Greenfield LIGHTNING® SERVICE

Rely on Greenfield's Lightning® Service program to deliver the special taps you need, when and where you need them, via your local authorized distributor. Within minutes of a call, Greenfield can quote, process, and release your order to the factory. This rapid response allows us to make and ship your order quickly, often with only a 24-hour lead time.

Greenfield special taps can be used for tapping popular materials such as Steels, Cast Iron, Aluminum, or Brass. We can also custom design tools to thread even the most difficult materials such as Inconel, Titanium, and other High-Pressure Alloys. When success is measured by accurate thread pitch diameters and proper gage fits, you can depend on Greenfield Tap and Die for special taps made to your order.

Let Greenfield's Lightning Service program spark your production. Contact your authorized Greenfield distributor for details.

Greenfield LIGHTNING® SERVICE Available

QUICK REFERENCE

Technical Data

Tapping Guide

Based on 65-75% threads, 1-2X diameter, through hole

Material	Condition	Hardness		Speed	EM Style Taps									Forming Taps			GUN®
		BHN	HRC	FPM	SS	SS TiN	SS TiCN	Mold	NI	NI TiCN	TI	AL	ALS	*EM-TL TiCN	*EM-TLD TiCN	#5500	GUN GP+
Low Carbon Steel, Wrought																	
1005-1029, 1513-1522	Normalized or	< 175	< 9	50-75	•	•	•							•	•	•	•
	Cold Drawn	< 276	< 30	40-60	•	•	•										•
Medium Carbon Steel, Wrought																	
1030-1055, 1525-1522	Normalized	< 250	< 25	30-50	•	•	•							•	•	•	•
	Hardened	< 350	< 38	15-25	■	■	■	•	•	•							
High Carbon Steel, Wrought																	
1060-1069, 1070-1078	Annealed	< 275	<30	30-50	•	•	•							•	•	•	•
1080-1086, 1095, 1561	Hardened	<350	< 38	15-25				■	•	•							
Low Carbon Alloy Steel, Wrought																	
4023, 4320, 5120	Normalized	< 250	< 25	30-45	•	•	•							•	•	•	•
8115, 8622	Hardened	< 350	<38	25-35				•	•	•							
Medium Carbon Alloy Steel, Wrought																	
4032, 4130	Normalized	< 250	< 25	25-35	•	•	•							•	•	•	•
5135, 8630	Hardened	< 350	< 38	15-20				•	•	•							
Aluminum Alloys, Wrought																	
2011-2025, 5050	Cold Drawn	< 80	-	95-125	■†	•						•	•	■	■	•	
6061, 7075	Treated	< 150	-	75-100	■†	•						•	•	■	■	•	
Aluminum Die Cast	As Cast	< 100	-	100-150	■†	•						•	•	■	■	•	
	Treated	<125	-	70-100	■†	•						•	•	■	■	•	
High Silicon Aluminum	Si > 10%	<125	-	25-40	■†	•						•	•	■	■	•	■
Brass, Cast		-	-	50-70	■†	•			■					■	■	•	
Bronze, Cast		-	-	40-60	■†	•			■					■	■	•	
Copper		-	-	30-50	■†	•					■	•	•	■	■	•	
Copper, Beryllium		-	-	35-80	■†	•					■	•		■	■	•	
Magnesium Alloys		< 100	-	100-150	■†	•					■		•	■	■	•	
Type 8 Exotic Cobalt Base Alloys Wrought and Cast																	
AiResist 213, V36, S-816	Treated	< 230	< 22	5-8	■				•	•							
Haynes 25(L-605), Stellite	Treated/Aged	<320	<34	3-5					•	•	■						
HS-31, HS-51	Cast/Aged	<290	<32	3-5					•	•	■						
Type 9 Exotic Iron Base Alloys, Wrought																	
A-286, Discaloy, N-155	Treated	<230	<22	10-15	■	■			•								
V57, W-545, Incoloy 800, Incoloy 801	Treated/Aged	<320	<34	7-10					•		■						
Incoloy 802, 16-25-6, 19-90L									•								
Type 10 Tool Steels, Wrought																	
H10, H11, H12, H13, H14	Annealed	<250	<25	15-25	•	■	■	•									
H19, H21, H26, H42	Hardened	<375	<41	15-20				•	■	•							
D2, D3, D4, D5, D7, A7	Annealed	<150		30-45	•	■		•									
P2, P4, P5, P6	Annealed	<250	<25	10-15	■		■	•									
P20, P21	Annealed	<200	<16	25-35	■	■	■	•									
Type 11 Armor Plate, Wrought																	
HY80, HY100	Annealed	<250	<25	25-35	•	•		■	•	•							
MIL-S-12560, MIL-S-16216	Hardened	<300	<33	18-30	■	■		■	•	•							
	Hardened	<350	<38	15-25				■	•	•							
Type 12 High Strength Steels, Wrought																	
300M, 4340, D6AC, 4340Si	Normalized	<350	<38	15-20	■	■	■	■	•	•							
98BV40	Normalized	<400	<43	10-15				■	•	•							
	Hardened	<460	<48	5-7					•	•							
HP9-4-20, HP25, HP30, HP45	Annealed	<375	<41	10-15				■	•	•							
	Hardened	<460	<48	7-10					•	•							
Type 13 Maraging Steels, Wrought																	
200Grade, 250Grade, 300Grade	Annealed	<325	<35	15-20	■		■	■	•	•							
350Grade, HY230																	
120Grade, 180Grade	Annealed	<325	<35	25-35	■		■	■	•	•							
	Maraged	<425	<45	7-10					•	•							

