulas for calculating the values are included in this Standard.

(e) The practice of marking taps NPS has been changed to NPSC/NSPM.

(f) The practice of marking taps NC, NF, NEF, NS has been changed to UNC, UNF, UNEF, UNS for machine screw and fractions sizes.

(g) The inclusion of HS (high speed steel) and G (ground thread) has been made optional in the marking of taps.

(h) Nomenclature definitions for high speed steel, ground thread taps, and cut thread taps have been added

This Standard was approved as an American National Standard on June 18, 2008.

ASME B1 COMMITTEE
Screw Threads

(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 proposing revisions, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B1 Standards 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.

Proposing a Case. Cases may be issued for the purpose of providing alternative rules when justified, to permit early implementation of an approved revision when the need is urgent, or to provide rules not covered by existing provisions. Cases are effective immediately upon ASME approval and shall be posted on the ASME Committee Web page.

Requests for Cases shall provide a Statement of Need and Background Information. The request should identify the Standard, the paragraph, figure or table number(s), and be written as a Question and Reply in the same format as existing Cases. Requests for Cases should also indicate the applicable edition(s) of the Standard to which the proposed Case applies.

Attending Committee Meetings. The B1 Standards Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B1 Standards Committee.

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TAPS: GROUND THREAD WITH CUT THREAD APPENDIX (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 types and styles of taps listed below. For thread series designations, refer to Table 1.

Type	Style	Applicable Section(s)
Standard straight thread, general purpose; Tables 2, 3, and 4	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
	Straight fluted	3.1
Pulley; Table 6	Straight fluted	3.7
Pipe, taper thread; Table 7	Straight fluted	3.8
Pipe, straight thread; Table 10	Straight fluted	3.8
Thread forming; Tables 2 and 3	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.

ASME B1.1, Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.7, Screw Threads: Nomenclature, Definitions, and Letter Symbols
ASME B1.12, Class 5 Interference-Fit Thread
ASME B1.13M, Metric Screw Threads — M Profile
ASME B1.15, Unified Inch Screw Threads (UNJ Thread Form)
ASME B1.20.1, Pipe Threads, General Purpose (Inch)
ASME B1.20.3, Dryseal Pipe Threads (Inch)
ASME B1.20.7, Hose Coupling Screw Threads (Inch)
ASME B1.21M, Metric Screw Threads: MJ Profile
ASME B1.30, Screw Threads — Standard Practice for Calculating and Rounding Dimensions
ASME B18.29.1, Helical Coil Screw Thread Inserts — Free Running and Screw Locking (Inch Series)
Publisher: The American Society of Mechanical Engineers (ASME), Three Park Avenue, New York, NY 10016-5990; Order Department, 22 Law Drive, P.O. Box 2300, Fairfield, NJ 07007-2300

SAE AS-8879, Screw Threads-UNJ Profile Inch Controlled Radius Root With Increased Minor Diameter
SAE AS-71051, Pipe Threads Taper, Aeronautical National Form, Symbol ANPT-Design and Inspection Standard
Publisher: Society of Automotive Engineers (SAE), 400 Commonwealth Drive, Warrendale, PA 15096-0001

1.3 Basic Form of Thread

The basic angle of thread between the flanks of thread measured in an axial plane is 60 deg (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 is obtained by subtracting the symmetrical single thread height, h, from the basic major diameter as follows:

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

where

D_{bsc} = basic major diameter
h = symmetrical height of thread
n = number of threads per inch
P = pitch of thread

1.4 Tap Pitch Diameter Size

A range of tap pitch diameter limits from which the user may select to suit local conditions is available. Tables A-1 and A-2 in Nonmandatory Appendix A list tap pitch diameter 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

Fig. 1 Illustrations of Terms Applying to Taps

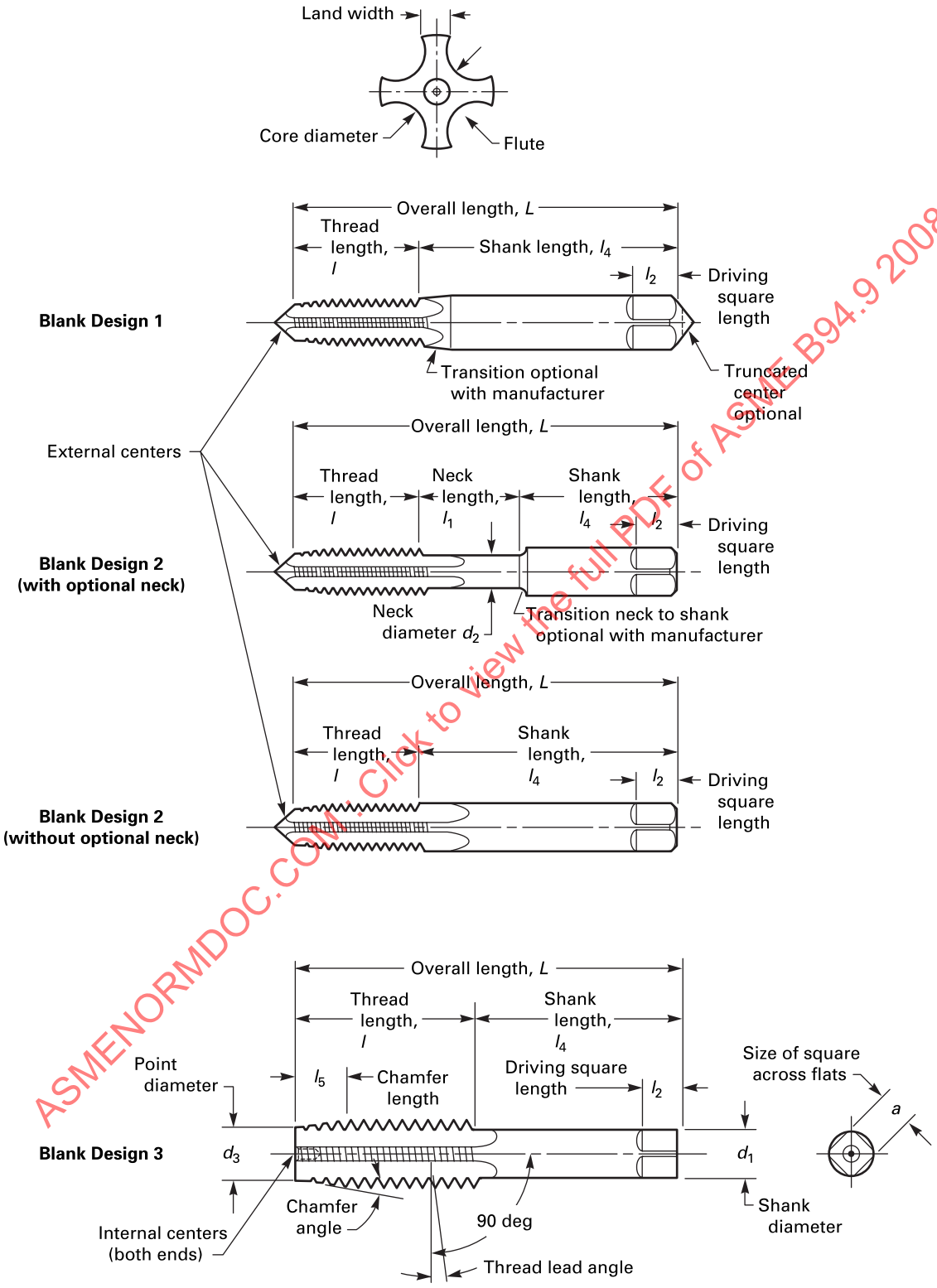
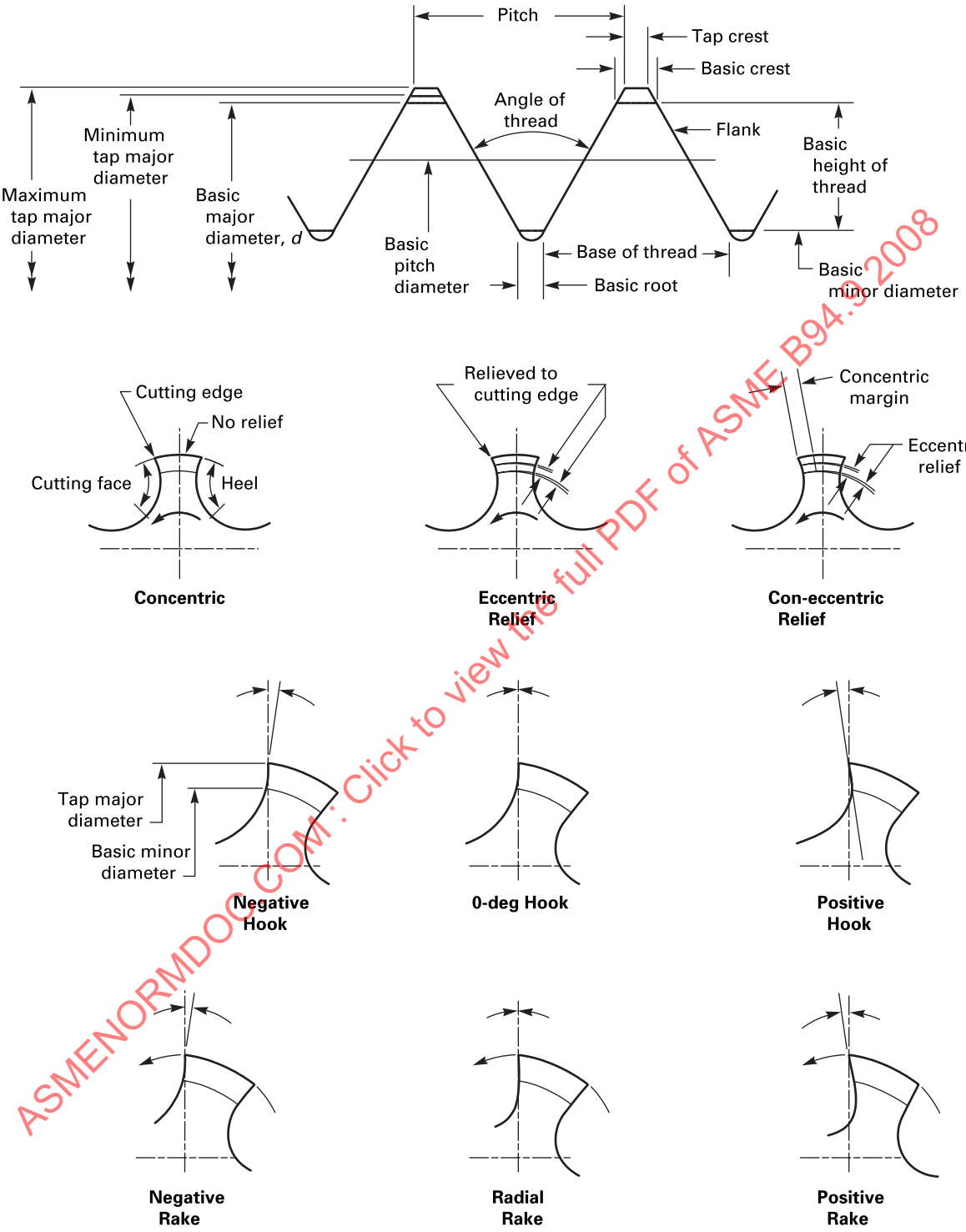


Fig. 1 Illustrations of Terms Applying to Taps (Cont'd)



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 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 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 8 and 9.

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. See Fig. 1.

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 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, 3, 4, and 5. For number of flutes see Table 11. For ground thread limits see Tables 12, 13, and 14. For cut thread limits see Tables A-3 and A-4. For chamfer designations, including taper, plug, semibottom, and bottom, see Table 8. For runout tolerance see Table 15.

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, 3, 4, and 5. For number of flutes see Table 11. For ground thread limits see Tables 12, 13, and 14. For cut thread limits see Tables A-3 and A-4. For chamfer designations, including taper, plug, semibottom, and bottom see Table 8. For runout tolerance see Table 15.

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 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, 3, 4, and 5. For number of flutes see Table 11. For ground thread limits see Tables 12, 13, and 14. For cut thread limits see Tables A-3 and A-4. For chamfer designations, including taper, plug, semibottom, and bottom see Table 8. For runout tolerance see Table 15.

3.4 Regular Spiral Fluted Style Taps

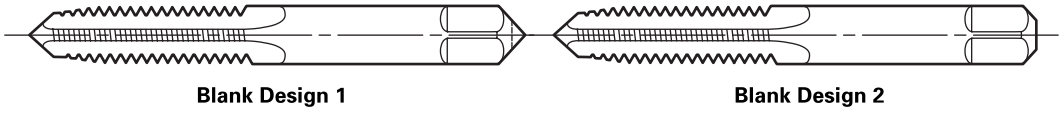
Regular spiral fluted style taps, illustrated in Fig. 5, have right-hand spiral flutes with a helix angle of 25 deg to 35 deg. They are designed to help extract the chips from the hole and/or to bridge a keyway. This Standard applies to machine screw, fractional, metric, and STI sizes in high-speed steel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

For general dimensions, optional necks, shortened thread length, and tolerance see Tables 2, 3, 4, and 5. For number of flutes see Table 11. For ground thread limits see Tables 12, 13, and 14. For cut thread limits see Tables A-3 and A-4. For chamfer designations, including taper, plug, semibottom, and bottom, see Table 8. For runout tolerance see Table 15.

