ASME B1.7-2006

(Revision of ANSI/ASME B1.7M-1984)

Screw Threads: Nomenclature, Definitions, and Letter Symbols

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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

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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.

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

CONTENTS

Tables

Nonmandatory Appendices

FOREWORD

The first revision of ASA B1.7-1949, the first American Standard on Nomenclature, Definitions, and Letter Symbols for Screw Threads, was approved in January 1965. These earlier definitions and symbols were subsequently published as appendix material in ASA B1.1, B2.1, and B2.2. As such they underwent some revision over the years. A draft based on such revisions, dated July 1961, was prepared by Subcommittee 8 and widely circulated by the sponsors for comment. Extensive comments were received from members of Sectional Committee B1, B2, B4, and others, which were reviewed and acted upon at a meeting of Subcommittee 8, held November 28, 1961.

A second revised draft, dated July 1962, was prepared and submitted to the American-British-Canadian Conference on Engineering Standards, held in Harriman, New York, on September 22–26, 1962. Suggested revisions agreed upon by the conference were embodied in the draft, which was then submitted to letter ballot by Sectional Committees B1 and B2 on July 9, 1963.

Further refinements were made in the proposal because of comments received from the sectional committee ballots, and a new draft was issued in May 1964. The draft was submitted to the American Standards Association for approval and designation as an American Standard. This was granted on January 19, 1965, and reaffirmed in 1972 by the American National Standards Institute as American National Standard ANSI B1.7.

Following the 1972 reaffirmation, comments from members of the American National Standards Committee B1, and others, indicated that a complete revision be undertaken. A new draft was prepared and submitted in March 1975 to Subcommittee 7 for review and approval. After numerous comments and subsequent changes, the proposed standard was submitted to and approved by American National Standards Committee B1. The document was then transmitted to the Secretariat and ANSI in October 1976. It was approved as an American National Standard, ANSI B1.7-1977, on September 16, 1977.

Within the period from 1977 to 1984 there was considerable B1 standards activity in the development of metric screw thread standards for U.S. usage. ISO standards were blended with ANSI standards, requiring many revisions in ANSI symbology and definitions of terms. ISO symbols were adopted, except those where a change from American practice would confuse the general understanding of the elements symbolized. Also, many ISO definitions were incorporated into American definitions in order to facilitate the correct interpretation of both ISO and ANSI terminology. These revisions were approved and designated as American National Standard ANSI/ASME B1.7M-1984, on November 2, 1984.

Screw thread standards are constantly being revised as required by the ASME B1 Committee. Additionally, the title of this document was changed to “Screw Threads: Nomenclature, Definitions, and Letter Symbols.” This revision was approved and designated by the American National Standards Institute on September 11, 2006.

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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SCREW THREADS: NOMENCLATURE, DEFINITIONS, AND LETTER SYMBOLS

1 GENERAL

1.1 Scope

The purpose of this Standard is to establish a uniform practice for standard screw threads with regard to the following:

(a) screw thread nomenclature

(b) letter symbols for the designating features of a screw thread for use on drawings, in tables that set forth dimensional standards, in other records, and for expressing mathematical relationship

This Standard consists of: a glossary of terms, illustrations, an illustrated table showing the application of symbols, and a table of thread series designations. Many of the terms and symbols specified in this Standard vary considerably from those prior to the 1984 issue, because ISO terms and symbols have been adopted where the intended definition is the same.

1.2 References

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

ANSI/CGA V-1, National Gas Screw Threads[1]

Publisher: Canadian Gas Association (CGA), 350 Sparks Street, Ottawa, Ontario K1R 7S8, Canada

ASME B1.20.7, Hose Coupling Screw Threads

ASME Y14.5M, Dimensioning and Tolerancing

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

ISO 7-1, Pipe Threads Where Pressure Tight Joints are Made on Threads—Part 1: Designation, Dimensions, and Tolerances

ISO 228-1, Pipe Threads Where Pressure Tight Joints are Not Made on the Threads—Part 1: Designation, Dimensions, and Tolerances

ISO 1502, ISO General Purpose Metric Screw Thread-Gauging

ISO 2901, ISO Metric Trapezoidal Screw Threads

ISO 2902, ISO Metric Trapezoidal Screw Threads

ISO 2903, ISO Metric Trapezoidal Screw Threads

ISO 2904, ISO Metric Trapezoidal Screw Threads

ISO/R1501, ISO Miniature Screw Threads

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

1.3 Federal Government Use

When this Standard is approved by the Department of Defense and Federal agencies, and is incorporated into FED-STD-H28/1, *Screw Thread Standards for Federal Services, Section 1*, the use of this Standard by the Federal Government is subject to all requirements and limitations of FED-STD-H28/1.

2 DEFINITION OF TERMS

The definitions presented herein are listed alphabetically and apply generally to all forms of screw threads, thread gages, and thread measurements. They relate to the following:

(a) types of screw threads

(b) size and fit of threaded parts in general

(c) geometric elements, attributes, and dimensions of screw threads

ISO nomenclature is used where the exact meaning is coincident with the U.S. practice.

actual fit: the measured difference, subject to measurement uncertainty, before assembly, between the sizes of two mating parts that are to be assembled.

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

addendum: the addendum of an external thread is the radial distance between the major and pitch cylinders or cones, respectively. The addendum of an internal thread is the radial distance between the minor and pitch cylinders or cones, respectively. This term applies to those threads having a recognized pitch cylinder or pitch cone.

allowance: a prescribed difference between the maximum material limits of mating parts. It is the minimum clearance (positive allowance) or maximum interference (negative allowance) between such parts. It is numerically equal to the absolute value of ISO term fundamental deviation (see Fig. 1).

attribute: nondimensional thread element(s) and characteristic(s), taken singly or in a group. Inspection/evaluation by limit gages is an attribute inspection.

axis of thread: the axis of the thread pitch cylinder or cone (see Fig. 2).

[1] May also be obtained from American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036.

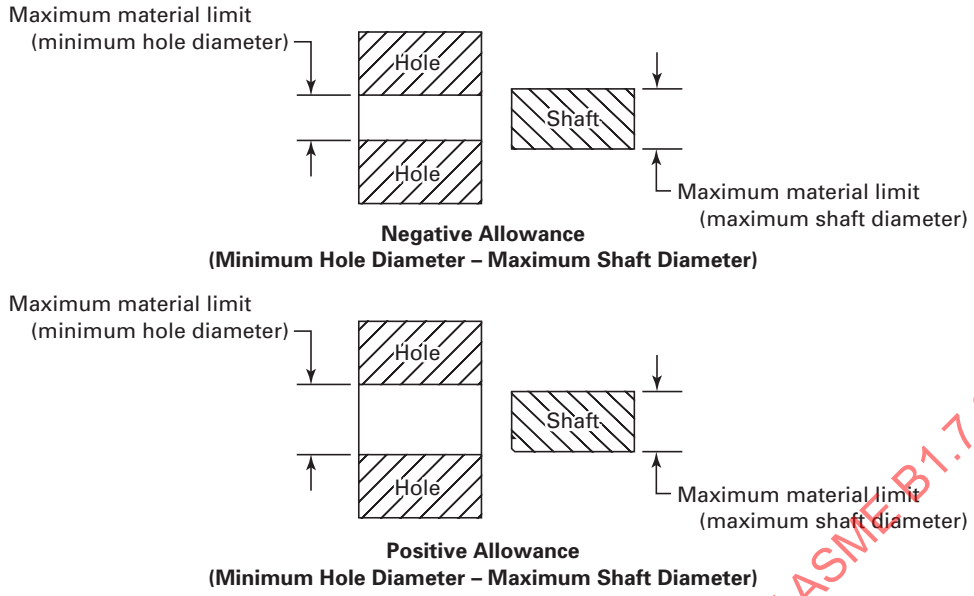


Fig. 1 Allowance

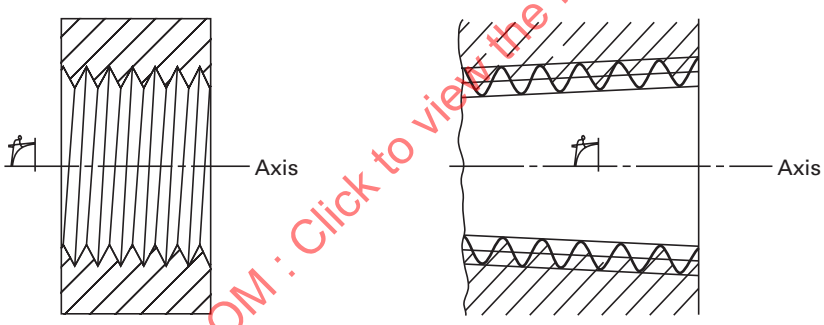


Fig. 2 Axis of Thread

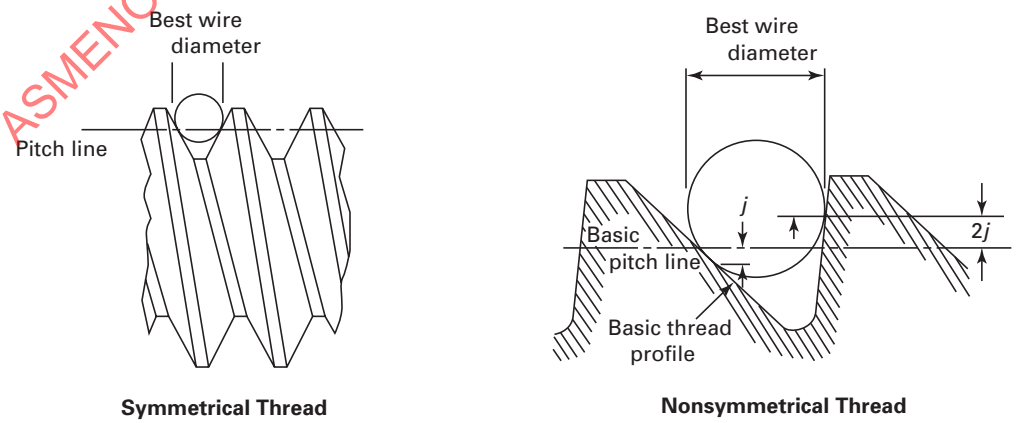


Fig. 3 Best Wire Size

basic hole system: a system of fits in which the design size of the hole is the basic size, and the allowance, if any, is applied to the shaft.

basic profile of thread: see *profile, basic thread.*

basic shaft system: a system of fits in which the design of the shaft is the basic size, and the allowance, if any, is applied to the hole.

basic size: that size from which the limits of size are derived by the application of allowances and tolerances.

best wire size: for symmetrical threads, the size of a wire that would touch at the pitch diameter on a basic profile thread of zero lead angle. For nonsymmetrical threads, governed by ASME B1.9, the best wire size will contact the load flank at a point twice the distance above the pitch line that the contact point on the clearance flank is below the pitch line (see Fig. 3).

bilateral tolerance: a tolerance in which variation is equally larger and smaller than the specified dimension.

bilateral tolerance system: a design plan that uses only bilateral tolerances.

black crest thread: a thread whose crest displays the unfinished cast, rolled, or forged surface.

blunt start thread: a thread with removal of the incomplete thread at the starting end (see Fig. 4). This is a feature of the threaded parts that are repeatedly assembled by hand, such as hose couplings and thread gages, to prevent cutting of hands and crossing of threads. Also known as Higbee cut or a convoluted thread.

bottom of chamfer: the intersection of the chamfer cone and the pitch cone of an internal taper pipe thread (see Fig. 5).

chamfer: a conical surface at the starting end of a thread.

characteristic: the quality(s), peculiarity(s), or feature(s) that is a conspicuous or prominent detail(s) of the thread. See also *attribute* and *element*.

class of thread: an alphanumerical designation to indicate the standard grade of tolerance and allowance specified for a thread (e.g., 2A, 2B).

clearance fit: a fit between mating assembled parts that provides a clearance at their maximum material condition.

clearance flank: the flank that does not take the externally applied axial load in an assembly (see Fig. 6).

coated thread: a thread with one or more applications of additive material. This includes dry film lubricants, but excludes soft or liquid lubricants that are readily displaced in assembly and gaging. Plating and anodizing are included as coatings.

common boundary: the portion of the basic profile common to the maximum material conditions of the external and internal threads. Violation of the common boundary produces interference.

