TECHNICAL DATA

JIS (Japanese Industrial Standard)

Screw Thread

Specifications

Note: Although these specifications are based on JIS they also apply to ISO and DIN threads.

Some comments added by Maryland Metrics

Courtesy of:

OSG CORPORATION

<Exterior features of thread ridge>

(1) Flank : Thread face (excluding crest and root of thread profile)

(2) Crest : The tap surface joining the two sides or flanks of a thread

(3) Root : The bottom surface joining the flanks of two adjacent flanks

(4) Angle of thread : Angle between adjacent flanks measured at the cross section of screw thread - including the axis of the screw thread

(5) Flank angle : The angle between the individual flank and the perpendicular to the axis of the thread measured in the axial plane

(6) Pitch : The distance from a point on one thread to a corresponding point on the next thread measured parallel to the axis

(7) Lead : The distance a screw thread advances axially in one complete turn

(8) Lead angle : Angle formed by a helix passing a point on a flank and plane perpendicular to the axis of the screw thread (applies to parallel thread)

Figure 1 Basic designation of thread (1)

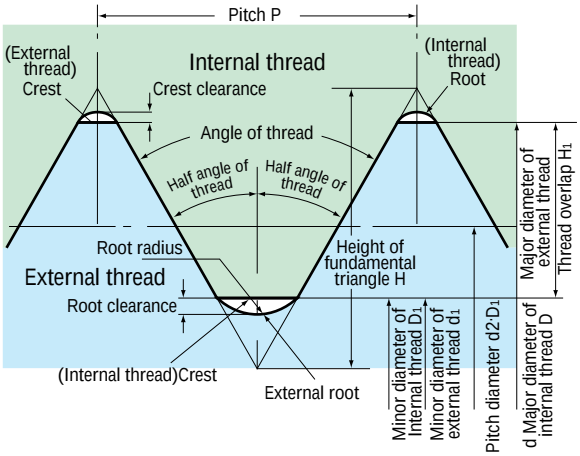
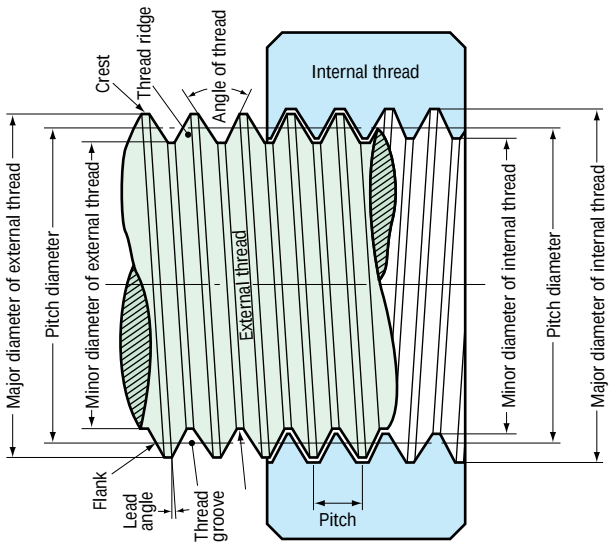


Figure 2 Basic designation of thread (2)



(9) Major diameter of external thread : Diameter of a virtual cylinder which touches the crest of the external thread

(10) Minor diameter of internal thread : Diameter of a virtual cylinder which touches the crest of the internal thread

(11) Minor diameter of external thread : Diameter of a virtual cylinder which touches the root of the external thread

(12) Major diameter of internal thread : Diameter of a virtual cylinder which touches the root of the internal thread

(13) Pitch diameter : On a straight screw thread, the diameter of an imaginary cylinder where the width of the thread and the width of the space threads are equal.

(14) Simple pitch diameter : Diameter of an imaginary cylinder when a thread groove width, which is determined by the direction of an axis of screw thread, equals half of the reference pitch. For many standard taps, the simple pitch diameter equals the pitch diameter.

(15) Virtual pitch diameter : Virtual pitch diameter of a thread with a reference pitch and reference flank angle that fit without interference and play in the thread over the given thread engagement

(16) Height of Thread : Distance between a virtual cylinder that touches a crest of the thread and a virtual cylinder that touches a root; determined by measuring perpendicular to the axis of the screw thread.

(17) Height of fundamental triangle : Right angle distance between a virtual cylinder (including the helix) formed by extending and intersecting flanks of thread to the direction of crest and a virtual cylinder formed by extending and intersecting flanks of thread to the direction of root

(18) Crest truncation : The distance measured perpendicular to the axis, between the sharp crest and the cylinder or cone which bounds the actual root.