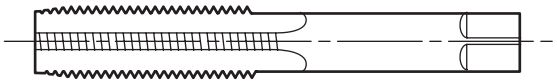
3.5 Fast Spiral Fluted Style Taps

Fast spiral fluted style taps, illustrated in Fig. 6, have right-hand spiral flutes with a helix angle of 45 deg to

Fig. 2 Straight Flute Style Taps

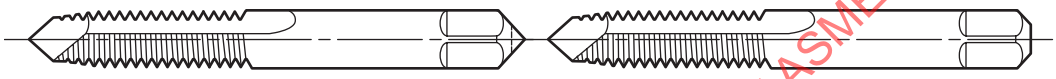


Blank Design 1 Blank Design 2

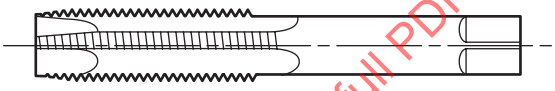


Blank Design 3

Fig. 3 Spiral Pointed Style Taps

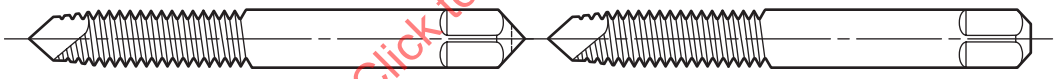


Blank Design 1 Blank Design 2

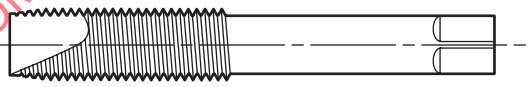


Blank Design 3

Fig. 4 Spiral Pointed Only Style Taps

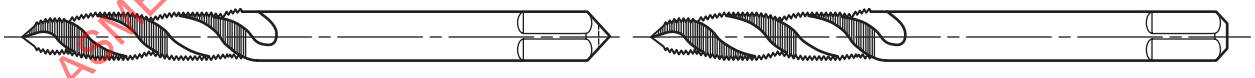


Blank Design 1 Blank Design 2

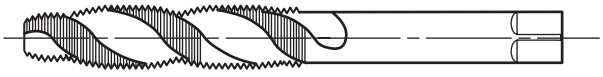


Blank Design 3

Fig. 5 Regular Spiral Fluted Style Taps

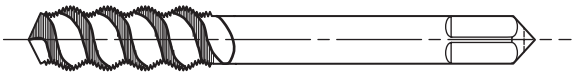


Blank Design 1 Blank Design 2

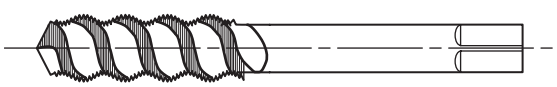


Blank Design 3

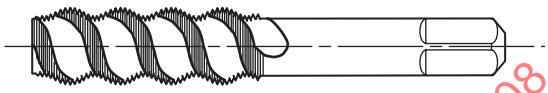
Fig. 6 Fast Spiral Fluted Style Taps



Blank Design 1

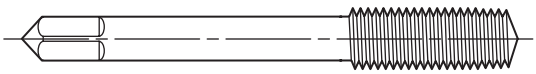


Blank Design 2

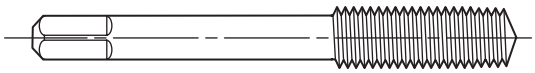


Blank Design 3

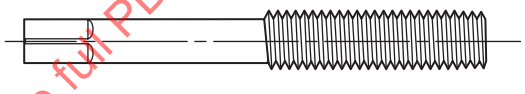
Fig. 7 Thread Forming Type Taps



Blank Design 1



Blank Design 2



Blank Design 3

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.

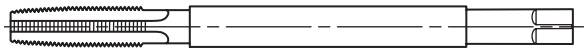
For general dimensions, optional necks, shortened thread length, and tolerance see Tables 2, 3, 4, and 5. For number of flutes see Table 11. For standard ground thread limits see Tables 12, 13, and 14. For cut thread limits see Tables A-3 and A-4. For chamfer designations, including taper, plug, semibottom, and bottom see Table 8. For runout tolerance see Table 15.

3.6 Thread Forming Type Taps

Thread forming type taps, illustrated in Fig. 7, are fluteless except as optionally designed with one or 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, 3, 4, and 5. For standard ground thread limits see Tables 12, 13, and 14. For entry taper designations, including plug and bottom, see Table 9. For runout tolerance see Table 15.

Fig. 8 Pulley Type Taps



3.7 Pulley Type Taps

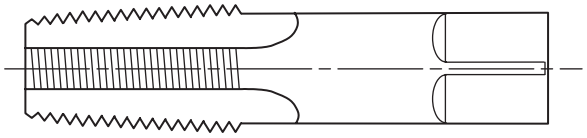
Pulley type taps, illustrated in Fig. 8, were originally designed for tapping line shaft pulleys by hand. Today, the pulley tap, which is used where extended reach is required, is commonly driven by machine. Because shank diameter is the same as the nominal diameter, the shank diameter and square size 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 16. For number of flutes see Table 16. For standard ground thread limits see Tables 12, 13, and 14. For chamfer designations see Table 8. For runout tolerance see Table 15.

3.8 Pipe Type Taps

Pipe type taps, illustrated in Fig. 9, are designed for producing standard straight or taper pipe threads. This

Fig. 9 Pipe Type Taps



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 3½ threads chamfered.

For general dimensions, optional necks, and tolerance and for number of flutes see Table 6. For taper thread ground thread limits see Table 17. For taper thread cut thread limits see Table A-5. For straight thread ground thread limits see Tables 18 and 19. For straight thread cut thread limits see Table A-5. For chamfer designations see Table 8. For runout tolerance see Table 15.

4 STANDARD SYSTEM OF TAP MARKING

4.1 Ground Thread Taps, Inch Screw Threads: UN Profile

Ground thread taps in the United States are marked with the nominal size, number of threads per inch, the proper symbol to identify the thread form, designators for tap pitch diameter, and special features such as left-hand. Taps with pitch diameter designators, systems of limits, and special features are specified in section 5. Thread series designators are specified in Table 1. "HS" for high speed steel and "G" for ground thread are optional with the manufacturer.

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 pitch in millimeters, separated by the sign "X," designators for tap pitch diameter, and special features such as left-hand. Taps with pitch diameter designators, system of limits, and special features are specified in section 5. Thread series designators are specified in Table 1. "HS" for high speed steel and "G" for ground thread taps are optional with the manufacturer.

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

5.1 Tap Thread Limits (Unified Inch Screw Threads)

5.1.1 H or L Limits. When the maximum tap pitch diameter limit is over the basic pitch diameter by an even multiple of 0.0005, or the minimum tap pitch diameter limit is under basic pitch diameter 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:

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

$$\text{L limit number} = \frac{\text{Amount minimum tap pitch diameter limit is under basic pitch diameter.}}{0.0005}$$

Tap pitch diameter tolerances for H or L limits are found in Table 7, column D. Standard tap pitch diameter limits for various H limits numbers are shown in Tables 12 and 13.

When unified inch screw thread taps are ordered without a specified pitch diameter for H limit, the tap pitch diameter is determined by the formulas in Table 7 and is marked with the appropriate H limit.

EXAMPLES: Tap marking with H or L limit numbers.

(a) $\frac{3}{8}$ – 16 UNC H1

(1) Maximum tap pitch diameter = Basic pitch diameter + 0.0005 in.

(2) Minimum tap pitch diameter = Maximum tap pitch diameter – 0.0005 in.

(b) $1\frac{1}{4}$ – 7 UNC H4

(1) Maximum tap pitch diameter = Basic pitch diameter + 0.0020 in.

(2) Minimum tap pitch diameter = Maximum tap pitch diameter – 0.0010 in.

(c) 2 – 16 UN H8

(1) Maximum tap pitch diameter = Basic pitch diameter + 0.0040 in.

(2) Minimum tap pitch diameter = Maximum tap pitch diameter – 0.0015 in.

(d) $\frac{3}{8}$ – 16 UNC L2

(1) Minimum tap pitch diameter = Basic pitch diameter – 0.0010 in.

(2) Maximum tap pitch diameter = Minimum tap pitch diameter + 0.0005 in.

5.1.1.1 Optional Marking. "HS" (high speed steel) may be included in the marking to denote the base material from which the tap is manufactured. "G" (ground thread tap) may be included in the marking at the option of the tap manufacturer.

EXAMPLES:

(a) $\frac{3}{8}$ – 16 UNC HS H1

(b) $\frac{3}{8}$ – 16 UNC HS G H1

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

EXAMPLES: $^{7}/_{16}$ – 14 UNC +0.0017

(a) Minimum tap pitch diameter = Basic pitch diameter +0.0017 in.

(b) Maximum tap pitch diameter = Minimum tap pitch diameter +0.0005 in.

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

5.1.3 Special Tap Pitch Diameter. Taps not made to H or L limit, 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.

EXAMPLES:

(a) $^{1}/_{2}$ – 13 UNC Ⓢ

(b) $^{1}/_{2}$ – 13 UNC Spec

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

EXAMPLE: $^{3}/_{8}$ – 16 UNC LH H3

NOTE: 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 inch values are required, they are soft-converted from the three-place millimeter tap diameters, only after calculations are complete.

5.2.1 D or DU Limits. When the maximum tap pitch diameter limit is over the basic pitch diameter by an even multiple of 0.013 mm (0.000512 in. reference), or the minimum tap pitch diameter limit is under basic pitch diameter 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:

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

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

Tap pitch diameter tolerances, associated with the respective D or DU limit number see Table 10, column Z. For standard taps, pitch diameter limits for various D limit numbers are shown in Table 12.

When metric screw thread (M profile) taps are ordered without a specified pitch diameter, or a D limit number, the tap pitch diameter will be determined by the formulas in Table 10, and the tap will be marked with the appropriate D limit number.

EXAMPLES: Tap marking with D or DU limit numbers.

(a) M1.6 × 0.35 D3

(1) Maximum tap pitch diameter = Basic pitch diameter + 0.039 mm

(2) Minimum tap pitch diameter = Maximum tap pitch diameter – 0.015 mm

(b) M12 × 1.75 D6

(1) Maximum tap pitch diameter = Basic pitch diameter + 0.078 mm

(2) Minimum tap pitch diameter = Maximum tap pitch diameter – 0.031 mm

(c) M39 × 4 D10

(1) Maximum tap pitch diameter = Basic pitch diameter + 0.130 mm

(2) Minimum tap pitch diameter = Maximum tap pitch diameter – 0.052 mm

(d) M6 × 1 DU4

(1) Minimum tap pitch diameter = Basic pitch diameter – 0.052 mm

(2) Maximum tap pitch diameter = Minimum tap pitch diameter + 0.025 mm

5.2.1.1 Optional Marking. "HS" (high speed steel) may be included in the marking to denote the base material from which the tap is manufactured. "G" (ground thread tap) may be included in the marking at the option of the tap manufacturer.

EXAMPLES:

(a) M6 × 1.0 HS D6

(b) M6 × 1.0 G D6

5.2.2 Special Tap Pitch Diameter. Taps not made to D or DU limits, to the specifications in Table 10, or to the formula for oversize or undersize taps may be marked with "S" enclosed by a circle or another special identifier.

EXAMPLES:

(a) M10 × 1.5 HS Ⓢ

(b) M10 × 1.5 Spec

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

EXAMPLE:

(a) M10 × 1.5 LH D6

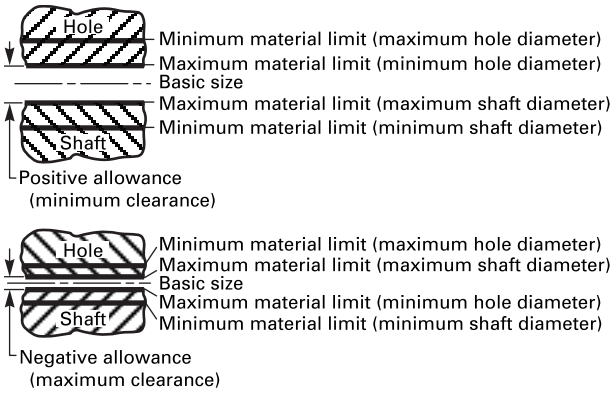
5.2.4 Screw Thread Inserts (STI). Refer to Tables 20 and 21 for additional information about tap thread limits.

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

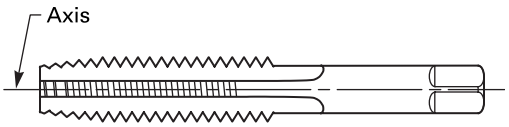
actual size: the measured size of a characteristic or element subject to measurement uncertainty.

allowance: a prescribed difference between the maximum material limits of mating parts. It is the minimum clear-

ance (positive allowance) or maximum interference (negative allowance) between such parts.

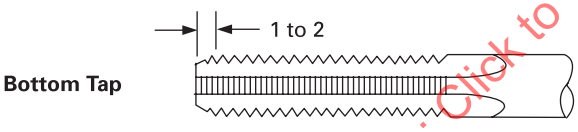


axis: the imaginary straight line that forms the longitudinal centerline of the tool or threaded part.



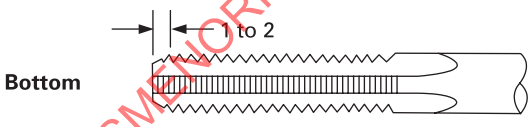
basic size: the size from which the limits are derived by application of allowance and tolerance.

bottom tap: a tap having a chamfer length of 1 to 2 pitches.

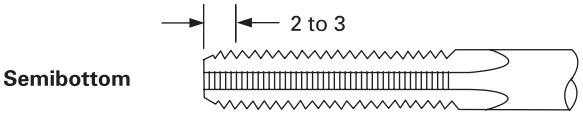


chamfer: the tapering of the threads at the front end of each land of a tap by cutting away and relieving the crest of the first few teeth to distribute the cutting action over several teeth.

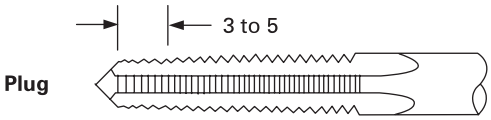
(a) bottom taps: chamfered 1 to 2 pitches.



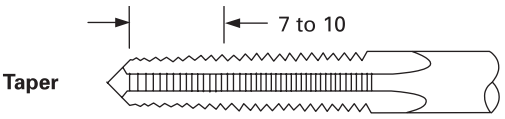
(b) semibottom taps: chamfered 2 to 3 pitches.



(c) plug taps: chamfered 3 to 5 pitches.

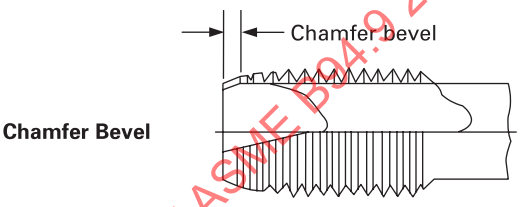


(d) taper taps: chamfered 7 to 10 pitches.

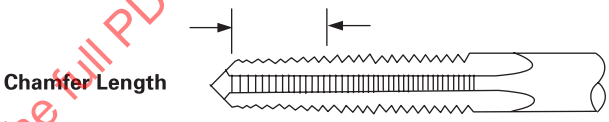


chamfer angle: the angle formed between the chamfer and the axis of the tap measured in an axial plane at the cutting edge.

chamfer bevel: an angular surface of revolution (which may or may not be relieved) preceding the point diameter on a tap.



