Ground Thread Tap Limits

In addition to the nominal size and pitch of a tap, there is another important dimensional factor to be considered when selecting a ground thread tap for a given job. This factor is the pitch diameter tap limit, “H” and “L.” “H” represents (high) above basic pitch diameter; “L” (low) is below basic pitch diameter. Tap limits have been established to provide a choice in the selection of the tap size best suited to produce the class of thread desired.

Figure 1 illustrates the numbering system and the .0005” diameter increment separation between successive limits. Because the starting point is basic pitch diameter, dividing the limit number by two establishes, in thousandths of an inch, the amount the maximum tap pitch diameter is above basic in the “H” series and the amount the minimum tap pitch diameter is under basic in the “L” series.

Figure 2 illustrates the positioning of the tap limits in relation to the various classes of threads for a 1/4-20 size.

Figure 1

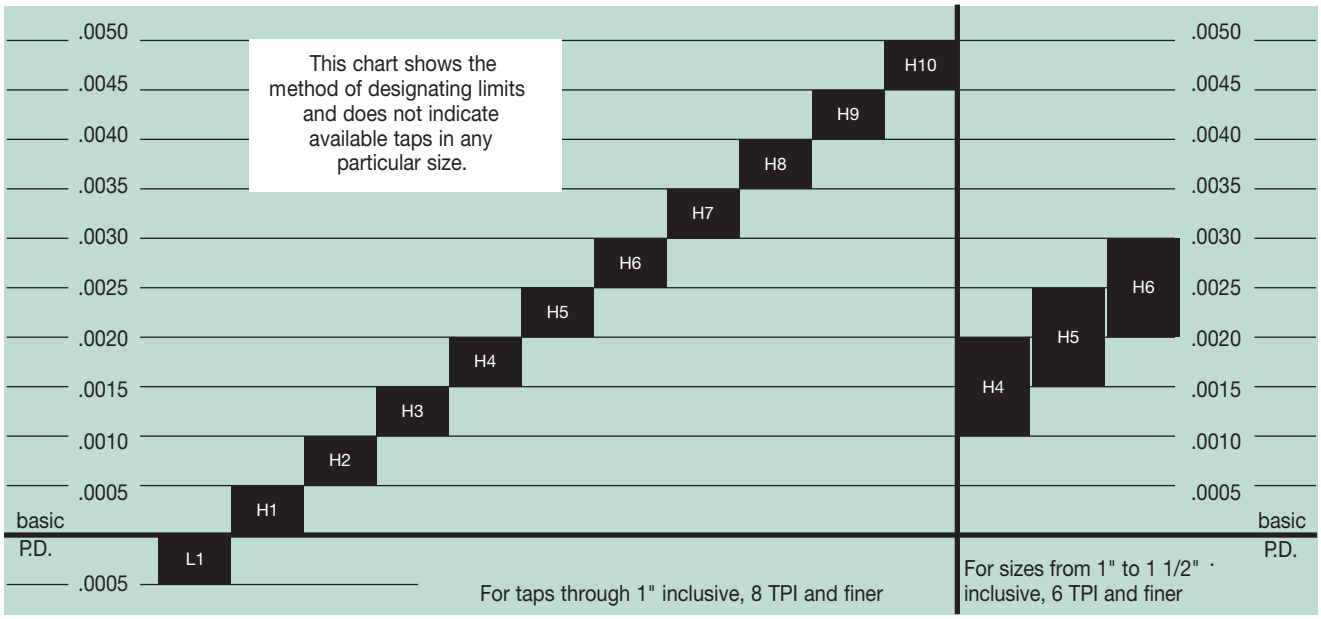
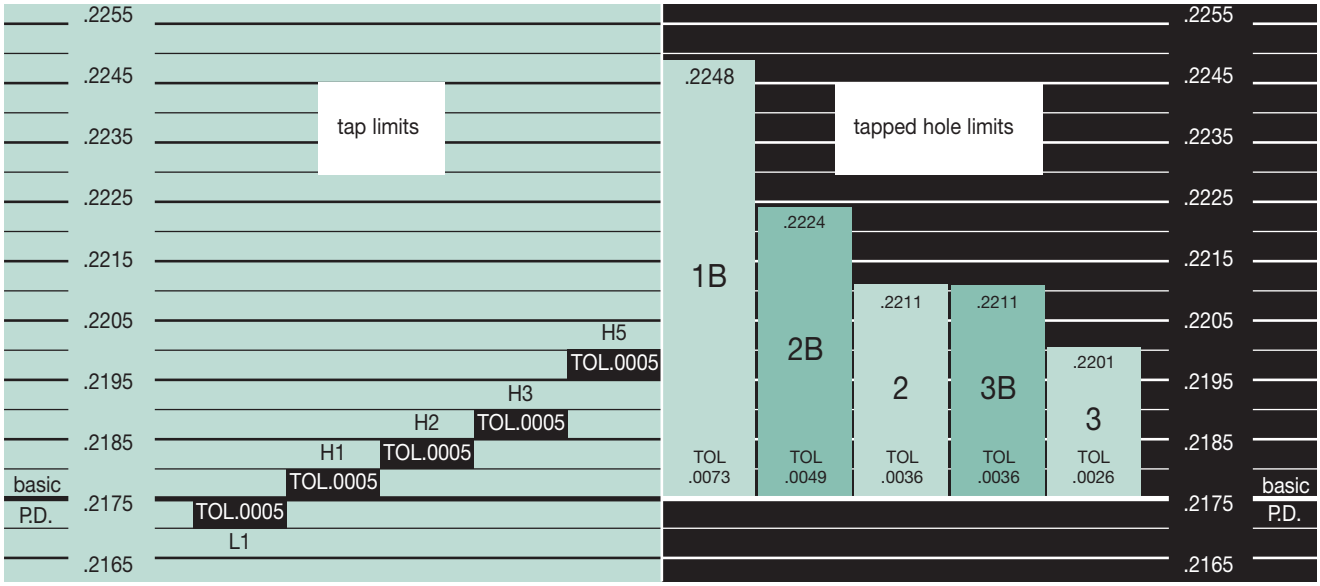


Figure 2

Class of Thread – 1/4 -20 UNC and NC



Tap Drill Recommendations

Tap Size & Pitch		Cutting Taps		Forming Taps	
Inch	Metric	Drill Size	Dec. Equiv.	Drill Size	Dec. Equiv.
0-80		3/64	.0469	54	.0550
	M1.6 x 0.35	1.25	.0492	1.45	.0571
	M1.8 x 0.35	1.45	.0571	1.65	.0650
1-64		53	.0595	51	.0670
1-72		53	.0595	51	.0670
	M2 x 0.4	1.6	.0630	1.8	.0709
2-56		50	.0700	5/64	.0781
2-64		50	.0700	47	.0785
	M2.2 x 0.45	1.75	.0689	2.0	.0787
	M2.5 x 0.45	2.05	.0807	2.3	.0906
3-48		47	.0785	43	.0890
3-56		46	.0810	2.3	.0905
4-40		43	.0890	38	.1015
4-48		42	.0935	2.6	.1024
	M3 x 0.5	2.5	.0984	7/64	.1094
5-40		38	.1015	33	.1130
5-44		37	.1040	2.9	.1142
	M3.5 x 0.6	2.9	.1142	3.2	.1260
6-32		36	.1065	1/8	.1250
6-40		33	.1130	3.25	.1280
	M4 x 0.7	3.3	.1299	3.7	.1476
8-32		29	.1360	25	.1495
8-36		29	.1360	24	.1520
	M4.5 x 0.75	3.7	.1476	4.1	.1614
10-24		26	.1470	11/64	.1719
10-32		21	.1590	16	.1770
	M5 x 0.8	4.2	.1654	14	.1820
12-24		16	.1770	8	.1990
12-28		15	.1800	7	.2010
	M6 x 1	5.0	.1969	7/32	.2188
1/4-20		7	.2010	1	.2280
1/4-28		3	.2130	15/64	.2340
	M7 x 1	6.0	.2362	F	.2570
5/16-18		F	.2570	L	.2900
5/16-24		I	.2720	M	.2950
	M8 x 1.25	6.7	.2638	7.4	.2913
	M8 x 1	7.0	.2756	19/64	.2969
3/8-16		5/16	.3125	S	.3480
3/8-24		Q	.3320	T	.3580
	M10 x 1.5	8.5	.3346	U	.3680
	M10 x 1.25	8.7	.3425	9.4	.3701
7/16-14		U	.3680	Y	.4040
7/16-20		25/64	.3906	Z	.4130
	M12 x 1.75	10.2	.4016	11.2	.4409
	M12 x 1.25	10.8	.4252	11.5	.4528
1/2-13		27/64	.4219	15/32	.4682
1/2-20		29/64	.4531	12.25	.4823
	M14 x 2	12.0	.4724	33/64	.5156
9/16-12		31/64	.4844	17/32	.5312
9/16-18		33/64	.5156	13.5	.5315
5/8-11		17/32	.5312	14.75	.5807
5/8-18		37/64	.5781	15.25	.6004
	M16 x 2	14.0	.5512	19/32	.5938
	M16 x 1.5	14.5	.5709	15.25	.6004
	M18 x 2.5	15.5	.6102	39/64	.6094
	M18 x 1.5	16.5	.6496	17.25	.6791
3/4-10		21/32	.6562	45/64	.7031
3/4-16		11/16	.6875	23/32	.7188
	M20 x 2.5	17.5	.6890	*	*
	M20 x 1.5	18.5	.7283	*	*
	M22 x 2.5	19.5	.7677	*	*
	M22 x 1.5	20.5	.8071	*	*
7/8-9		49/64	.7656	*	*
7/8-14		13/16	.8125	*	*
	M24 x 3	21.0	.8268	*	*
	M24 x 2	22.0	.8661	*	*
1-8		7/8	.8750	*	*
1-12		59/64	.9219	*	*
	M27 x 3	24.0	.9449	*	*
	M27 x 2	25.0	.9843	*	*
1 1/8-7		63/64	.9844	*	*
1 1/8-12		1 3/64	1.0469	*	*
	M30 x 3	26.5	1.0433	*	*
	M30 x 2	28.0	1.1024	*	*
1 1/4-7		1 7/64	1.1094	*	*
1 1/4-12		1 11/64	1.1719	*	*
	M33 x 3	29.5	1.1614	*	*
	M33 x 2	31.0	1.2205	*	*
1 3/8-6		1 7/32	1.2188	*	*
1 3/8-12		1 19/64	1.2969	*	*
	M36 x 4	32.0	1.2598	*	*
	M36 x 3	33.0	1.2992	*	*
1 1/2-6		1 11/32	1.3438	*	*
1 1/2-12		1 27/64	1.4219	*	*
	M39 x 4	35.0	1.3780	*	*
	M39 x 3	36.0	1.4173	*	*

