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AN AMERICAN NATIONAL STANDARD

Nomenclature, Definitions, and Letter Symbols for Screw Threads

ANSI/ASME B1.7M-1984

(REVISION OF ANSI B1.7-1977)

SPONSORED AND PUBLISHED BY

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

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FOREWORD

(This Foreword is not part of ANSI/ASME B1.7M-1984.)

The first revision of ASA B1.7-1949, the first American Standard for 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, dated July 1961, based on such revisions, was prepared by Subcommittee No. 8 and widely circulated by the sponsors for comment. Extensive comments were received from members of Sectional Committees 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 at Harriman, New York, 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 Committee 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. Following the approval of the sectional committee and sponsor organizations on the May 1964 draft, the proposal 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 American National Standards Committee B1 and others indicated that a complete revision be undertaken. A new draft was prepared and submitted (March 1975) to Subcommittee 7 for review and approval. After numerous comments and subsequent changes, the proposed standard was submitted to, and finally approved by American National Standards Committee B1. The document was then transmitted to the Secretariat and ANSI in October 1976, and 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.A. usage. ISO standards were blended with ANSI standards, requiring many revisions in ANSI symbology and definitions of terms. ISO symbols were adopted except for those where a change from American practice would confuse the general understanding of the element 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.

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Standardization and Unification of Screw Threads

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CONTENTS

Foreword iii
Standards Committee Roster v

1 General 1
2 Definition of Terms 1
3 Symbols for Screw Threads 8

Tables

1 General Symbols 10
2 Thread Series Designations 15

Appendices

A Superseded Thread Series Designations 17
B ISO Symbols for Screw Threads 19
C Greek Alphabet 21

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NOMENCLATURE, DEFINITIONS, AND LETTER SYMBOLS FOR SCREW THREADS

1 GENERAL

1.1 Scope

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

(*a*) screw thread nomenclature, and

(*b*) letter symbols for designating features of screw threads for use on drawings, in tables of dimensions which set forth dimensional standards and in other records, and for expressing mathematical relationship.

This Standard consists of a glossary of terms, 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 of previous issues because ISO terms and symbols have been adopted where the intended definition is the same.

1.2 Reference Documents

ANSI B18.12, Glossary of Terms for Mechanical Fasteners

ISO 5408, Cylindrical Screw Threads – Vocabulary

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 the 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 measurement. 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 USA practice.

A

actual fit – the measured difference, before assembly, between the sizes of two mating parts which are to be assembled

actual size – the measured size of a characteristic or attribute

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 – the prescribed difference between the design (maximum material) size and the basic size. It is numerically equal to the absolute value of the ISO term *fundamental deviation* (see Table 1, Item Nos. 12 and 13)

attribute – an essential quality or characteristic. Inspection by attributes implies acceptance by limit gages.

axis of thread – the axis of the thread pitch cylinder or cone

B

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 – the cyclical outline, in an axial plane, of the permanently established boundary between the provinces of the external and internal threads. All deviations are with respect to this boundary.

NOTE: Various thread forms are described in their respective standards (see Table 2).

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basic shaft system – a system of fits in which the design size 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

bilateral tolerance – a tolerance in which variation is permitted to be both larger and smaller than the specified dimension

bilateral tolerance system – a design plan that uses only bilateral tolerances is known as a bilateral tolerance system

black crest thread – the thread whose crest displays the unfinished cast, rolled, or forged surface

blunt start thread – this term designates the removal of the incomplete thread at the starting end of the thread. This is a feature of threaded parts that are repeatedly assembled by hand, such as hose couplings and thread plug gages, to prevent cutting of hands and crossing of threads.

bottom of chamfer – on an internal taper pipe thread, it is the intersection of the chamfer cone and the pitch cone of the thread

C

chamfer – the conical surface at the starting end of a thread

characteristics – qualities, peculiarities, or features which are conspicuous or prominent details of the thread

class of thread – an alphanumerical designation to indicate the standard grade of tolerance and allowance specified for a thread

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

complete thread – the thread whose profile lies within the size limits. See *effective thread*, *length of complete thread.*

NOTE: Formerly in pipe thread terminology this was referred to as *the perfect thread* but that term is no longer considered desirable.

countersink – a bevel or flare at the end of a hole

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

creat 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 or the minor diameter of an internal thread.

crest truncation – the crest truncation of a thread is the radial distance between the sharp crest (crest apex) and the cylinder or cone that would bound the crest

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* and *pitch diameter.*

cumulative pitch – the distance measured parallel to the axis of the thread between corresponding points on any two threads regardless of whether they are in the same axial plane

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.