• FIRST CHOICE ■ ALTERNATE

** EM-TLD a TiCN coated forming tap designed to tap dry, or with mist coolant for 1 to 1 1/2 diameters in tapping depth. EM forming taps & TRU-LEDE forming taps can be run 1.5 to 2 times faster than the tapping speeds recommended for thread cutting taps.*

Recommendations adapted from the Machining Data Handbook, 3rd edition, by permission of the Machinability Data Center, © 1980 by Metcut Research Associates, Inc.

Continued on next page.

†Uncoated finish

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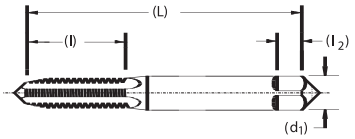
Tapping Guide

Material	Condition	Hardness BHN	Hardness HRC	Speed FPM	EM Style Taps SS	SS TiN	SS TiCN	Mold	NI	NI TiCN	TI	Forming Taps EM-TL TiCN	Forming Taps *EM-TLD TiCN	GUN® GUN GP+
Type 1 Ferritic Stainless Steel, Wrought														
405, 409, 430, 434, 436, 442, 446, 502	Annealed	< 185	<12	25-40	•	•	•					•	■	•
Type 2 Austenitic Stainless Steel, Wrought														
201, 202, 301, 302, 303, 304,	Annealed	< 185	<12	18-25	•	•	•					•	■	•
305, 308, 309, 310, 314, 316,	Cold Drawn	< 275	< 30	12-20	•	•	•		•	•		•	■	•
317, 321, 330, 347, 384, 385														
Nitronic	Annealed	< 250	< 25	12-20	•	•	•		•	•		•	■	•
	Cold Drawn	< 375	< 41	7-15		■	■		•	•				
Type 3 Martensitic Stainless - Steel Wrought														
403, 410, 420, 422	Annealed	< 175	< 9	25-40	•	•	•		■			•	■	•
501, 502	Annealed	< 225	< 21	18-30	•	•	•		■			•	■	•
	Hardened	< 325	< 35	18-25	■	•	•		•	•				
	Hardened	< 425	< 45	10-18		■	■		•	•				
414, 431	Annealed	< 275	< 30	18-25	■	■	■		•	•				
Greek Ascoloy	Hardened	< 325	< 35	12-20	■	■	■		•	•				
	Hardened	< 425	< 45	7-15					•	•				
440A, 440B, 440C	Annealed	< 275	< 30	12-20	■	■	■		•	•				
	Hardened	< 325	< 35	10-18		■	■		•	•				
	Hardened	< 425	< 45	7-15					•	•				
Type 4 Precipitation Hardening - Stainless Steel Wrought														
15-5PH, 16-6PH, 17-4PH	Annealed	< 200	< 16	18-30		■		•	•	•				
17-7PH, AF71, AM350, AM355	Hardened	< 325	< 35	15-25		■		■	•	•				
PH13-8MO, PH14-8MO, PH15-7MO	Hardened	< 375	< 41	12-20				■	•	•				
Custom 450 HNM	Hardened	<440	< 47	6-12				■	•	•				
Type 5 Titanium Alloys, Wrought														
Commercial Pure	Annealed	< 170	< 7	40-60	•	•					•			
Commercial Pure	Annealed	< 200	< 16	30-50	■	■					•			
Commercial Pure	Annealed	< 275	< 30	25-40		■					•			
Ti-5AL-2.5Sn	Annealed	< 340	< 37	15-25							•			
Ti-6AL-4V	Annealed	< 350	< 38	15-20							•			
Ti-6AL-6V-2Sn	Annealed	< 370	< 40	10-15							•			
Ti-6AL-4V	Treated	< 380	< 41	7-10							•			
Ti-6AL-6V-2Sn	Treated	< 440	< 46	5-7							•			
Type 6 Nickel Alloys, Wrought and Cast														
Nickel 200 - Nickel 270	Annealed	< 170	< 7	15-25					•	•	■			
Monel 400, 401, 404, Monel R405	Annealed	< 240	< 23	15-20					•	•	■			
Monel 502, Monel K500	Treated	< 360	< 39	3-5					•	•	■			
Perma Nickel 300, Duranickel 301									•	•				
Type 7 Exotic Nickel, Base Alloys - Wrought and Cast														
Inconel 625, 702, 706, 718, 721, 722	Annealed	< 300	< 33	7-10					•	•	■			
Inconel X-759, 751, 901, Haynes 263	Treated	< 400	< 43	4-7					•	•	■			
M252, Nimonic 75, 80, Waspaloy									•	•				
Astroloy, Inconel 700	Treated	< 300	< 33	5-8					•	•	■			
Nimonic 90, 95, Rene 41, 63	Treated	< 400	< 43	3-5					•	•	■			
Udimett 500, 700, 710									•	•				
AF2-1DA, Rene 77, Rene 95	Treated	< 390	< 43	4-7					•	•	■			
Unitemp 1753	Treated	< 475	< 49	3-5					•	•	■			
Hastelloy B, C, G, S, X	Annealed	< 220	< 20	7-10					•	•	■			
Incoloy 804, Incoloy 825	Cold Drawn	< 310	< 34	4-7					•	•	■			
Inconel 600, Inconel 601									•	•				
Udimet 630, Retractaloy 26									•	•				
M252, Rene 80, Rene 125	As cast or	< 320	< 34	3-5					•	•	■			
B-1900, GMR-235, IN-100, IN-738	Cast/Aged								•	•				
MAR-M200, 246, 421, 432									•	•				
Inconel 718, Udimet 500, 700									•	•				