* Contact Technical Service for recommendations.
Hole sizes shown may not suit UNJ and MJ hole requirements.

metric fractional wir e gage letter size

Pipe Taps — NPT, NPTF, NPSM, NPSC, NPSF

Nominal Pipe Tap Size	NPT & NPTF Without Reamer	NPT & NPTF With Reamer	NPSM	NPSC	NPSF
1/16-27	C (.242)	A (.234)	—	.250	D (.246)
1/8-27	Q (.332)	21/64	T (.358)	Q (.332)	R (.339)
1/4-18	7/16	27/64	15/32	7/16	7/16
3/8-18	9/16	9/16	.603**	37/64	37/64
1/2-14	45/64	11/16	19,0 mm	18,0 mm	18,0 mm
3/4-14	29/32	57/64	61/64	59/64	59/64
1-11 1/2	1 9/64	1 1/8	1 13/64	1 5/32	1 5/32
1 1/4–11 1/2	1 31/64	1 15/32	1 35/64	1 1/2	—
1 1/2–11 1/2	1 23/32	1 45/64	1 25/32	1 47/64	—
2–11 1/2	2 3/16	2 11/64	2 1/4	2 13/64	—

**special

Tap Drill Recommendations

Recommended Minor Diameters and Tap Drills for STI

Nominal Size STI	Threads per Inch NC UNC	Threads per Inch NF UNF	Aluminum Recommended Drill Nominal Size	Aluminum Recommended Drill Dec. Equivalent	Plastic - Steel - Magnesium Recommended Drill Nominal Size	Plastic - Steel - Magnesium Recommended Drill Dec. Equivalent
2	56	—	3/32	.0938	41	.0960
4	40	—	31	.1200	31	.1200
6	32	—	26	.1470	25	.1495
8	32	—	17	.1730	16	.1770
10	24	—	13/64	.2031	5	.2055
10	—	32	7	.2010	13/64	.2031
1/4	20	—	H	.2660	H	.2660
1/4	—	28	G	.2610	6.7MM	.2638
5/16	18	—	Q	.3320	Q	.3320
5/16	—	24	21/64	.3281	21/64	.3281
3/8	16	—	X	.3970	X	.3970
3/8	—	24	25/64	.3906	25/64	.3906
7/16	14	—	29/64	.4531	29/64	.4531
7/16	—	20	29/64	.4531	29/64	.4531
1/2	13	—	33/64	.5156	17/32	.5312
1/2	—	20	33/64	.5156	17/32	.5312

Surface Treatment

The best surface treatment is applied to each tap depending on the tapping purpose. Characteristics and effectiveness of surface treatment are introduced at next section.

Oxidizing

This treatment was proceed by using HOMO furnace of LEED AND NORTHUP company USA in 1938, and it is called HOMO treatment. This treatment is also called vapor treatment and steam treatment. Through this treatment, Fe304 layer of blue black color is produced over the tool surface.

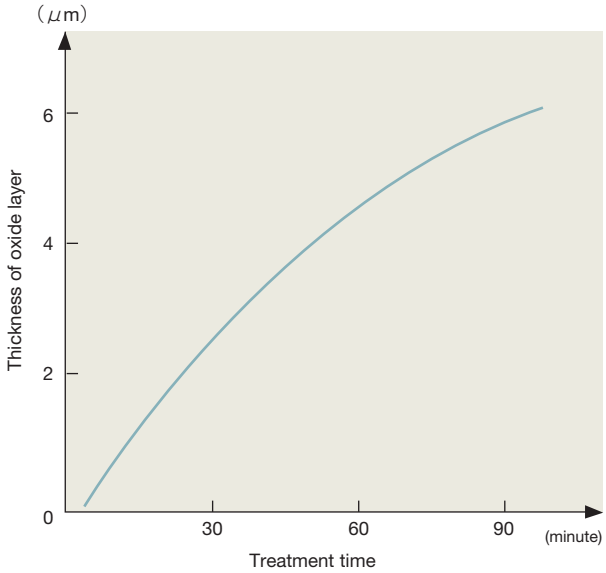
Oxidization treatment produces porous layer an tool's surface. This porous layer working as oil pocket keeps to reduce friction, to avoid welding and to improve the surface roughness of internal screw. Moreover, longer tool life is expected because the treatment reduces the remaining stress of HSS tools.

This treatment does not increase the hardness on tool surface. Using the furnace of YAMAWA original design and choosing the proper treatment time, we have been marked good result of oxidizing for YAMAWA HSS tools.

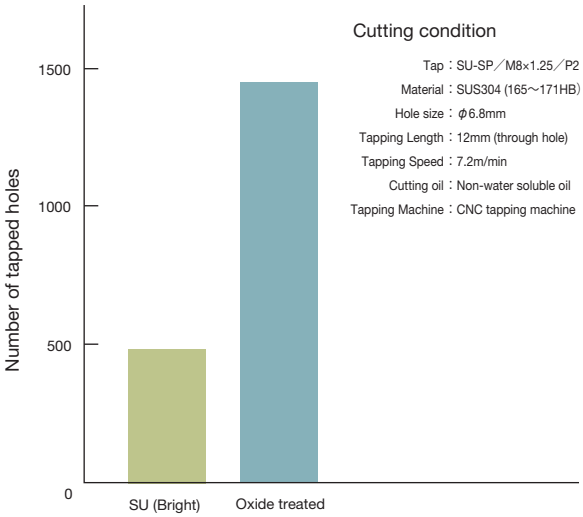
Stainless steel and low carbon steel are the material that as easy to get welding. We are applying this treatment to the special purpose taps for these materials to get good result. Further due to the reduction of friction resistance, this treatment has good result for wide range of steel type material.

We combine oxidizing with nitriding for the taps designed for such steel and alloy tool steel. This double treatment how work good reputation of the market.

Thickness of oxide layer and the time of treatment



Efficiency of oxide treatment



Surface Treatment

The best surface treatment is applied for each tap depending on the tapping purpose. Now, characteristics and effectiveness of surface treatment are introduced at next section.

Nitriding

In this treatment, we have Nitrogen and Carbon soak into the surface of HSS tools, and react with chemical of HSS material to react hard nitride. There are 3 method in the treatment, as composition gas method, salt bath nitride method and ion nitride method.

Salt bath nitride treatment is shifted into gas nitride treatment method because of cyanic environmental pollution.

The temperature of treatment is 500 to 550 degree. Hardness and depth of the treatment can be controlled by active nitrogen concentration and reaction time.

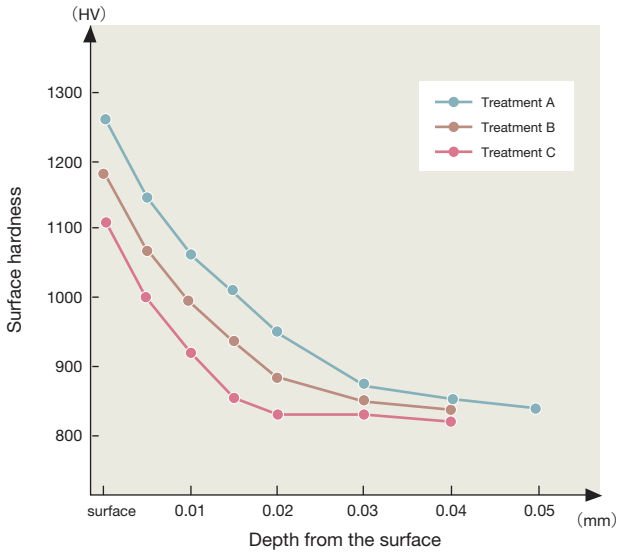
The high hardness of tool surface minimize chemical attraction result is less welding and the resulting of friction resistance Great improvement is expected in tool's performance.

We have found out the best combinations of hardness and toughness through our treatment technology

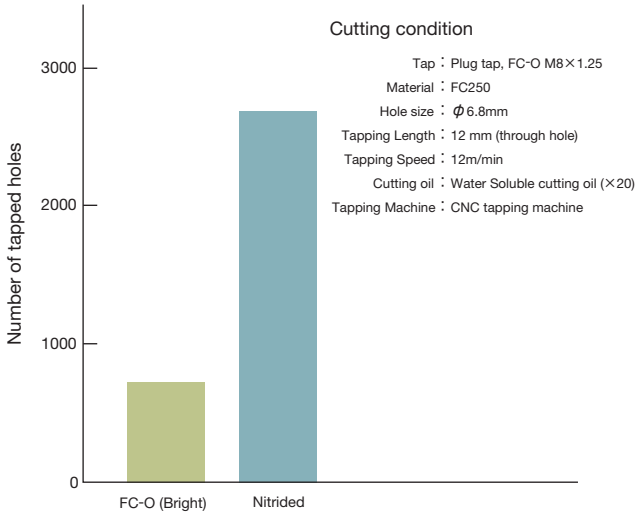
The nitriding treatment will be widely applicable to workpiece materials such as gray cast irons, special cast irons, aluminum diecastings with higher silicone content, copper alloys, and resinoids (plastics), these materials produce small segmental chips and are very abrasive.