D

dedendum – the dedendum of an external thread is the radial distance between the pitch and minor cylinders or cones, respectively. The dedendum of an internal thread is the radial distance between the major and pitch cylinders or cones, respectively. 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 overlap between two coaxially assembled mating threads

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*

deviation – a variation from an established dimension, position, standard, or value. In ISO usage, 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 *error.*

deviation, fundamental (ISO term) – for standard threads, the upper or lower deviation closer to the basic size. This is the upper deviation *es* for an external thread and the lower deviation *EI* for an internal thread (see Table 1, Item Nos. 12 and 13). See also *allowance* and *tolerance position.*

deviation, lower (ISO term) – the algebraic difference between the minimum limit of size and the basic size. It is designated *EI* for internal and *ei* for external thread

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diameters, from the French term *écart inferieur* (see Appendix B, Fig. B1).

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, from the French term *écart superieur* (see Appendix B, Fig. B1).

differential – the difference or displacement between any two values of an element not otherwise designated as a tolerance or constant (see Table 1, Item No. 20)

dimension – a numerical value expressed in appropriate units of measure and indicated on a drawing along with lines, symbols, and notes to define the geometrical characteristic of an object

drunken lead – see preferred term *helix variation*

E

effective size – see *pitch diameter, functional diameter*

effective thread – the effective (or useful) thread includes the complete thread, and those portions of the incomplete thread which are fully formed at the root but not at the crest (in taper pipe threads this includes the so-called black crest threads), thus excluding the vanish thread

element – elements of a thread are flank angle, root, crest, pitch, lead angle, surface finish, major, minor, and pitch diameters

error – the algebraic difference between an observed or measured value beyond tolerance limits and the specified value

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

end threads – see *incomplete threads.*

F

face flank – see *leading flank*

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

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

(*b*) a single cylindrical or spherical surface or 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 sizes of two mating parts which are to be assembled. See *actual fit, clearance fit, interference fit,* and *transition fit.*

flank – the part of a helical thread surface that connects the crest and the root and which is theoretically a straight line in an axial plane section

flank angle – the angle formed by a flank and a perpendicular to the thread axis in an axial plane (see Table 1, Item No. 14)

flank diametral displacement – in a boundary profile defined system twice the radial distance between the straight thread flank segments of the maximum and minimum boundary profiles. The value of flank diametral displacement is equal to pitch diameter tolerance in a pitch line reference thread system.

flat form – the term applied to a thread form having a nominally straight or flat form between the thread flanks on the cylinder or cone from which the thread projects; in other words, a thread with an unrounded root form

following flank – the following (trailing) flank of a thread is the one that is opposite to the leading flank

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

form of thread – the form of a thread is its profile in an axial plane for a length of one pitch of the complete thread

full form thread – see *complete thread*

functional diameter – see *pitch diameter, functional diameter*

functional gaging – the practice of using threaded gages of perfect form and maximum or minimum material limits to determine functional size conformance

functional size – the size of the *functional diameter.* See *pitch diameter, functional diameter.*

fundamental triangle – the triangle whose corners coincide with three consecutive intersections of the extended flanks of the basic form

G

gage – a device for establishing a boundary or limit of a specified product dimension. The following are devices customarily used for measuring screw threads to determine if they are within the established boundary.

(*a*) *thread indicating gage* – a device utilizing gaging elements such as segments, rolls, balls, or fingers of which one or more is movable; used to numerically compare a thread characteristic or attribute to a known standard. Thus, by selection of appropriate contacts and standards, size measurements of screw threads may be made. Also, because of differential readings, diameter equivalents of individual thread characteristics and/or cumulation of thread characteristics may be determined.

(*b*) *thread limit gage* – a gage designed to determine

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whether a thread is within the maximum or minimum material limit. See also *attribute.*

(*c*) *thread plug gage* – a plug that has external threads used as a limit gage to check characteristics or attributes of an internal thread

(*d*) *thread ring gage* – a ring that has internal threads used as a limit gage to check characteristics or attributes of an external thread

(*e*) *thread snap gage* – a limit gage that utilizes movable threaded 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. For an internal thread a snap gage is placed within the thread and spring-loaded contacts released to provide thread engagement.

gaging length – see *length, gaging*

H

height of fundamental triangle – the height of the fundamental triangle of a thread, that is, the height of a sharp V-thread, is the distance, measured radially, between the sharp major and minor cylinders or cones, respectively (see Table 1, Item No. 1)

height of thread – the height (or depth) of thread is the distance, measured radially, between the major and minor cylinders or cones, respectively

helical path – see *helix variation*

helix – the curve formed on any cylinder by a straight line angular to the axis, and in a plane that is wrapped around the cylinder

helix angle – the complement of the lead angle (see Table 1, Item No. 3)

helix variation – the axial variation of the screw thread actual helical path on the pitch cylinder relative to its true helix within the gaging length

I

imperfect thread – see *incomplete thread*

included angle – see *thread angle*

incomplete thread – a threaded profile having either crests or roots, or both crests and roots not fully formed, resulting from the intersection with the cylindrical or end surface of the work or the vanish cone. It may occur at either end of the thread.

incomplete lead thread – the incomplete thread at the starting end of a screw thread

incomplete runout thread – the incomplete thread at the terminating end of a screw thread

interference fit – a fit between mating assembled parts that always provides an interference

internal thread – a screw formed on the inside of a cylindrical or conical surface. See also *thread, nut.*

L

lead – the axial distance between two consecutive points of intersection of a helix by a line parallel to the axis of the cylinder on which it lies, i.e., the axial movement of a threaded part rotated one turn in its mating thread (see Table 1, Item No. 3)

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, with the plane perpendicular to the axis, at the pitch line (see Table 1, Item No. 3).