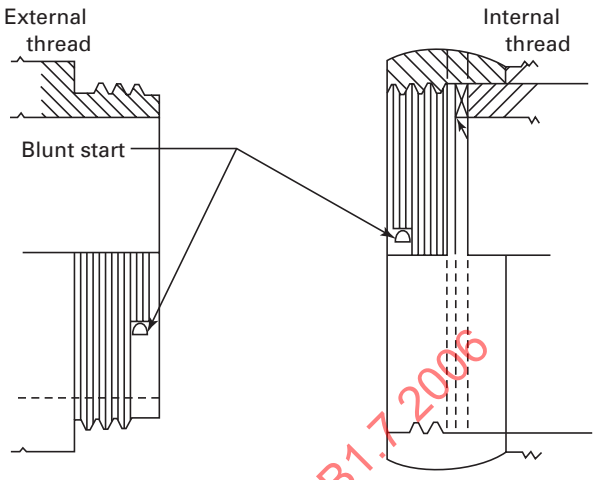


Fig. 4 Blunt Start Thread

complete thread: thread(s) whose profile lies within the size limits. See also *effective thread* and *length of complete thread*.

NOTE: In pipe threads terminology, this was formerly referred to as the perfect thread, but that term is no longer considered desirable.

concentricity: twice the value of eccentricity.

convoluted thread: see *blunt start thread*.

countersink: a bevel or flare at the end of a hole (see Fig. 7).

crest: the surface of a thread that joins the flanks of the same thread, and is farthest from the cylinder or cone from which the thread projects (see Fig. 8).

crest apex: see *sharp crest.*

crest diameter: the diameter of an imaginary cylinder or cone bounding the crest of a screw thread. This is the major diameter of an external thread and minor diameter of an internal thread.

crest truncation: the crest truncation of a thread is the radial distance from the sharp crest (crest apex) and the cylinder or cone that would bound the crest (see Fig. 9).

crest width: the distance between the points of intersection of the flanks of the thread ridge and the imaginary cylinder defined by the crest diameter (see Fig. 9).

cumulative form variation: the combined effect on functional size of individual thread variations in lead (pitch), helix, flank angle, taper, and roundness. It is the maximum difference between GO functional diameter size and pitch diameter size taken along and around the axis of the usable thread.

cumulative pitch: the distance measured parallel to the axis of the thread between corresponding points on any two threads.

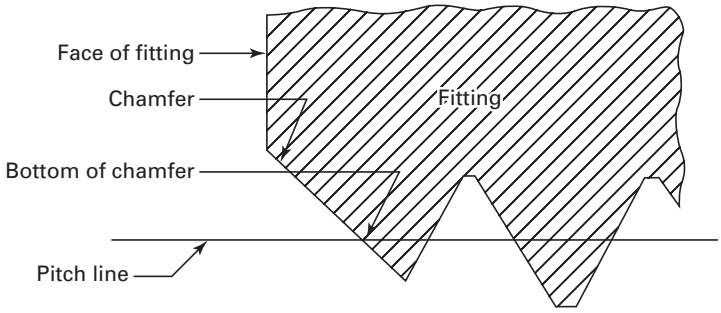


Fig. 5 Bottom of Chamfer

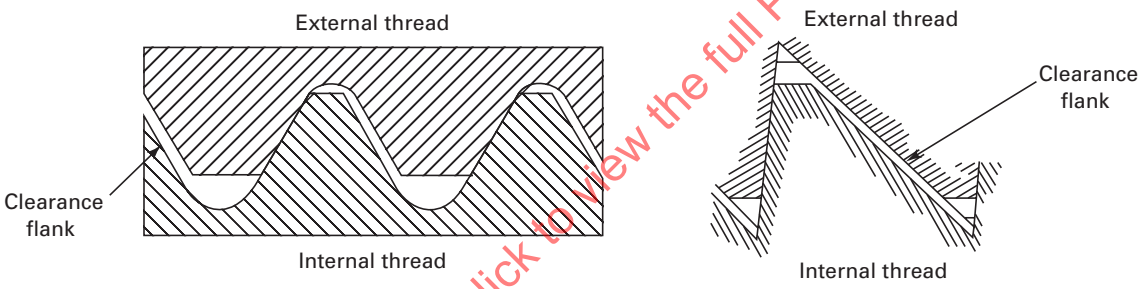


Fig. 6 Clearance Flank

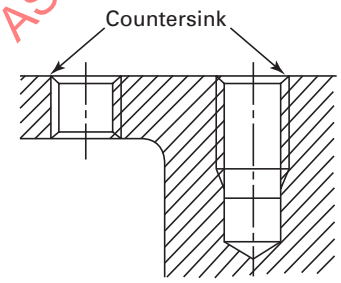


Fig. 7 Countersink

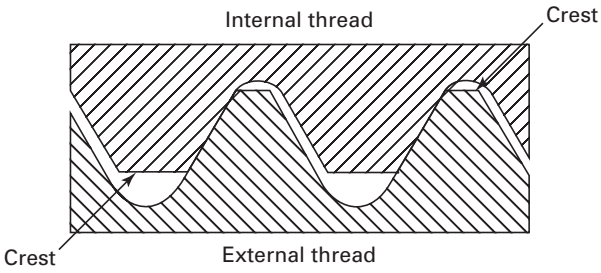


Fig. 8 Crest

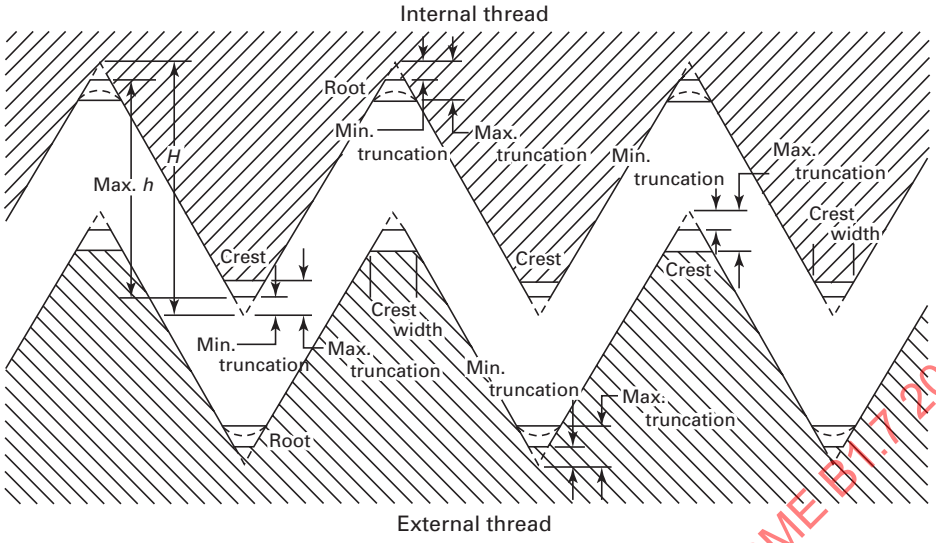


Fig. 9 Root and Crest Truncation

cylindricity: the condition of a surface of revolution in which all points of the surface are equidistant from a common axis.

NOTE: The cylindricity tolerance is a composite control of form, which includes roundness, straightness, and taper of a cylindrical feature.

dedendum: the radial distance between the pitch and root diameter cylinders or cones. This term applies to those threads having a recognized pitch cylinder or pitch cone.

depth of thread engagement: the radial distance, crest-to-crest, by which the thread forms engage mating threads in an assembly. See also *height of thread engagement*.

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

design thread form: see *profile, design.*

designations: see *symbols and designations.*

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

deviation, fundamental (ISO term): for standard threads, the upper deviation is "*es*" for an external thread, and the lower deviation is "*EI*" for an internal thread (see Fig. 10). See also *allowance* and *tolerance position.*

deviation, lower (ISO term): the algebraic difference between the minimum limit of size and the basic size. It is designated "*EI*" for the internal and "*ei*" for the external thread. Diameters are from the French term écart inferieur (see Fig. 11).

deviation, upper (ISO term): the algebraic difference between the maximum limit of size and the basic size. It is designated "*ES*" for internal and "*es*" for external thread. Diameters are from the French term écart superieur (see Fig. 11).

differential: the difference or displacement between any two values of an element not otherwise designated as a tolerance or constant. A Δ is used as a prefix to the symbol(s) of one or more related elements.

EXAMPLES:
(1) Pitch diameter equivalent of the flank angle variation = $\Delta D_2\alpha$
(2) Pitch diameter equivalent of the lead variation = $\Delta d_2\lambda$

dimension: a numerical value expressed in an appropriate unit of measure and indicated on a drawing along with lines, symbols, and notes to define the geometrical characteristics of an object.

drunken thread or drunken lead: a periodic advance and retardation of the actual thread from the true helix. See also *helix variation.*

eccentricity: the distance between the axis of the pitch cylinder and either the axis of the major diameter cylinder or the axis of the minor diameter cylinder. Eccentricity is half of the concentricity.

effective size: see *pitch diameter, functional diameter*.

effective thread: the effective (or useful) thread includes the complete thread and those portions of the complete thread that are fully formed at the root but not at the crest (in taper pipe threads this includes the black crest threads), thus excluding the vanish thread.

element: characteristic(s) of a thread including, but not limited to, thread angles, root, crest, pitch, lead, lead angle, major, minor, and pitch diameters (see Fig. 12). See also *characteristic.*

end threads: see *incomplete thread*.

error: the difference (+ or −) between an observed or measured value beyond a tolerance limit and of the specified value.

external thread: a screw thread formed on the outside of a cylinder or conical surface. See also *thread*, *bolt.*

face flank: see *leading flank*.

feature: any component portion of a part that can be used as a basis for a datum. An individual feature may be a

(*a*) plane surface (in which case there is no consideration of feature size)

(*b*) single cylindrical or spherical surface of two plane parallel surfaces (all of which are associated with a size dimension)

fit: the relationship resulting from the designed difference, before assembly, between the size of two mating parts that are to be assembled. See also *actual fit*, *clearance fit, interference fit, transition fit*, and *allowance*.

fitting allowance: an ISO taper pipe thread term for the length of useful thread beyond the gage plane of an external thread required to provide for assembly with an internal thread at the upper limit of the tolerance. Not used in the U.S.

flank: the part of a helical thread surface that connects the crest and the root, which is theoretically a straight line in an axial plane section (see Fig. 13).

flank angle: the angle formed by a contacting line tangent to the actual flank profile and a plane perpendicular to the thread axis (see Fig. 14). Also referred to as half-angle.

flat form: the term applied to a thread form having a normally straight or flat form between the thread flanks on the cylinder or cone from which the thread projects (see Fig. 15). In other words, a thread with an unrounded crest or root form.

following flank: the following, or trailing, flank of a thread is the one opposite to the leading flank (see Fig. 16).