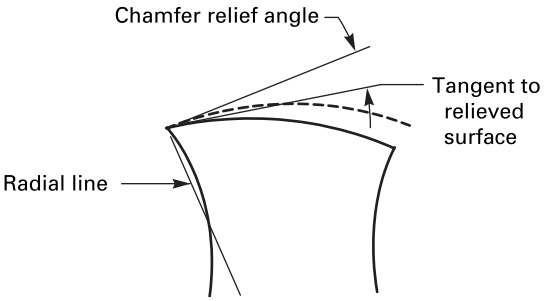
chamfer length: the length of the chamfer measured parallel to the axis at the cutting edge.



chamfer point diameter: see *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.

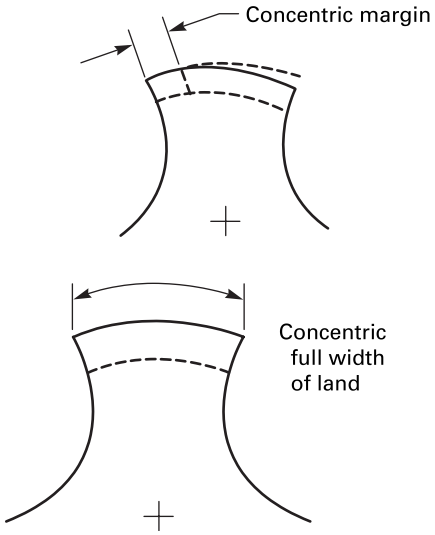


classes of threads: distinguished by the amounts of tolerance or tolerances and all allowance specified. Both inch and metric screw threads have alphanumeric class designations. Class designations do not apply to the tap.

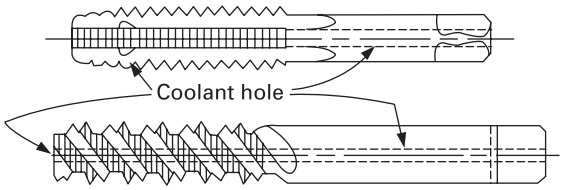
concentric: having a common center.

concentric margin: a portion of the threaded land, adjacent to the cutting edge that has concentric threads (tap outside diameter only).

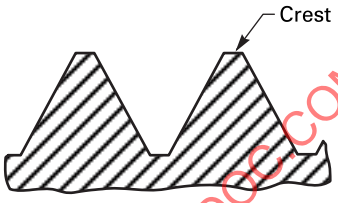
concentric thread: threads that are substantially circular for the full land width with a center coincident with the tool axis; that is, having no relief in the thread form except for that slight amount produced by back taper.



coolant hole: holes through which cutting fluid is fed through the axis of the tool and/or radial into the tap flutes.

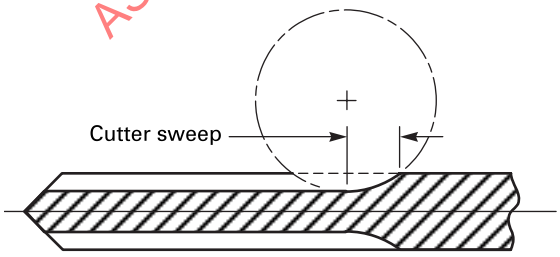


crest: the surface of the thread that joins the flanks of the thread and is farthest from the cylinder or cone from which the thread projects.

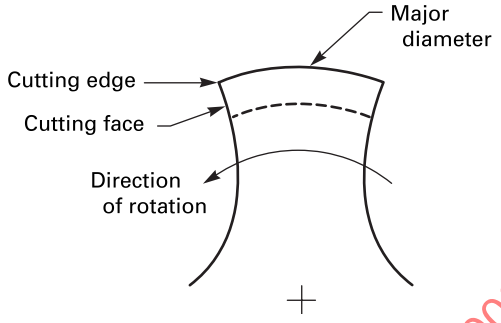


cut thread tap: a tap that has the thread produced before the base material has been heat treated. Cut thread taps have a liberal tolerance.

cutter sweep: the section removed by the milling cutter or the grinding wheel in entering or leaving a flute.



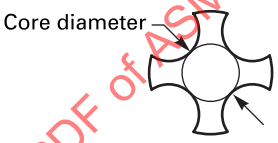
cutting edge: the intersection of the cutting face and major diameter in the direction of rotation for cutting and which does the actual cutting.



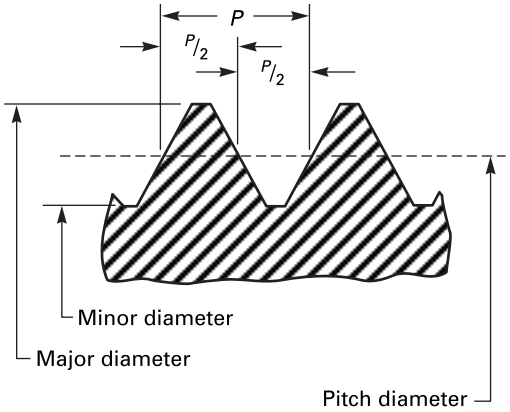
cutting face: the leading side of the land in the direction of rotation for cutting on which the chip impinges.

diameter:

core: the diameter of a circle that is tangent to the bottom of the flutes at a given point on the axis.



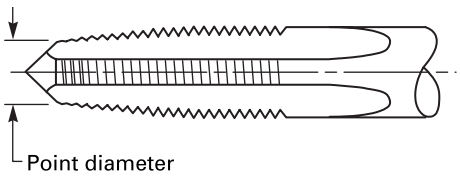
major: on a straight thread, the major diameter is that of the major cylinder. On a taper thread, the major diameter at a given position on the thread axis is that of the major cone at that position.



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.

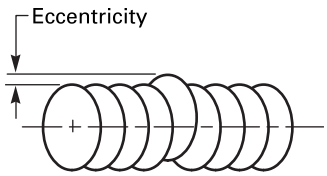
point: the diameter at the cutting edge of the leading end of the chamfered section. The diameter is approximately the same as the basic minor diameter and varies with manufacturers.



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.

eccentric: not having a common center.

eccentricity (with respect to the tool axis): one-half of the full indicator movement (FIM). (See also *relative eccentricity* and *runout,* which is the preferred term.)



entry taper: the portion of a thread-forming type 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.

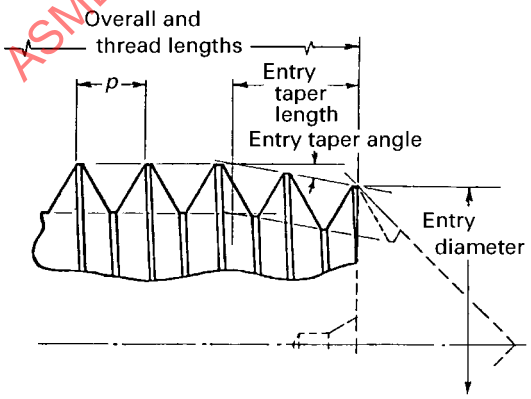
entry taper angle: the angle at which the thread form is tapered from the major diameter to the entry diameter portion.

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.

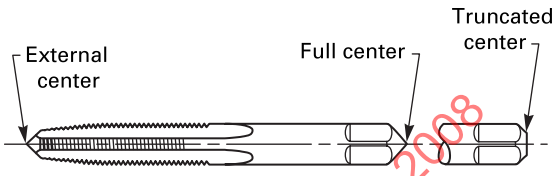
entry taper length: the length, measured on the full diameter of the thread forming lobe, from the entry diameter position on the theoretical intersection to the tap major diameter and entry taper angle.

(a) bottom length: 1 to 2½ pitches.

(b) plug length: 3 to 5 pitches.

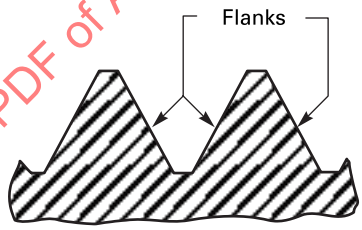


external center, full or truncated: the pointed end on a tap. Its included angle varies with manufacturing practice. It must not be confused with a tap chamfer or a chamfer bevel. On bottoming chamfered taps the point on the front end may be removed, which is optional with manufacturer.



female center: see *internal center,* which is the preferred term.

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.



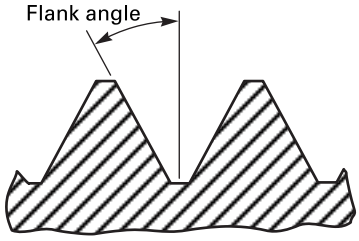
(a) leading

(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.

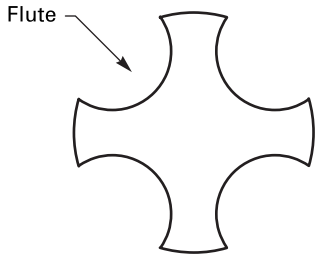
(b) trailing: the flank of a thread that is opposite to the leading flank.

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.

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.

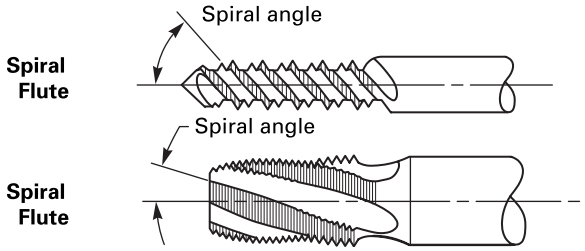


lead angle: the angle that a helical or spiral cutting edge at a given point makes with an axial plane through the same point.

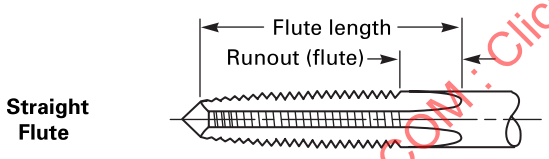
length: as applied to taps, the full axial length of a flute including the cutter sweep.

runout: see *cutter sweep.*

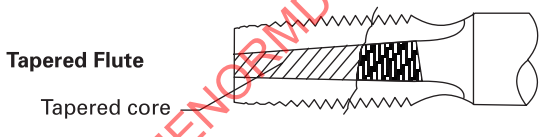
spiral: a flute with axial lead and helix in a helical path around the axis of a cylindrical tap. A regular spiral angle is 25 deg to 35 deg, and a fast spiral angle is 45 deg to 60 deg. On taper pipe taps the spiral angle is usually less than that described above.



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.

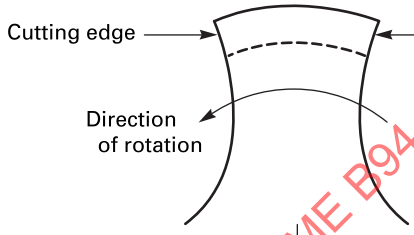


full indicator movement (FIM): the total movement of an indicator where appropriately applied to a surface to measure its variations.

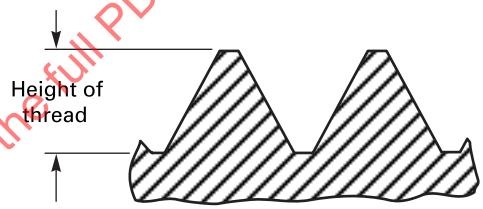
functional size: the functional diameter of an external thread is the pitch diameter of the enveloping thread of perfect pitch, lead, and flank angles, having full depth of engagement but clear at crests and roots, and of a specified length of engagement. It may be derived by adding to the pitch diameter in the case of an external thread, or subtracting from the pitch diameter in the case of an internal thread, the cumulative effects of variations 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.

ground thread tap: a tap that has the thread produced by the thread grinding process after the base material has been heat treated. Ground thread taps have higher precision than cut thread taps.

heel: the edge of the land opposite the cutting edge.



height of thread: the height of a thread is the distance, measured radially between the major and minor cylinders or cones, respectively.

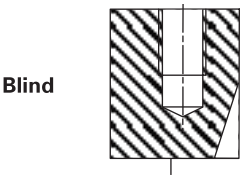


helix angle: see *flute, lead angle,* and see *thread lead angle.*

high speed steel (HS): based on the major alloying elements in their composition: molydbenum or tungsten. High speed steels in which molybdenum is the major alloying element are designated by the letter "M" as the first character in the symbol. Examples include M1, M2, M7, M10, M35, and M42. Similarly, the letter "T" designates tungsten alloys. Examples include T1, T2, T5, and T15. Analyses may contain both molybdenum and tungsten, but the letter symbol is determined by which of the two has the major alloying effects.

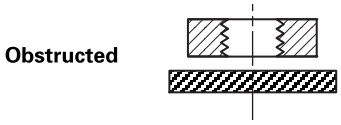
holes:

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.

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.

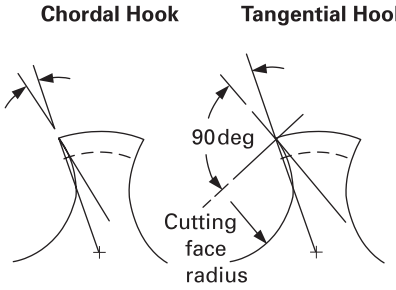
stepped: a blind or open hole with a change in diameter that limits the thread depth.

through: a hole that passes through the work piece and is threaded to its full depth.

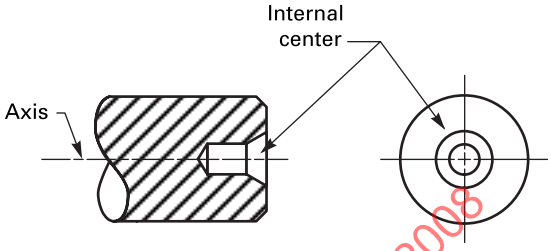
hook angle: the inclination of a concave cutting face, usually specified as either chordal hook or tangential hook.

hook angle 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.

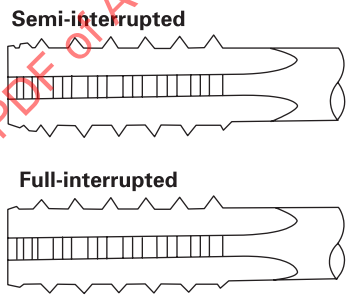
hook angle tangential: the angle between a line tangent to the radius of the cutting face at the major diameter and a radial line to the same point.



internal center: a countersink with clearance at the bottom, in one or both ends of a tool, which establishes the tool axis.