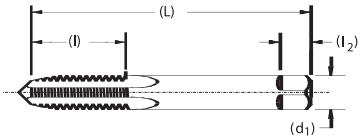
• FIRST CHOICE ■ ALTERNATE

*See note on page 181.

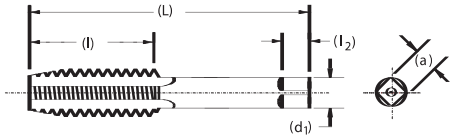
Standard Tap Dimensions, Ground Thread - Reference USCTI Table 302



Blank Design 1



Blank Design 2



Blank Design 3

Nominal Diameter Range Inches Over	To (Inc.)	Machine Screw Size Number (Inches)	Nominal Fractional Diameter Inches	Nominal Metric Diameter Millimeters, (Inches)	Blank Design No.	Overall Length L	Thread Length l	Square Length l2	Shank Diameter d1	Square Size a
.052	.065	0 (.0600)		M1.6 (.0630)	1	1.63	.31	.19	.1410	.110
.065	.078	1 (.0730)		M1.8 (.0709)	1	1.69	.38	.19	.1410	.110
.078	.091	2 (.0860)		M2 (0787), M2.2 (.0866)	1	1.75	.44	.19	.1410	.110
.091	.104	3 (.0990)		M2.5 (.0984)	1	1.81	.50	.19	.1410	.110
.104	.117	4 (.1120)			1	1.88	.56	.19	.1410	.110
.117	.130	5 (.1250)		M3 (.1181)	1	1.94	.63	.19	.1410	.110
.130	.145	6 (.1380)		M3.5 (.1378)	1	2.00	.69	.19	.1410	.110
.145	.171	8 (.1640)		M4 (.1575)	1	2.13	.75	.25	.1680	.131
.171	.197	10 (.1900)		M4.5 (.1772),M5 (.1969)	1	2.38	.88	.25	.1940	.152
.197	.223	12 (.2160)			1	2.38	.94	.28	.2200	.165
.223	.260		1/4 (.2500)	M6 (.2362)	2	2.50	1.00	.31	.2550	.191
.260	.323		5/16 (.3125)	M7 (.2756), M8 (.3150)	2	2.72	1.13	.38	.3180	.238
.323	.395		3/8 (.3750)	M10 (.3937)	2	2.94	1.25	.44	.3810	.286
.395	.448		7/16 (.4375)		3	3.16	1.44	.41	.3230	.242
.448	.510		1/2 (.5000)	M12 (.4724)	3	3.38	1.66	.44	.3670	.275
.510	.573		9/16 (.5625)	M14 (.5512)	3	3.59	1.66	.50	.4290	.322
.573	.635		5/8 (.6250)	M16 (.6299)	3	3.81	1.81	.56	.4800	.360
.635	.709		11/16 (.6875)	M18 (.7087)	3	4.03	1.81	.63	.5420	.406
.709	.760		3/4 (.7500)		3	4.25	2.00	.69	.5900	.442
.760	.823		13/16 (.8125)	M20 (.7874)	3	4.47	2.00	.69	.6520	.489
.823	.885		7/8 (.8750)	M22 (.8661)	3	4.69	2.22	.75	.6970	.523
.885	.948		15/16 (.9375)	M24 (.9449)	3	4.91	2.22	.75	.7600	.570