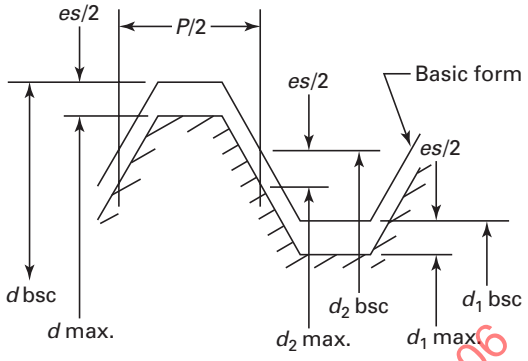
form diameter: the diameter at the point nearest the root from which the flank is required to be straight.

form of thread: see *profile, thread.*

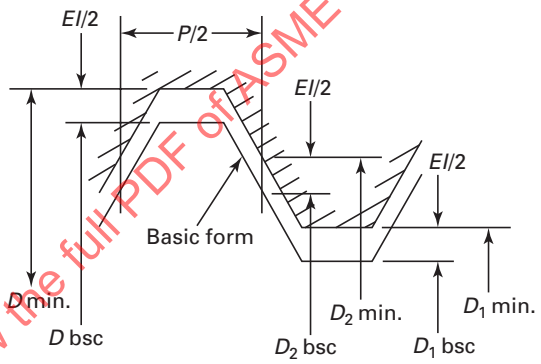
full form of thread: see *complete thread.*

functional diameter: see *pitch diameter, functional diameter.*

functional gaging: the practice of using thread gages of near perfect form at the maximum or minimum material limits to simulate the contact interface of the mating part.



Allowance (Fundamental Deviation), External Thread



Allowance (Fundamental Deviation), Internal Thread

Fig. 10 Fundamental Deviation

functional size: the size of the functional diameter. See also *pitch diameter*, *functional diameter*.

fundamental triangle: a triangle from which the shape and dimensions of the basic thread profile may be defined by the application of truncations at the thread crest and root. The corners of this triangle coincide with the three consecutive intercepts of the extended flanks of the basic profile.

gage: a device for inspecting/evaluating a limit or size of a specified product dimension. The spelling can also be gauge.

gage, setting gage: used to set fixed attribute and indicating gages.

gage, thread indicating gage: used to numerically compare thread characteristics or attributes to a known standard. The device utilizes gaging elements such as segments, rolls, balls, or fingers, of which one or more is moveable. Thus, by selection of appropriate contacts and standards, size measurement of screw threads may be made. Also, by use of differential readings, diameter

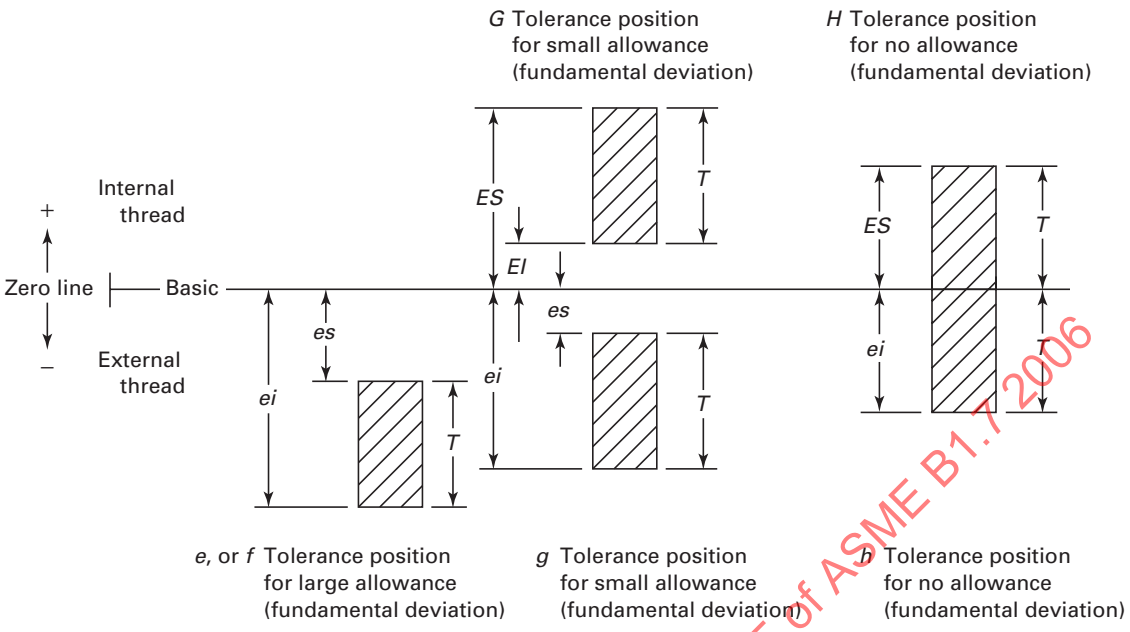


Fig. 11 Metric Tolerance System for Screw Threads

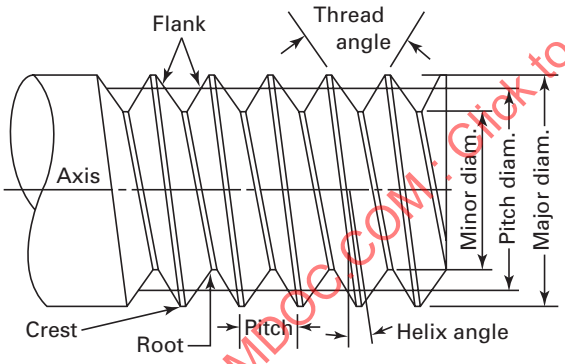


Fig. 12 Element

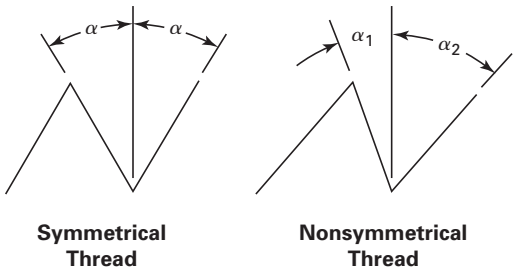


Fig. 14 Flank Angle

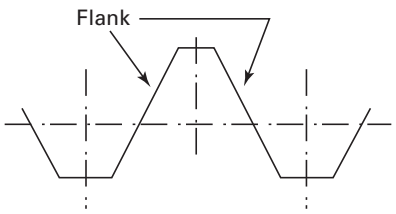


Fig. 13 Flank

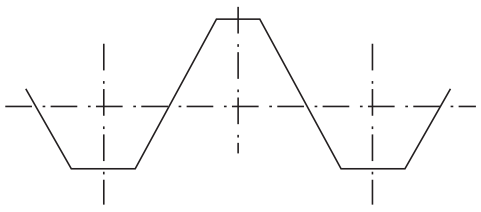


Fig. 15 Flat Form

equivalents and variations of individual thread characteristics may be determined.

gage, thread limit gage: used to determine whether a thread is within the maximum or minimum material limit. See also *attribute*.

gage, thread plug gage: a plug that has an external thread, used as a setting or work gage.

gage, thread ring gage: a ring that has internal threads, used as a setting or work gage.

gage, thread snap gage: a limit gage that utilizes movable thread segments or rolls to check a characteristic or attribute of a thread. A snap gage for an external thread engages by passing over the threaded part. A snap gage for an internal thread is placed within the thread and spring loaded contacts release to provide thread engagement.

gaging length: see *length, gaging*.

gauge plane: An ISO taper pipe thread term equivalent to the U.S. term "plane of hand tight engagement, $X=1$". Its location from the reference plane at the small end of the thread is called the gauge length, L_1 in the U.S., and the major diameter at this plane is called the gauge diameter, D_1 in the U.S. (see Fig. 17).

groove diameter: see *pitch diameter, thread groove diameter*.

half-angle: see *flank angle.*

height of fundamental triangle: the height of the fundamental triangle of the thread. The height of a sharp V-thread is the distance measured radially, between the sharp major diameter and sharp minor diameter cylinders or cones respectively (see Fig. 18).

height of thread: the height (or depth) of a thread is the radial distance, measured perpendicular to the thread axis, between the major and minor cylinders or cones respectively (see Fig. 19).

height of thread engagement: the radial distance, measured perpendicular from the crest of the internal to the crest of the external, where the thread forms engage mating threads in an assembly (see Fig. 20).

helical path: see *helix variation.*

helix: the curve on a cylindrical or conical surface, which intersects all planes perpendicular to the axis, at a constant oblique angle (see Fig. 21). A helix on a cylindrical surface, which has been unrolled (developed), will appear as a series of equidistant straight lines.

helix angle: a complement to the lead angle (see Fig. 21).

helix variation: the axial variation of the screw thread's actual helical path on the pitch cylinder relative to its true helix within the gaging length (see Fig. 22). See also *drunken thread* or *lead*.

imperfect thread: see *incomplete thread.*

included angle: see *thread angle.*

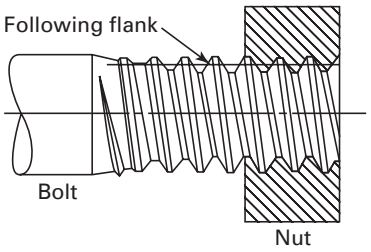


Fig. 16 Following Flank

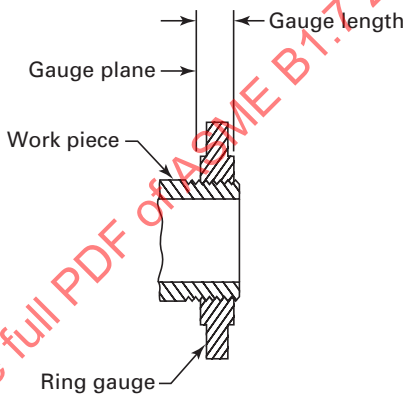


Fig. 17 Gauge Plane

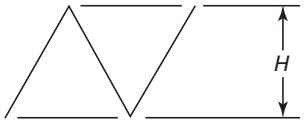


Fig. 18 Height of Fundamental Triangle

incomplete lead thread: the incomplete thread at the starting end of a screw thread.

incomplete run-out thread: the incomplete thread at the terminating end of a screw thread.

incomplete thread: a thread profile having either crests or roots, or both, whose profiles lie outside the size limits, resulting from the intersection with the cylinder or end surface of the work or vanish cone (see Fig. 23). It may occur at either end of the thread.

interference fit: a fit between mating assembled parts that always provides an interference (see Fig. 24).

internal thread: a screw thread formed on the inside of a cylindrical or conical surface (see Fig. 25). See also *thread, nut*.