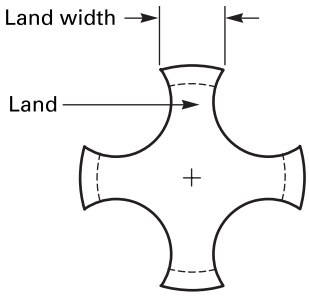


interrupted thread tap: a tap having an odd number of lands with alternate teeth in the thread helix removed. Alternate teeth are generally removed only for a portion of the thread length beyond the chamfer (semi-interrupted thread), or in some cases on the full thread length including the chamfer (full-interrupted thread).



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.



lead: the distance a screw thread advances axially in one complete turn.

lead deviation: the deviation from the basic nominal thread.

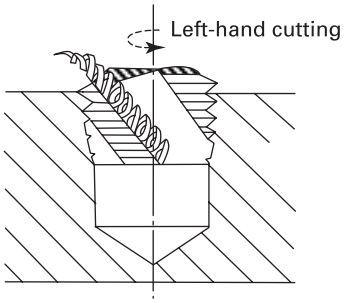
lead error: the deviation from prescribed limits.

lead progressive:

(a) on the straight thread the deviation from a true helix where the thread helix advances uniformly, or

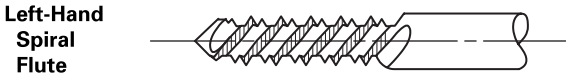
(b) on a taper thread the deviation from a true spiral where the thread spiral advances uniformly.

left-hand cut: rotation in a counterclockwise direction when cutting or cold-forming thread.

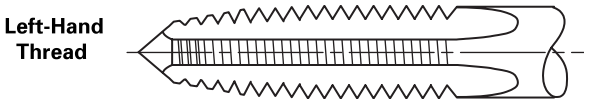


Left-Hand Cut

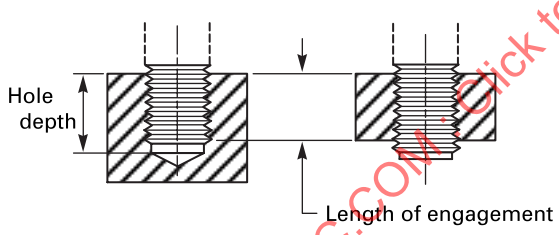
left-hand spiral flute: flutes that twist in a counterclockwise direction when viewed axially.



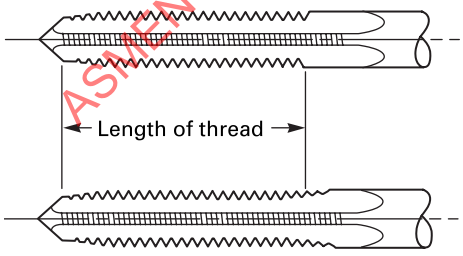
left-hand thread: a screw thread that is screwed in or on counterclockwise. All left-hand threads are designated by the symbol (LH).



length of engagement: the length of engagement of two mating threads is the axial distance over which two mating threads are designed to contact.



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.

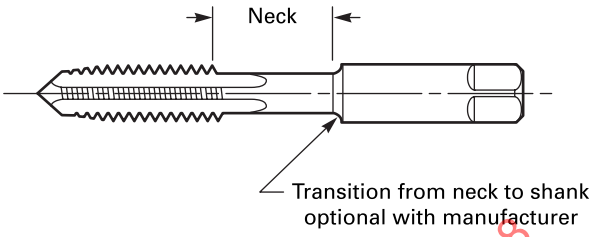


limits: the limits of size are the applicable maximum and minimal sizes.

male center: see *external center,* which is the preferred term.

margin: see *concentric margin.*

neck: a section of reduced diameter between two adjacent portions of a tool.



nominal size: a designation consisting of basic specified size before any allowance or tolerance is applied, used for general identification.

number of threads: see *threads per inch,* which is the preferred term.

oil holes: See *coolant hole,* which is the preferred term.

optional number of flutes: taps with more or less flutes than standard.

overall length: see Fig. 1.

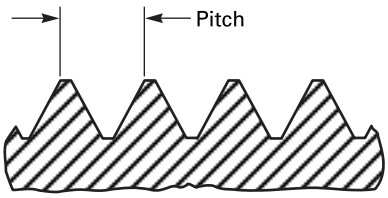
percent of thread: one half the difference between the basic major diameter and the actual minor diameter of an internal thread, divided by the basic thread height, expressed as a percentage.

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.

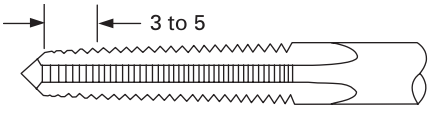
pitch error: the deviation from the true basic pitch measured between adjacent teeth on a land.

Examples:

$^1/_4$–20 UNC	M6 x 1
Pitch = $^1/_{20}$	Pitch = 1 mm
Pitch = 0.05 in.	

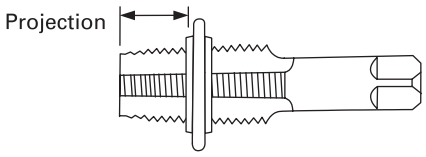


plug tap: a tap having a chamfer length of 3 to 5 pitches.



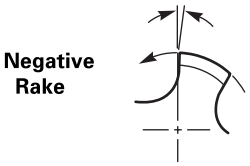
Plug Tap

projection: the distance the small end of a taper thread projects through a taper thread ring gage.



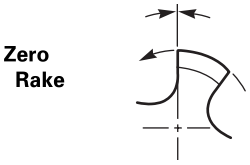
rake: the angular relationship of the straight cutting face of a tooth with respect to the radial line through the crest of the tooth at the cutting edge.

negative: the crest of the cutting face is angularly behind the balance of the cutting face of the tooth.

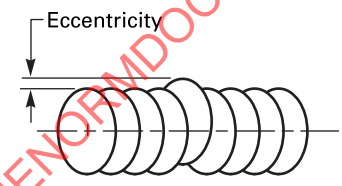


positive: the crest of the cutting face is angularly ahead of the balance of the cutting face of the tooth.

zero: the cutting face is directly on a radial line.



relative eccentricity: the distance between the geometric centerline of one portion of a tool and geometric centerline of some other portion.



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.

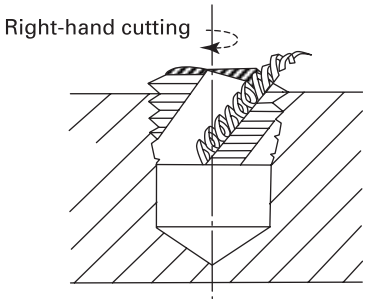
eccentric: radial relief in the thread form starting at the cutting edge and continuing to the heel.

flatted land: clearance produced on a portion of the tap land by truncating the thread between the cutting edge and heel.

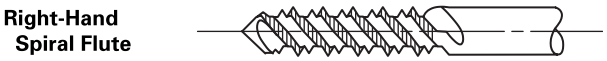
grooved land: clearance produced on a tap land by forming a longitudinal groove in the center of the land.

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.

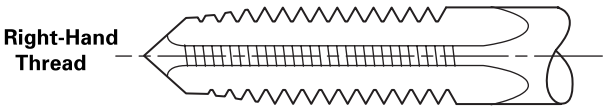
right-hand cut: rotation in a clockwise direction when cutting or cold-forming a thread.



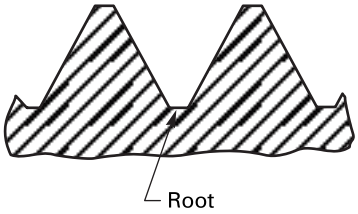
right-hand flutes: flutes that twist in a clockwise direction when viewed axially.



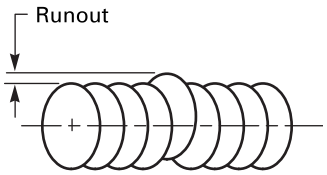
right-hand thread (RH): a screw thread that is screwed in or on clockwise.



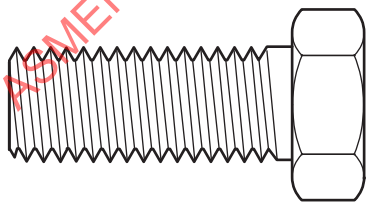
root: the surface of the thread that joins the flanks of adjacent thread forms and is identical to or immediately adjacent to the cylinder or cone from which the thread projects.



runout: the radial variation from a true circle that lies in a diametral plane and is concentric with the tool axis. [See also *full indicator movement (FIM).*]



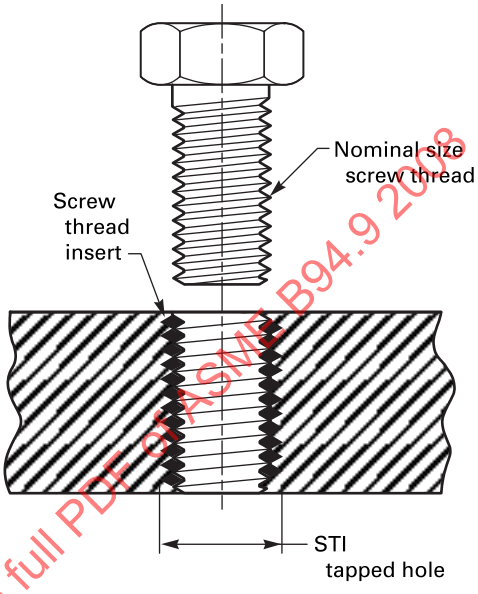
screw thread: a ridge, usually of uniform section and produced by forming a groove in the form of a helix on the external or internal surface of a cylinder, or in the form of a conical spiral on the external or internal surface of a cone or frustum of a cone. A screw thread formed on a cylinder is known as a straight or parallel thread, to distinguish it from a taper screw thread that is formed on a cone frustum of a cone.



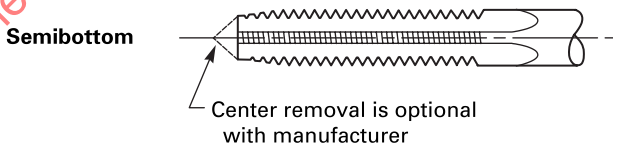
Example of Straight Screw Thread

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."

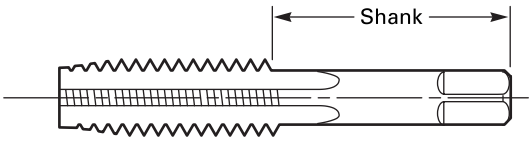
screw thread insert (STI) tap: these taps are over the nominal size to the extent that the internal thread they produce will accommodate a helical coil screw thread insert, which at final assembly will accept a screw thread of the nominal size and pitch.



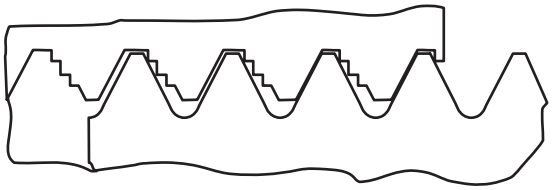
semibottom tap: a tap having 2 to 3 pitches in chamfer length.



shank: the portion of the tool body by which it is held and driven.

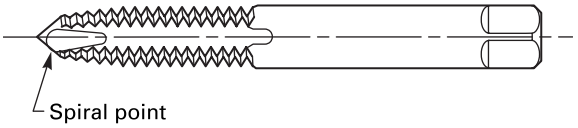


shaving: the excessive removal of material from the product thread profile by the tool thread flanks caused by an axial advance per revolution less than or more than the actual lead on the tool. In tapping, this results in an increase in product pitch diameter without an increase in product major diameter.



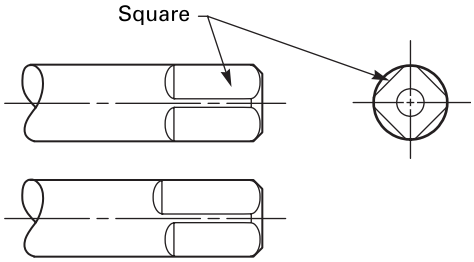
spiral point: the angular fluting in the cutting face of the land at the chamfered end. It is formed at an angle

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.



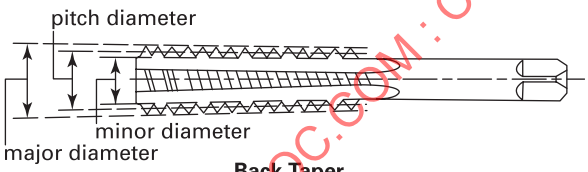
spiral point angle: the angle made by the projection of the spiral point flute into an axial plane parallel to the tap axis.

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.



taper:

back taper: 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.



Back Taper

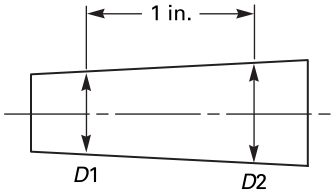
front taper: opposite of the back taper.

taper per inch:

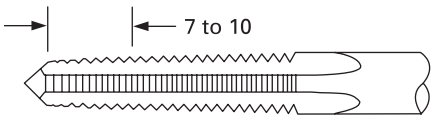
(a) on a taper threaded part or on a taper shank, the difference in diameter in one inch measured parallel to the axis.

(b) on a taper tap, the difference in diameter in one inch measured parallel to the axis at the cutting face.

Taper per inch = $D2 - D1$

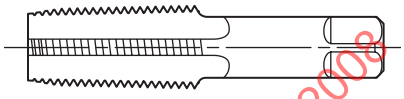


taper tap: a tap having a chamfer length of 7 to 10 pitches.



Taper Tap

taper thread tap: a tap with tapered threads for producing a tapered internal thread.



Taper Thread Tap

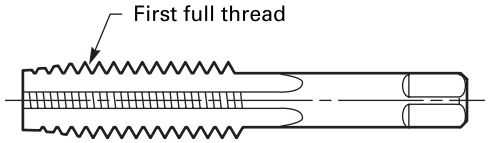
thread:

angle of: also known as included angle of a thread. The angle between the flanks of the thread measured in an axial plane.

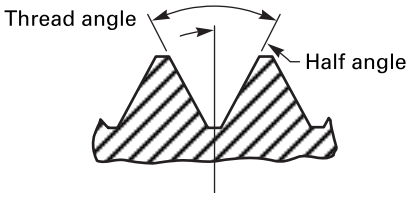
base of: that which coincides with the cylindrical or conical surface from which the thread projects.