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

lead variation – the helix variation within the gaging length specification

leading flank – the flank that, when the thread is about to be assembled with a mating thread, faces the mating thread

left-hand thread – a screw thread that is screwed in or on counterclockwise. All left-hand threads are designated LH.

length, gaging – the axial length of the gaging boundary provided by the designed length of a gage or gaging specification (see Table 1, Item No. 16)

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 (see Table 1, Item No. 15)

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 (see Table 1, Item No. 15)

limits of size – the applicable maximum and minimum sizes

load flank – that flank that takes the externally applied axial load in an assembly. The term is used particularly

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in relation to buttress, square, acme, and stub acme threads.

M

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

major cone – an imaginary cone that would bound the crests of an external taper thread or the roots of an internal taper thread

major cylinder – an imaginary cylinder that would bound the crests of an external straight thread or the roots of an internal straight thread

major diameter – on a straight thread the major diameter is that of the major cylinder. On a taper thread the major diameter at a given position on the thread axis is that of the major cone at that position. See *major cylinder* and *major cone*. (See Table 1, Item Nos. 4, 8, and 9.)

maximum material condition – the condition where a feature of size contains the maximum amount of material within the stated limits of size – for example, minimum internal thread size, maximum external thread size

minimum material condition – the condition where a feature of size contains the least amount of material within the stated limits of size – for example, maximum internal thread size, minimum external thread size

minor clearance – the radial distance between the crest of the internal thread and the roots of the external thread of the coaxially assembled design forms of mating threads

minor cone – an imaginary cone that would bound the roots of an external taper thread or the crests of an internal taper thread

minor cylinder – an imaginary cylinder that would bound the roots of an external straight thread or the crests of an internal straight thread

minor diameter – on a straight thread the minor diameter is that of the minor cylinder. On a taper thread the minor diameter at a given position on the thread axis is that of the minor cone at that position (see Table 1, Item Nos. 5, 6, and 10).

multi-start thread – a screw thread with two or more threads. For this condition, pitch is equal to the thread lead divided by the number of thread starts.

N

nominal size – the designation which is used for the purpose of general identification

P

parallel thread – see *screw thread*

partial thread – see *vanish thread*

percent of thread – the ratio in percent of the actual height of thread to the value $0.75H$. 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 $0.625H$ and for UNJ and MJ is $0.5625H$.

pitch – the pitch 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 Table 1, Item No. 2).

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 widths of the thread ridge and the thread groove equal and, therefore, is located equidistantly between the sharp major and minor cones of a given thread form. On a theoretically perfect taper thread these widths are equal to one-half of the basic pitch. See *axis of thread* and *pitch diameter*. (See Table 1, Item No. 17.)

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 and, therefore, is located equidistantly between the sharp major and minor cylinders of a given thread form. On a theoretically perfect thread these widths are equal to one-half of the basic pitch. See *axis of thread* and *pitch diameter*.

pitch diameter – on a straight thread the pitch diameter is the diameter of the pitch cylinder. On a taper thread, the pitch diameter at a given position on the thread axis is the diameter of the pitch cone at that position (see Table 1, Item Nos. 7 and 11).

NOTE: When the crest of a thread is truncated beyond the pitch line, the pitch diameter, pitch cylinder, or pitch cone would be based on a theoretical extension of the thread flanks.

The terms listed below are related to pitch diameter and used in gaging practice.

(*a*) *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 (measured parallel to the axis) equal to one-half of the basic pitch. It is the diameter yielded by measuring over or under cylinders (wires) or spheres (balls) inserted in the thread groove on oppo-

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site sides of the axis and computing the thread groove diameter as thus defined.

Simple effective diameter and *simple pitch diameter* are defined the same as the preferred term thread groove diameter.

(*b*) *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 one-half of the basic pitch

(*c*) *functional diameter* – the pitch diameter of an enveloping thread with perfect pitch, lead, and flank angles and having a specified length of engagement. This diameter includes the cumulative effect of variations in lead (pitch), flank angle, taper, straightness, and roundness. Variations at the thread crest and root are excluded.

Virtual diameter, *effective size*, *virtual effective diameter*, and *thread assembly diameter* are defined the same as the preferred term functional diameter.