We combine nitrogen and oxidizing for comparatively sticky material such as high carbon steel and refined alloy steel. This double treatment improve the chipping resistance and have won good reputation.

Depth and hardness of Nitride Surface Treatment



Efficiency of Nitride Treatment



Surface Treatment

The best surface treatment is applied for each tap depending on the tapping purpose. Now, characteristics and effectiveness of surface treatment are introduced at next section.

High speed cutting and hard-to-machine cutting are the recent technology. To meet this tendency, the hard layer coating by vapor deposition over tool's surface has become popular. There are two coating methods, CVD and PVD.
PVD is mainly used for tap.

Physical Vapor Deposition

Inside of the container of high vacuum, are heat vapor deposition material and vapor it. And we vapor deposit particles ionized by electric discharge on tool's surface.

Due to its low reaction temperature (lower than 500°C), PVD makes little change of shape and hardness to HSS tools.

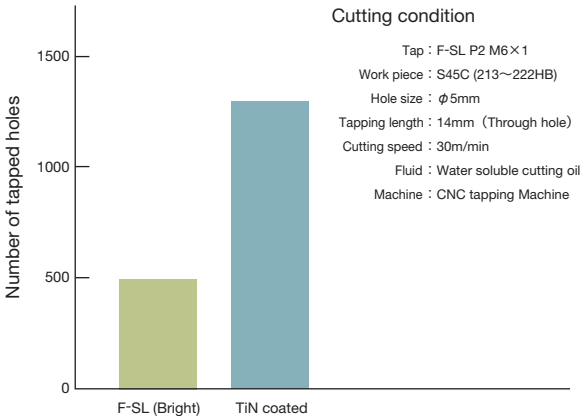
We have adopted iron plating method, and are coating thin layer (1-4um) over our HSS and carbide tools. This layer processed by this method is very high in its adherence and its wear resistance.

The features and classification of coating

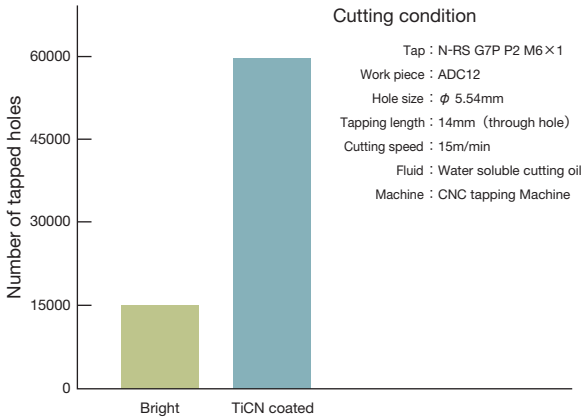
Classification / Features	Titanium nitride (TiN)	Titanium carbonitride (TiCN)	Titanium nitride aluminum (TiAlN)	Hard chromium plating (CrN)
Vickers Hardness	2000～2400	3000～3500	2300～2700	1800～2200
Wear resistance	Good	Excellent	Excellent	Normal
Welding resistance	Good	Good	Good	Excellent
Heat resistance	Good	Normal	Excellent	Excellent
Acid resistance	Good	Normal	Excellent	Good
Slippery	Good	Excellent	Good	Excellent
Color	Gold	Blue Dray Violet	Violet	Silver
Workpiece materials	Carbon Steels Aluminum forging	Carbon Steels Hard Steels Stainless Steels Aluminum forging Cast Irons Brass・Bronze	Stainless Steels Cast Irons	Copper

Note: Evaluation (tri-level) of characteristic features is just comparative of these four coatings, TiN, TiCN, TiAlN, and CrN, in the table. These coatings have great advantages of wear resistance, welding resistance, and reduced friction resistance. The values of vickers hardness are also higher than the heat treatment or nitriding of HSS cutting tools from the table.

The efficiency of TiN coating



The efficiency of TiCN coating



About combination use of machines, holders, and taps

The function and aspect of machine feed system

Fully synchronous feed (Rigid) system

Since spindle revolution and feed are synchronizing , perfect feed is expected.

Master lead screw feed system

Better-feed condition is expected because the tap is fed by master lead screw shaft that same pitch as this tap.

Gear feed system

The tap is fed as same pitch itself by the combinations of gears. This is also better-feed condition that is expected.

Asynchronous feed system by approximation

It is possible to set the values of spindle rotation and feed independently, but no inspection and control checking system are equipped that is unable to build complete feed system.

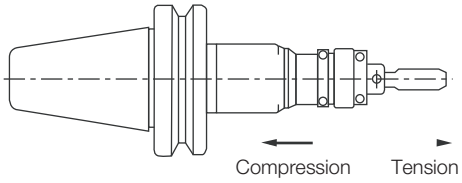
Hydraulic or Pneumatic pressure feed system

Feed is controlled by pressure regulation system, however, it is very hard to get optimum condition that usually makes results miss feeding.

Manual feed

Feed is controlled by worker that is very hard to keep stable amount of feed.

Holders aspects



Spring direction

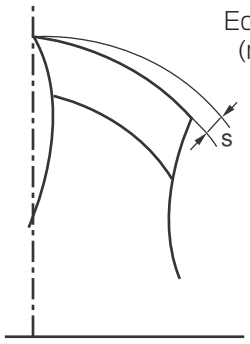
Complete fixed holder type

The tap is completely mounted with no clearance gap at collet and holder.

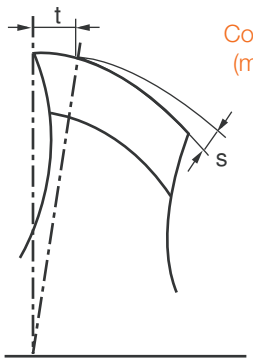
Adjustable spring floating holder (Tension & Compression)

Machine feed and tap's pitch errors are corrected by two types of spring system, Vertical tap's tensional direction and Vertical tap's compressional direction.)

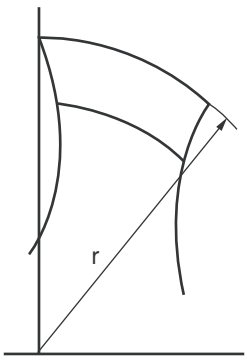
Types for characteristics of self-guidance behavior tapping



Cutting and machining performance are very high for this type; however, fully synchronous machining system with fixing holder is needed.
Example: "High speed tapping" and "fully synchronous tapping."



The combination of nice portion of margin and chamfer relief helps to make appropriate tap guidance.

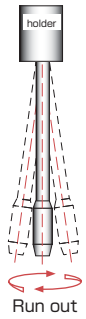


There is no relief at cutting edge that makes easy self-guidance tapping under less synchronous feed condition

The reasons for over-cutting of internal thread and its mechanism

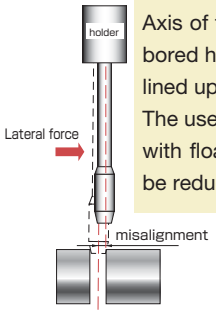
1. Run out, misalignment, inclined hole/cutting at inclined hole → Over-cutting at radial direction

Run out during tapping



Chuck needs to be adjusted-Tapping with run out could be observed and checked by idle running.

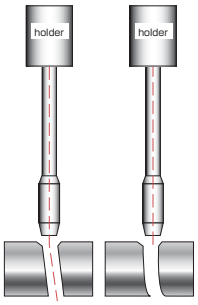
Misalignment during tapping



Solutions

Axis of tapping process and bored hole should be lined up correctly.
The use of adjustable holder with floating attachment will be reduced this problem.

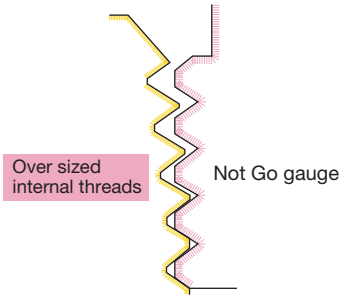
Inclined hole/Cutting at inclined hole



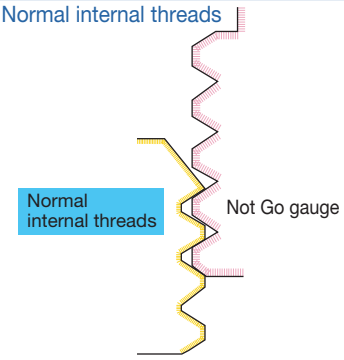
Confirmation of prepared hole condition.

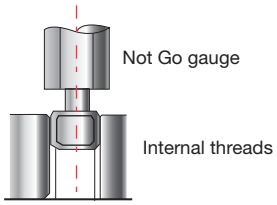
Over-cutting is caused by extra cutting of workpiece at rotational direction. This process is followed along bored hole, which small amount of over-cutting would be observed at bored hole bottom, and over-cutting would be observed at bored hole entrance.

Over-cutting at radial direction



Normal internal threads





2. Using not suitable selected tap or dull cutting edge might cause galling and over-cutting. → Over-cutting caused by galling and excess cutting

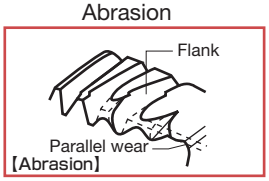
Tapping process with incorrect tap for workpiece

Tap
- Straight fluted tap
- Spiral fluted tap
- Spiral pointed tap
- Roll tap

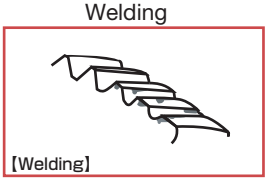
Selection of correct taps are strongly recommanded.