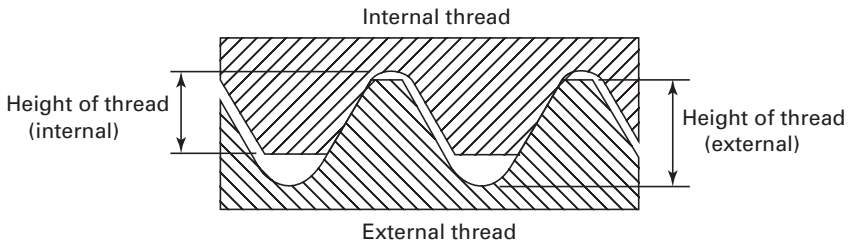


Fig. 19 Height of Thread

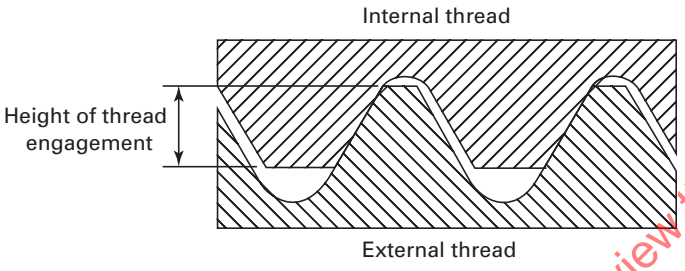


Fig. 20 Height of Thread Engagement

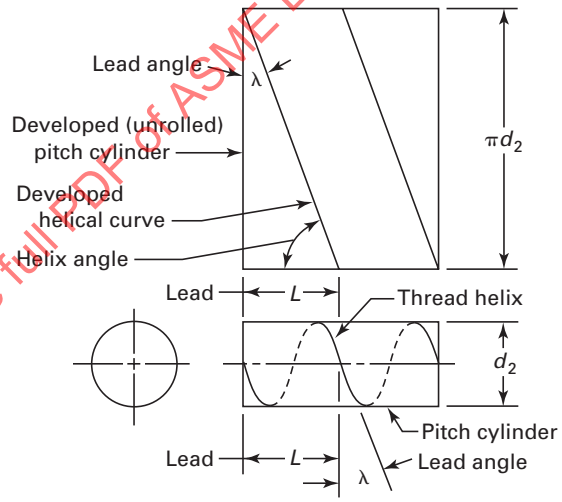


Fig. 21 Helix

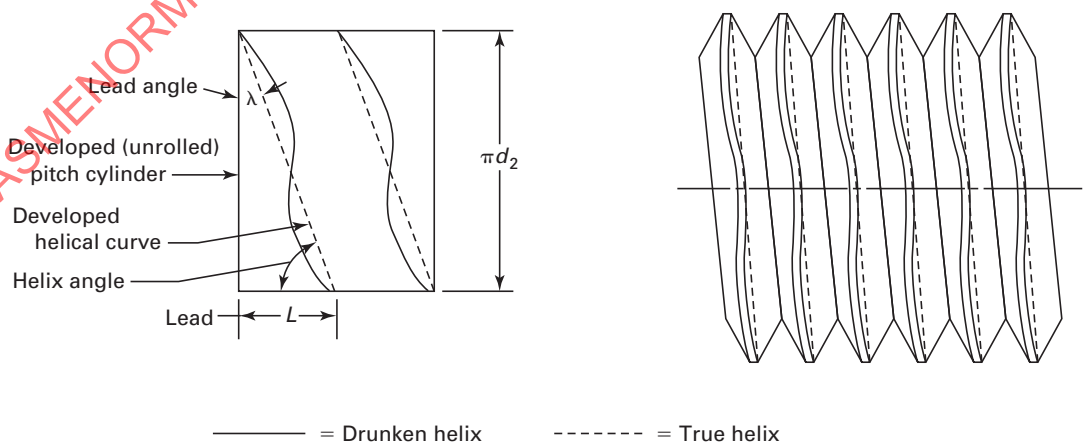


Fig. 22 Helix Variation (Drunken Thread)

lead: the axial distance between two corresponding points on a helix. When a threaded part is rotated about its axis with respect to a fixed mating thread, the lead is the axial distance moved by the part in relation to the amount of angular rotation. On a single lead thread, the lead is equal to the pitch. On a double lead thread (double start), the lead is equal to twice the pitch. It is necessary to distinguish measurement of lead from measurement of pitch, as uniformity of pitch does not assure uniformity of lead (see Fig. 26).

lead angle: on a straight thread, the lead angle is the angle made by the helix of the thread at the pitch line with a plane perpendicular to the axis. On a taper thread, the lead angle at a given position is the angle made by the conical spiral of the thread at the pitch line with the plane perpendicular to the axis (see Fig. 26).

lead thread: that portion of the incomplete thread that is fully formed at the root but not fully formed at the crest that occurs at the entering end of external or internal threads.

lead variation: the helix variation within the gaging length specification (see Fig. 22).

leading flank: the flank that, when the thread is about to be assembled with a mating thread, faces the mating thread (see Fig. 27).

least material condition (LMC): the condition where a feature of size contains the least amount of material within the stated limits of size (e.g., maximum internal thread size, minimum external thread size). Also referred to as minimum material condition.

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

length, gaging: the axial length of the gaging boundary provided by the designed length of a gage or gaging specification (see Fig. 28). The gaging length is designated by *LG*.

length of assembly: the axial distance over which two mating threads are designed to engage. The length includes any incomplete threads of both the external and internal member within the assembled length. The length of assembly is designated by *LA* (see Fig. 29).

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

length of thread engagement: the axial distance over which two mating threads, each having full form at both crest and root, are designed to engage. The length of thread engagement is designated by *LE* (see Fig. 30).

limit of size: the specified maximum or minimum size of a feature allowed.

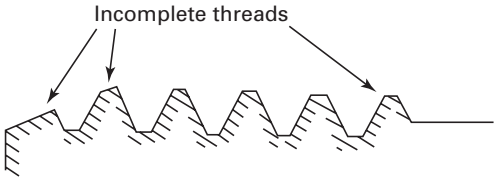


Fig. 23 Incomplete Thread

load flank: the flank that takes the externally applied axial load in an assembly (see Fig. 31).

major clearance: the radial distance between the root of the internal thread and the crest of the external thread of the coaxially assembled design forms of mating threads (see Fig. 32).

major cone: an imaginary cone that would bound the crest of an external taper thread or the root of an internal taper thread.

major cylinder: an imaginary cylinder that would bound the crest of an external straight thread or the root of an internal straight thread.

major diameter: on a straight thread, the major diameter is that of the major cylinder. On a taper thread, the major diameter at a given position on the thread axis is that of the major cone at that position (see Figs. 33–36). See also *major cylinder* and *major cone*.

maximum material condition (MMC): the condition where a feature of size contains the maximum amount of material within the stated limits of size (e.g., the minimum internal thread size, maximum external thread size).

measurement uncertainty: an uncertainty is a figure of merit associated with the measured value. It is the boundary limits within which the "true" value lies. Contributors to this "potential for inaccuracy" include: the performance of the equipment used to make the measurement, the test process or technique itself, and environmental effects. Additional imprecision may result from the behavior of the phenomenon or item being measured.

minimum material condition: see *least material condition (LMC).*

minor clearance: the radial distance between the crest of the internal thread and the root of the external thread of the coaxially assembled design form of mating threads (see Fig. 37).

minor cone: an imaginary cone that would bound the root of an external taper thread or the crest of an internal taper thread.

minor cylinder: an imaginary cylinder that would bound the root of an external straight thread or the crest of an internal straight thread.