(*d*) *NOT GO*, *HI*, and *LO functional diameters* – the pitch diameters of enveloping threads with perfect pitch, lead, and flank angles and having a thread height and length of engagement given in the applicable gage standard

pitch line – a generator of the cylinder or cone specified in the definitions of pitch cylinder and pitch cone

pitch radius – the radius equal to one-half of the pitch diameter

plane of vanish point – the plane of vanish point of an external thread is the intersection of generators of the vanish cone with generators of the cylinder of the largest major diameter of the thread

pressure flank – see *load flank*

profile of thread – the contour of a screw thread ridge and groove delineated by a cutting plane passing through the thread axis; also called *form of thread*

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.

profile, boundary – a system that defines basic thread profile and the maximum and minimum thread boundaries at two radial positions on the thread flanks (instead of the pitch cylinder); also, a profile defined in accordance with this system

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

R

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

right-hand thread – a screw thread that is screwed in or on clockwise

root – that surface of the thread that joins the flanks of adjacent thread forms and is immediately adjacent to the cylinder or cone 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. 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 curvature of a specified rounded form profile of the root surface that is tangent to the thread flank and root cylinder or cone (see Table 1, Item Nos. 6 and 9)

root truncation – the radial distance between the sharp root (root apex) and the cylinder or cone that would bound the root

rounded form – the general term applied to a thread form having a specified root radius to distinguish it from one having a flat root form

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

S

screw thread – a continuous and projecting helical ridge usually of uniform section on a cylindrical or conical surface

sharp crest (*crest apex*) – the apex formed by the intersection of the flanks of a thread when extended, if necessary, beyond the crest

sharp 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

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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 (root apex) – the apex formed by the intersection of the adjacent flanks of adjacent threads when extended, if necessary, beyond the root

sharp V-thread height – see *height of fundamental triangle*

simple effective pitch diameter – see *pitch diameter, thread groove diameter*

single element gaging – the practice of separately gaging or measuring thread elements. This 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 – a screw thread having the lead equal to the pitch. See *pitch*, *lead*, and *screw thread.*

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

spindown – 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 other specified conditions

straight thread – a screw thread projecting from a cylindrical surface

symbols and designations – symbols associated with screw threads are of two kinds: (a) letter symbols for designating dimensions of screw threads and threaded products, and (b) abbreviations used as designations for various standard thread forms, thread series, and feature designations for use on drawings

(*a*) *dimensional symbols* – standard letter symbols to designate the dimensions of screw threads in text, formulas, and drawings are given in Table 1. These follow the designation and system of symbology adopted by ISO for screw threads except as noted in Table 1 to avoid confusion with long established U.S.A. symbology.

(*b*) *thread designations* – 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, and commonly consist of combinations of such abbreviations. There are assembled in Table 2 and Appendix A, the names and abbreviations which are now in use, together with references to standards in which they occur for various standard threads.

T

taper thread – a screw thread projecting from a conical surface

taylor principle – a basic principle of gaging that states that the maximum 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 arbitrarily selected area for computing the tensile strength of an externally threaded fastener so that the fastener strength is consistent with the basic material strength of the fastener. The tensile stress area is typically defined as a function of pitch diameter and/or minor diameter to calculate a circular cross section of the fastener correcting for the notch and helix effect of the threads.

thread – a screw thread

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

thread angle – the angle formed by two adjacent flanks in an axial plane

thread, bolt (ISO term) – a term used to describe any external thread

thread groove diameter – see *pitch diameter, thread groove diameter*

thread groove width – the distance between the flanks of adjacent thread ridges normally measured parallel to the axis at the specified pitch radius. The width of thread groove may be specified and measured parallel to the axis at any other specified radius.

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

thread ridge diameter – see *pitch diameter, thread ridge diameter*

thread ridge thickness – the distance between the flanks of one thread ridge, normally measured parallel to the axis at the specified pitch radius. The thickness of thread ridge may be specified and measured parallel to the axis at any other specified radius.

thread runout – see *vanish thread*

thread series – groups of diameter/pitch combinations distinguished from each other by the number of threads per inch applied to specific diameters

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

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.

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*. (See Table 1, Item No. 18.)

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

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

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

tolerance position (*metric*) – 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

total thread – includes the complete and all of the incomplete thread; thus, including the vanish thread and the 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

turns per inch – the number of turns per inch is the reciprocal of the lead in inches

U

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

V

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

vanish point – see *plane of vanish point*

vanish thread (*partial thread, washout thread, or thread runout*) – that portion of the incomplete thread which is not fully formed at root or at crest and root. It is produced by the chamfer at the starting end of the thread forming tool. See *vanish cone.*

variables – quantities or measurements that may assume a succession of observed values when measured under different (or similar) conditions. Inspection by variables implies acceptance by size measurement gages.

virtual diameter – see *pitch diameter, functional diameter*

virtual effective diameter – see *pitch diameter, functional diameter*

virtual (*functional*) *diameter taper thread* – when a thread size of a taper thread is verified by means of a taper thread plug or ring gage, or equivalent, having a basic gaging notch or 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 engagement lies within specified size limits. The thread size thus verified may be designated the *taper thread virtual diameter.*

W

washout thread – see *vanish thread*

3 SYMBOLS FOR SCREW THREADS

(*a*) The symbols recommended in this Standard coincide with most symbols used in ISO standards except in those cases where a change from existing U.S.A. practice will confuse the generally accepted understanding of the feature to which the symbol has been applied.