.948	1.010		1 (1.0000)	M25 (.9843)	3	5.13	2.50	.81	.8000	.600
1.010	1.073		1-1/16 (1.0625)	M27 (1.0630)	3	5.13	2.50	.88	.8960	.672
1.073	1.135		1-1/8 (1.1250)		3	5.44	2.56	.88	.8960	.672
1.135	1.198		1-3/16 (1.1875)	M30 (1.1811)	3	5.44	2.56	1.00	1.0210	.766
1.198	1.260		1-1/4 (1.2500)		3	5.75	2.56	1.00	1.0210	.766
1.260	1.323		1-5/16 (1.3125)	M33 (1.2992)	3	5.75	2.56	1.06	1.1080	.831
1.323	1.385		1-3/8 (1.3750)		3	6.06	3.00	1.06	1.1080	.831
1.358	1.448		1-7/16 (1.4375)	M36 (1.4173)	3	6.06	3.00	1.13	1.2330	.925
1.448	1.510		1-1/2 (1.5000)		3	6.38	3.00	1.13	1.2330	.925
1.510	1.635		1-5/8 (1.6250)	M39 (1.5354)	3	6.69	3.19	1.13	1.3050	.979
1.635	1.760		1-3/4 (1.7500)	M42 (1.6535)	3	7.00	3.19	1.25	1.4300	1.072
1.760	1.885		1-7/8 (1.8750)		3	7.31	3.56	1.25	1.5190	1.139
1.885	2.010		2 (2.0000)	M48 (1.8898)	3	7.63	3.56	1.38	1.6440	1.233
2.010	2.135		2 1/8 (2.1250)		3	8.00	3.56	1.38	1.7690	1.327
2.135	2.260		2 1/4 (2.2500)	M56 (2.2047)	3	8.25	3.56	1.44	1.8940	1.420
2.260	2.385		2 3/8 (2.3750)		3	8.50	4.00	1.44	2.0190	1.514
2.385	2.510		2 1/2 (2.5000)		3	8.75	4.00	1.50	2.1000	1.575
2.510	2.635		2 5/8 (2.6250)	M64 (2.5197)	3	8.75	4.00	1.50	2.2250	1.669
2.635	2.760		2 3/4 (2.7500)		3	9.25	4.00	1.56	2.3500	1.762
2.760	2.885		2 7/8 (2.8750)	M72 (2.8346)	3	9.25	4.00	1.56	2.4750	1.856
2.885	3.010		3 (3.0000)		3	9.75	4.56	1.63	2.5430	1.907
3.010	3.135		3 1/8 (3.1250)		3	9.75	4.56	1.63	2.6680	2.001
3.135	3.260		3 1/4 (3.2500)	M80 (3.1496)	3	10.00	4.56	1.75	2.7930	2.095
3.260	3.385		3 3/8 (3.3750)		3	10.00	4.56	1.75	2.8830	2.162
3.385	3.510		3 1/2 (3.5000)		3	10.25	4.94	2.00	3.0080	2.256
3.510	3.635		3 5/8 (3.6250)	M90 (3.5433)	3	10.25	4.94	2.00	3.1330	2.350
3.635	3.760		3 3/4 (3.7500)		3	10.50	5.31	2.13	3.2170	2.413
3.760	3.885		3 7/8 (3.8750)		3	10.50	5.31	2.13	3.3420	2.506
3.885	4.010		4 (4.0000)	M100 (3.9370)	3	10.75	5.31	2.25	3.4670	2.600