(19) Root truncation : The distance measured perpendicular to the axis, between the sharp root and the cylinder or cone which bounds the actual root.

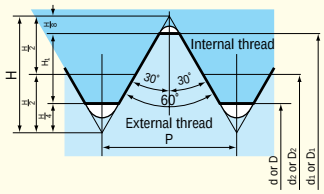
(20) Thread overlap : Distance measured perpendicular to the axis of the screw thread between the virtual cylinder of the major diameter of external thread and the virtual cylinder of the minor diameter of internal thread, in external thread and internal thread which mutually fit in concentric.

(21) Percentage of thread engagement : Ratio of thread overlap in product against reference of thread overlap

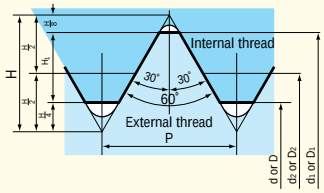
(22) Length of engagement : Length measured in the direction of the thread axis, when an external thread and internal thread are fit and mutually contact. Usually this length equals the length of internal thread and includes the chamfers of both ends of the internal thread

(23) Threaded portion : Threaded portion of tap that can be effectively used for screw thread. The incomplete chamfered thread portion is included.

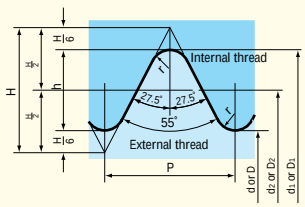
<Types and Applications>

Type	Symbol	Basic Profile	Equation for Basic Size
Metric screw thread JIS B0205 (coarse) JIS B0207 (fine)	M		H=0.866025P H_1=0.541266P d_2=d - 0.649519P d_1=d - 1.082532P D=d D_1=d_1 D_2=d_2 P=Pitch D=For internal thread

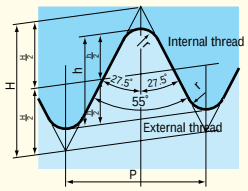
Angle of thread is 60°. The Crest is flat, and there is clearance at the root. External thread and internal thread engage well. Larger root radius and lower thread height enable easy screw thread processing and increase thread screw strength. The Major diameter of external thread and pitch are specified by a simple numerical value (most commonly measured in millimeters).

Unified screw thread JIS B0206 (coarse) JIS B0208 (fine)	U		P=25.4/n H=0.866025P H_1=0.541266P d_2=d - 0.649519P d_1=d - 1.082532P D=d D_1=d_1 D_2=d_2

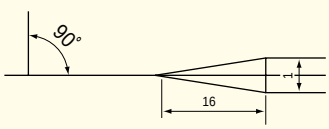
The thread profile is same as for metric thread. Major diameter of external thread is measured in inches and the number thread ridges is represented by the number of thread ridges per inch.

Parallel pipe thread JIS B0202	G (PF)		P=25.4/n H=0.960491P H_1=0.640327P r=0.137329P d_2=d - h d_1=d - 2h D=d D_1=d_1 D_2=d_2

Pipe thread mainly for mechanical coupling. It is specified according to JIS and ISO R228. For the US method, some threads have a 60° angle.

Taper pipe thread JIS B0203	R·Rc (PT)		H=0.960237P H_1=0.640327P r=0.137278P

Pipe thread mainly for tighter thread portion. Taper 1/16 and 55° thread angle. For the US method, some threads have a 60° angle



Note: JIS PT = BSPT JIS PF = BSPF

<Tolerance>

The following are the requirements for proper external and internal thread engagement:

1. External thread and internal thread must have sufficient contact at the flank
2. External thread and internal thread must have enough engagement. [SAME AS ABOVE!]

In order to meet these requirements, JIS uses classes to define the limits of size and tolerance for the major and minor diameter of internal thread, pitch diameter, and the major and minor diameter of external thread.

Tolerance Class

The reason for setting tolerance in thread is:

1. The ensure compatibility
2. Limit the quality within a given range

Factors that effect the quality of screw thread include:

1. material: type, heat processing, surface processing, uniformity, etc...
2. shape: root radius, incomplete thread, roundness, surface roughness, concentration of stress
3. detentions: major diameter, pitch diameter, and minor diameter.

Tolerance class of thread ridge is primarily determined by dimensions.