(*b*) Upper and lower case italicized letters are used to identify dimensional elements and lower case Greek letters are used to identify angular elements (except for π which is universally used to represent a specific constant and Δ which represents a differential). A subscript, prefix, and/or suffix consisting of one or more combinations of numbers or lower case letters may be added to the element symbol to delineate a specific value of the element.

Generally the following criteria for upper or lower case letters, subscripts, and suffixes are used.

(*1*) *Letter symbols* applying to external threads use lower case letters and those applying to internal threads use upper case letters. Letter symbols that apply equally to or are unrelated to either use an upper case letter.

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(2) *Subscript numbers* are used to delineate a major division of an element. In this Standard the following are used: the symbol for thread diameter having no subscript represents *major diameter,* a subscript 1 represents *minor diameter,* a subscript 2 represents *pitch diameter*, and a subscript 3 represents the diameter (minor if external, major if internal) having a rounded root form. The symbol for flank angle, if it has no subscript, represents a symmetrical angular form, and if it has a subscript 1 or 2, represents unequal angles.

(3) *Suffix letters* are used to identify the relative magnitude of an element. In this Standard when the thread diameter is basic, the lower case suffix letters *bsc* are applied to the element symbol with its delineating subscript. Similarly, the suffix letters *min.* representing a specified minimum value and *max.* representing a specified maximum value are added to the element symbols.

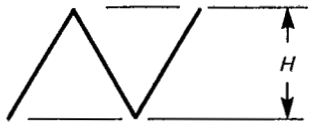
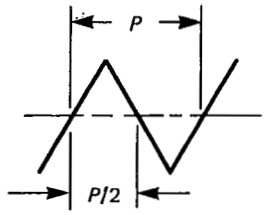
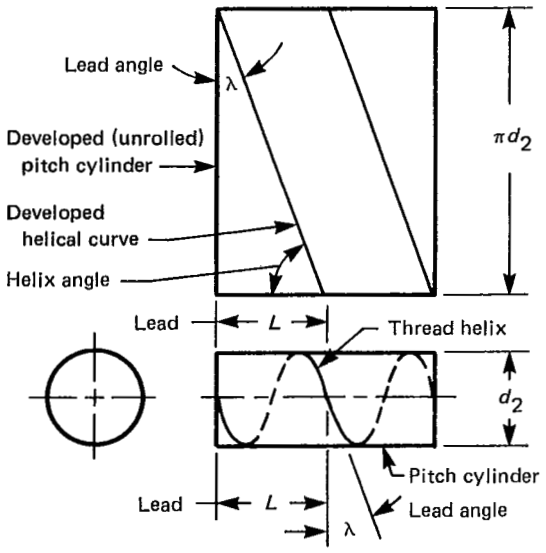
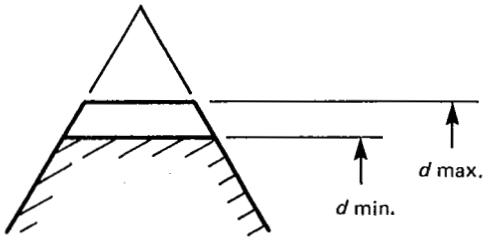
Reference planes that are used to identify the location for specific dimensions, such as tapered threads, will have a lower case suffix added to the specific element to be identified. This letter suffix is to be preceded by a dash for clarity. (See Table 1, Item No. 19.)

(4) *Prefix letters* are applied to an element symbol to indicate a function of that element. In this Standard the prefix *T* denotes *tolerance* and Δ denotes a *differential* function of that element.

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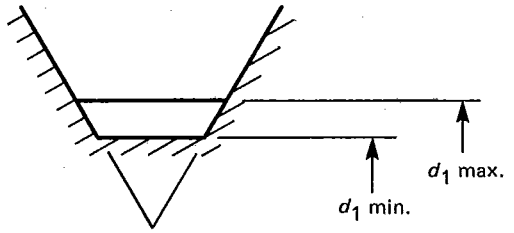
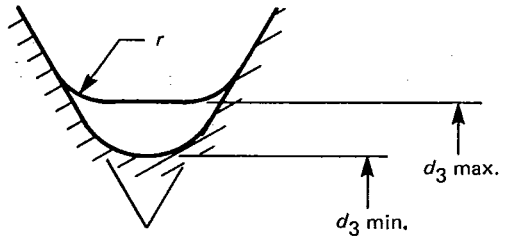
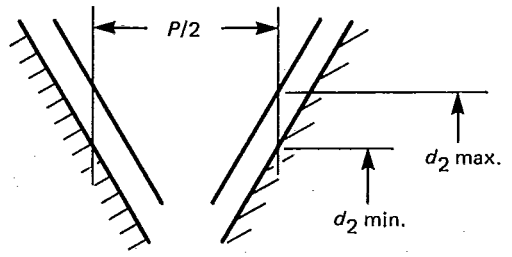
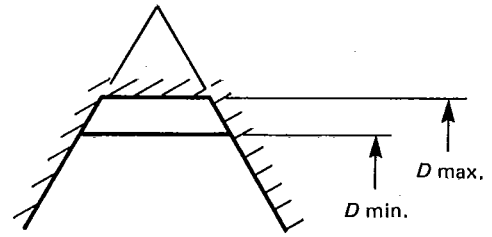
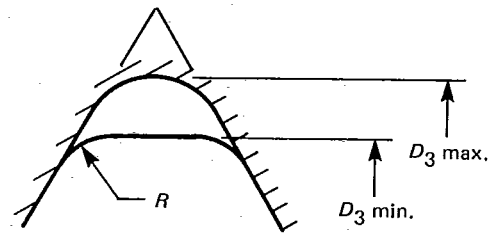
TABLE 1
GENERAL SYMBOLS