Standard Tap Dimensions, Ground Thread - Reference USCTI Table 302

Tolerances

Element	Nominal Diameter Range in Inches Over	To (Inc.)	Direction	Tolerance (Inches)
Length Overall - L	.0520	1.0100	Plus or Minus	.031
	1.0100	4.0100	Plus or Minus	.063
Length of Thread - l	.0520	.2230	Plus or Minus	.047
	.2230	.5100	Plus or Minus	.063
	.5100	1.5100	Plus or Minus	.094
	1.5100	4.0100	Plus or Minus	.125
Length of square - l2	.0520	1.0100	Plus or Minus	.031
	1.0100	4.0100	Plus or Minus	.063
Diameter of shank - d1	.0520	.2230	Minus	.0015
	.2230	.6350	Minus	.0015
	.6350	1.0100	Minus	.0020
	1.0100	1.5100	Minus	.0020
	1.5100	2.0100	Minus	.0030
	2.0100	4.0100	Minus	.0030
Size of square - a	.0520	.5100	Minus	.004
	.5100	1.0100	Minus	.006
	1.0100	2.0100	Minus	.008
	2.0100	4.0100	Minus	.010

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Special Taps

Unless otherwise specified:

Special taps over 1.010" to 1.510" diameter inclusive, having 14 or more threads per inch or 1.75 millimeter pitch and finer, and sizes over 1.510" diameter with 10 or more threads per inch or 2.5 millimeter pitch and finer, are made to general dimensions shown in USCTI Table 303.

Special tap thread limits are determined using the formulas shown in USCTI Table 331 for Unified Inch Screw Threads and USCTI Table 341 for Metric M-Profile Screw Threads.

NOTES

Tap sizes .395" and smaller have an external center on the thread end (may be removed on bottoming taps). Sizes .125" and smaller have an external center on the shank end. Sizes .224" thru .395" have truncated partial cone centers on the shank end (length of cone approx. 1/4 of diameter of shank). Sizes over .395" have internal centers on both the thread and shank ends.

For standard thread limits and tolerances for Unified Inch Screw Threads see USCTI Table 327 and for Metric Threads see USCTI Table 337.

For eccentricity tolerances of tap elements see USCTI Table 317.

Importance of Proper Lubricants in Tapping

Applying the proper lubricants in tapping operations can result in longer tap life, increased production, better workpiece size control, smoother and more accurate threads, less resharpening, and more efficient chip removal.

Generally, for best tap performance, straight cutting oil should be used. For non-ferrous and non-metallic materials, a coolant or a cutting fluid (light oil or soluble oil) is recommended.

Often, machining centers are equipped with a coolant or a cutting fluid that contains enough water and oil to provide adequate cooling and lubrication for a variety of tools and workpieces. However, most soluble blends are not suitable for tapping applications. Tapping, especially with thread-forming taps, requires more lubrication than cooling. A coolant or cutting fluid might lack the lubrication necessary to obtain acceptable tool life and part finish. Consult your coolant specialist for recommendations.

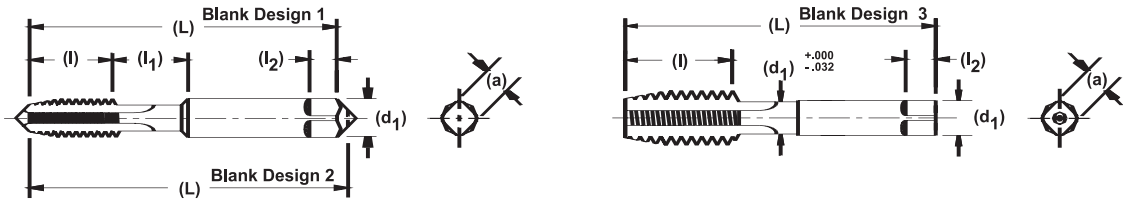
After you select the proper lubricant, it is also important to choose the right method of application and pressure. For tapping, use more than one nozzle around the tap. The nozzles should be located as close to the surface of the part as possible, be positioned at an angle close to the axis of the tool, and point directly into the hole to flush the chips from the flutes. For horizontal tapping, where the tap is stationary and the workpieces is rotating, consider using two streams of lubricant, one on each side of the tap.

