ASME B1.7-2006

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

Screw Threads: Nomenclature, Definitions, and Letter Symbols

AN AMERICAN NATIONAL STANDARD

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The American Society of Mechanical Engineers
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CONTENTS

Foreword v
Committee Roster vi

1 General 1

2 Definition of Terms 1

Figures
1 Allowance 2
2 Axis of Thread 2
3 Best Wire Size 2
4 Blunt Start Thread 3
5 Bottom of Chamfer 4
6 Clearance Flank 4
7 Countersink 4
8 Crest 4
9 Root and Crest Truncation 5
10 Fundamental Deviation 6
11 Metric Tolerance System for Screw Threads 7
12 Element 7
13 Flank 7
14 Flank Angle 7
15 Flat Form 7
16 Following Flank 8
17 Gauge Plane 8
18 Height of Fundamental Triangle 8
19 Height of Thread 9
20 Height of Thread Engagement 9
21 Helix 9
22 Helix Variation (Drunken Thread) 9
23 Incomplete Thread 10
24 Interference Fit 11
25 Internal Thread 11
26 Lead 11
27 Leading Flank 11
28 Gaging Length 11
29 Length of Assembly 11
30 Length of Thread Engagement 12
31 Load Flank 12
32 Major Clearance 12
33 Major Diameter, External Thread 12
34 Major Diameter, Internal Thread 12
35 Major Diameter, Internal Thread (Rounded Form) 12
36 Major Diameter, Taper Thread 12
37 Minor Clearance 13
38 Minor Diameter, External Thread (Flat Form) 14
39 Minor Diameter, External Thread (Rounded Form) 14
40 Minor Diameter, Internal Thread 14
41 Minor Diameter, Taper Thread 14
42 Multiple Start Thread 14

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Zimvie_Zimmer Biomet v. Jackson
IPR2023-01433; Petitioners' EX1031
Page 4 of 9

43 Pitch 14
44 Pitch Cone 14
45 Pitch Cylinder 14
46 Pitch Diameter, External Thread 15
47 Pitch Diameter, Internal Thread 15
48 Plane of Vanish Point 15
49 Profile, Basic Thread 16
50 Root Radius 16
51 Screw Thread 16
52 Sharp Crest and Root 16
53 Shear Area 17
54 Straight Thread 18
55 Thread Angle 23
56 Thread Ridge Thickness 23
57 Truncation 23
58 Vanish Cone 24

Tables

1 General Symbols 19
2 ISO General Symbols 20
3 Thread Series Designations 21
4 ISO Thread Series Designations 22

Nonmandatory Appendices

A Superseded Thread Series Designations 25
B ISO Symbols for Screw Threads 26
C Greek Alphabet 27

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Zimvie_Zimmer Biomet v. Jackson
IPR2023-01433; Petitioners' EX1031
Page 5 of 9

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.

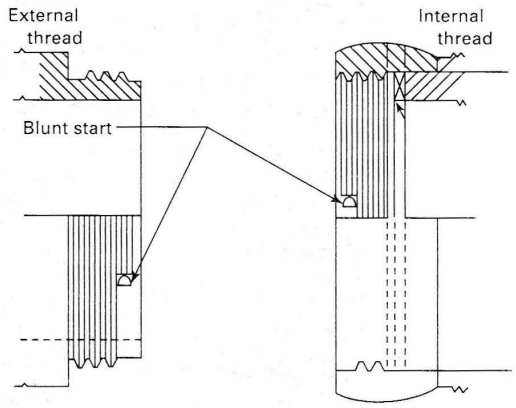

Fig. 4 Blunt Start Thread

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.

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Zimvie_Zimmer Biomet v. Jackson
IPR2023-01433; Petitioners' EX1031
Page 6 of 9

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.

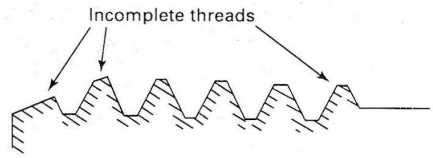

Fig. 23 Incomplete Thread

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.