Item No.	Symbol	Element	Graphic Definition and Delineating Subscripts
1	*H*	Height of fundamental triangle	
2	*P*	Pitch	
3	*L*	Lead	
	λ	Lead angle	
4	*d*	Major diameter, external thread	

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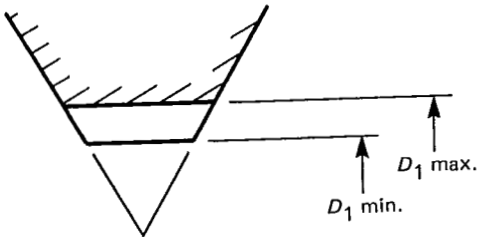
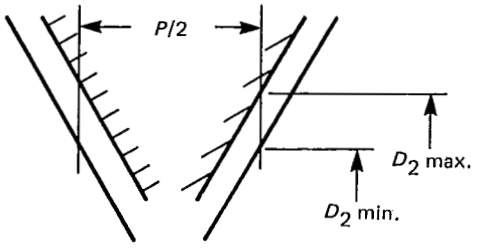
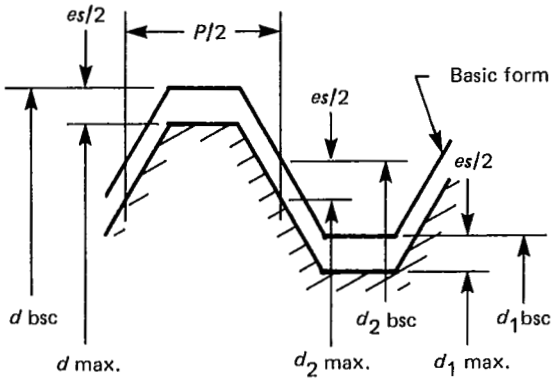
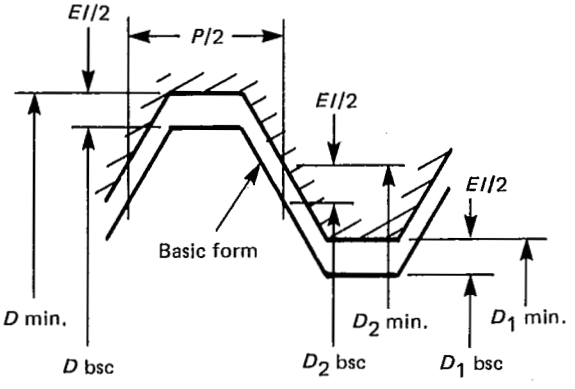
TABLE 1 (CONT'D)
GENERAL SYMBOLS

Item No.	Symbol	Element	Graphic Definition and Delineating Subscripts
5	d_1	Minor diameter, external thread (flat form)	
6	d_3	Minor diameter, external thread (rounded form)	
	r	Root radius, external thread	
7	d_2	Pitch diameter, external thread	
8	D	Major diameter, internal thread (flat form)	
9	D_3	Major diameter, internal thread (rounded form)	
	R	Root radius, internal thread	