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.



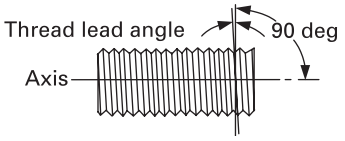
half angle: the angle formed by one thread flank top or line perpendicular to the axial plane.



height: see *height of thread.*

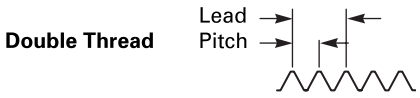
interrupted: see *interrupted thread tap.*

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.



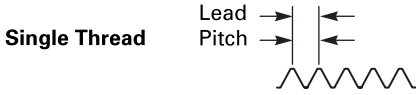
length: see *length of thread.*

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.

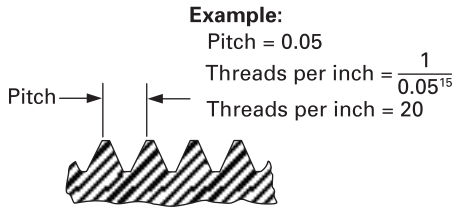


screw: see *screw thread.*

single: a thread having a lead equal to the pitch.



threads per inch (TPI): the number of thread pitches in one inch of thread length.



tolerance:

(a) the total permissible variation of size

(b) the difference between the limits of size

total indicator variation (TIV): the difference between maximum and minimum indicator readings during a checking cycle. [See also *full indicator movement (FIM),* which is the preferred term.]

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.

truncation root: the root truncation of a thread is the radial distance between the sharp root and the cylinder or cone that binds the root.

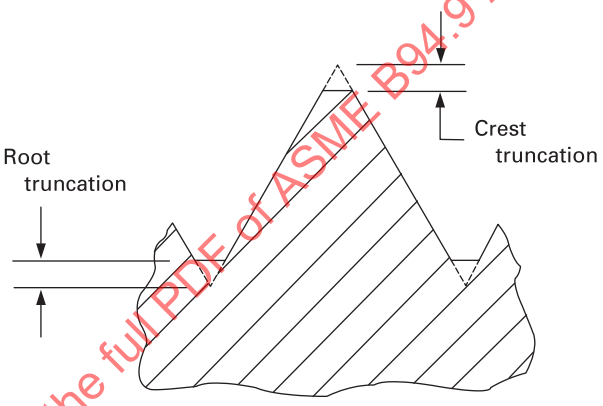
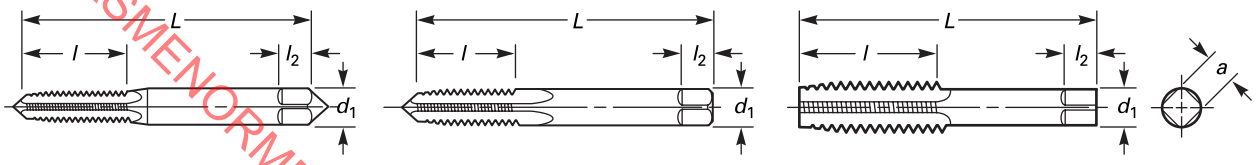


Table 1 Thread Series Designations

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
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
NPSC [Note (1)]	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
NPSM [Note (1)]	NPSM	American Standard straight pipe threads for free-fitting mechanical joints for fixtures	B1.20.1
ANPT	ANPT	Pipe threads, taper, aeronautical, national form	AS-71051
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)	AS-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 AS-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 AS-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 AS-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

NOTE:
(1) Ground thread taps to be marked NPSC/NPSM.

Table 2 Standard Tap Dimensions



Blank Design 1 | Blank Design 2 | Blank Design 3

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.				
Over	To (Inclusive)			mm	in.		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
0.078	0.091	2 (0.0860)	...	M2.2	(0.0866)	1	1.75	0.44	0.19	0.1410	0.110
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
0.171	0.197	10 (0.1900)	...	M5	(0.1969)	1	2.38	0.88	0.25	0.1940	0.152
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
0.260	0.323	...	5/16 (0.3125)	M8	(0.3150)	2	2.72	1.13	0.38	0.3180	0.238
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

Table 2 Standard Tap Dimensions (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.				
Over	To (Inclusive)			mm	in.		Overall Length, L	Thread Length, l	Square Length, l_2	Shank Diameter, d_1	Size of Square, a
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	(0.8661)	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

Table 2 Standard Tap Dimensions (Cont'd)

Tolerances				
Element	Nominal Diameter Range, in. Over	To (Inclusive)	Direction	Tolerance, Ground Thread in.
Length overall, L	0.0520	1.0100	Plus or minus	0.03
	1.0100	2.0000	Plus or minus	0.06
Length of thread, l	0.0520	0.2230	Plus or minus	0.05
	0.2230	0.5100	Plus or minus	0.06
	0.5100	1.5100	Plus or minus	0.09
	1.5100	2.0000	Plus or minus	0.13
Length of square, l_2	0.0520	1.0100	Plus or minus	0.03
	1.0100	2.0000	Plus or minus	0.06
Diameter of shank, d_1	0.0520	0.2230	Minus	0.0015
	0.2230	0.6350	Minus	0.0015
	0.6350	1.0100	Minus	0.0020
	1.0100	1.5100	Minus	0.0020
	1.5100	2.0000	Minus	0.0030
Size of square, a	0.0520	0.5100	Minus	0.004
	0.5100	1.0100	Minus	0.006
	1.0100	2.0000	Minus	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 A-8 in Nonmandatory Appendix A.

(b) For standard ground thread tap limits see Tables 12 and 13 for inch and Table 14 for metric.

(c) For cut thread tap limits see Tables A-3 and A-4.

(d) Special ground thread tap limits are determined by using the equations shown in Table 7 for unified inch screw threads and Table 10 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 (1/4 of diameter of shank). Sizes greater than 0.395 in. have internal centers on both the thread and shank ends.

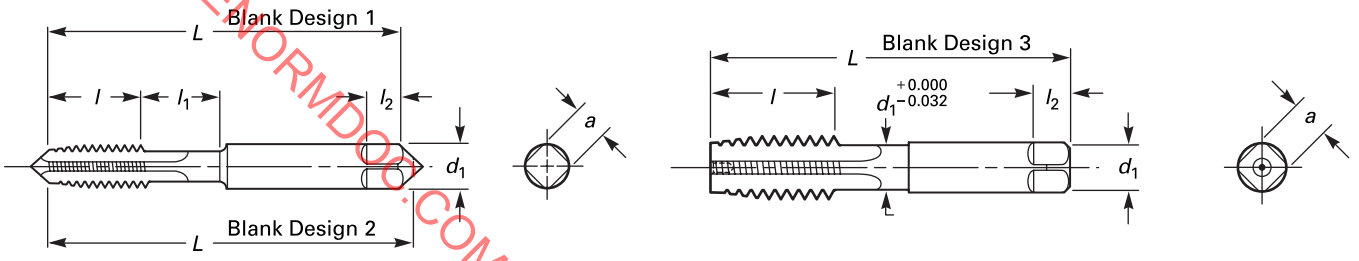
(f) For standard thread limits and tolerances see Table A-1 in Nonmandatory Appendix A for unified inch screw threads and Table A-2 in Nonmandatory Appendix A for metric threads.

(g) For runout tolerances of tap elements see Table 15.

(h) For number of flutes see Table 11.

(i) For cut thread tolerance see Table A-10.

Table 3 Optional Neck and Optional Shortened Thread Length (Tap Dimensions)



General Dimensions												
Nominal Diameter		Machine Screw Size No.	Nominal Fractional Diameter (Decimal Equivalent), in.	Nominal Metric Diameter		Blank Design No.	Tap Dimensions, in.					
Over	To (Inclusive)			mm	in.		Overall Length, L	Thread Length, l	Neck Length, l_1	Square Length, l_2	Shank Diameter, d_1	Size of Square, a
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	(0.1772)	1	2.38	0.50	0.38	0.25	0.1940	0.152
0.171	0.197	10 (0.1900)	...	M5	(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	(0.2756)	2	2.72	0.69	0.44	0.38	0.3180	0.238
0.260	0.323	...	5/16 (0.3125)	M8	(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

Table 3 Optional Neck and Optional Shortened Thread Length (Tap Dimensions) (Cont'd)

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.							
0.823	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.

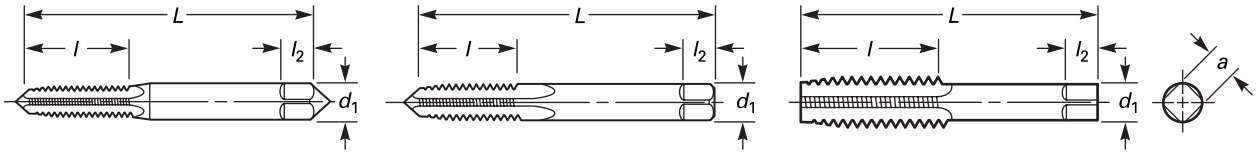
(c) When thread length, l, is added to neck length, l_1, the total shall be no less than the minimum Table 2 thread length, l.

(d) Unless otherwise specified, all tolerances are in accordance with Table 2.

(e) For runout tolerances, see Table 15.

(f) For number of flutes see Table 11.

Table 4 Standard Tap Dimensions [Screw Thread Inserts (STI): Machine Screw and Fractional Size, Taps]



Blank Design 1 **Blank Design 2** **Blank Design 3**

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	
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

Table 4 Standard Tap Dimensions [Screw Thread Inserts (STI): Machine Screw and Fractional Size, 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	
$\frac{7}{8}$	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	$1\frac{1}{4}$
	...	12	3	5.44	2.56	0.88	0.8960	0.672	$1\frac{1}{8}$
	...	14 NS	3	5.44	2.56	0.88	0.8960	0.672	$1\frac{1}{8}$
$1\frac{1}{8}$	7	...	3	6.06	3.00	1.06	1.1080	0.831	$1\frac{3}{8}$
	...	12	3	5.75	2.56	1.00	1.0210	0.766	$1\frac{1}{4}$
$1\frac{1}{4}$	7	...	3	6.38	3.00	1.13	1.2330	0.925	$1\frac{1}{2}$
	...	12	3	6.06	3.00	1.06	1.1080	0.831	$1\frac{3}{8}$
$1\frac{3}{8}$	6	...	3	6.69	3.19	1.13	1.3050	0.979	$1\frac{5}{8}$
	...	12	3	6.38	3.00	1.13	1.2330	0.925	$1\frac{1}{2}$
$1\frac{1}{2}$	6	...	3	7.00	3.19	1.25	1.4300	1.072	$1\frac{3}{4}$
	...	12	3	6.69	3.19	1.13	1.3050	0.979	$1\frac{5}{8}$

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 thread insert, which at final assembly will accept a screw thread of the nominal size and pitch.

(b) For optional necks, refer to Table 3 using dimensions for equivalent blank sizes.

(c) Ground thread taps, STI sizes $\frac{5}{16}$ in. and smaller, have external center on thread end (may be removed on bottom taps).

(d) Ground thread taps, STI sizes No. 10 through $\frac{5}{16}$ in., will have an external partial cone center on the shank end, with the length of the cone center approximately $\frac{1}{4}$ of the diameter of shank.

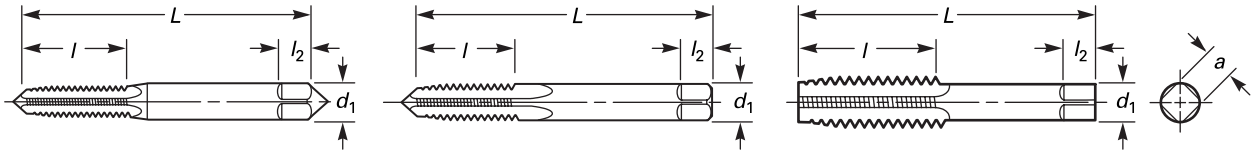
(e) Ground thread taps, STI sizes larger than $\frac{5}{16}$ in., may have internal centers in both the thread and shank ends.

(f) For runout tolerances of tap elements, refer to Table 15 using dimensions for equivalent blank sizes.

(g) For number of flutes, refer to Table 11 using dimensions for equivalent blank sizes.

(h) For general dimension tolerances, refer to Table 2 using Table 2 equivalent blank size.

Table 5 Standard Tap Dimensions [Screw Thread Inserts (STI), Metric Size Taps]



Blank Design 1 | Blank Design 2 | Blank Design 3

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	0.4	...	1	1.81	0.50	0.19	0.1410	0.110	No. 3
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
	...	1.25	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	1.00	1.0210	0.766	1 3/16

Table 5 Standard Tap Dimensions [Screw Thread Inserts (STI), Metric Size Taps] (Cont'd)

Nominal Size (STI)	Thread Pitch, mm		Blank Design No.	Tap Dimensions, in.					Table 2 Blank Equivalent (Reference)
				Overall Length, L	Thread Length, l	Square Length, l_2	Shank Diameter, d_1	Size of Square, a	
M30	3.5	...	3	6.06	3.00	1.06	1.1080	0.831	$1\frac{3}{8}$
	...	2	3	5.75	2.56	1.06	1.1080	0.831	$1\frac{5}{16}$
M33	3.5	...	3	6.38	3.00	1.13	1.2330	0.925	$1\frac{1}{2}$
	...	2	3	6.06	3.00	1.13	1.2330	0.925	$1\frac{7}{16}$
M36	4	...	3	6.69	3.19	1.13	1.3050	0.979	$1\frac{5}{8}$
	...	3	3	6.69	3.19	1.13	1.3050	0.979	$1\frac{5}{8}$
	...	2	3	6.69	3.19	1.13	1.3050	0.979	$1\frac{5}{8}$
M39	4	...	3	7.00	3.19	1.25	1.4300	1.072	$1\frac{3}{4}$
	...	3	3	7.00	3.19	1.25	1.4300	1.072	$1\frac{3}{4}$
	...	2	3	7.00	3.19	1.25	1.4300	1.072	$1\frac{3}{4}$

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 thread insert, which at final assembly will accept a screw thread of the nominal 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 M5 through M8, will have an external partial cone center on the shank end with the length of the cone center approximately $\frac{1}{4}$ of the diameter of shank.