Whether you are tapping vertically, horizontally, or on an angle, make sure the lubricant reaches the cutting lands of the tap at all times, especially at the point or chamfered portion. Brushing or squirting oil or fluid onto the tap does not provide sufficient lubrication. In fact, heavy viscosity oil may cause the chips to "stick" or "cling" to the tap, increasing the chance of breakage. In addition, when the lubricant is automatically applied only on the forward motion of the tap, you should time the application of the lubricant so that it will reach the hole before the tap starts to cut. This applies particularly to machines on which the cutting fluid is automatically shut off during the tap's reversal.

For maximum effectiveness, it is often best to force the lubricant into the hole under pressure. The amount of pressure applied varies depending on the tapping method, hole depth, and tapping speed.

Try to keep tapping lubricants as clean as possible using a filtering system or other equipment. Dust and other foreign particles can contaminate the oil and decrease its effectiveness. Be sure to thoroughly clean machines and oil tanks when adding new lubricant and at regular intervals to ensure optimum tapping results.

Optional Neck and Optional Shortened Thread Length Dimensions - Reference USCTI Table 302A

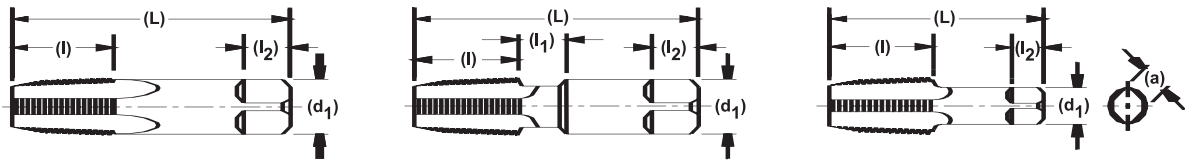


General Dimensions

Nominal Diameter Range—Inches Over	To (inc.)	Machine Screw Size No. (Inches)	Nominal Fractional Diameter Inches	Nominal Metric Diameter MM (inches)	Blank Design No.	Overall Length L	Tap Dimensions—Inches Thread Length l	Neck Length l1	Square Length l2	Shank Diameter d1	Size of Square a
.104	.117	4 (.1120)			1	1.88	.31	.25	.19	.1410	.110
.117	.130	5 (.1250)		M3 (.1181)	1	1.94	.31	.31	.19	.1410	.110
.130	.145	6 (.1380)		M3.5 (.1378)	1	2.00	.38	.31	.19	.1410	.110
.145	.171	8 (.1640)		M4 (.1575)	1	2.13	.38	.38	.25	.1680	.131
.171	.197	10 (.1900)		M4.5 (.1772) M5 (.1969)	1	2.38	.50	.38	.25	.1940	.152
.197	.223	12 (.2160)			1	2.38	.50	.44	.28	.2200	.165
.223	.260		1/4 (.2500)	M6 (.2362)	2	2.50	.63	.38	.31	.2550	.191
.260	.323		5/16 (.3125)	M7 (.2756) M8 (.3150)	2	2.72	.69	.44	.38	.3180	.238
.323	.395		3/8 (.3750)	M10 (.3937)	2	2.94	.75	.50	.44	.3810	.286
.395	.448		7/16 (.4375)		3	3.16	.88	–	.41	.3230	.242
.448	.510		1/2 (.5000)	M12 (.4724)	3	3.38	.94	–	.44	.3670	.275
.510	.573		9/16 (.5625)	M14 (.5541)	3	3.59	1.00	–	.50	.4290	.322
.573	.635		5/8 (.6250)	M16 (.6299)	3	3.81	1.09	–	.56	.4800	.360
.635	.709		11/16 (.6875)	M18 (.7087)	3	4.03	1.09	–	.63	.5420	.406
.709	.760		3/4 (.7500)		3	4.25	1.22	–	.69	.5900	.442
.760	.823		13/16 (.8125)	M20 (.7874)	3	4.47	1.22	–	.69	.6520	.489
.823	.885		7/8 (.8750)	M22 (.8661)	3	4.69	1.34	–	.75	.3670	.523
.885	.948		15/16 (.9375)	M24 (.9449)	3	4.91	1.34	–	.75	.7600	.570
.948	1.010		1 (1.0000)	M25 (.9843)	3	5.13	1.50	–	.81	.8000	.600

Notes:
Thread Length l is based on a length of 12 pitches of the UNC thread series.
Thread Length l is a minimum value and has no tolerance.
When Thread Length l is added to Neck Length l1, the total shall be no less than the minimum USCTI Table 302 Thread Length l.
Unless otherwise specified, all tolerances are in accordance with USCTI Table 302.
For eccentricity tolerances, see USCTI Table 317.
Table 302 is provided for reference only. GTD's tap dimensions may differ.