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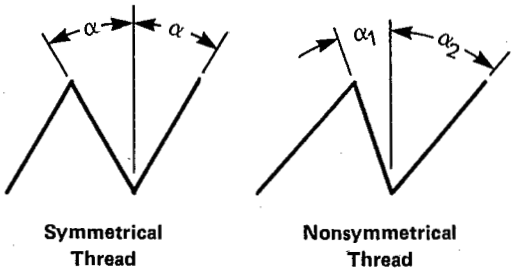
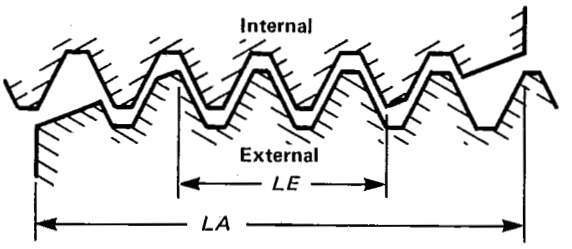
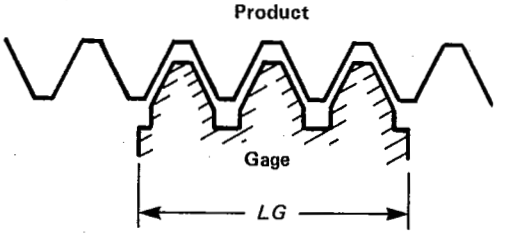
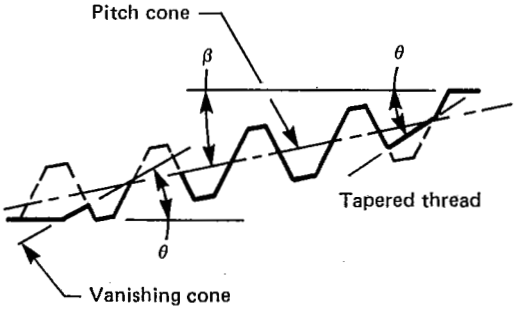
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TABLE 1 (CONT'D)
GENERAL SYMBOLS

Item No.	Symbol	Element	Graphic Definition and Delineating Subscripts
10	D_1	Minor diameter, internal thread	
11	D_2	Pitch diameter, internal thread	
12	*es*	Allowance (fundamental deviation), external thread	
13	*EI*	Allowance (fundamental deviation), internal thread	

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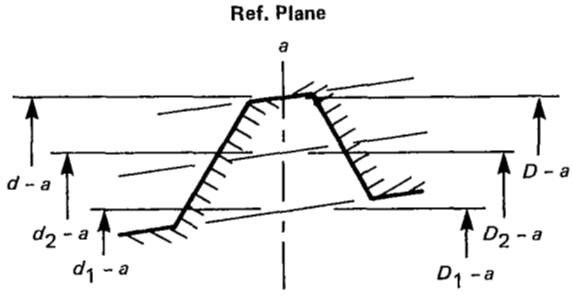
TABLE 1 (CONT'D)
GENERAL SYMBOLS

Item No.	Symbol	Element	Graphic Definition and Delineating Subscripts
14	α	Flank angle	
15	*LE*	Length of thread engagement	
	LA	Length of assembly	
16	*LG*	Gaging length	
17	β	Half apex angle of pitch cone, tapered thread	
	θ	Half apex angle of vanishing cone, straight or tapered thread	

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TABLE 1 (CONT'D)
GENERAL SYMBOLS

Item No.	Symbol	Element	Graphic Definition and Delineating Subscripts
18	T	Tolerance	The total amount of variation permitted for the sizes of a dimension. It is the difference between the maximum limit of size and the minimum limit of size. T is used as a prefix to the symbol of the element to which the tolerance will apply. For example: $TD = D$ max. $- D$ min. $Td_2 = d_2$ max. $- d_2$ min.
19	$-a$, $-b$, etc.	Reference plane symbols	
20	Δ	Differential	The difference or displacement between any two values of an element not otherwise designated as a tolerance or constant. Δ is used as a prefix to the symbol(s) of one or more related elements. For example: pitch diameter equivalent of the flank angle variation = $\Delta D_{2\alpha}$

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TABLE 2
THREAD SERIES DESIGNATIONS[1-3]

Designations	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 (2)	...
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, B1.18M
MJ	Metric scrrew threads — MJ profile with rounded root of radius 0.15011*P* to 0.18042*P*	B1.21M
MJS	Metric screw threads — MJ profile special series	B1.21M
	Class 5 interference fit external threads	B1.12
NC5 HF	For driving in hard ferrous material of hardness over 160 Bhn	
NC5 CSF	For driving in copper alloy and soft ferrous material of 160 Bhn or less	
NC5 ONF	For driving in other nonferrous material (nonferrous materials other than copper alloys), any hardness	
	Class 5 interference fit internal threads	B1.12
NC5 IF	Entire ferrous material range	
NC5 INF	Entire nonferrous material range	
NGO	National gas outlet threads (1)	ANSI/CGA V-1 (B57.1)
NGS	National gas straight threads	ANSI/CGA V-1 (B57.1)
NGT	National gas taper threads (see also SGT)	ANSI/CGA V-1 (B57.1)
NH	American Standard hose coupling threads of full form	B2.4 (B1.20.7)
NHR	American Standard hose coupling threads for garden hose applications	B2.4 (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 to American Standard taper pipe threads	B2.4
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)
S	ISO miniature screw threads 0.25 to 1.4 mm, incl.	...
SGT	Special gas taper threads	ANSI/CGA V-1 (B57.1)
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 of radius 0.15011*P* to 0.18042*P* (3)	...
UNJC	Unified inch screw thread, coarse-pitch series, with rounded root of radius 0.15011*P* to 0.18042*P* (3)	...
UNJF	Unified inch screw thread, fine-pitch series, with rounded root of radius 0.15011*P* to 0.18042*P* (3)	...
UNJEF	Unified inch screw thread, extra-fine pitch series, with rounded root of radius 0.15011*P* to 0.18042*P* (3)	...