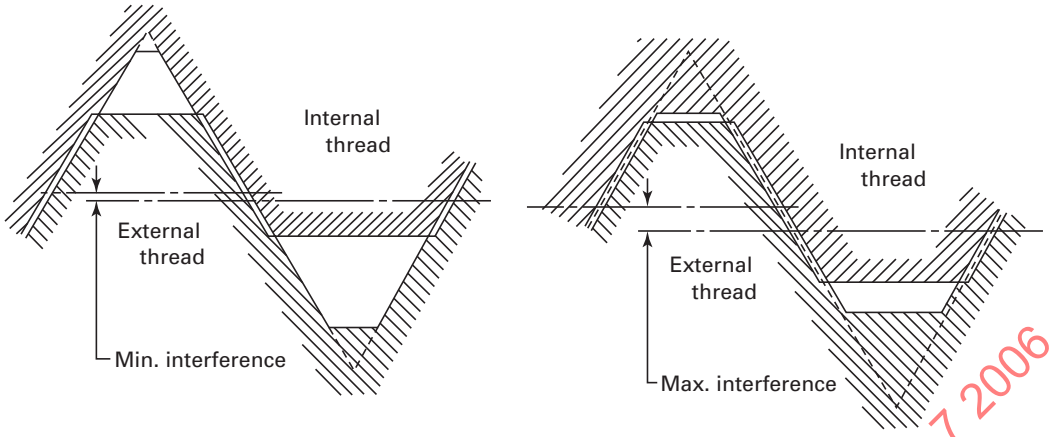


Fig. 24 Interference Fit

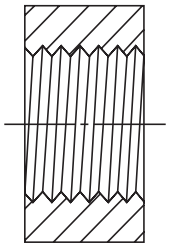


Fig. 25 Internal Thread

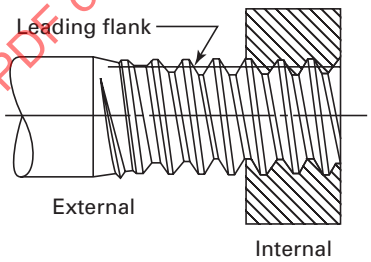


Fig. 27 Leading Flank

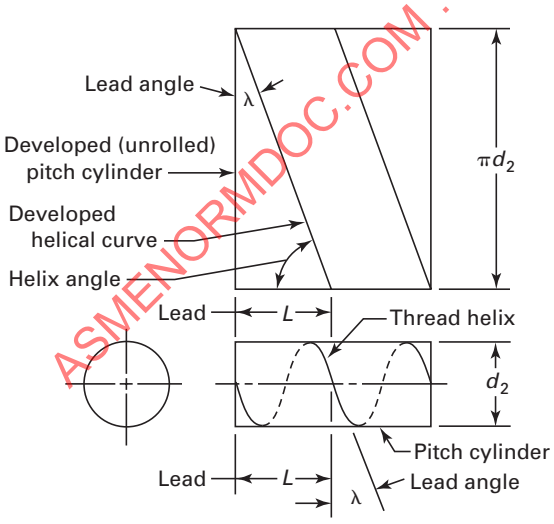


Fig. 26 Lead

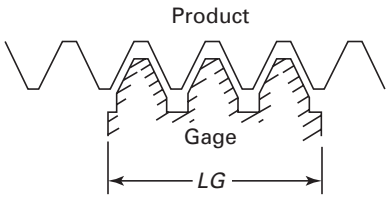


Fig. 28 Gaging Length

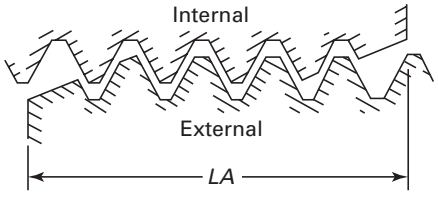


Fig. 29 Length of Assembly

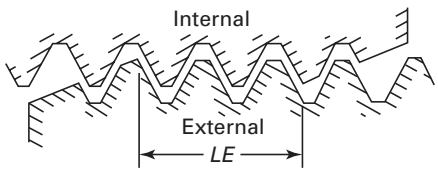


Fig. 30 Length of Thread Engagement

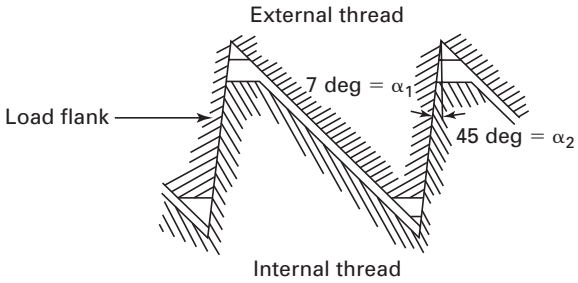


Fig. 31 Load Flank

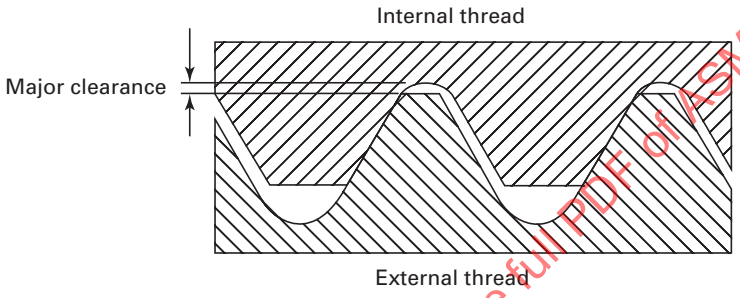


Fig. 32 Major Clearance

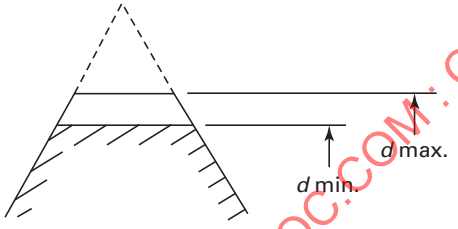


Fig. 33 Major Diameter, External Thread

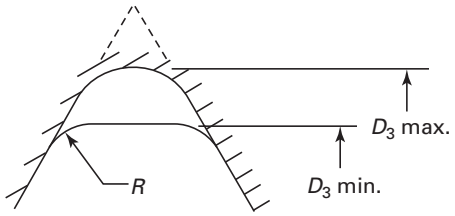


Fig. 35 Major Diameter, Internal Thread (Rounded Form)

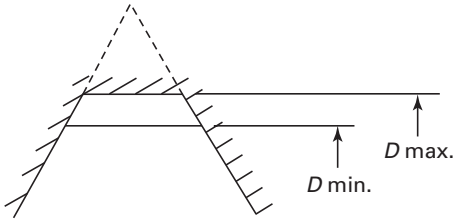
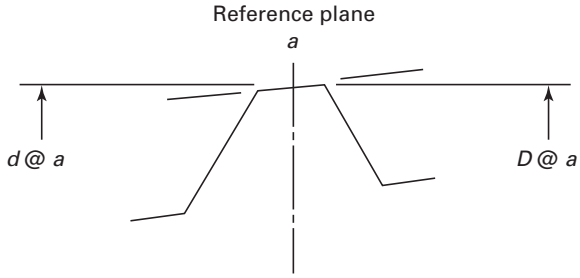


Fig. 34 Major Diameter, Internal Thread



GENERAL NOTE: a = center line.

Fig. 36 Major Diameter, Taper Thread

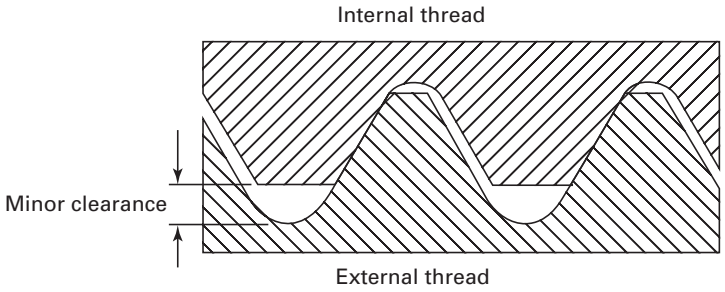


Fig. 37 Minor Clearance

minor diameter: on a straight thread, the minor diameter is that of the minor cylinder. On a taper thread, the minor diameter at a given position on the thread axis is that of the minor cone at that position (see Figs. 38–41). See also *minor cylinder* and *minor cone*.

multiple start thread: a screw thread with two or more threads where the pitch is equal to the thread lead divided by the number of thread starts (see Fig. 42). Also called multiple lead thread.

nominal size: the designated size which is used for the purpose of general identification.

out-of-round: see *roundness*.

parallel thread: see *straight thread*.

partial thread: see *vanish thread*.

percent of thread (obsolete term): the ratio in percent of the actual height of thread to the value 0.75 *H*. This is a theoretical value based upon the old American National Thread Profile. A 100% value cannot actually be achieved since the basic height of thread for UN and M profiles is 0.625 *H*, and for UNJ and MJ is 0.5625 *H*.

pitch: the pitch, *P*, of a thread having uniform spacing is the distance, measured parallel to its axis, between corresponding points on adjacent thread forms in the same axial plane and on the same side of the axis. Pitch is equal to the lead divided by the number of thread starts (see Fig. 43).

pitch cone: an imaginary cone of such apex angle and location of its vertex and axis that its surface would pass through a taper thread in such a manner as to make the axially measured widths of the thread ridge and the thread groove equal. Therefore, it is located equidistant between the sharp major and minor cones of a given thread (see Fig. 44). On a theoretically perfect taper thread, these widths are equal to half of the basic pitch. See also *axis of thread* and *pitch diameter*.

pitch cylinder: an imaginary cylinder of such diameter and location of its axis that its surface would pass through a straight thread in such a manner as to make the widths of the thread ridge and the thread groove equal. Therefore, it is located equidistant between the sharp major and minor cylinders of a given thread form (see Fig. 45). On a theoretically perfect thread, these widths are equal to half of the pitch. See also *axis of thread* and *pitch diameter*.

pitch diameter: on a straight thread, the pitch diameter is the diameter at any point on the pitch cylinder over a length of engagement of not more than one pitch. On a taper thread, the pitch diameter at a given position on the thread axis is the diameter of the pitch cone at that position (see Figs. 46 and 47).

NOTE: The terms listed below are related to pitch diameter when used in gaging practice.

pitch diameter, functional diameter: the pitch diameter of the enveloping thread of perfect pitch, lead, and flank angles, having full depth of engagement, but clear at the crests, and of a specified length of engagement. Design pitch diameter of the enveloping thread is equal to that of the product maximum material limit. Functional diameter 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. It is the cumulative effects of variation from specified profile, including variations in lead and flank angles 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. The term functional diameter refers to the GO functional diameter. GO thread gages are used to inspect/evaluate GO functional diameters. Virtual diameter, effective size, virtual effective diameter, and thread assembly diameter are defined the same as the preferred term functional diameter.

pitch diameter, NOT GO, HI, and LO functional diameters: the pitch diameters of the enveloping threads of perfect pitch, lead, and flank angles, having reduced depth of engagement and reduced length of engagement as compared to the "GO" functional diameter. Design pitch diameter of the enveloping thread is equal to that of the product minimum material limit. NOT GO, HI, and LO thread gages are used to inspect/evaluate NOT GO, HI, and LO functional diameters.

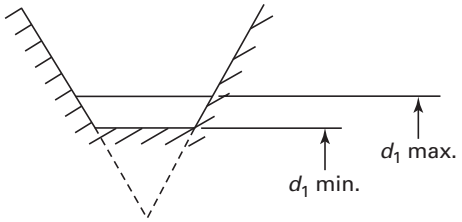


Fig. 38 Minor Diameter, External Thread (Flat Form)

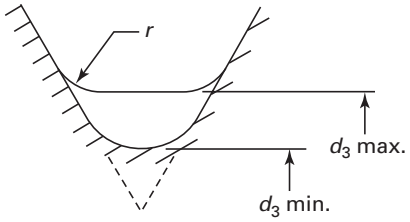


Fig. 39 Minor Diameter, External Thread (Rounded Form)

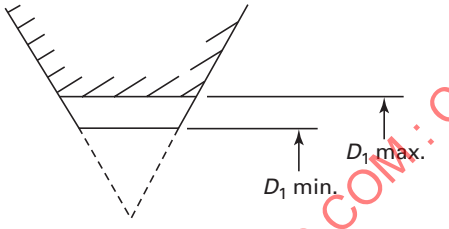
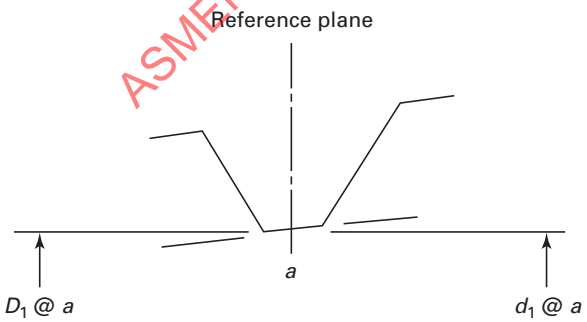
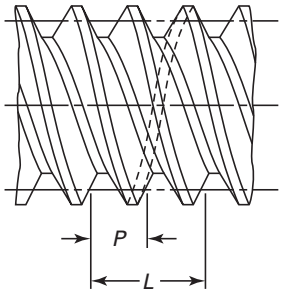


Fig. 40 Minor Diameter, Internal Thread



GENERAL NOTE: a = center line.

Fig. 41 Minor Diameter, Taper Thread



GENERAL NOTE: Two-start thread illustrated.