Standard Pipe Tap Dimensions, Straight and Taper, Ground Thread - Ref. USCTI Table 311



General Dimensions

Dimensions—Inches

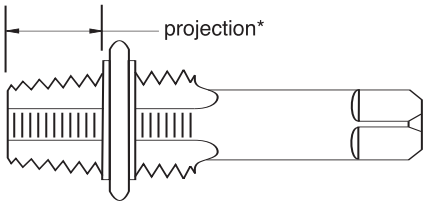
Nominal Size Inches	Length Overall L	Length of Thread l	Length of Square l2	Diameter of Shank d1	Size of Square a	Length Optional Neck l1
1/16	2.13	.69	.38	.3125	.234	.375
1/8	2.13	.75	.38	.3125	.234	–
1/8	2.13	.75	.38	.4375	.328	.375
1/4	2.44	1.06	.44	.5625	.421	.375
3/8	2.56	1.06	.50	.7000	.531	.375
1/2	3.13	1.38	.63	.6875	.515	–
3/4	3.25	1.38	.69	.9063	.679	–
1	3.75	1.75	.81	1.1250	.843	–
1-1/4	4.00	1.75	.94	1.3125	.984	–
1-1/2	4.25	1.75	1.00	1.5000	1.125	–
2	4.25	1.75	1.13	1.8750	1.406	–
2-1/2	5.50	2.56	1.25	2.2500	1.687	–
3	6.00	2.63	1.38	2.6250	1.968	–
3-1/2	6.50	2.69	1.50	2.8125	2.108	–
4	6.75	2.75	1.56	3.0000	2.250	–

Tolerances

Element	Range	Direction	Tolerance
Length Overall - L	1/16" to 3/4" inc.	Plus or Minus	.031
	1" to 4" inc.	Plus or Minus	.063
Length of Thread - l	1/16" to 3/4" inc.	Plus or Minus	.063
	1" to 1-1/4" inc.	Plus or Minus	.094
	1-1/2" to 4"	Plus or Minus	.125
Length of Square - l2	1/16" to 3/4" inc.	Plus or Minus	.031
	1" to 4" inc.	Plus or Minus	.063
Diameter of Shank - d1	1/16" to 1/8"	Minus	.0015
	1/4" to 1" inc.	Minus	.0020
	1-1/4" to 4" inc.	Minus	.0030
Size of Square - a	1/16" to 1/8"	Minus	.004
	1/4" to 3/4" inc.	Minus	.006
	1" to 4" inc.	Minus	.008

Taper Pipe Tap Thread Limits, Ground Thread - Reference USCTI Table 338

American National Standard Taper Pipe Thread Form (NPT)
Aeronautical National Taper Pipe Thread Form (ANPT)
Dryseal American National Standard Taper Pipe Thread Form (NPTF)



Nominal Size Inches	Threads Per Inch	Projection* (inches)	Projection Tolerance + or –	Taper Per Foot Limits Min.	Taper Per Foot Limits Max.	L1 Length	Tap Drill Size** NPT, ANPT, NFTF
1/16	27	.312	.063	.719	.781	.160	C
1/8	27	.312	.063	.719	.781	.1615	Q
1/4	18	.459	.063	.719	.781	.2278	7/16
3/8	18	.454	.063	.719	.781	.240	9/16
1/2	14	.579	.063	.719	.781	.320	45/64
3/4	14	.565	.063	.719	.781	.339	29/32
1	11 1/2	.678	.094	.719	.781	.400	1 9/64
1 1/4	11 1/2	.686	.094	.719	.781	.420	1 31/64
1 1/2	11 1/2	.699	.094	.719	.781	.420	1 23/32
2	11 1/2	.667	.094	.719	.781	.436	2 3/16
2 1/2	8	.925	.094	.734	.781	.682	2 39/64
3	8	.925	.094	.734	.781	.766	3 15/64
3 1/2	8	.938	.125	.734	.781	.821	–
4	8	.950	.125	.734	.781	.844	–

NOTE:

**Distance small end of tap projects through L1 Taper Thread Ring Gage.*
***Recommended size given permits direct tapping without reaming the hole, but only gives a full thread for approximately the L1 length.*

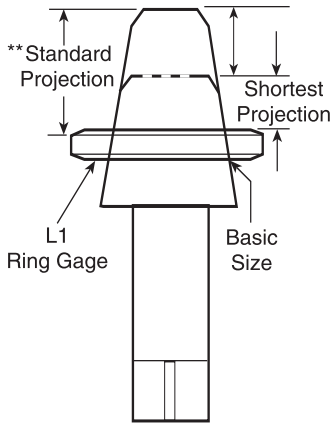
■ *Pipe Taps*

General purpose pipe taps are appropriate for threading a wide variety of materials, both ferrous and non-ferrous.