See Notes at end of Table.

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TABLE 2 (CONT'D)
THREAD SERIES DESIGNATIONS[1-3]

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

NOTES:
(1) All threads, except NGO, are right hand, unless otherwise designated. For NGO threads, designations RH or LH are required.
(2) As published in Military Specification MIL-P-7105.
(3) As published in Military Specification MIL-S-8879, and ISO 3161.

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APPENDIX A
SUPERSEDED THREAD SERIES DESIGNATIONS[1]

(This Appendix is not part of ANSI/ASME B1.7M-1984 and is included for information purposes only.)

Designation	Thread Series
8N	American National 8-thread series [Note (2)]
12N	American National 12-thread series [Note (2)]
16N	American National 16-thread series [Note (2)]
NC	American National coarse-thread series [Note (2)]
NEF	American National extra-fine thread series [Note (2)]
NF	American National fine-thread series [Note (2)]
NR	American National thread with a 0.108p to 0.144p controlled root radius [Note (3)]
NS	American National threads of special diameters, pitches, and length of engagement [Note (2)]

NOTES:
(1) For information only.
(2) Superseded by the Unified Thread Series.
(3) As published in Military Specification MIL-B-7838.

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APPENDIX B
ISO SYMBOLS FOR SCREW THREADS

(This Appendix is not part of ANSI/ASME B1.7M-1984 and is included for information purposes only.)

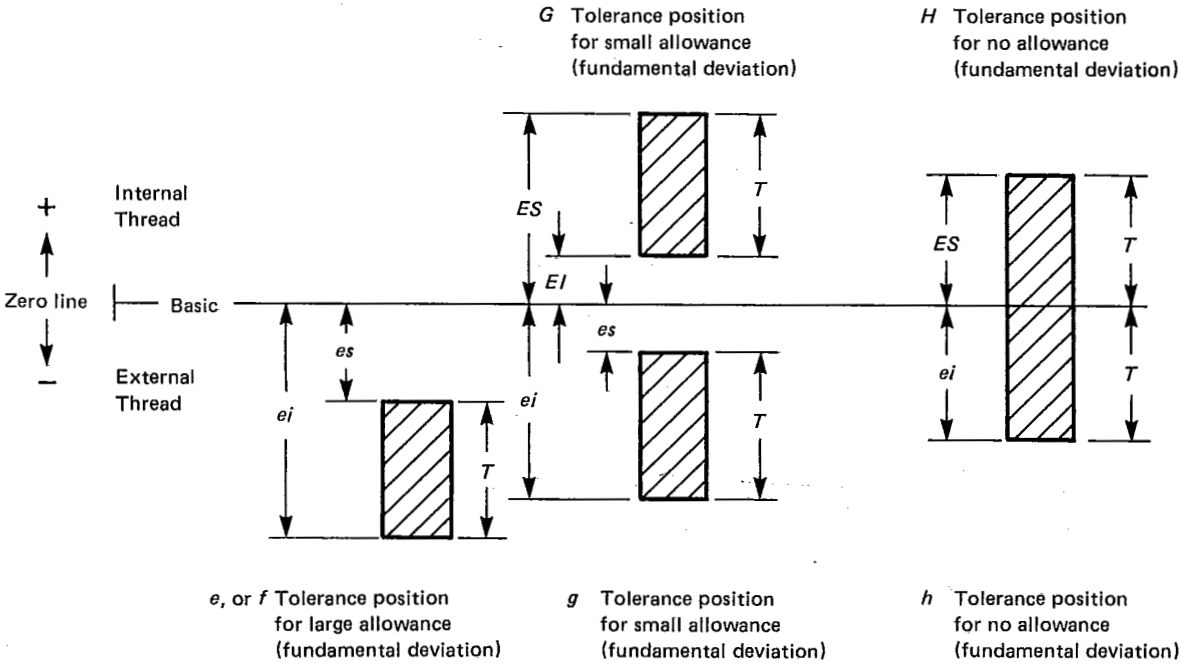


FIG. B1 METRIC TOLERANCE SYSTEM FOR SCREW THREADS

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APPENDIX C
GREEK ALPHABET

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A	α	Alpha	N	ν	Nu
B	β	Beta	Ξ	ξ	Xi
Γ	γ	Gamma	O	σ	Omicron
Δ	δ	Delta	Π	π	Pi
E	ϵ	Epsilon	P	ρ	Rho
Z	ζ	Zeta	Σ	σ	Sigma
H	η	Eta	T	τ	Tau
Θ	θ	Theta	Υ	υ	Upsilon
I	ι	Iota	Φ	ϕ	Phi
K	κ	Kappa	X	χ	Chi
Λ	λ	Lambda	Ψ	ψ	Psi
M	μ	Mu	Ω	ω	Omega

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