Fig. 42 Multiple Start Thread

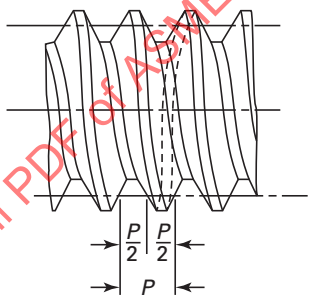


Fig. 43 Pitch

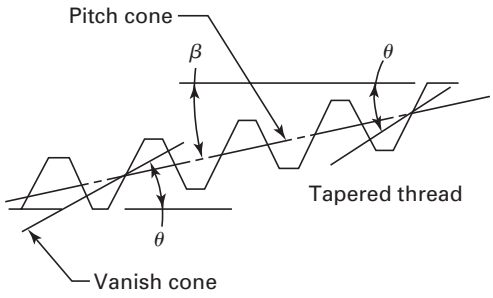


Fig. 44 Pitch Cone

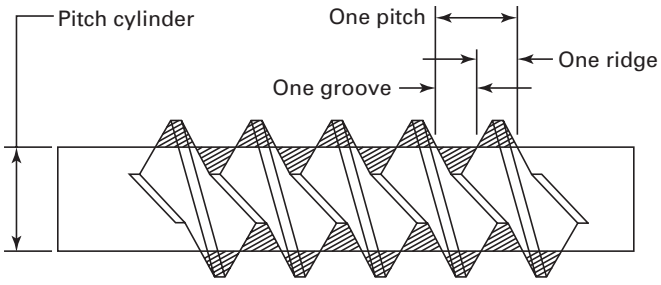


Fig. 45 Pitch Cylinder

pitch diameter, thread groove diameter: the diameter of an imaginary cylinder or cone, the surface of which would pass through the thread profiles at such points as to make the width of the thread groove or thread vee (measured parallel to the axis) equal to half of the pitch. It is the diameter yielded by measuring over or under cylinders (wires) or spheres (balls) inserted in the thread groove on opposite sides of the axis to compute the thread groove diameter. Simple effective diameter and simple pitch diameter are defined the same as the preferred term thread groove diameter. It is also commonly referred to as groove diameter.

pitch diameter, thread ridge diameter: the diameter of an imaginary cylinder or cone, the surface of which would pass through the thread profiles at such points as to make the width of the thread ridge (measured parallel to the axis) equal to half of the pitch.

pitch line: a generator of a cylinder or cone specified in the definitions of pitch cylinder and pitch cone. See also *pitch cylinder* and *pitch cone*.

plane of vanish point: the plane of vanish point of an external tapered thread, is the intersection of the generators of the vanish cone with the generators of the cylinder of the largest major diameter of the thread (see Fig. 48).

plated thread: see *coated thread.*

pressure flank: see *load flank.*

profile, basic thread: the cyclical outline, in an axial plane, of the permanently established boundary between the provinces of the external and internal threads. Allowances and deviations are with respect to this boundary (see Fig. 49).

profile, design: the maximum material profile permitted for an external or internal thread for a specified thread class or tolerance class, also called design thread form.

profile, limiting: a profile defining a limiting acceptable condition.

profile, thread: the profile of a thread is its profile in an axial plane, for the length of one pitch of the complete thread.

reference dimension: a dimension usually without tolerance, used for information purposes only. It does not govern production or inspection. A reference dimension is derived from other values shown on the drawing or on related drawings.

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

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

root apex: see *sharp root.*

root diameter: the diameter of an imaginary cylinder or cone bounding the bottom of the roots of a screw thread.

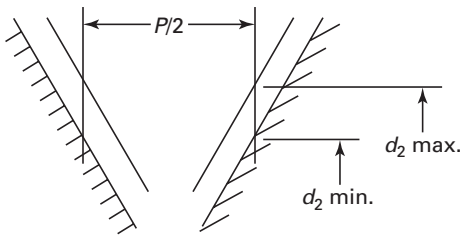


Fig. 46 Pitch Diameter, External Thread

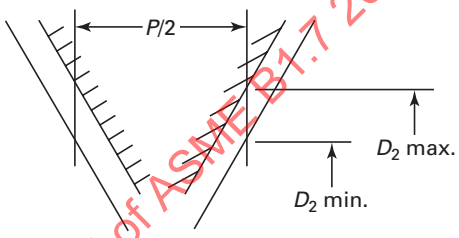


Fig. 47 Pitch Diameter, Internal Thread

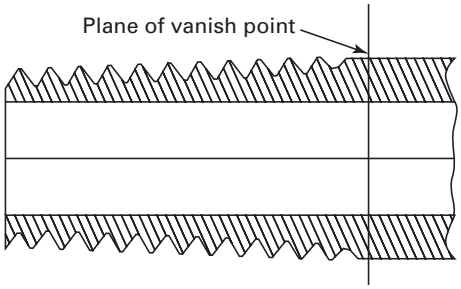


Fig. 48 Plane of Vanish Point

Root diameter is a nonpreferred term for the minor diameter of an external thread or the major diameter of an internal thread.

root radius: the radius of a specified rounded form profile of the root surface that is tangent to the thread flank and root cylinder or cone (see Fig. 50).

root truncation: the radial distance between the sharp root (root apex) and cylinder or cone that would bound the root (see Fig. 9).

rounded form: the general term applied to a thread form having a specified root radius to distinguish it from one having a flat or other form (see Fig. 50).

roundness: (of screw threads) half the maximum variation in pitch diameter of a screw thread around the circumference of a pitch cylinder. Also known as out-of-round.

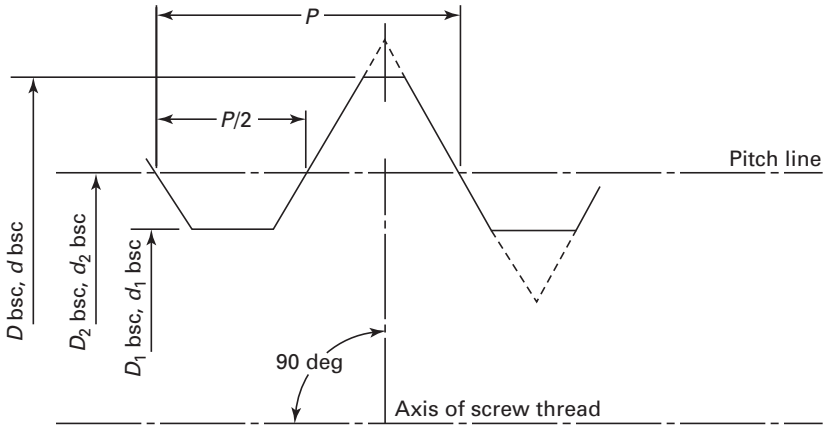


Fig. 49 Profile, Basic Thread

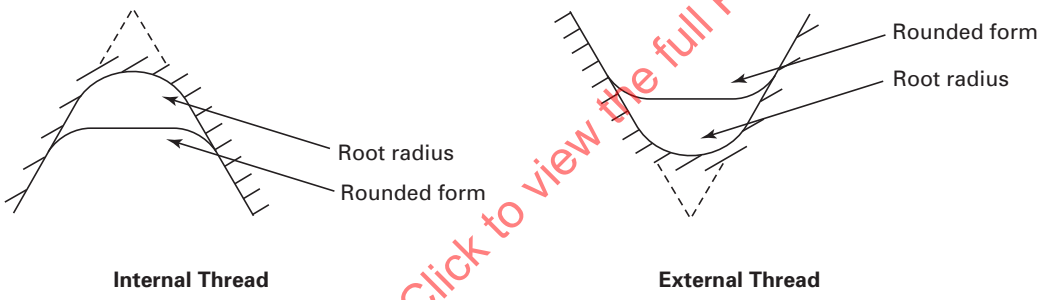


Fig. 50 Root Radius

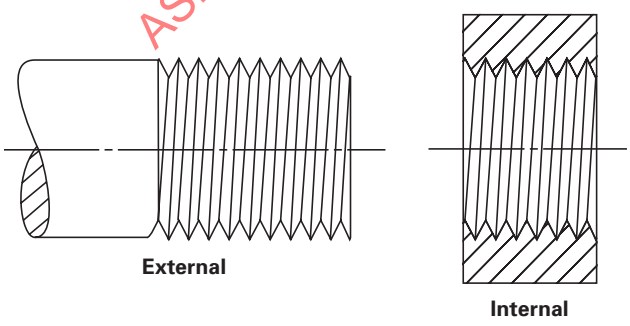


Fig. 51 Screw Thread

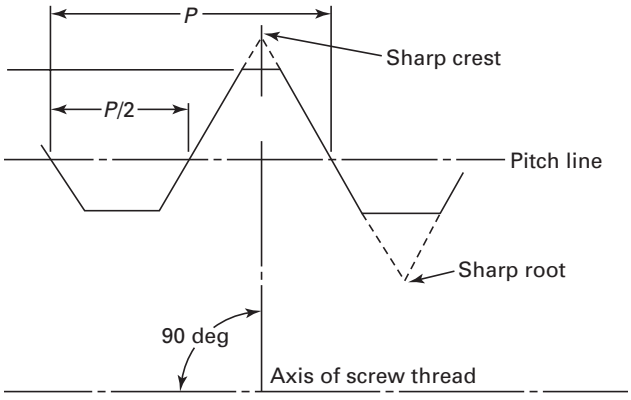
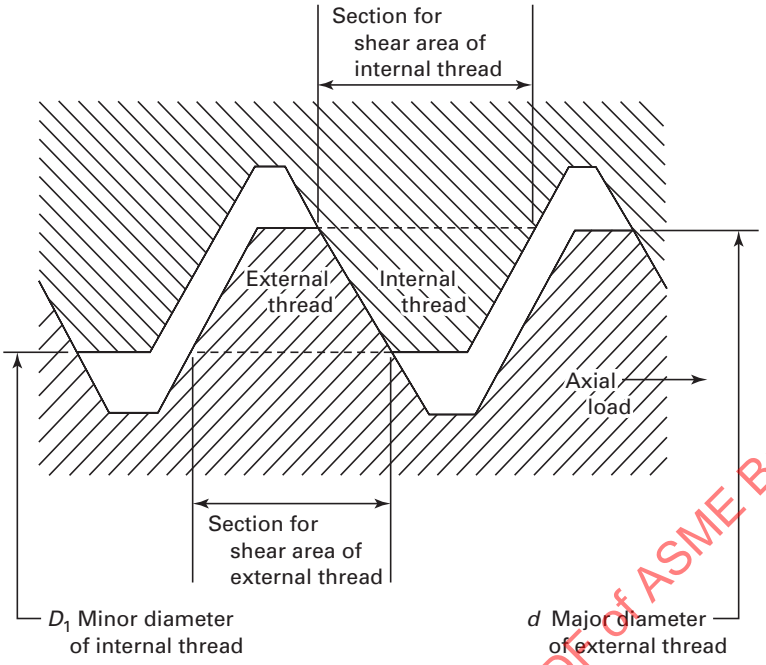


Fig. 52 Sharp Crest and Root



GENERAL NOTES:
(a) Shear area, internal thread = $3.1416d \times$ (section for shear area of internal thread) $\times$ ($LE \times n$)
(b) Shear area, external thread = $3.1416D \times$ (section for shear area of external thread) $\times$ ($LE \times n$)

Fig. 53 Shear Area

NOTE: This definition differs from that of circularity (roundness) in ASME Y14.5M, which pertains to radial variation.

roundness, multilobe: (3 points at 120 deg) half the difference between maximum and minimum variations in positions of one side of an equilateral triangle which envelopes the pitch cylinder, and the theoretical positions of that side as this enveloping triangle is rotated around the circumference of the pitch cylinder. Term used in screw thread gaging practice.

roundness, out-of-round: radial variation of the actual profile from ideal round profile when the profile is rotated equidistant from a single center. Term used in screw thread gaging practice.

roundness, oval: (2 points at 180 deg) half the difference between maximum and minimum pitch diameters of the pitch cylinder circumference. Term used in screw thread gaging practice.