Tapping process with dull edge

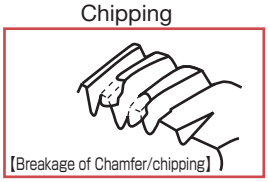
Abrasion



Welding

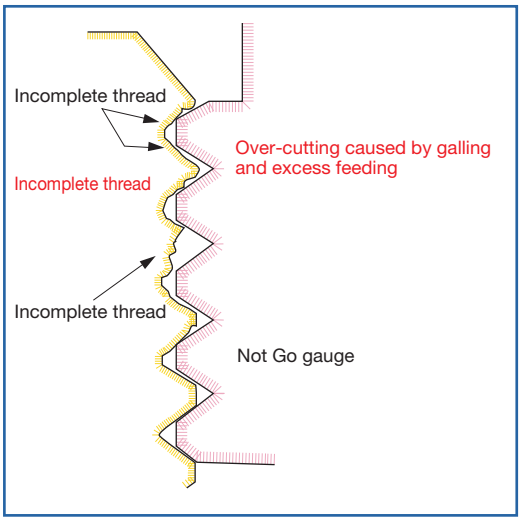


Chipping



Proper use of cutting oil, confirmed value to establish tool life constant

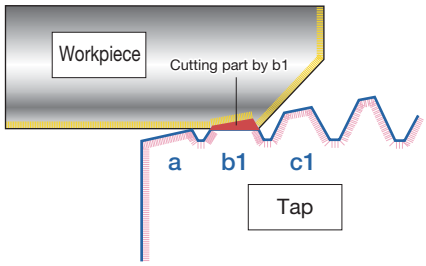
Torn thread is observed at the surface of internal thread.
When this situation is progressed, over-cutting of internal thread, deformed threads extraordinary, interrupted threads, and finally led into over-cutting of internal thread will be observed.



3. Tapping with miss feed condition ⟶ over-cutting at axial direction

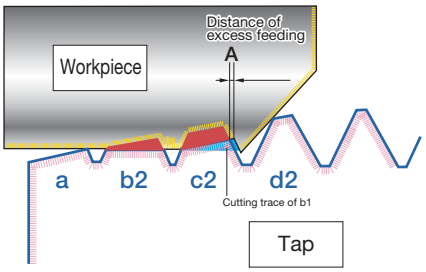
The mechanism that have done incomplete thread by

① At cutting edge b1, cutting chamfer



② Position after tapping 1 rotation

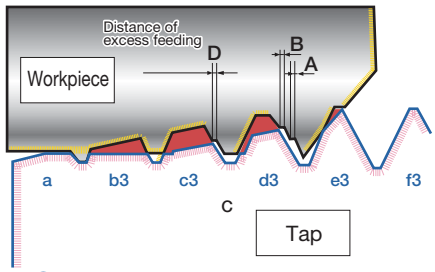
Cutting trace(b1) and thread phase of cutting face(c2) are misaligned until the distance of excess feeding A.



③ Position after tapping 2 rotations.

Cutting chamfer(c3) is misaligned until the distance of excess feeding B and cutting chamfer (d3) is misaligned until the distance of over feeding A+B.

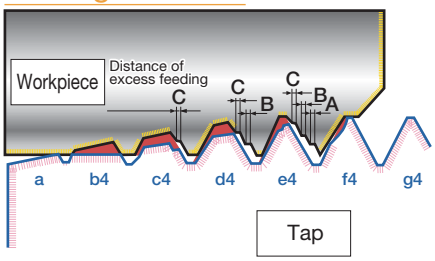
Cutting situation



④ Position after tapping 3 rotations.

Further, misaligned until the distance of excess feeding C

Cutting situation



Solutions

Feed adjustment is strongly recommended.

＊(Use of fully synchronous feed system and fixing holder)

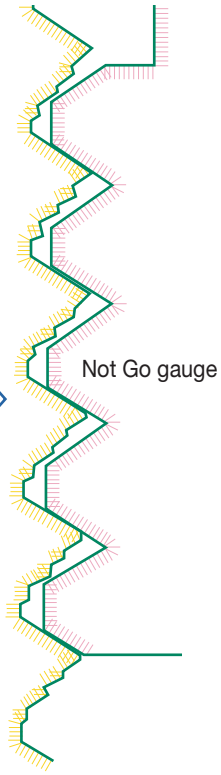
Cutting machine that doesn't have those listed functions such as drilling machine.

＊ The balance of main spindle adjustment is strongly recommended

＊ Use of floating holder and its adjustment

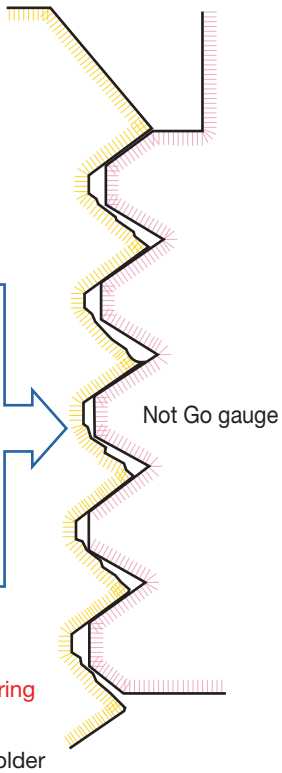
over-cutting thread by excess feeding

Clearance gap is observed at back frank,
and extra portion is cut at front frank that makes result incomplete threads



over-cutting thread by slow feeding

This mechanism makes result completely opposite to excess feeding over-cutting internal thread.
Clearance gap is observed at front frank and extra portion is cut at back frank.



The reason for over-cutting during tapping process (overview)

① tap mounted condition at holder
② condition of bored hole
③ cutting oil selection
④ adjustment of feed balance
⑤ proper use of tapping selection

Trouble Shooting

Troubles / Check point / Segments		Breakage			Excessive wear	
		Prevent excessive cutting torque	Prevent clogging of chips	Tap	Workpiece	Tap
Workpiece	Hardness	●Use workpiece which has even structure and hardness.			○Use workpiece which has even structure and hardness.	
	Shape	●Pay attention for tapping position and material thickness.			●Pay attention for tapping position and material thickness.	
	Bored hole	◎Provide bigger bored holes. ●Prevent work hardening.			○Provide bigger bored holes. ●Provide countersinking on hole entrance. ○Prevent work hardening.	
		◎Provide deeper tapping hole. ●Prevent slanting of hole.				
Machine		●Avoid inconsistent feed. ●Adjust feed stroke.				
Jigs, Holders		●Use tap holder of floating type. ◎Use tap holder with torque limiter.				
Cutting condition		○Reduce cutting speed.			○Reduce cutting speed.	
Lubricant		●Use the other cutting oil which prevents cold welding. ●Use non soluble type cutting oil.			●Provide proper timing for changing or filling-up of cutting oil. ●Prevent mixing of other oil into cutting oil. ●Use other cutting oil which prevents cold welding. ●Use cutting oil of non soluble type. ●Adjust flow of cutting oil and method of lubrication.	
On process			●Remove unnecessary chips during tapping. ●Provide bigger space for chips disposal.			
Tap	Selection			●Use PO tap(through hole). ●Use SP tap(blind hole). ●Use Roll tap.		
	Design		●Provide bigger chiproom.	●Change material of taps. ●Provide proper hardness on taps.		●Use set tap. ●Change material of taps. ●Provide proper hardness on taps.
		●Reconsider length of cutting chamfer. ●Use set tap.			●Reconsider length of cutting chamfer. ●Provide nitride on taps.	
	Re-grind	●Be careful about burning during re-sharpening. ●Provide proper land.			●Be careful about burning during re-sharpening. ●Increase re-sharpening frequency.	

<table>
<tr><th colspan="3">Undersize cutting of internal thread</th><th colspan="3">Bad surface, surface damaged</th></tr>
<tr><th>Improve cutting performance</th><th>Selection and design of tap</th><th>Work material</th><th>Improve cutting performance</th><th>Prevent welding</th><th>Check cutting condition</th></tr>
<tr><td></td><td></td><td>●Check workmaterial.</td><td></td><td></td><td>●Provide proper hardness on workpiece material.</td></tr>
<tr><td></td><td></td><td>●Pay attention for tapping position and material thickness.</td><td></td><td></td><td>●Pay attention for tapping position and material thickness.</td></tr>
<tr><td rowspan="2">●Adopt bigger tapping hole.
●Prevent work hardening of material.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>●Prevent work hardening of material.</td><td>●Adopt bigger tapping hole.</td><td>○Prevent slanting of hole.</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>○Feed according to pitch.</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>●Use the tap holder of floating type.
●Prevent vibrating of axis of tap
●Prevent centering -off with work piece.</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">●Reduce cutting speed.</td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="2">●Provide proper timing for changing or filling-up of cutting oil.
●Prevent mixing of other oil into cutting oil.
●Use other cutting oil which prevents cold welding.
●Use cutting oil with non soluble type.
●Adjust flow of cutting oil and method of lubrication.</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>●Remove unnecessary chips around tapping.</td><td></td></tr>
<tr><td>●Provide Nitride on taps.</td><td>◎Use oversize taps.</td><td></td><td>●Use spiral pointed taps (for through hole).</td><td>◎Provide oxide coating on taps.</td><td>◎Use oil hole taps.</td></tr>
<tr><td rowspan="2">○Provide larger cutting angle.</td><td rowspan="2">●Adjust relief angle on cutting chamfer.
○Provide thread relief.</td><td rowspan="2"></td><td>◎Provide larger cutting angle.
●Adjust relief angle on cutting chamfer.
○Provide more narrow margin.</td><td>●Change of no. of flutes on taps.</td><td>●Reconsider length of cutting chamfer.</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3" rowspan="2">●Increase re-sharpening frequency.</td><td>●Increase re-sharpening frequency.</td><td>●Provide better surface finishing on flutes.</td><td></td></tr>
<tr><td colspan="3">●Provide precise re-sharpening.
●Be careful about burning during re-sharpening.</td></tr>
</table>

Trouble Shooting

Troubles / Check point / Segments		Over-cutting of internal thread				
		Prevent uneven in feed of tap	Prevent over cutting on thread	Prevent welding	Check cutting condition	Prevent unbalance on entering
Workpiece	Hardness	●Use workpiece which has even structure and hardness.				
	Shape					
	Bored hole			●Provide bigger hole.	●Prevent slanting of hole.	●Provide countersinking on the hole entrance.
Machine		●Adjust a feed. ◎Feed according to pitch.				
Jigs, Holders					○Use tap holder of floating type.	◎Prevent vibrating of axis of tap. ○Prevent centering-off with work piece. ●Use tap holder of floating type.
Cutting condition				●Reduce cutting speed.		
Lubricant				●Use other cutting lubricant which prevents cold welding. ●Check the viscosity.		
On process						
Tap	Selection			◎Provide oxide surface treatment. ○Use tap with oil hole.		
	Design		○Provide small cutting angle. ●Adjust chamfer relief angle. ◎Check the width of thread margin.	●Provide short thread length.	●Reconsider number of flutes of tap.	●Reconsider number of flutes of tap.
	Re-grind		●Remove burrs on teeth after re-grinding. ●Provide proper land.		●Provide precise re-sharpening.	◎Care for vibration.