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Zimvie_Zimmer Biomet v. Jackson
IPR2023-01433; Petitioners' EX1031
Page 7 of 9

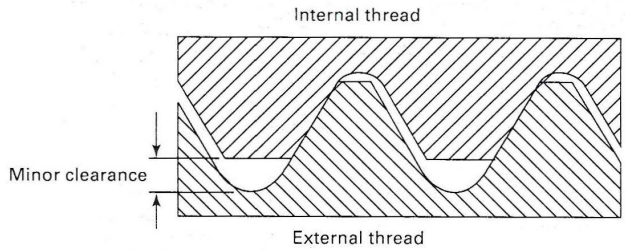

Fig. 37 Minor Clearance

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.

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Zimvie_Zimmer Biomet v. Jackson
IPR2023-01433; Petitioners' EX1031
Page 8 of 9

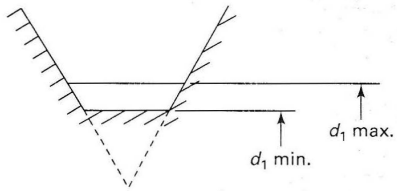


Fig. 38 Minor Diameter, External Thread (Flat Form)

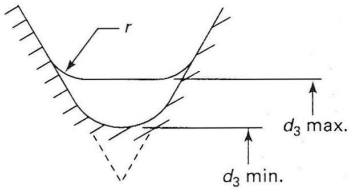


Fig. 39 Minor Diameter, External Thread (Rounded Form)

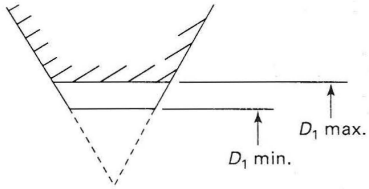
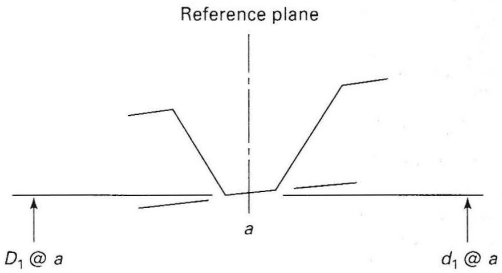
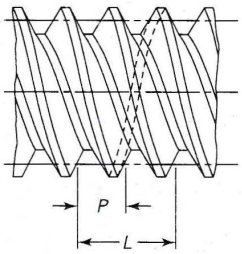


Fig. 40 Minor Diameter, Internal Thread



GENERAL NOTE: a = center line.

Fig. 41 Minor Diameter, Taper Thread



GENERAL NOTE: Two-start thread illustrated.

Fig. 42 Multiple Start Thread

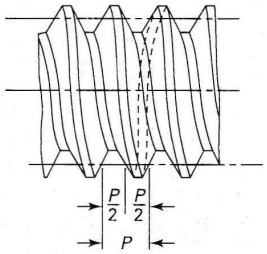


Fig. 43 Pitch

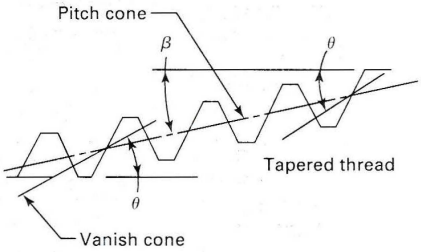


Fig. 44 Pitch Cone

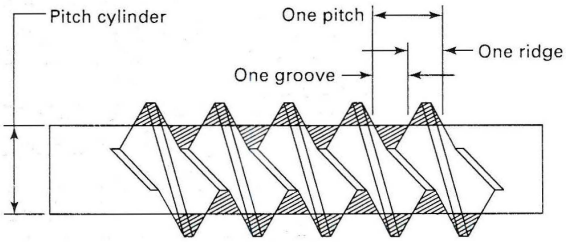


Fig. 45 Pitch Cylinder

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