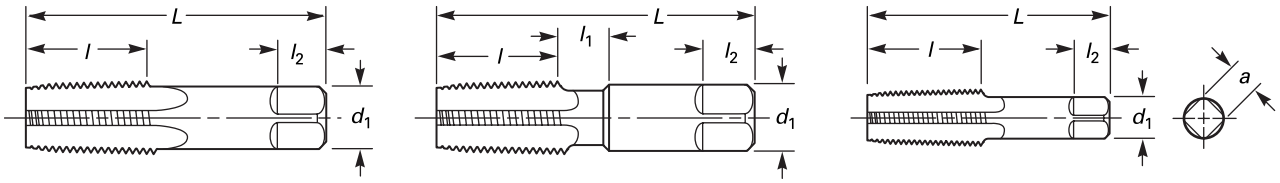
(e) Ground thread taps, STI sizes larger than M8, will have internal centers in both the thread and shank ends.

(f) For runout tolerances of tap elements, refer to Table 15 using dimensions for equivalent blank sizes.

(g) For number of flutes, refer to Table 11 using dimensions for equivalent blank sizes.

(h) For general dimension tolerances, refer to Table 2 using Table 2 equivalent blank size.

Table 6 Straight and Taper Pipe Taps



Standard Tap Dimensions

Nominal Size, in. [Note (1)]	Threads per Inch	Number of Flutes		Overall Length, 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	
		Regular Thread	Interrupted Thread							NPT NPTF ANPT	NPSC NPSM NPSF
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)]
1/8	27	4	5	2.13	0.75	0.38	0.4375	0.328	0.375	[Notes (2), (3)]	[Notes (5), (6)]
1/4	18	4	5	2.44	1.06	0.44	0.5625	0.421	0.375	[Notes (2), (3)]	[Notes (5), (6)]
3/8	18	4	5	2.56	1.06	0.50	0.7000	0.531	0.375	[Notes (2), (3)]	[Notes (5), (6)]
1/2	14	4	5	3.13	1.38	0.63	0.6875	0.515	...	[Notes (2), (3)]	[Notes (5), (6)]
3/4	14	5	5	3.25	1.38	0.69	0.9063	0.679	...	[Notes (2), (3)]	[Notes (5), (6)]
1	11 1/2	5	5	3.75	1.75	0.81	1.1250	0.843	...	[Notes (2), (3)]	[Notes (5), (6)]
1 1/4	11 1/2	5	5	4.00	1.75	0.94	1.3125	0.984	...	[Notes (2), (3)]	...
1 1/2	11 1/2	7	7	4.25	1.75	1.00	1.5000	1.125	...	[Notes (2), (3), (4)]	...
2	11 1/2	7	7	4.50	1.75	1.13	1.8750	1.406	...	[Notes (2), (3), (4)]	...
2 1/2	8	8	...	5.50	2.56	1.25	2.2500	1.687	...	...	...
3	8	8	...	6.00	2.63	1.38	2.6250	1.968	...	...	...

Tolerances

Element	Ground Thread		
	Size Range	Direction	Tolerance
Length overall	1/16 to 3/4 inclusive	Plus or minus	0.031
	1 to 2 inclusive	Plus or minus	0.063
Length of thread	1/16 to 3/4 inclusive	Plus or minus	0.063
	1 to 1 1/4 inclusive	Plus or minus	0.094
	1 1/2 to 2 inclusive	Plus or minus	0.125
Length of square	1/16 to 3/4 inclusive	Plus or minus	0.031
	1 to 2 inclusive	Plus or minus	0.063
Diameter of shank	1/16 and 1/8	Minus	0.0015
	1/4 to 1 inclusive	Minus	0.002
	1 1/4 to 2 inclusive	Minus	0.003
Size of square	1/16 and 1/8	Minus	0.004
	1/4 to 3/4 inclusive	Minus	0.006
	1 to 2 inclusive	Minus	0.008

Table 6 Straight and Taper Pipe Taps (Cont'd)

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 15.
(e) These taps have 2 to $3\frac{1}{2}$ threads chamfer. See Table 2.
(f) Optional neck is for manufacturing use only.
(g) For taper pipe thread limits see Table 17.
(h) For straight pipe thread limits see Tables 18, 19, and A-5.
(i) For cut thread dimensions see Table A-10.

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

Table 7 Tap Thread Limits and Tolerances, Formulas for Unified Inch Screw Threads (Ground Thread)

Formulas
Maximum major diameter = Basic plus *A*
Minimum major diameter = Maximum minus *B*
Maximum pitch diameter = Basic plus *C*
Minimum pitch diameter = Maximum minus *D*

where
A = Constant to add = 0.1300*P* for all pitches
B = Major diameter tolerance = 0.08700*P* for 48 through 80 TPI
= 0.07600*P* for 36 through 47 TPI
= 0.06500*P* for 4 through 35 TPI
C = Amount over basic for Maximum Pitch Diameter
D = Pitch Diameter Tolerance

			C					*D*				
Threads per Inch	*A*	*B*	To 5/8 in., Inclusive	Over 5/8 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.	To 5/8 in., Inclusive	Over 5/8 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	0.0010	0.0015	0.0020	0.0020	0.0030	0.0005	0.0005	0.0010	0.0010	0.0015
72	0.0018	0.0012	0.0010	0.0015	0.0020	0.0020	0.0030	0.0005	0.0005	0.0010	0.0010	0.0015
64	0.0020	0.0014	0.0010	0.0015	0.0020	0.0020	0.0030	0.0005	0.0005	0.0010	0.0010	0.0015
56	0.0023	0.0016	0.0010	0.0015	0.0020	0.0020	0.0030	0.0005	0.0005	0.0010	0.0010	0.0015
48	0.0027	0.0018	0.0010	0.0015	0.0020	0.0020	0.0030	0.0005	0.0005	0.0010	0.0010	0.0015
44	0.0030	0.0017	0.0010	0.0015	0.0020	0.0020	0.0030	0.0005	0.0005	0.0010	0.0010	0.0015
40	0.0032	0.0019	0.0010	0.0015	0.0020	0.0020	0.0030	0.0005	0.0005	0.0010	0.0010	0.0015
36	0.0036	0.0021	0.0010	0.0015	0.0020	0.0020	0.0030	0.0005	0.0005	0.0010	0.0010	0.0015
32	0.0041	0.0020	0.0015	0.0015	0.0020	0.0020	0.0030	0.0005	0.0005	0.0010	0.0010	0.0015
28	0.0046	0.0023	0.0015	0.0015	0.0020	0.0020	0.0030	0.0005	0.0005	0.0010	0.0010	0.0015
24	0.0054	0.0027	0.0015	0.0015	0.0020	0.0025	0.0030	0.0005	0.0005	0.0010	0.0015	0.0015
20	0.0065	0.0032	0.0015	0.0015	0.0020	0.0025	0.0030	0.0005	0.0005	0.0010	0.0015	0.0015
18	0.0072	0.0036	0.0015	0.0015	0.0020	0.0025	0.0030	0.0005	0.0005	0.0010	0.0015	0.0015
16	0.0081	0.0041	0.0015	0.0015	0.0020	0.0025	0.0035	0.0005	0.0005	0.0010	0.0015	0.0020
14	0.0093	0.0046	0.0015	0.0020	0.0025	0.0030	0.0035	0.0005	0.0005	0.0010	0.0015	0.0020
13	0.0100	0.0050	0.0015	0.0020	0.0025	0.0030	0.0035	0.0005	0.0005	0.0010	0.0015	0.0020
12	0.0108	0.0054	0.0015	0.0020	0.0025	0.0030	0.0035	0.0005	0.0005	0.0010	0.0015	0.0020
11	0.0118	0.0059	0.0015	0.0020	0.0025	0.0030	0.0040	0.0005	0.0005	0.0010	0.0015	0.0020
10	0.0130	0.0065	. . .	0.0020	0.0025	0.0030	0.0040	. . .	0.0005	0.0010	0.0015	0.0020
9	0.0140	0.0072	. . .	0.0020	0.0025	0.0030	0.0040	. . .	0.0005	0.0010	0.0015	0.0020
8	0.0162	0.0081	. . .	0.0020	0.0025	0.0030	0.0040	. . .	0.0005	0.0010	0.0015	0.0020
7	0.0186	0.0093	. . .	0.0025	0.0025	0.0035	0.0045	. . .	0.0010	0.0010	0.0020	0.0025
6	0.0217	0.0108	. . .	0.0025	0.0025	0.0035	0.0045	. . .	0.0010	0.0010	0.0020	0.0025
5 1/2	0.0236	0.0118	. . .	0.0025	0.0030	0.0035	0.0045	. . .	0.0010	0.0015	0.0020	0.0025
5	0.0260	0.0130	. . .	0.0025	0.0030	0.0035	0.0045	. . .	0.0010	0.0015	0.0020	0.0025
4 1/2	0.0289	0.0144	. . .	0.0025	0.0030	0.0035	0.0045	. . .	0.0010	0.0015	0.0020	0.0025
4	0.0325	0.0162	. . .	0.0025	0.0030	0.0035	0.0045	. . .	0.0010	0.0015	0.0020	0.0025

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.

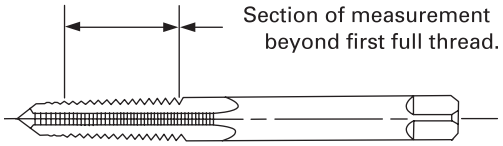
(c) When the tap major diameter must be determined from a specified tap pitch diameter, the minimum major diameter equals the maximum specified tap pitch diameter minus Constant *C*, plus 0.64951904*P* Constant *A*.

(d) For intermediate pitches use value for next coarser pitch for *C* and *D*, but use equations for *A* and *B*.

(e) Note formulas for calculating pitch diameter have been changed to be consistent with current practice. No changes in final dimensional values have been affected.

Cumulative Pitch Error
(formerly Lead Tolerance)

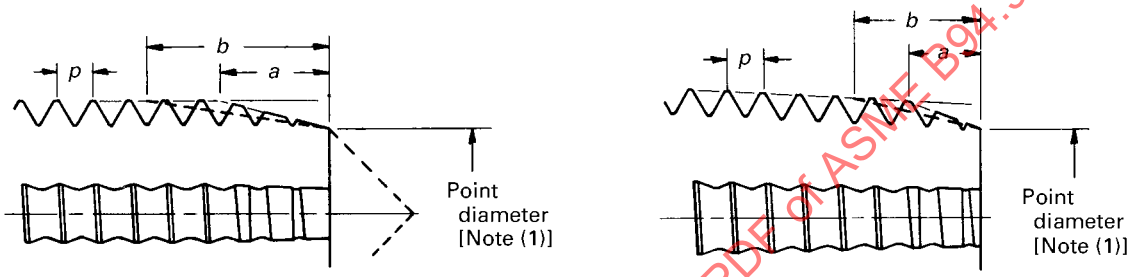
Cumulative pitch error is fixed at ±0.05% of the measured length, rounded to the nearest 0.0001 inch. It shall be measured over the greatest number of full threads possible on the tap being measured.



Angle Tolerance

Threads per Inch	Variation 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 Standard Chamfers for Thread Cutting Taps



Straight Thread Taps **Taper Pipe Taps**

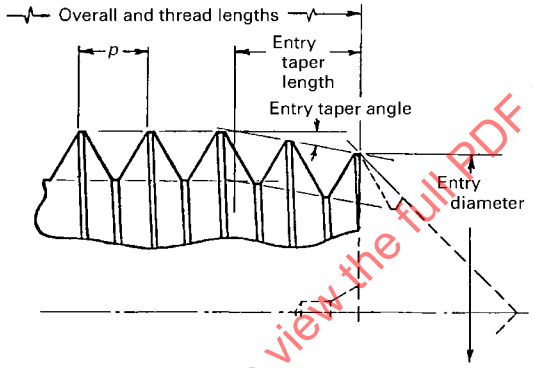
The chamfer length is measured at the cutting edge and is the axial length from the point diameter to the theoretical intersection of the tap major diameter and the chamfer angle. Whenever chamfer length is specified in terms of number of threads, this length is measured in number of pitches as shown.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

Type of Tap		Chamfer Length	
		a	*b*
Straight Threads Taps:	Bottom	1*p*	2*p*
	Semi-bottom	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.

Table 9 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.

Table 10 Tap Thread Limits and Tolerances, Formulas for Metric Threads (Ground Thread)

Formulas
Minimum major diameter = Basic plus W
Maximum major diameter = Maximum plus X
Maximum pitch diameter = Basic plus Y
Minimum pitch diameter = Maximum minus Z

where
W = constant to add to basic major diameter ($W = 0.0800P$)
X = major diameter tolerance
Y = amount over basic for maximum pitch diameter
Z = pitch diameter

			Y				Z			
P 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

Table 10 Tap Thread Limits and Tolerances, Formulas for Metric Threads (Ground Thread) (Cont'd)

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.

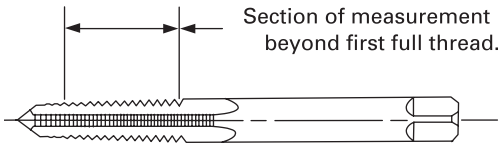
(c) When the tap major diameter must be determined from a specified tap pitch diameter, the minimum major diameter equals the maximum specified tap pitch diameter minus Constant *Y*, plus 0.64951904*P* plus Constant *W*.

(d) For intermediate pitches use value for next coarser pitch.

Cumulative Pitch Error

(formerly Lead Tolerance)

Cumulative pitch error is fixed at ±0.05% of the measuring length, rounded to the nearest 0.00254 mm. It shall be measured over the greatest number of full threads possible on the tap being measured.



Angle Tolerance

Pitch, mm	Variation 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 11 Standard Number of Flutes

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	2, 3	3
...	...	M7	(0.2756)	18	24	1.0	4	2, 3	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	...	...	...	...	...	...

Table 11 Standard Number of Flutes (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 16.
(b) For taper pipe taps see Table 6.
(c) For straight pipe taps see Table 6.
(d) For STI taps, use number of flutes for blank size equivalent on Table 2.
(e) For optional flutes see section 6, optional number of flutes.