◎ : Most suitable solution ○ : Second most suitable solution

Chipping				Tapping operation	
Prevent clogging of chips	Prevent excessive cutting torque	Improve tapping method	Tap	Prevent clogging of chips	Tap
	●Use workpiece material which has even structure and hardness.				
		○Pay attention for tapping position and material thickness.		●If possible, use finer pitch tap or shorter tapping length.	
Provide deeper tapping hole(Blind hole).	◎Provide bigger tapping hole. ●Prevent work hardening.	●Prevent slanting of holes.		○Reduce cutting speed. ◎Provide deeper tapping hole(Blind hole).	
●Provide countersinking on hole the entrance.					
	●Avoid inconsistent feed.				
	○Use tapping holder with torque limiter.	●Prevent centering-off with workpiece. ●Prevent vibration of axis of tap. ●Use the tap holder of floating type.			●Use the tap holder of floating type. ●Prevent vibrating of axis of tap. ●Prevent centering -off with workpiece.
●Reduce cutting speed.				●Reduce cutting speed.	
	●Use the other cutting oil which prevent cold welding.			●Check the viscosity.	
●Remove unnecessary chips during tapping. ●Provide bigger space for chip disposal.				●Remove unnecessary chips during tapping. ●Provide bigger space for chip disposal.	
			●Use PO taps (Through hole). ●Use SP taps (Blind hole). ●Use Roll tap.		●Use PO taps (Through hole). ●Use SP taps (Blind hole). ●Use Roll tap.
●Provide bigger chip room.			●Change material of tap. ●Provide smaller cutting angle. ●Provide proper hardness.	●Provide bigger chip room. ●Reconsider length of cutting chamfer. ◎Use oil hole tap. ●Provide shorter thread length to tap.	
●Reduce cutting speed. ●Reduce cutting speed. ●Adjust relief angle on cutting chamfer.					
●Be careful about burning during re-sharpening.					

Thread Series

Unified Threads

Unit：mm

Size Column 1	Size Column 2	Nominal Dia. inch	Nominal Dia. mm	Threads per inch: Coarse UNC	Fine UNF	Extra Fine UNEF	Constant pitch series: 4UN	6UN	8UN	12UN	16UN	20UN	28UN	32UN
No. 0		0.0600	1.524		80									
	No. 1	0.0730	1.854	64	72									
No. 2		0.0860	2.184	56	64									
	No. 3	0.0990	2.515	48	56									
No. 4		0.1120	2.845	40	48									
No. 5		0.1250	3.175	40	44									
No. 6		0.1380	3.505	32	40									UNC
No. 8		0.1640	4.166	32	36									UNC
No.10		0.1900	4.826	24	32									UNF
	No.12	0.2160	5.486	24	28	32							UNF	UNEF
1/4		0.2500	6.350	20	28	32						UNC	UNF	UNEF
5/16		0.3125	7.938	18	24	32						20	28	UNEF
3/8		0.3750	9.525	16	24	32					UNC	20	28	UNEF
7/16		0.4375	11.112	14	20	28					16	UNF	UNEF	32
1/2		0.5000	12.700	13	20	28					16	UNF	UNEF	32
9/16		0.5625	14.288	12	18	24				UNC	16	20	28	32
5/8		0.6250	15.875	11	18	24				12	16	20	28	32
	11/16	0.6875	17.462			24				12	16	20	28	32
3/4		0.7500	19.050	10	16	20				12	UNF	UNEF	28	32
	13/16	0.8125	20.638			20				12	16	UNEF	28	32
7/8		0.8750	22.225	9	14	20				12	16	UNEF	28	32
	15/16	0.9375	23.812			20				12	16	UNEF	28	32
1		1.0000	25.400	8	12	20			UNC	UNF	16	UNEF	28	32
	1 1/16	1.0625	26.988			18			8	12	16	20	28	
1 1/8		1.1250	28.575	7	12	18			8	UNF	16	20	28	
	1 3/16	1.1875	30.162			18			8	12	16	20	28	
1 1/4		1.2500	31.750	7	12	18			8	UNF	16	20	28	
	1 5/16	1.3125	33.338			18			8	12	16	20	28	
1 3/8		1.3750	34.925	6	12	18		UNC	8	UNF	16	20	28	
	1 7/16	1.4375	36.512			18		6	8	12	16	20	28	
1 1/2		1.5000	38.100	6	12	18		UNC	8	UNF	16	20	28	
	1 9/16	1.5625	39.688			18		6	8	12	16	20		
1 5/8		1.6250	41.275			18		6	8	12	16	20		
	1 11/16	1.6875	42.862			18		6	8	12	16	20		
1 3/4		1.7500	44.450	5				6	8	12	16	20		
	1 13/16	1.8125	46.038					6	8	12	16	20		
1 7/8		1.8750	47.625					6	8	12	16	20		
	1 15/16	1.9375	49.212					6	8	12	16	20		
2		2.0000	50.800	4 1/2				6	8	12	16	20		
	2 1/8	2.1250	53.975					6	8	12	16	20		
2 1/4		2.2500	57.150	4 1/2				6	8	12	16	20		
	2 3/8	2.3750	60.325					6	8	12	16	20		
2 1/2		2.5000	63.500	4			UNC	6	8	12	16	20		
	2 5/8	2.6250	66.675				4	6	8	12	16	20		
2 3/4		2.7500	69.850	4			UNC	6	8	12	16	20		
	2 7/8	2.8750	73.025				4	6	8	12	16	20		
3		3.0000	76.200	4			UNC	6	8	12	16	20		
	3 1/8	3.1250	79.375				4	6	8	12	16			
3 1/4		3.2500	82.550	4			UNC	6	8	12	16			
	3 3/8	3.3750	85.725				4	6	8	12	16			
3 1/2		3.5000	88.900	4			UNC	6	8	12	16			
	3 5/8	3.6250	92.075				4	6	8	12	16			
3 3/4		3.7500	95.250	4			UNC	6	8	12	16			
	3 7/8	3.8750	98.425				4	6	8	12	16			
4		4.0000	101.600	4			UNC	6	8	12	16			
	4 1/8	4.1250	104.775				4	6	8	12	16			
4 1/4		4.2500	107.950				4	6	8	12	16			
	4 3/8	4.3750	111.125				4	6	8	12	16			
4 1/2		4.5000	114.300				4	6	8	12	16			
	4 5/8	4.6250	117.475				4	6	8	12	16			
4 3/4		4.7500	120.650				4	6	8	12	16			
	4 7/8	4.8750	123.825				4	6	8	12	16			
5		5.0000	127.000				4	6	8	12	16			
	5 1/8	5.1250	130.175				4	6	8	12	16			
5 1/4		5.2500	133.350				4	6	8	12	16			
	5 3/8	5.3750	136.525				4	6	8	12	16			
5 1/2		5.5000	139.700				4	6	8	12	16			
	5 5/8	5.6250	142.875				4	6	8	12	16			
5 3/4		5.7500	146.050				4	6	8	12	16			
	5 7/8	5.8750	149.225				4	6	8	12	16			
6		6.0000	152.400				4	6	8	12	16			

※：Please select the first column by priority. And select second column and third column if necessary.