Table 3

Name			Class			
Types	Group					
			First	Second	Third	
Metric screw thread (M)	External thread	JIS ISO	4h	6g	8g	
	Internal thread	JIS ISO	4H, 5H	5H, 6H	7H	
Unified screw thread (U)	External thread	JIS ISO	3A	2A		1A
	Internal thread	JIS ISO	3B	2B		1B
Whitworth screw thread (W)				Second	Third	Fourth
Use			Conforming engagement	Clamping general machine	General service for general machine	Regular bolt

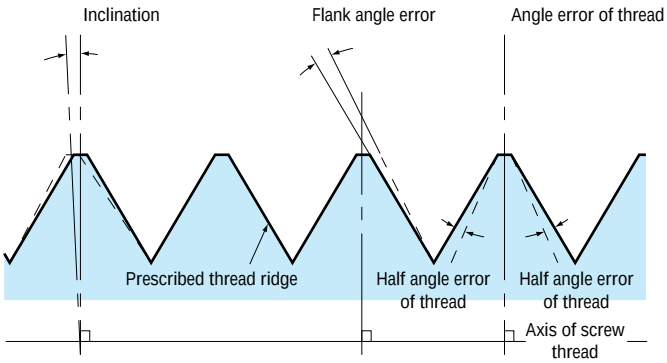
Angle Error

The difference between the actual angle of thread and the prescribed angle of thread. Angles larger than the prescribed angel are " plus", while angles smaller than the prescribed angle are "minus". It doubles half angle error.

Flank angle error : Difference between the actual flank angle and prescribed flank angle

Half angle error of thread : Flank angle error at point where thread profile is symmetrical to the center line of the thread ridge.

Figure 3 Angle Error Examples



Pitch Error

The difference between the actual pitch and the prescribed pitch. Pitch that is larger than the prescribed pitch is " plus", while pitch that is smaller than the prescribed pitch is "minus". Generally this is for one pitch, but some is for two pitches.

Pitch error includes:

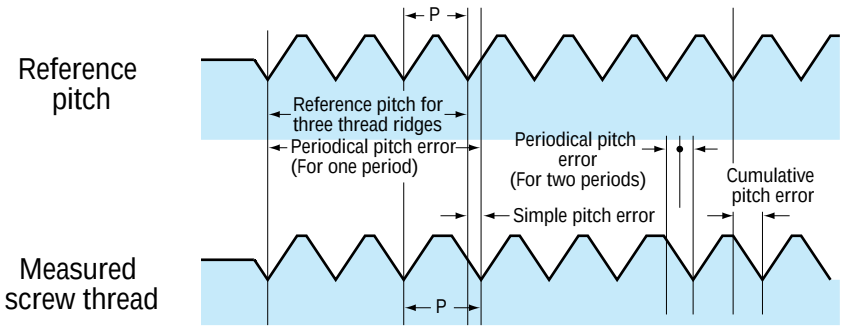
Simple pitch error : Pitch error for one pitch

Cumulative pitch error : Total pitch error between thread ridges which mutually depart two pitches or more.

Progressive pitch error : Pitch error that simple pitch error is positive or negative

Periodical pitch error : Pitch error that simple pitch periodically increases and decreases.

Figure 4 Pitch error examples



<ISO and Former JIS for Pipe Thread>

In 1982 the JIS for pipe threads was revised and PT and PF which were prescribed by that time, have been in the Appendix. R and G are included in the main body of the standard. For taps, as in the case with pipe threads, PT PS and PF have been in the Appendix. Rc, Rp, and G are in the main body of the standard.
Compatibility between a tap, die, and gauge of each screw thread are shown in the following table.

Table 4

Group	Types	ISO Symbol	Compatibility	Reference
Tap	Parallel internal thread for tightness	Rc	Compatible using second class tap for PT - short or long type	Precision of screw thread can be compatible, but there is a difference in the shape of the tap.
	Taper internal thread for tightness	Rp	Compatible using second class tap for PS	
	Parallel internal thread for mechanical coupling	G	Compatible using second class tap for PS	
Die	Taper external thread for tightness	R	Compatible using die for PT	
	Parallel external thread for mechanical coupling	G	Compatible using die for PF	
Gauge	Taper external thread for tightness	R	PT incompatible	Different gauge precision and shape
	Parallel internal thread for tightness	Rp	PS incompatible (Judged by tapered plug)	
	Taper internal thread for tightness	Rc	PT incompatible	
	Parallel internal thread for mechanical coupling	G	PF incompatible	
	Parallel internal thread for mechanical coupling	G	PF incompatible	

Note: JIS PT = BSPT JIS PF = BSPF