Table 12 Tap Thread Limits: Machine Screw Sizes, Ground Thread (Unified and American National Thread Forms, Standard Thread Limits)

Size, in.	Threads per Inch NC UNC	NF UNF	NS	Major Diameter Basic	Min.	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	...	...	0.1120	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 13 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	...	...	...	...	...	...	1.0332	1.0342	...	...	...	...	...	...	...	...
1 1/8	...	12	...	1.1250	1.1304	1.1358	1.0709	...	...	...	...	...	...	1.0719	1.0729	...	...	...	...	...	...	...	...
1 1/4	7	...	...	1.2500	1.2593	1.2686	1.1572	...	...	...	...	...	...	1.1582	1.1592	...	...	...	...	...	...	...	...
1 1/4	...	12	...	1.2500	1.2554	1.2608	1.1959	...	...	...	...	...	...	1.1969	1.1979	...	...	...	...	...	...	...	...

Table 13 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															
	NC UNC	NF UNF	NS	Basic	Min.	Max.	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 Min.	H7 Limit Max.	H8 Limit [Note (2)] Min.	H8 Limit [Note (2)] Max.
1 3/8	6	...	...	1.3750	1.3859	1.3967	1.2667	...	...	...	...	...	...	1.2677	1.2687	...	...	...	...	...	...	...	...
1 3/8	...	12	...	1.3750	1.3804	1.3858	1.3209	...	...	...	...	...	...	1.4469	1.3229	...	...	...	...	...	...	...	...
1 1/2	6	...	...	1.5000	1.5109	1.5217	1.3917	...	...	...	...	...	...	1.6201	1.3937	...	...	...	...	...	...	...	...
1 1/2	...	12	...	1.5000	1.5054	1.5108	1.4459	...	...	...	...	...	...	1.4469	1.4479	...	...	...	...	...	...	...	...
1 3/4	5	...	...	1.7500	1.7630	1.7760	1.6201	...	...	...	...	...	...	1.6201	1.6221	...	...	...	...	...	...	...	...
2	4.5	...	...	2.0000	2.0145	2.0289	1.8557	...	...	...	...	...	...	1.8557	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 14 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	...	...	13.209 (1)	13.240 (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	...	...	17.047 (1)	17.078 (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 A-6 in Nonmandatory 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 10.

NOTES:

(1) These sizes are intended for spark plug applications.

(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.

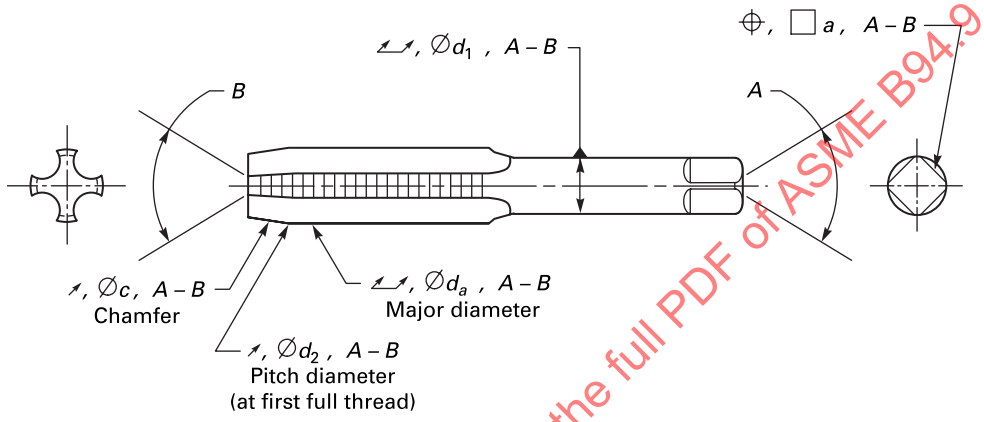
(5) Minimum and maximum major diameters are 0.052 larger than shown.

(6) Minimum and maximum major diameters are 0.065 larger than shown.

Table 14 Tap Thread Limits: Metric Sizes, Ground Thread (M Profile: Standard Thread Limits in Millimeters) (Cont'd)

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	...	...
...	...	...	...	...	...	...	...	44.818	44.882	...	...

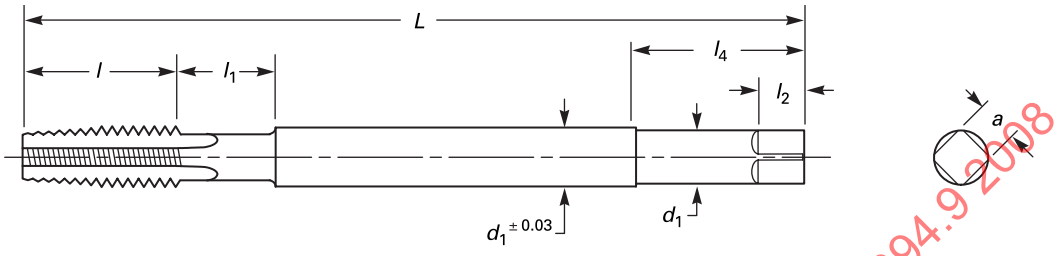
Table 15 Runout of Tap Elements



	Range Sizes (Inclusive)			Total Runout, FIM, in. Ground Thread
	Fractional Machine Screw	Metric	Pipe, in.	
Shank, d_1	# 0–$\frac{5}{16}$	M1.6–M8	$\frac{1}{16}$	0.0010
	Over $\frac{5}{16}$–4	Over M8–M100	$\frac{1}{8}$–4	0.0016
Major diameter, d_a	# 0–$\frac{5}{16}$	M1.6–M8	$\frac{1}{16}$	0.0010
	Over $\frac{5}{16}$–4	Over M10–M100	$\frac{1}{8}$–4	0.0016
Pitch diameter, d_2 (at first full thread)	# 0–$\frac{5}{16}$	M1.6–M8	$\frac{1}{16}$	0.0010
	Over $\frac{5}{16}$–4	Over M8–M100	$\frac{1}{8}$–4	0.0016
Chamfer, c [Note (1)]	# 0–$\frac{1}{2}$	M1.6–M12	$\frac{1}{16}$–$\frac{1}{8}$	0.0020
	Over $\frac{1}{2}$–4	Over M12–M100	$\frac{1}{4}$–4	0.0030
Square, a (at central point)	# 0–$\frac{1}{2}$	M1.6—M12	$\frac{1}{16}$–$\frac{1}{8}$	0.0060
	Over $\frac{1}{2}$–4	Over M12–M100	$\frac{1}{4}$–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 16 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

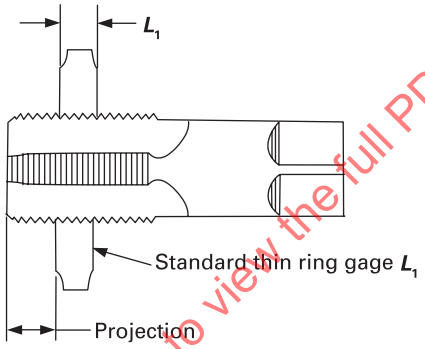
Tolerances			
Element	Size Range	Direction	Tolerance
Overall length, L	0.25 to 0.75 inclusive	Plus or minus	0.06
Thread length, l	0.25 to 0.75 inclusive	Plus or minus	0.06
Neck length, l_1	0.25 to 0.75 inclusive	[Note (4)]	[Note (4)]
Square length, l_2	0.25 to 0.75 inclusive	Plus or minus	0.03
Length of close tolerance shank, l_4	0.25 to 0.75 inclusive	[Note (1)]	[Note (1)]
Shank diameter, d_1 [Note (3)]	0.250 to 0.635 inclusive	Minus	0.0015
	Over 0.635 to 0.750 inclusive	Minus	0.0020
Size of square, a [Note (2)]	0.25 to 0.50 inclusive	Minus	0.004
	Over 0.50 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 13.
(e) For runout tolerances of tap elements see Table 15.
(f) For chamfer dimensions, see Table 8.

NOTES:
(1) Length of close tolerance shank, l_4, is a minimum length that is held to runout tolerances per Table 15.
(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 and diameter, are optional with manufacturer.

Table 17 Taper Pipe Tap Thread Limits (Ground Thread; Ground Thread for NPT, NPTF, and ANPT)

Nominal Size, in.	Threads per Inch	Gage Measurement, in.		Taper per Inch on Diameter [Note (2)] Ground Thread		Reference Dimensions	
		Projection, in. [Note (1)]	Tolerance, Plus or Minus Ground Thread	Min.	Max.	l_1 Length [Note (3)]	Tap Drill Size NPT, ANPT, NPTF [Note (4)]
1/16	27	0.312	0.0625	0.0599	0.0651	0.1600	C
1/8	27	0.312	0.0625	0.0599	0.0651	0.1615	Q
1/4	18	0.459	0.0625	0.0599	0.0651	0.2278	7/16
3/8	18	0.454	0.0625	0.0599	0.0651	0.2400	9/16
1/2	14	0.579	0.0625	0.0599	0.0651	0.3200	45/64
3/4	14	0.565	0.0625	0.0599	0.0651	0.3390	29/32
1	11 1/2	0.678	0.0937	0.0599	0.0651	0.4000	1 9/64
1 1/4	11 1/2	0.686	0.0937	0.0599	0.0651	0.4200	1 31/64
1 1/2	11 1/2	0.699	0.0937	0.0599	0.0651	0.4200	1 23/32
2	11 1/2	0.667	0.0937	0.0599	0.0651	0.4360	2 3/16
2 1/2	8	0.925	0.0937	0.0612	0.0651	0.6820	2 39/64
3	8	0.925	0.0937	0.0612	0.0651	0.7660	3 15/16



Cumulative Pitch Error
(formerly Lead Tolerances)

Cumulative pitch error is fixed at ±0.05% of the measuring length, rounded to the nearest 0.0001 in. It shall be measured over the greatest number of full threads possible on the tap being measured.

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

Table 17 Taper Pipe Tap Thread Limits (Ground Thread; Ground Thread for NPT, NPTF, and ANPT) (Cont'd)

Widths of Flats at Tap Crests and Roots					
		Column I		Column II	
Threads per Inch	Tap Flat Width at	NPT: Ground Thread [Note (5)] ANPT: Ground Thread [Note (5)]		NPTF	Ground Thread [Note (5)]
		Min. [Note (6)]	Max.	Min. [Note (6)]	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
$11\frac{1}{2}$	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) ($\frac{3}{4}$ 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) 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 18 Straight Pipe Tap Thread Limits: NPSC/NPSM, 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 NPSC/NPSM 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	

Cumulative Pitch Error (formerly Lead Toterance)

Cumulative pitch error is fixed at ±0.05% of the measuring length, rounded to the nearest 0.0001 in. It shall be measured over the greatest number of full threads possible on the tap being measured.

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 NPSC/NPSM and are used for NPSC and NPSM.

(b) All dimensions are given in inches.

Table 19 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 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

Cumulative Pitch Error
(formerly Lead Tolerance)
Cumulative pitch error is fixed at ±0.05% of the measuring length, rounded to the nearest 0.0001 in. It shall be measured over the greatest number of full threads possible on the tap being measured.

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 20 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
	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

Table 20 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.
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								
1⅛	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
1¼	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
1⅜	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
1½	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 21 Tap Thread Limits [Screw Thread Inserts (STI), Ground Thread, Metric Size (mm)]

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	Min.	Max.	H Limit	Min.	Max.
M2	0.4	2.555	2.581	H1	2.261	2.273	H2	2.273	2.286
M2.2	0.45	2.819	2.845	H1	2.494	2.507	H2	2.507	2.520
M2.5	0.45	3.122	3.147	H1	2.794	2.807	H2	2.807	2.819
M3	0.5	3.691	3.716	H1	3.325	3.338	H2	3.338	3.350
M3.5	0.6	4.328	4.354	H1	3.891	3.904	H2	3.904	3.917
M4	0.7	4.966	5.006	H2	4.468	4.481	H3	4.481	4.493
M5	0.8	6.104	6.142	H2	5.535	5.547	H3	5.547	5.555
M6	1	7.381	7.422	H2	6.665	6.678	H3	6.678	6.690
M7	1	8.382	8.423	H2	7.663	7.676	H3	7.676	7.689
M8	1	9.383	9.423	H2	8.664	8.677	H3	8.677	8.689
	1.25	9.723	9.787	H2	8.827	8.839	H3	8.839	8.852
M10	1	11.382	11.422	H2	10.663	10.676	H3	10.676	10.688
	1.25	11.725	11.788	H2	10.825	10.838	H3	10.838	10.851
	1.5	12.068	12.131	H3	11.001	11.013	H4	11.013	11.026
M12	1.25	13.724	13.787	H3	12.837	12.850	H4	12.850	12.863
	1.5	14.069	14.133	H3	13.000	13.012	H4	13.012	13.025
	1.75	14.415	14.478	H3	13.162	13.175	H4	13.175	13.188
M14	1.5	16.068	16.132	H3	15.001	15.014	H4	15.014	15.027
	2	16.759	16.822	H3	15.326	15.339	H5	15.352	15.364
M16	1.5	18.070	18.133	H3	17.000	17.013	H4	17.013	17.026
	2	18.758	18.821	H3	17.325	17.338	H5	17.351	17.363
M18	1.5	20.069	20.132	H3	18.999	19.012	H4	19.012	19.025
	2	20.759	20.823	H3	19.324	19.337	H5	19.350	19.362
	2.5	21.450	21.514	H3	19.649	19.662	H5	19.675	19.688
M20	1.5	22.068	22.131	H3	21.001	21.013	H4	21.013	21.026
	2	22.758	22.822	H3	21.326	21.339	H5	21.351	21.364
	2.5	23.449	23.513	H3	21.651	21.664	H5	21.676	21.689
M22	1.5	24.067	24.130	H3	23.000	23.012	H4	23.012	23.025
	2	24.760	24.823	H3	23.325	23.338	H5	23.350	23.363
	2.5	25.448	25.512	H3	23.650	23.663	H5	23.675	23.688
M24	2	26.756	26.820	H4	25.326	25.352	H6	25.352	25.377
	3	28.138	28.237	H4	25.974	25.999	H6	25.999	26.025
M27	2	29.759	29.822	H4	28.326	28.351	H6	28.351	28.377
	3	31.138	31.237	H4	28.974	28.999	H6	28.999	29.025
M30	2	32.758	32.822	H4	31.326	31.351	H6	31.351	31.377
	3.5	34.826	34.925	H4	32.299	32.324	H6	32.324	32.349
M33	2	35.758	35.822	H4	34.328	34.354	H6	34.354	34.379
	3.5	37.826	37.925	H4	35.298	35.324	H6	35.324	35.349
M36	2	38.758	38.821	H4	37.328	37.353	H6	37.353	37.379
	3	40.137	40.236	H6	38.001	38.026	H8	38.026	38.052
	4	41.516	41.615	H6	38.649	38.674	H8	38.674	38.699
M39	2	41.758	41.821	H4	40.328	40.353	H6	40.353	40.378
	3	43.137	43.236	H6	41.001	41.026	H8	41.026	41.051
	4	44.516	44.615	H6	41.648	41.674	H8	41.674	41.699

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 thread 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 ($2 \times 0.64951904P$) to the basic dimensions of the nominal thread size.