Conversion Table

Threads per inch	Pitch
100	0.2540
80	0.3175
72	0.3528
64	0.3969
60	0.4233
56	0.4536
48	0.5292
44	0.5773
40	0.6350
36	0.7056
32	0.7938
28	0.9071
27	0.9407
24	1.0583
20	1.2700
19	1.3368
18	1.4111
16	1.5875
14	1.8143
13	1.9538
12	2.1167
11 1/2	2.2087
11	2.3091
10	2.5400
9	2.8222
8	3.1750
7	3.6286
6	4.2333
5	5.0800
4 1/2	5.6444
4	6.3500

Dimension table for Metric threads

Dimension table for Metric threads

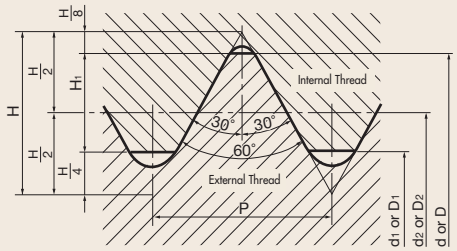
Unit:mm

nominal size \ pitch	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.6	0.7	0.75	0.8	1	1.25	1.5	1.75	2	2.5	3	3.5	4	4.5	5
1	0.2	0.25																				
1.1	0.2	0.25																				
1.2	0.2	0.25																				
1.4	0.2		0.3																			
1.6	0.2			0.35																		
1.7	0.2			0.35																		
1.8	0.2			0.35																		
2		0.25			0.4																	
2.2		0.25				0.45																
2.3		0.25			0.4																	
2.5				0.35		0.45																
2.6				0.35		0.45																
3				0.35			0.5	0.6														
3.5				0.35				0.6														
4							0.5		0.7	0.75												
4.5							0.5			0.75												
5							0.5			0.75	0.8											
5.5							0.5			0.75		1										
6							0.5			0.75		1										
7							0.5			0.75		1										
8							0.5			0.75		1	1.25									
9							0.5			0.75		1	1.25									
10							0.5			0.75		1	1.25	1.5								
11							0.5			0.75		1	1.25	1.5								
12							0.5			0.75		1	1.25	1.5	1.75							
13							0.5			0.75		1	1.25	1.5	1.75							
14							0.5			0.75		1	1.25	1.5	1.75	2						
15							0.5			0.75		1	1.25	1.5		2						
16							0.5			0.75		1	1.25	1.5		2						
17							0.5			0.75		1	1.25	1.5		2						
18							0.5			0.75		1	1.25	1.5		2	2.5					
19							0.5			0.75		1	1.25	1.5		2	2.5					
20							0.5			0.75		1	1.25	1.5		2	2.5					
22							0.5			0.75		1	1.25	1.5		2	2.5					
24							0.5			0.75		1	1.25	1.5		2		3				
25												1		1.5		2		3				
26												1		1.5		2		3				
27												1		1.5		2		3				
28												1		1.5		2		3				
30												1		1.5		2		3	3.5			
32												1		1.5		2		3	3.5			
33												1		1.5		2		3	3.5			
34												1		1.5		2		3				
35												1		1.5		2		3				
36												1		1.5		2		3		4		
37														1.5								
38												1		1.5		2		3				
39														1.5		2		3		4		
40														1.5		2		3		4		
42														1.5		2		3		4	4.5	
44														1.5		2		3		4		
45														1.5		2		3		4	4.5	
46														1.5		2		3		4		
48														1.5		2		3		4		5

※Letters in red mean Coarse screw threads.
※Please refer to PRAD system page 2 when you'd like to use PRAD system.
※Please contact our sales staff if you require the thread shown in above table,but its thread is not listed in this catalog.

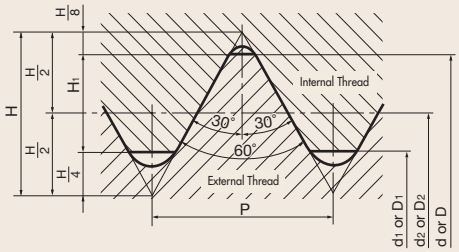
Basic profile of threads

Metric Screw Threads (M)



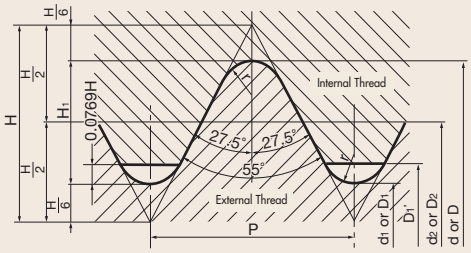
H =0.866025P
H_1 =0.541266P
d_2 =d−0.649519P
d_1 =d−1.082532P
D =d
D_2 =d_2
D_1 =d_1

Unified Screw Threads (UNC, UNF, etc.)



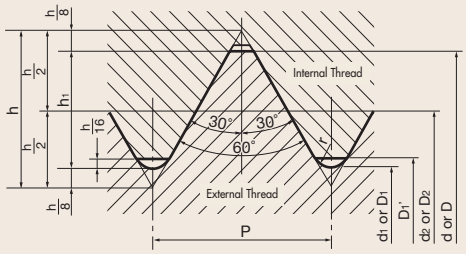
H =0.866025P
H_1 =0.541266P
d_2 =d−0.649519P
d_1 =d−1.082532P
D =d
D_2 =d_2
D_1 =d_1
P =25.4/n
n =Threads per inch

Whitworth Screw Threads (W)



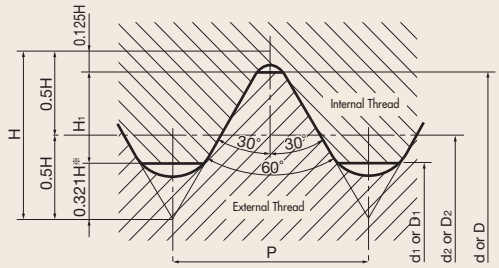
H =0.9605P
H_1 =0.6403P
d_2 =d−H_1
d_1 =d−2H_1
D =d
D_2 =d_2
D_1 =d_1
D_1' =d_1+2×0.0769H
r =0.1373P
P =25.4/n
n =Threads per inch

Screw Threads for Sewing Machine (SM)



H =0.8660P
H_1 =0.6495P
d_2 =d−h_1
d_1 =d−2h_1
D =d
D_2 =d_2
D_1 =d_1
D_1' =2×d_1+h/16
r =0.1083P
P =25.4/n
n =Threads per inch

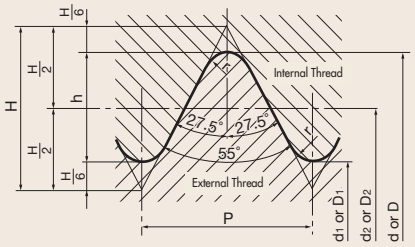
Miniature Screw Threads (S)



H =0.866025P
H_1 =0.48P
d_2 =d−0.649519P
d_1 =d−0.96P
D =d
D_2 =d_2
D_1 =d_1

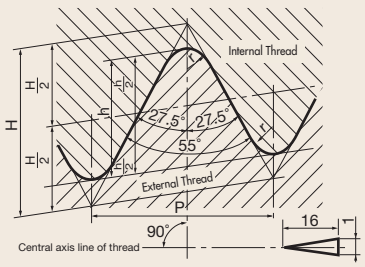
Note: This figure rounds off 0.320744H.

Parallel Pipe Threads (G, PF)



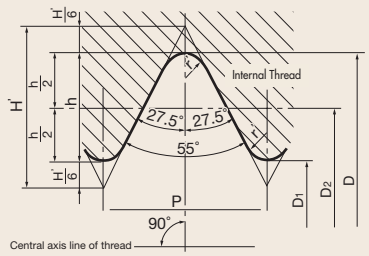
H =0.960491P
h =0.640327P
d_2 =d−h
d_1 =d−2h
D =d
D_2 =d_2
D_1 =d_1
r =0.137329P
P =25.4/n
n =Threads per inch

Taper Pipe Threads (R, Rc, PT)



H =0.960237P
h =0.640327P
r =0.137278P
P =25.4/n
n =Threads per inch

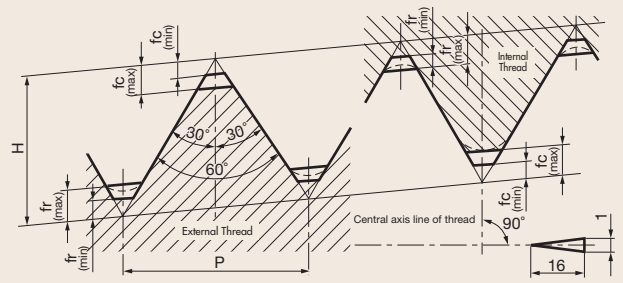
Taper Pipe Threads (Parallel) (Rp, PS)



H' =0.960491P
h =0.640327P
r' =0.137329P
P =25.4/n
n =Threads per inch

Basic profile of threads

American Standard Taper Pipe Threads (NPT)

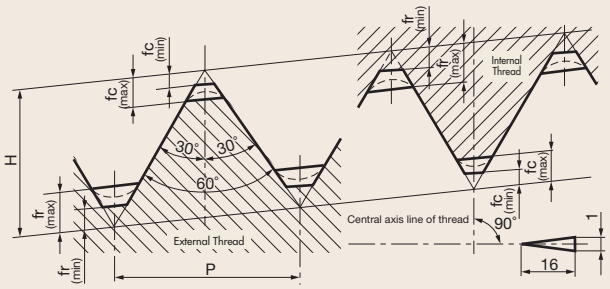


H =0.866025P
P =25.4/n
n =Threads per inch

Truncation Unit : mm

Threads per inch	Section	fc=fr
27	Max.	0.096P
	Min.	0.033P
18	Max.	0.088P
	Min.	0.033P
14	Max.	0.078P
	Min.	0.033P
11.5	Max.	0.073P
	Min.	0.033P
8	Max.	0.062P
	Min.	0.033P

Dryseal American Standard Taper Pipe Threads (NPTF)

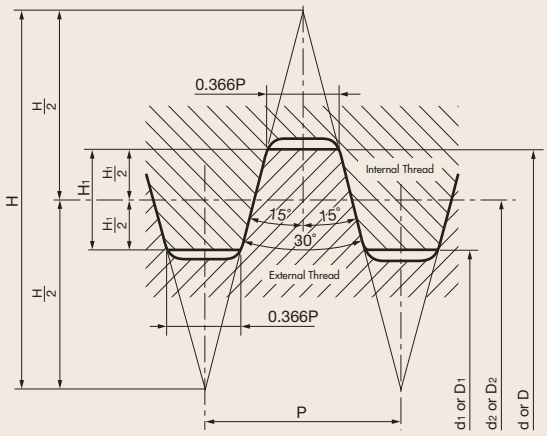


H =0.866025P
P =25.4/n
n =Threads per inch

Truncation Unit : mm

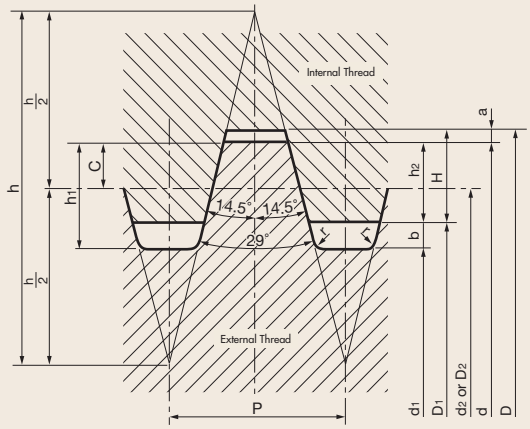
Threads per inch	Section	fc	fr
27	Max.	0.094P	0.140P
	Min.	0.047P	0.094P
18	Max.	0.078P	0.109P
	Min.	0.047P	0.078P
14	Max.	0.060P	0.085P
	Min.	0.036P	0.060P
11.5	Max.	0.060P	0.090P
	Min.	0.040P	0.060P
8	Max.	0.055P	0.076P
	Min.	0.042P	0.055P