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

runout, circular runout: based upon ASME Y14.5M the circular runout, as applied to screw threads, is the variation (FIM) on the major cylinder of an external thread, or the minor cylinder of an internal thread, when rotating the thread 360 deg on the axis of the functional diameter envelope. See also *pitch diameter, functional diameter.*

screw thread: a continuous projecting helical ridge usually of uniform section on a cylindrical or conical surface (see Fig. 51).

series: see *thread series.*

sharp crest: the apex formed by the intersection of the flanks of a thread when extended (see Fig. 52). Also known as crest apex.

sharp major cone: an imaginary cone having an apex angle equal to that of the pitch cone, the surface of which would bound the sharp crests of an external taper thread or the sharp roots of an internal taper thread.

sharp major cylinder: an imaginary cylinder which would bound the sharp crests of an external straight thread or the sharp roots of an internal straight thread.

sharp minor cone: an imaginary cone having an apex angle equal to that of the pitch cone, the surface of which would bound the sharp roots of an external taper thread or the sharp crests of an internal taper thread.

sharp minor cylinder: an imaginary cylinder which would bound the sharp roots of an external straight thread or the sharp crests of an internal straight thread.

sharp root: the apex formed by the intersection of the adjacent flank of the adjacent thread when extended (see Fig. 52). Also known as root apex.

sharp V thread height: see *height of fundamental triangle.*

shear area: the theoretical area of thread intersected by an imaginary cylinder defined by the crest diameter of the mating thread and extending for the length of engagement. The effective shear area may differ due to deformation of threads and threaded parts under load (see Fig. 53).

simple effective diameter: see *pitch diameter*, *thread groove diameter*.

simple pitch diameter: (ISO term) see *pitch diameter*, *thread groove diameter*.

single element gaging: the practice of separately gaging or measuring thread elements. The term has been used primarily in relation to pitch diameter check as a single element rather than as a component of the functional size.

single-start thread: the screw thread having the lead equal to the pitch. See also *pitch*, *lead*, and *screw thread*.

size: a designation of magnitude. When a value is assigned to a dimension, it is referred to as the size of that dimension. See also *actual size*, *basic size*, *design size*, *functional size*, *limits of size*, and *nominal size.*

spin-down: the reduction in the minor diameter of an internal thread due to extrusion of metal below the original hole diameter.

standoff: the axial distance between specified reference points on external and internal taper threaded members or gages when assembled with a specified torque or under specified conditions.

straight thread: a screw thread projecting from a cylindrical surface (see Fig. 54).

straightness: a condition where points of a surface or axis are in a straight line. For screw threads it refers to the variation of a thread pitch cylinder or cone axis from the theoretical straight line. The straightness tolerance specifies a tolerance zone within which the pitch cylinder axis must lie. Straightness may also be applied to the major cylinder and minor cylinder.

surface imperfections: thread surface flaws usually greater in depth than the average surface roughness and not characteristic of the surface lay or form. These imperfections are not included in surface texture or roughness values.

surface texture: repetitive or random variations from the normal surface which form the pattern of the surface.

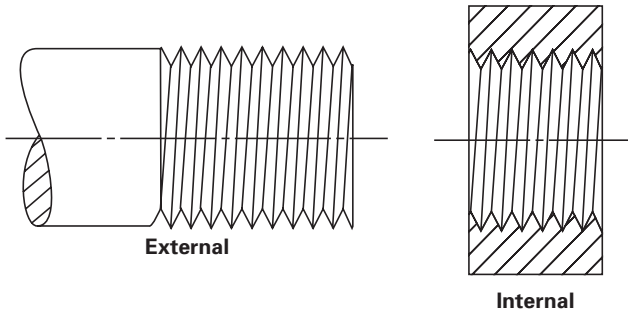


Fig. 54 Straight Thread

Roughness, waviness, and form are three ways in which a surface can depart from perfect smoothness and flatness.

symbols and designations: symbols associated with screw threads are of two kinds.

(a) dimensional symbols: letter symbols for the designating dimensions of screw threads and threaded products. These are standard alpha numeric symbols to designate the dimensions of screw threads in text (see Tables 1 and 2).

(b) thread designation: abbreviations used as designations for various standard thread forms, thread series, and feature designations for use on drawings. Thread series designations are capital letter abbreviations of names used on drawings, in tables, and otherwise to designate various forms of thread and thread series. They commonly consist of combinations of such abbreviations. These are assembled in Table 3, Table 4, and Appendix A, which include the names and abbreviations that are now in use, together with references to standards in which they occur for various standard threads.

taper thread: a screw thread projecting from a conical surface.

Taylor principle: a basic principle of gaging which states that the maximum material limits of as many elements or dimensions as practicable should be incorporated in the GO gage, but the minimum material limits of such elements or dimensions may be gaged only as individual (single) elements.

tensile stress area: an empirically derived area for computing the tensile stress of an externally threaded part, so its strength is consistent with the basic material strength of the part. The tensile stress area is typically defined as a function of either pitch diameter or minor diameter, or both, to calculate a circular cross section of the fastener, correcting for the notch and helix effects of the thread.

Table 1 General Symbols

Position Number	Symbol: External Thread	Symbol: Internal Thread	Description
1	A	· · ·	External thread
2	· · ·	B	Internal thread
3	BUTT	BUTT	Buttress thread—push or pull type
4	c	c	Wire angle correction for large lead angles
5	C	· · ·	Correction to measurement over best size wires to give pitch diameter
6	d	D	Major diameter
7	d bsc	D bsc	Major diameter, basic
8	d max.	· · ·	Major diameter, maximum
9	d min.	· · ·	Major diameter, minimum
10	d_1 bsc	D_1 bsc	Minor diameter, basic
11	d_2	D_2	Pitch diameter
12	d_2 bsc	D_2 bsc	Pitch diameter, basic
13	d_2 min.	D_2 min.	Pitch diameter, minimum
14	d_2 max.	D_2 max.	Pitch diameter, maximum
15	d_3	· · ·	Minor diameter, rounded form
16	d_3 min.	· · ·	Minor diameter, rounded form, minimum
17	d_3 max.	· · ·	Minor diameter, rounded form, maximum
18	· · ·	D min.	Major diameter, minimum (flat form)
19	d_1	· · ·	Minor diameter (flat form)
20	d_1 min.	· · ·	Minor diameter, minimum (flat form)
21	d_1 max.	· · ·	Minor diameter, maximum (flat form)
22	· · ·	D_1 min.	Minor diameter, minimum
23	· · ·	D_1 max.	Minor diameter, maximum
24	· · ·	D_3	Major diameter, rounded form
25	· · ·	D_3 min.	Major diameter, rounded form, minimum
26	· · ·	D_3 max.	Major diameter, rounded form, maximum
27	es	EI	Allowance at major, pitch, and minor diameters
28	f_{cs}	f_{cn}	Crest truncation
29	f_{rs}	f_{rn}	Root truncation
30	F_{cs}	F_{cn}	Crest width
31	F_{rs}	F_{rn}	Root width
32	h	h	Thread height, basic
33	h_s	h_n	Height of thread
34	H	H	Height of sharp -vee thread
35	LA	LA	Length of assembly
36	LE	LE	Length of thread engagement
37	LG	LG	Gaging length
38	M_w	M_w	Measurement over wires
39	n	n	Number of threads per inch
40	P	P	Pitch
41	r max.	R max.	Root radius, maximum
42	r min.	R min.	Root radius, minimum
43	r_{rs} min.	· · ·	Root radius, minimum
44	r_{rs} max.	· · ·	Root radius, maximum
45	r_{rs}	R_{rn}	Root radius
46	s	s	Rounded truncation
47	s_{cs}	s_{cn}	Rounded crest truncation
48	s_{rs}	s_{rn}	Rounded root truncation
49	s min.	s min.	Rounded truncation, minimum
50	s max.	s max.	Rounded truncation, maximum
51	Td_1	TD_1	Tolerance for d_1 and D_1
52	Td_2	TD_2	Tolerance for d_2 and D_2
53	Td	TD	Tolerance for d and D

Table 1 General Symbols (Cont'd)

Position Number	Symbol: External Thread	Symbol: Internal Thread	Description
54	*TPI*	*TPI*	Threads per inch
55	*W*	*W*	Diameter of measuring wires
56	*w*	*w*	Average diameter of three-wire set
57	α	α	Angles between flanks of a symmetrical thread and normal to the axis of the thread
58	α_1	α_1	Angle between leading flank of thread and normal to axis of the thread
59	α_2	α_2	Angle between following flank of thread and normal to axis of the thread
60	λ	λ	Lead angle
61	λ'	. . .	Wire angle
62	$\Delta d_2\alpha$	$\Delta D_2\alpha$	Pitch diameter increments for flank angles of symmetrical threads
63	$\Delta d_2\alpha_1$	$\Delta D_2\alpha_1$	Pitch diameter increment for leading flank angle
64	$\Delta d_2\alpha_2$	$\Delta D_2\alpha_2$	Pitch diameter increment for following flank angle
65	$\Delta d_2\lambda$	$\Delta D_2\lambda$	Pitch diameter increment for lead

Table 2 ISO General Symbols

Symbol	Element	Equivalent US Symbol
P_η	Lead	*L*
ψ	Lead angle	λ
β	Flank angle	α
α	Thread angle	$\alpha_1 + \alpha_2$ [Note (1)] 2 α [Note (2)]

NOTES:
(1) For nonsymmetrical thread.
(2) For symmetrical thread.

thread: a portion of a screw thread encompassed by one pitch. On a single-start thread, it is equal to one turn. See *threads per inch* and *turns per inch.*

thread, bolt: (ISO term) a term used to described any external thread.

thread, nut: (ISO term) a term used to describe any internal thread.

thread angle: the included angle formed by two adjacent flanks in an axial plane (see Fig. 55).

thread groove diameter: see *pitch diameter*.

thread groove width: the distance between the flanks of adjacent thread ridges measured parallel to the thread cone or cylinder at the specified pitch radius.

thread ridge diameter: see *pitch diameter*.

thread ridge thickness: the distance between the flanks of one thread ridge, inspected/evaluated parallel to the thread cone or cylinder at the specified pitch radius (see Fig. 56).

thread series: standardized groups of diameter/pitch combinations.

thread shear area: see *shear area.*

thread size: see *size.*

threads per inch: the number of thread pitches per inch. It is the reciprocal of the axial pitch value in inches ($1/P$).

tolerance: the total amount of variation permitted for the size of a dimension. It is the difference between the maximum limit of size and the minimum limit of size. See also *tolerance limit*. *T* is used as a prefix to the symbol of the element to which the tolerance will apply.

EXAMPLES:
(1) $TD = D$ max. $- D$ min.
(2) $Td_2 = d_2$ max. $- d_2$ min.

tolerance class: (metric) the combination of a tolerance position with a tolerance grade. It specifies the allowance (fundamental deviation), pitch diameter tolerance, and the crest diameter tolerance.

EXAMPLE: 4*g*6*g*

tolerance grade: (metric) a numerical symbol which designates the tolerance of crest diameters and pitch diameters applied to design profiles.

tolerance limit: the variation, positive or negative, by which a size is permitted to depart from the design size.

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

tolerance zone: the zone between the maximum and minimum limits of size.