(c) Major and pitch diameters are extracted from obsolete MIL-T-21309E. They do not follow Table 6 practice.

(d) "H" limits are used for pitch diameter limits per established practice in obsolete MIL-T-21309E.

(e) Soft inch conversion reference Nonmandatory Appendix Table A-14.

NONMANDATORY APPENDIX A
TAP SIZE RECOMMENDATIONS

Table A-1 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	64	...	G H2	G H1	0.0629	0.0655	0.0648
1	...	72	G H2	G H1	0.0640	0.0665	0.0659
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
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

Table A-1 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
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	0.9605	0.9588
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
1 1/4	7	...	G H8	G H4	1.1572	1.1668	1.1644
1 1/4	...	12	G H6	G H4	1.1959	1.2039	1.2019
1 3/8	6	...	G H8	G H4	1.2667	1.2771	1.2745
1 3/8	...	12	G H6	G H4	1.3209	1.3291	1.3270
1 1/2	6	...	G H8	G H4	1.3917	1.4022	1.3996
1 1/2	...	12	G H6	G H4	1.4459	1.4542	1.4522

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 1 1/2 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 A-2 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
M14	1.25	D4	13.188	13.368	0.51921	0.52629
16	2	D7	14.701	14.913	0.57878	0.58713
18	1.5	D4	17.026	17.216	0.67031	0.67780
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
M42	4.5	D10	39.077	39.392	1.53846	1.55087
M48	5	D10	44.752	45.087	1.76189	1.77508

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 A-3 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 A-12.

Table A-4 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

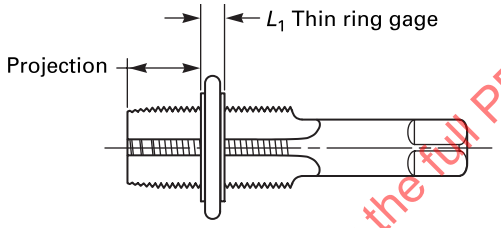
GENERAL NOTES:

(a) All dimensions are given in inches.

(b) Thread limits are computed from Table A-12.

Table A-5 Taper Pipe Tap Thread Limits (NPT Cut Thread)

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		l_1 Length [Note (3)]	Tap Drill Size NPT, ANPT, NPTF [Note (4)]
			Cut Thread	Min.	Max.		
1/16	27	0.312	0.0625	0.0599	0.0703	0.1600	C
1/8	27	0.312	0.0625	0.0599	0.0703	0.1615	Q
1/4	18	0.459	0.0625	0.0599	0.0703	0.2278	7/16
3/8	18	0.454	0.0625	0.0599	0.0703	0.2400	9/16
1/2	14	0.579	0.0625	0.0599	0.0677	0.3200	45/64
3/4	14	0.565	0.0625	0.0599	0.0677	0.3390	29/32
1	11 1/2	0.678	0.0937	0.0599	0.0677	0.4000	1 9/64
1 1/4	11 1/2	0.686	0.0937	0.0599	0.0677	0.4200	1 31/64
1 1/2	11 1/2	0.699	0.0937	0.0599	0.0677	0.4200	1 23/32
2	11 1/2	0.667	0.0937	0.0599	0.0677	0.4360	2 3/16
2 1/2	8	0.925	0.0937	0.0612	0.0664	0.6820	2 39/64
3	8	0.925	0.0937	0.0612	0.0664	0.7660	3 15/16



Lead Tolerances

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

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

Table A-5 Taper Pipe Tap Thread Limits (NPT Cut Thread) (Cont'd)

Widths of Flats at Tap Crests and Roots			
		Column I	
		NPT: Cut Thread [Note (5)]	
Threads per Inch	Tap Flat Width at	Min. [Note (6)]	Max.
27	Major diameter	0.0014	0.0041
	Minor diameter	. . .	0.0041
18	Major diameter	0.0021	0.0057
	Minor diameter	. . .	0.0057
14	Major diameter	0.0027	0.0064
	Minor diameter	. . .	0.0064
$11\frac{1}{2}$	Major diameter	0.0033	0.0073
	Minor diameter	. . .	0.0073
8	Major diameter	0.0048	0.0090
	Minor diameter	. . .	0.0090

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) ($\frac{3}{4}$ 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.
(6) Minimum minor diameter flats are not specified and may be sharp as practicable.

Table A-6 Tap Thread Limits: Metric Sizes, Ground Thread M Profile (Standard Thread Limits Soft Conversion to 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	0.0630	0.0641	0.0651	0.0541	0.0550	0.0556	...	...	...	...	...	...
2	0.4	0.0787	0.0800	0.0810	0.0685	0.0694	0.0700	...	...	...	...	...	...
2.5	0.45	0.0984	0.0998	0.1008	0.0869	0.0879	0.0885	...	...	...	...	...	...
3	0.5	0.1181	0.1197	0.1207	0.1053	0.1063	0.1069	...	(1),(2)	0.1073	0.1079	...	...
3.5	0.6	0.1378	0.1397	0.1407	0.1224	...	...	0.1237	0.1245	...	...	...	...
4	0.7	0.1575	0.1597	0.1613	0.1396	...	...	0.1408	0.1416	...	(1),(2)	0.1419	0.1426
4.5	0.75	0.1772	0.1795	0.1811	0.1580	...	...	0.1593	0.1600	...	...	...	...
5	0.8	0.1969	0.1994	0.2010	0.1764	...	...	0.1776	0.1784	...	...	...	...
6	1	0.2362	0.2394	0.2410	0.2106	...	...	...	...	0.2122	0.2132	...	(3),(2)
7	1	0.2756	0.2787	0.2804	0.2500	...	...	...	...	0.2516	0.2526	...	...
8	1.25	0.3150	0.3189	0.3214	0.2830	...	...	...	...	0.2843	0.2856	...	...
10	1.5	0.3937	0.3984	0.4009	0.3554	...	...	...	...	...	...	0.3572	0.3584
12	1.75	0.4724	0.4780	0.4805	0.4277	...	...	...	...	...	...	0.4295	0.4307
14	1.25	0.5512	0.5550	0.5560	0.5192	...	...	0.5207 (6)	0.5212 (6)	...	...	...	...
14	2	0.5512	0.5575	0.5800	0.5000	...	...	...	...	...	...	...	...
16	2	0.6299	0.6362	0.6387	0.5788	...	...	...	...	...	...	...	...
18	1.5	0.7087	0.7135	0.7145	0.6703	...	...	0.6718 (6)	0.6723 (6)	...	...	...	...
20	2.5	0.7874	0.7953	0.7978	0.7235	...	...	...	...	...	...	...	...
24	3	0.9449	0.9543	0.9583	0.8681	...	...	...	...	...	...	...	...
30	3.5	1.1811	1.1921	1.1961	1.0916	...	...	...	...	...	...	...	...
36	4	1.4173	1.4299	1.4339	1.3150	...	...	...	...	...	...	...	...
42	4.5	1.6535	1.6677	1.7110	1.5385	...	...	...	...	...	...	...	...
48	5	1.8898	1.9055	1.9882	1.7619	...	...	...	...	...	...	...	...

GENERAL NOTES:

(a) Inch values in Table A-3 are a direct soft conversion of metric values in Table 12. All metric values were divided by 25.4 and rounded to four decimal places, per ASME B1.30.

(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 10.

NOTES:

(1) These sizes are intended for spark plug applications and use the pitch diameter tolerances from Table 7, column *D*.

(2) Minimum and maximum major diameters are 0.0015 in. larger than shown.

(3) Minimum and maximum major diameters are 0.0026 in. larger than shown.

(4) Standard D limit for thread forming taps.

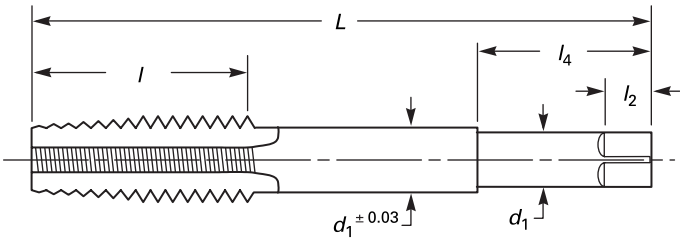
(5) Minimum and maximum major diameters are 0.0010 in. larger than shown.

(6) Minimum and maximum major diameters are 0.0020 in. larger than shown.

Table A-6 Tap Thread Limits: Metric Sizes, Ground Thread M Profile (Standard Thread Limits Soft Conversion to Inches) (Cont'd)

Pitch Diameter									
D7		D8		D9		D10		D11	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
0.1792	0.1800	...	...	...	...	...	...	...	...
...	(3),(2)	0.2137	0.2147	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
...	...	...	(4),(2)	0.2864	0.2876	...	...	...	...
...	...	...	...	...	...	0.3593	0.3605	...	...
...	...	...	...	...	...	...	...	0.4321	0.4333
...	...	...	...	...	(4),(2)	...	(5),(2)	...	...
0.5020	0.0536	...	...	...	...	...	...	...	...
0.5807	0.5284	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...
0.7254	0.7270	...	...	...	...	...	...	...	...
...	...	0.8706	0.8722	...	...	...	...	...	...
...	...	...	...	1.0942	1.0962	...	...	...	...
...	...	...	...	1.3176	1.3196	...	...	...	...
...	...	...	...	...	...	1.5415	1.5436	...	...
...	...	...	...	...	...	1.7650	1.7670	...	...

Table A-7 Special Extension Taps (Tap Dimensions, Ground and Cut Threads)



General Dimensions			
Nominal Tap Size			
Fractional	Machine Screw	Pipe	Shank Length, l_4
...	0–3	...	0.88
...	4	...	1.00
...	5–6	...	1.13
...	8	...	1.25
...	10–12	1/16 to 1/4 incl.	1.38
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

Tolerances				
For Shank Diameter, d_1 for l_4 Length				
	Nominal Diameter Range, in.			
Element	Over	To (Inclusive)	Direction	Tolerance, in. Ground Thread
Diameter of shank, d_1	0.0520	0.2230	Minus	0.0015
	0.2230	0.6350	Minus	0.0015
	0.6350	1.0100	Minus	0.0020
	1.0100	1.5100	Minus	0.0020
	1.5100	2.0000	Minus	0.0030

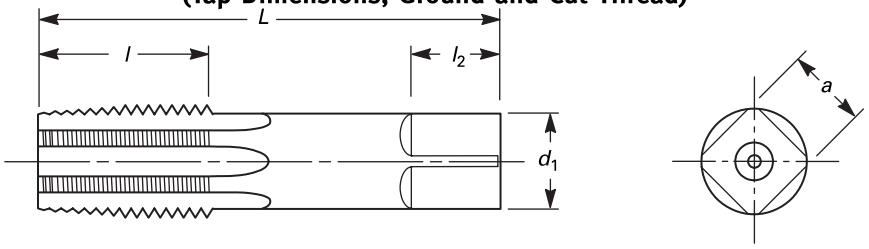
GENERAL NOTE: Unless otherwise specified, special extension taps will be furnished with dimensions and tolerances as shown for machine screw and fractional taps Tables 2 and 3 and for pipe taps in Table 6. Exceptions are as follows:

(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 A-8 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	$1\frac{1}{16}$	M27	4.00	1.50	0.88	0.8960	0.672
1.073	1.135	$1\frac{1}{8}$	...	4.00	1.50	0.88	0.8960	0.672
1.135	1.198	$1\frac{3}{16}$	M30	4.00	1.50	1.00	1.0210	0.766
1.198	1.260	$1\frac{1}{4}$	...	4.00	1.50	1.00	1.0210	0.766
1.260	1.323	$1\frac{5}{16}$	M33	4.00	1.50	1.00	1.1080	0.831
1.323	1.385	$1\frac{3}{8}$	...	4.00	1.50	1.00	1.1080	0.831
1.385	1.448	$1\frac{7}{16}$	M36	4.00	1.50	1.00	1.2330	0.925
1.448	1.510	$1\frac{1}{2}$	...	4.00	1.50	1.00	1.2330	0.925
1.510	1.635	$1\frac{5}{8}$	M39	5.00	2.00	1.13	1.3050	0.979
1.635	1.760	$1\frac{3}{4}$	M42	5.00	2.00	1.25	1.4300	1.072
1.760	1.885	$1\frac{7}{8}$	...	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	$2\frac{1}{8}$	...	5.25	2.00	1.38	1.7690	1.327
2.135	2.260	$2\frac{1}{4}$	M56	5.25	2.00	1.44	1.8940	1.420
2.260	2.385	$2\frac{3}{8}$	...	5.25	2.00	1.44	2.0190	1.514
2.385	2.510	$2\frac{1}{2}$	...	5.25	2.00	1.50	2.1000	1.575
2.510	2.635	$2\frac{5}{8}$	M64	5.50	2.00	1.50	2.1000	1.575
2.635	2.760	$2\frac{3}{4}$	...	5.50	2.00	1.50	2.1000	1.575
2.760	2.885	$2\frac{7}{8}$	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	$3\frac{1}{8}$	...	5.75	2.00	1.50	2.1000	1.575
3.135	3.260	$3\frac{1}{4}$	M80	5.75	2.00	1.50	2.1000	1.575
3.260	3.385	$3\frac{3}{8}$	...	5.75	2.00	1.50	2.1000	1.575
3.385	3.510	$3\frac{1}{2}$	...	5.75	2.00	1.50	2.1000	1.575
3.510	3.635	$3\frac{5}{8}$	M90	6.00	2.00	1.75	2.1000	1.575
3.635	3.760	$3\frac{3}{8}$	...	6.00	2.00	1.75	2.1000	1.575
3.760	3.885	$3\frac{7}{8}$	...	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 15.