Metric Trapezoidal Screw Threads (Tr)



H =1.866P
H1 =0.5P
d2 =d−0.5P
d1 =d−P
D =d
D2 =d2
D1 =d1

29° Trapezoidal Screw Threads (Tw)



h =1.9335P
h1 =2c+a
h2 =2c+a−b
H =2c+2a−b
c ≒0.25P
d2 =d−2c
d1 =d−2h1
P =25.4/n
D =d+2a
D2 =d2
D1 =d1+2b
n =Threads per inch

Symbols for Standard Threads

USA

Thread symbols	Kinds of threads	Related Standards
UN	Unified inch screw threads	ANSI B 1.1
UNC/UNRC	Unified coarse thread series	ANSI B 1.1
UNF/UNRF	Unified fine thread series	ANSI B 1.1
UNEF/UNREF	Unified extra-fine thread series	ANSI B 1.1
4UN/4UNR	Unified constant-pitch series with 4-threads	ANSI B 1.1
6UN/6UNR	Unified constant-pitch series with 6-threads	ANSI B 1.1
8UN/8UNR	Unified constant-pitch series with 8-threads	ANSI B 1.1
12UN/12UNR	Unified constant-pitch series with 12-threads	ANSI B 1.1
16UN/16UNR	Unified constant-pitch series with 16-threads	ANSI B 1.1
20UN/20UNR	Unified constant-pitch series with 20-threads	ANSI B 1.1
28UN/28UNR	Unified constant-pitch series with 28-threads	ANSI B 1.1
32UN/32UNR	Unified constant-pitch series with 32-threads	ANSI B 1.1
UN/UNRS	Unified threads of special diameters, pitches and lengths of engagement	ANSI B 1.1
NR	American National thread with a0.108p to 0.144p controlled root radius	MIL-B-7838
Acme	Acme screw threads	ANSI B 1.5
Stub-Acme	Stub Acme screw threads	ANSI B 1.8
Butt	Buttress inch screw threads	ANSI B 1.9
UNM	Unified miniature thread series	ANSI B 1.10
NC5	Class 5 interference-fit thread	ANSI B 1.12
NPT	American Standard taper pipe threads for general use	ANSI/ASME B 1.20.1
NPTR	American Standard taper pipe threads for railing joints	ANSI/ASME B 1.20.1
NPSC	American Standard straight pipe thread in pipe couplings	ANSI/ASME B 1.20.1
NPSL	American standard straight pipe threads for loose-fitting mechanical joints with locknuts	ANSI/ASME B 1.20.1
NPSM	American Standard straight pipe threads for free-fitting mechanical joints for fixture	ANSI/ASME B 1.20.1
NPSH	American Standard straight pipe threads for loose-fitting mechanical joints for hose couplings	ANSI/ASME B 1.20.1
NPTF	Dryseal American Standard taper pipe threads	ANSI B 1.20.3, 1.20.4
F-PTF	Dryseal fine taper pipe thread series	ANSI B 1.20.3, 1.20.4
PTF-SAE SHORT	Dryseal SAE short taper pipe threads	ANSI B 1.20.3, 1.20.4
PTF-SPL SHORT	Dryseal special short taper pipe threads	ANSI B 1.20.3, 1.20.4
PTF-SPL EXTRA SHORT	Dryseal special extra short taper pipe threads	ANSI B 1.20.3, 1.20.4
SPL-PTF	Dryseal special taper pipe threads	ANSI B 1.20.3, 1.20.4
NPSI	Dryseal American Standard intermediate internal straight pipe threads	ANSI B 1.20.3, 1.20.4
NPSF	Dryseal American Standard fuel internal straight pipe threads	ANSI B 1.20.3, 1.20.4
ANPT	Aeronautical National Form taper pipe threads	MIL-P-7150
NGO	National gas outlet threads	ANSI B 57.1
NGS	National gas straight threads	ANSI B 57.1
NGT	National gas taper threads	ANSI B 57.1
SGT	Special gas taper threads	ANSI B 57.1
NH	Hose coupling and firehose coupling threads	USAS B 2.4
NHR	Hose coupling and firehose coupling threads	USAS B 2.4
NPSH	Hose coupling and firehose coupling threads	USAS B 2.4
AMO	American standard microscope objective threads	ANSI B 1.11

Symbols for Standard Threads

Japan

Thread symbols	Kinds of threads	Related Standards
M	Metric screw threads, Coarse series	JIS B 0205-1～0205-4
M	Metric screw threads, Fine series	JIS B 0205-1～0205-4
S	Miniature screw threads	JIS B 0201
UNC	Unified threads, Coarse series	JIS B 0206
UNF	Unified threads, Fine series	JIS B 0208
Tr	Metric Trapezoidal screw threads	JIS B 0216
R	Taper external pipe threads	JIS B 0203（JIS main book）
Rc	Taper internal pipe threads	JIS B 0203（JIS main book）
Rp	Parallel internal pipe threads	JIS B 0203（JIS main book）
G	Parallel pipe threads	JIS B 0202（JIS main book）
PF	Parallel pipe threads	JIS B 0202（JIS Appendix）
PT	Taper pipe threads	JIS B 0203（JIS Appendix）
PS	Taper pipe threads (Parallel)	JIS B 0203（JIS Appendix）
CTC	Screw threads for rigid metal thin-walled conduit and fitting	JIS C 8305
CTG	Screw threads for rigid metal thick-walled conduit and fitting	JIS C 8305
BC	Cycle threads	JIS B 0225
SM	Screw threads for sewing machine	JIS B 0226(2001.2.20repeal)
E	Electric socket and lamp-base threads	JIS C 7709
V	Tyre valve threads of automobile	JIS D 4207
CTV	Tyre valve threads of cycle	JIS D 9422

ISO

Thread symbols	Kinds of threads	Related Standards
M	ISO Metric threads	ISO 261
S	ISO Miniature screw threads	ISO R 1501
Tr	ISO Metric trapezoidal screw threads	ISO 2902
UNC	ISO Unified threads, coarse series	ISO 263
UNF	ISO Unified threads, fine series	ISO 263
UNEF	ISO Unified threads, extra fine series	ISO 263
UN	ISO Unified threads, constant pitch series	ISO 263
UNJC	Unified threads (MIL Standard) coarse	ISO 3161
UNJF	Unified threads (MIL Standard) fine	ISO 3161
UNJEF	Unified threads (MIL Standard) extra fine	ISO 3161
UNJ	Unified threads (MIL Standard) constant pitch series	ISO 3161
MJ	Metric threads, MIL Standard	ISO 5855
R	Taper external pipe threads	ISO 7/1
Rc	Taper internal pipe threads	ISO 7/1
Rp	Parallel internal pipe threads	ISO 7/1
G	Parallel pipe threads	ISO 228/1
GL	Glass container threads	ISO R 1115
V	Tyre valve threads	ISO 4570/1～3

British※

Thread symbols	Kinds of threads	Related Standards
UNS	Unified special series	BS 1580
B.S.W.	British Standard Whitworth coarse threads	BS 84
B.S.F.	British Standard fine threads	BS 84
BSP	British Standard pipe thread (corresponding to R, Rc, Rp and G of ISO standard)	BS 21,2779
B.A.	B.A.-Screw threads	BS 93
Acme	General purpose, Acme screw threads	BS 1104
Buttress	Buttress threads	BS 1657
BSC	Cycle threads	BS 811
BSMO	Microscope objective threads	BS 3569
E	Edison screw threads	BS 5042
R.S.M	Rolled sheet metal screw threads and threads for molded plastics and die-cast materials	BS 2038

※：We left out the symbols after ISO standard was adopted.

German※

Thread symbols	Kinds of threads	Related Standards
GL	Glass containers thread.	DIN 168
S	Buttress thread.	DIN 513,2781,20401
Rd	Knuckle thread.	DIN 405,262,264,3182,7273,15403,20400
W	Whitworth-gewinde.	DIN 168,477,6630,4668,49301
KS,KT	Screw siles for packages made of Plastics.	DIN 6063
E	Edison screw thread.	DIN 40400
Pg	Steel conduit thread.	DIN 40430
Glasg	Thread for cover glasses, porcelain and cast iron caps.	DIN 40450
Vg	Automobile tyre valve thread.	DIN 7756
Gf	Thread for freezing pipes.	DIN 4930
Gg	Threads for drill pipe.	DIN 4941,20314
HA	Thread for bone screws and nuts.	DIN 58810
RMS	Thread connexion for microscope objectives.	DIN 58888
FG	Bicycle threads.	DIN 79012

※：We left out the symbols after ISO standard was adopted.