Table 3 Thread Series Designations

Designation	Thread Series	American National Standards Reference
ACME-C	Acme threads, centralizing	B1.5
ACME-G	Acme threads, general purpose (see also STUB ACME)	B1.5
AMO	American Standard microscope objective threads	B1.11
ANPT	Aeronautical National Form taper pipe threads [Note (1)]	AS71051
BUTT	Buttress threads, pull type	B1.9
PUSH-BUTT	Buttress threads, push type	B1.9
F-PTF	Dryseal fine taper pipe thread series	B1.20.3 (Appendix C)
M	Metric screw threads—M profile with basic ISO 68 profile	B1.13M
MJ	Metric screw threads—MJ profile with rounded root radius of 0.15011 *P* to 0.18042 *P*	B1.21M
MJS	Metric screw threads—MJ profile special series	B1.21M
NC5 HF	For driving in hard ferrous material of hardness over 160-BHN [Note (2)]	B1.12
NC5 CSF	For driving in copper alloy and soft ferrous material of 160-BHN or less [Note (2)]	B1.12
NC5 ONF	For driving in other nonferrous material (nonferrous materials other than copper alloys), any hardness [Note (2)]	B1.12
NC5 IF	Entire ferrous material range [Note (3)]	B1.12
NC5 INF	Entire nonferrous material range [Note (3)]	B1.12
NGO	National gas outlet threads [Note (4)]	ANSI/CGA V-1
NGS	National gas straight threads	ANSI/CGA V-1
NGT	National gas taper threads (see also SGT)	ANSI/CGA V-1
NH	American Standard hose coupling threads of full form	B1.20.7
NHR	American Standard hose coupling threads for garden hose applications	B1.20.7
NPSC	American Standard straight pipe threads in pipe couplings	B1.20.1
NPSF	Dryseal American Standard fuel internal straight pipe threads	B1.20.3
NPSH	American Standard straight hose coupling threads for joining	B1.20.7
NPSI	Dryseal American Standard intermediate internal straight pipe threads	B1.20.3
NPSL	American Standard straight pipe threads for loose-fitting mechanical joints with locknuts	B1.20.1
NPSM	American Standard straight pipe threads for free-fitting mechanical joints for fixtures	B1.20.1
NPT	American Standard taper pipe threads for general use	B1.20.1
NPTF	Dryseal American Standard taper pipe threads	B1.20.3
NPTR	American Standard taper pipe threads for railing joints	B1.20.1
PTF-SAE Short	Dryseal SAE short taper pipe threads	B1.20.3
PTF-SPL Short	Dryseal special short taper pipe threads	B1.20.3 (Appendix C)
PTF-SPL Extra short	Dryseal special extra short taper pipe threads (see also SPL-PTF)	B1.20.3 (Appendix C)
SGT	Special gas taper threads	ANSI/CGA V-1
SPL-PTF	Dryseal special taper pipe threads	B1.20.3 (Appendix C)
STUB ACME	Stub Acme threads	B1.8
UN	Unified inch screw thread, constant-pitch series	B1.1
UNC	Unified inch screw thread, coarse-pitch series	B1.1
UNF	Unified inch screw thread, fine-pitch series	B1.1
UNEF	Unified inch screw thread, extra-fine pitch series	B1.1
UNJ	Unified inch screw thread, constant-pitch series, with rounded root radius of 0.15011 *P* to 0.18042 *P* [Note (5)]	B1.15
UNJC	Unified inch screw thread, coarse-pitch series, with rounded root radius of 0.15011 *P* to 0.18042 *P* [Note (5)]	B1.15
UNJF	Unified inch screw thread, fine-pitch series, with rounded root radius of 0.15011 *P* to 0.18042 *P* [Note (5)]	B1.15
UNJEF	Unified inch screw thread, extra-fine pitch series, with rounded root radius of 0.15011 *P* to 0.18042 *P* [Note (5)]	B1.15
UNR	Unified inch screw thread, constant-pitch series, with rounded root radius of not less than 0.108 *P*	B1.1
UNRC	Unified inch screw thread, coarse-thread series, with rounded root radius of not less than 0.108 *P*	B1.1
UNRF	Unified inch screw thread, fine-pitch series, with rounded root radius of not less than 0.108 *P*	B1.1

Table 3 Thread Series Designations (Cont'd)

Designation	Thread Series	American National Standards Reference
UNREF	Unified inch screw thread, extra-fine pitch series, with rounded root radius of not less than 0.108 *P*	B1.1
UNM	Unified miniature thread series	B1.10M
UNS	Unified inch screw thread, special diameter pitch or length of engagement	B1.1

GENERAL NOTE: All threads except NGO are right hand, unless otherwise designated.

NOTES:
(1) As published in SAE AS-7105.
(2) Class 5 interference fit external threads.
(3) Class 5 interference fit internal threads.
(4) For NGO threads, designations RH or LH are required.
(5) As published in SAE AS-8879 and ISO 3161.

Table 4 ISO Thread Series Designations

Designation	ISO Number	Thread Series
G	ISO 228-1	Straight pipe threads, nonpressure tight (55 deg Whitworth form)
R	ISO 7-1	Taper external pipe threads, pressure tight (55 deg Whitworth form)
Rc	ISO 7-1	Taper internal pipe threads to mate with ISO "*R*" threads
Rp	ISO 7-1	Straight internal pipe threads to mate with ISO "*R*" threads
S	ISO/R1501	ISO/R1501 ISO miniature screw threads 0.3 mm to 1.4 mm, incl.
Tr	ISO 2901, ISO 2902, ISO 2903, ISO 2904	Metric 30 deg trapezoidal screw threads

total thread: includes all of the complete and incomplete thread, thus, including the vanish thread and lead thread.

trailing flank: see *following flank.*

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

truncation: See Fig. 57.

(a) The crest truncation of a thread is the distance perpendicular to the axis, between the basic profile sharp crest (or crest apex) and the cylinder or cone that would bound the adjacent basic profile (flat) crest.

(b) The root truncation of a thread is the distance measured perpendicular to the axis, between the basic profile sharp root (or root apex) and the cylinder or cone that would bound the root.

turns per inch: the number of turns per inch is the reciprocal of the lead in inches (1/*L*).

unilateral tolerance: a tolerance in which variation is permitted only larger or only smaller than the specified dimension.

unilateral tolerance system: a design plan that uses only unilateral tolerances is known as a unilateral tolerance system.

useful thread: (ISO term) see *effective thread.*

vanish cone: the conical surface bounding the roots of the vanish thread formed by the chamfer of the cutting tool or by the tool withdrawal pattern (see Fig. 58).

vanish point: see *plane of vanish point.*

vanish thread: that portion of the incomplete thread that is not fully formed at the root or at crest and root. It is produced by the chamfer at the starting end of the thread forming tool. Also known as partial thread, washout thread, or thread runout. See also *vanish cone.*

variables: quantities or measurements that may produce a succession of observed values when measured under different (or similar) conditions. Inspection/evaluation by variables implies size measurement gages.

virtual diameter: (ISO term) see *pitch diameter, functional diameter.*

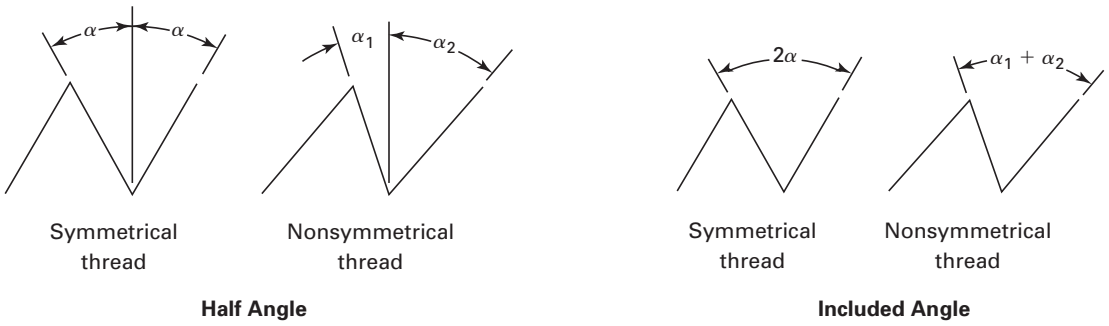


Fig. 55 Thread Angle

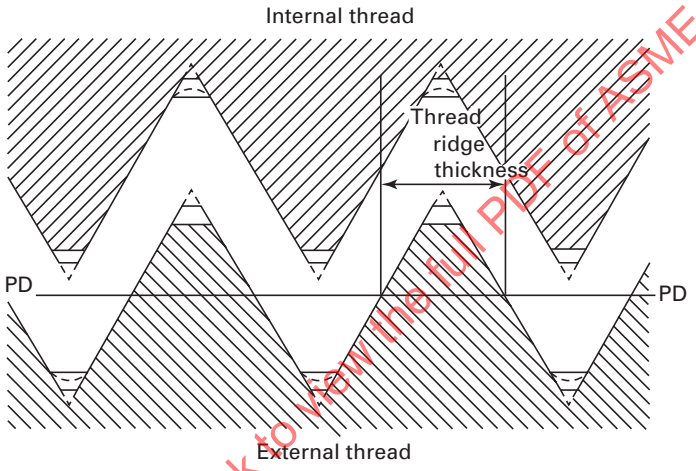


Fig. 56 Thread Ridge Thickness

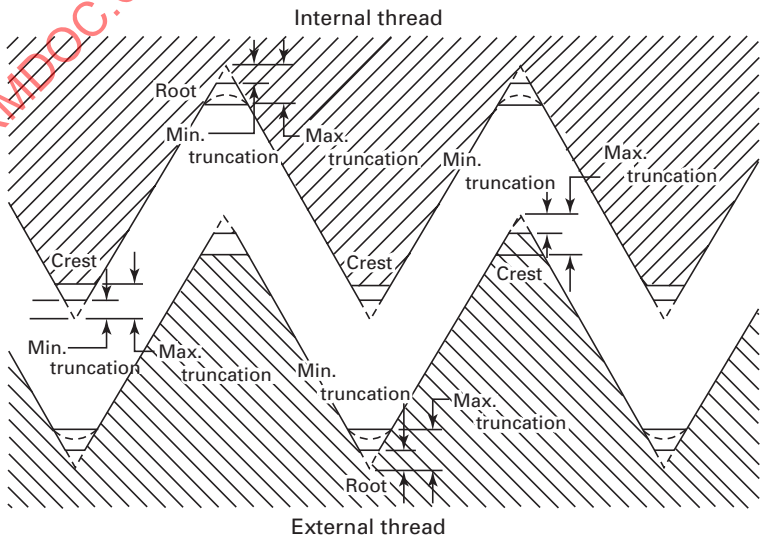


Fig. 57 Truncation

virtual effective diameter: (ISO term) see *pitch diameter, functional diameter.*

virtual functional diameter, taper thread: (ISO term) when a thread size of a taper thread is verified by measurement of a taper thread plug, ring gage, or equivalent, having a basic gage notch, surface, or limit notches, and which is within specified gage limits or tolerances, a determination is made that the virtual (functional) diameter throughout the specified length of hand-tight engagement lies within specified size limits. The thread size, thus verified, may be designated the taper thread virtual diameter.

washout thread: see *vanish thread.*

wrench make-up: length of effective thread provided for wrenching beyond the position of hand-tight engagement with an internal tapered thread. Also known as wrench take-up.

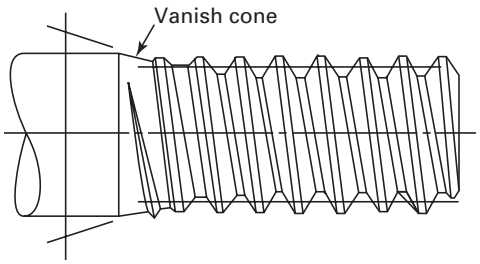


Fig. 58 Vanish Cone

wrenching allowance: an ISO taper pipe thread term for the length of effective thread provided for wrenching beyond the position of hand-tight engagement with an internal thread which is at maximum size.