Cross chart of thread cutting tool standard

Tap and Dies names	JIS	TAS	ISO	ANSI	BS	DIN
General specification		4051				
Measuring method		4053				
Technical requirement			8830			2197
Thread limit (Metric)		4052	2857			
Thread limit (Pipe)			5969			
Hand taps (Metric coarse)	B4430	4105	529	B94.9	949	352
Hand taps (Metric fine)	B4430	4106	529	B94.9	949	2181
Hand taps (Unified coarse)	B4432	4107	529	B94.9	949	
Hand taps (Unified fine)	B4438		529	B94.9	949	
Hand taps (Parallel pipe thread)	B4445		2284	B94.9	949	
Hand taps (Taper pipe thread)	B4446		2284	B94.9	949	
Hand taps (American parallel pipe thread)		4113		B94.9		
Hand taps (American taper pipe thread)		4114		B94.9		
Hand taps (American dryseal parallel pipe thread)		4115		B94.9		
Hand taps (American dryseal taper pipe thread)		4116		B94.9		
Nut taps (Metric coarse)	B4433	4109			357	
Nut taps (Metric fine)		4110				
Nut taps (Unified coarse)		4111		B94.9		
Nut taps (Unified fine)		4112				
Machine taps (Metric coarse)						371,376
Machine taps (Metric fine)						374
Bent shank taps (Metric coarse)		4101				
Bent shank taps (Metric fine)		4102				
Bent shank taps (Unified coarse)		4103				
Bent shank taps (Unified fine)		4104				
Long shank machine taps (Metric thread)		4153	2283			
Long shank machine taps (Inch thread)		4153	2283			
Spiral pointed taps		4155		B94.9		
Spiral fluted taps		4154		B94.9		
Shell taps (Metric thread)		4117				
Pulley taps				B94.9		
Thread Forming taps				B94.9		
Blanks for carbide taps				B94.1		
Thread cutting round dies (Metric coarse, Adjustable)	B4451					223
Thread cutting round dies (Metric fine, Adjustable)	B4451					223
Thread cutting round dies (Metric, Solid)	B4451		2568		1127	223
Thread cutting round dies (Unified coarse adjustable)	B4451					
Thread cutting round dies (Unified fine adjustable)	B4451					
Thread cutting round dies (Unified thread)	B4451		2568		1127	
Thread cutting round dies (Parallel pipe thread)	B4455		4231		1127	5158
Thread cutting round dies (Taper pipe thread)	B4456		4230			5159
Hexagon dies			7226		1127	382

※：We left out the symbols after ISO standard was adopted.

Symbols: Organization names
ISO: International Organization for Standardization
JIS: Japanese Industrial Standards Committee
TAS: The Japan Small Tool Makers' Association
ANSI: American National Standards Institute
BS: British Standards Institution, UK
DIN: Deutsches Institiut fur Normung

Hardness conversion table

Conversion table from Rockwell C hardness of steel.※1 (Approximate)

Rockwell C Scale Hardness	Vickers Hardness	Brinell Hardness		Rockwell Hardness※3			Rockwell Superficial Hardness			Shore Hardness	MPa※2 Tensile Strength	Rockwell C Scale Hardness※3
		Standard ball	Tungsten Carbide ball	A scale	B scale	D scale	15-N scale	30-N scale	45-N scale			
68	940	–	–	85.6	–	76.9	93.2	84.4	75.4	97	–	68
67	900	–	–	85.0	–	76.1	92.9	83.6	74.2	95	–	67
66	865	–	–	84.5	–	75.4	92.5	82.8	73.3	92	–	66
65	832	–	(739)	83.9	–	74.5	92.2	81.9	72.0	91	–	65
64	800	–	(722)	83.4	–	73.8	91.8	81.1	71.0	88	–	64
63	772	–	(705)	82.8	–	73.0	91.4	80.1	69.9	87	–	63
62	746	–	(688)	82.3	–	72.2	91.1	79.3	68.8	85	–	62
61	720	–	(670)	81.8	–	71.5	90.7	78.4	67.7	83	–	61
60	697	–	(654)	81.2	–	70.7	90.2	77.5	66.7	81	–	60
59	674	–	(634)	80.7	–	69.9	89.8	76.6	65.5	80	–	59
58	653	–	615	80.1	–	69.2	89.3	75.7	64.3	78	–	58
57	633	–	595	79.6	–	68.5	88.9	74.8	63.2	76	–	57
56	613	–	577	79.0	–	67.7	88.3	73.9	62.0	75	–	56
55	595	–	560	78.5	–	66.9	87.9	73.0	60.9	74	2075	55
54	577	–	543	78.0	–	66.1	87.4	72.0	59.8	72	2015	54
53	560	–	525	77.4	–	65.4	86.9	71.2	58.6	71	1950	53
52	544	(500)	512	76.8	–	64.6	86.4	70.2	57.4	69	1880	52
51	528	(487)	496	76.3	–	63.8	85.9	69.4	56.1	68	1820	51
50	513	(475)	481	75.9	–	63.1	85.5	68.5	55.0	67	1760	50
49	498	(464)	469	75.2	–	62.1	85.0	67.6	53.8	66	1695	49
48	484	451	455	74.7	–	61.4	84.5	66.7	52.5	64	1635	48
47	471	442	443	74.1	–	60.8	83.9	65.8	51.4	63	1580	47
46	458	432	432	73.6	–	60.0	83.5	64.8	50.3	62	1530	46
45	446	421	421	73.1	–	59.2	83.0	64.0	49.0	60	1480	45
44	434	409	409	72.5	–	58.5	82.5	63.1	47.8	58	1435	44
43	423	400	400	72.0	–	57.7	82.0	62.2	46.7	57	1385	43
42	412	390	390	71.5	–	56.9	81.5	61.3	45.5	56	1340	42
41	402	381	381	70.9	–	56.2	80.9	60.4	44.3	55	1295	41
40	392	371	371	70.4	–	55.4	80.4	59.5	43.1	54	1250	40
39	382	362	362	69.9	–	54.6	79.9	58.6	41.9	52	1215	39
38	372	353	353	69.4	–	53.8	79.4	57.7	40.8	51	1180	38
37	363	344	344	68.9	–	53.1	78.8	56.8	39.6	50	1160	37
36	354	336	336	68.4	(109.0)	52.3	78.3	55.9	38.4	49	1115	36
35	345	327	327	67.9	(108.5)	51.5	77.7	55.0	37.2	48	1080	35
34	336	319	319	67.4	(108.0)	50.8	77.2	54.2	36.1	47	1055	34
33	327	311	311	66.8	(107.5)	50.0	76.6	53.3	34.9	46	1025	33
32	318	301	301	66.3	(107.0)	49.2	76.1	52.1	33.7	44	1000	32
31	310	294	294	65.8	(106.0)	48.4	75.6	51.3	32.5	43	980	31
30	302	286	286	65.3	(105.5)	47.7	75.0	50.4	31.3	42	950	30
29	294	279	279	64.7	(104.5)	47.0	74.5	49.5	30.1	41	930	29
28	286	271	271	64.3	(104.0)	46.1	73.9	48.6	28.9	41	910	28
27	279	264	264	63.8	(103.0)	45.2	73.3	47.7	27.8	40	880	27
26	272	258	258	63.3	(102.5)	44.6	72.8	46.8	26.7	38	860	26
25	266	253	253	62.8	(101.5)	43.8	72.2	45.9	25.5	38	840	25
24	260	247	247	62.4	(101.0)	43.1	71.6	45.0	24.3	37	825	24
23	254	243	243	62.0	100.0	42.1	71.0	44.0	23.1	36	805	23
22	248	237	237	61.5	99.0	41.6	70.5	43.2	22.0	35	785	22
21	243	231	231	61.0	98.5	40.9	69.9	42.3	20.7	35	770	21
20	238	226	226	60.5	97.8	40.1	69.4	41.5	19.6	34	760	20
(18)	230	219	219	–	96.7	–	–	–	–	33	730	(18)
(16)	222	212	212	–	95.5	–	–	–	–	32	705	(16)
(14)	213	203	203	–	93.9	–	–	–	–	31	675	(14)
(12)	204	194	194	–	92.3	–	–	–	–	29	650	(12)
(10)	196	187	187	–	90.7	–	–	–	–	28	620	(10)
(8)	188	179	179	–	89.5	–	–	–	–	27	600	(8)
(6)	180	171	171	–	87.1	–	–	–	–	26	580	(6)
(4)	173	165	165	–	85.5	–	–	–	–	25	550	(4)
(2)	166	158	158	–	83.5	–	–	–	–	24	530	(2)
(0)	160	152	152	–	81.7	–	–	–	–	24	515	(0)

※1 : Bold-faced numbers are based on the table of ASTM E 140

※2 : 1 Mpa=1N/mm2

※3 : In above table, numbers in parenthesis are only for reference.

This table is abstracted from SAE J 417.

Screw Thread Terms and Definitions

Major Diameter — The largest diameter of a straight thread.

Minor Diameter — The smallest diameter of a straight thread

Angle of Thread — The angle included between the flanks of the thread measured in an axial plane.

Half Angle of Thread — The angle included between a flank of thread and the normal (90°) to the axis, measured in an axial plane.

Pitch — The distance from a point on a screw to a corresponding point on the next thread measured parallel to the axis.

Metric —The pitch in inches $= \frac{\text{Pitch in Millimeters}}{25.4}$

Inches — The pitch in inches $= \frac{1}{\text{Number of threads per inch}}$

Lead of Thread — The distance a screw thread advances axially in one turn. On a single-thread screw the lead and pitch are identical. On a double-thread, the lead is 2 x the pitch. On a triple-thread the lead is 3 x pitch, etc.

Lead Angle — The angle made by the helix of a thread at the pitch diameter with a line perpendicular to the axis.

Tolerance — The total amount of variation permitted from a specified dimension. Tolerance may be expressed plus, minus or both.

Allowance — The intentional minimum clearance between mating threads.

Length of Engagement — The length that is engaged measured parallel to the axis, when mating parts are fully assembled.

Pitch Diameter — On a straight screw thread, the diameter of an imaginary cylinder, the surface of which would pass through the threads at such points as to make equal the width of the threads and the width of the spaces cut by the surface of the cylinder.