Ground thread pipe taps are standard in American Standard Pipe Form (NPT) and American Standard Dryseal Pipe Form (NPFT). NPT threads require the use of a sealer, like Teflon® tape or pipe compound. Dryseal taps are used to tap fittings which will give a pressure-tight joint without the use of a sealer.

The nominal size of a pipe tap is that of the pipe fitting to be tapped, not the actual size of the tap. The thread tapers 3/4" per foot.

All pipe taps are furnished with 2 1/2 to 3 1/2 thread chamfer.



Short projection pipe taps are made with a projection shorter than standard for taper pipe tapping where the depth of tapping is limited.

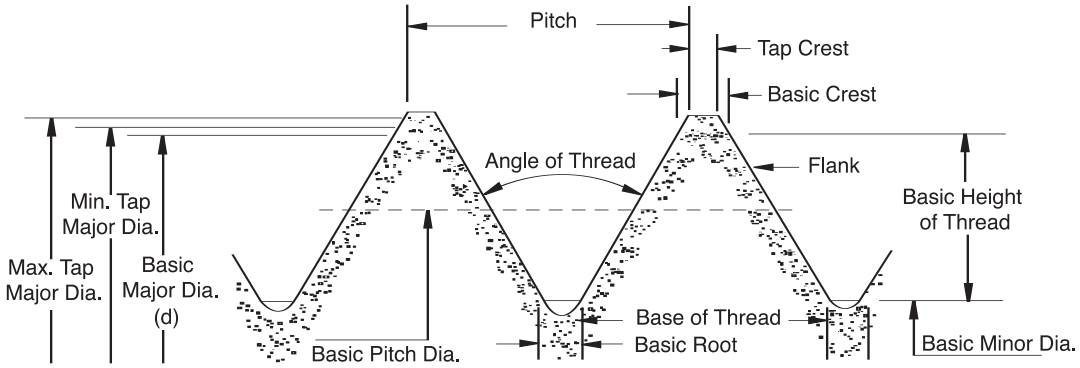
Special short projection taper pipe taps can be furnished with American National Standard Taper Pipe thread (ANPT), or Dryseal American National Standard Taper Pipe thread (NPTF, PTF-SAE Short, or PTF-SPL Extra Short).

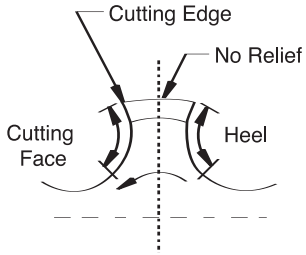
For information on short projection pipe taps and hole preparation for NPT, NPTF, and ANPT internal pipe threads, consult Greenfield's Technical Bulletins.

Special short projection pipe taps and left hand pipe taps are available through Lightning® Service.

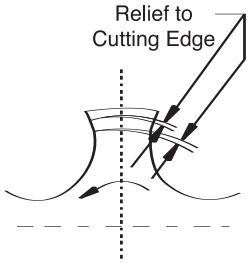
Greenfield LIGHTNING® SERVICE Available

Illustrations of Tap Terms

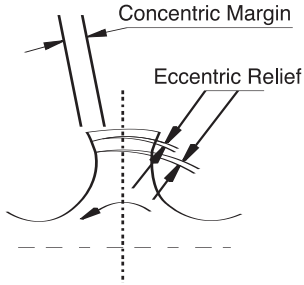




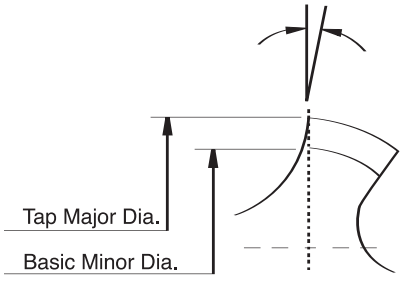
Concentric



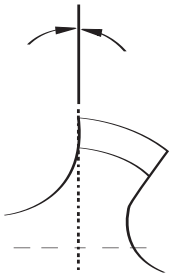
Eccentric Relief



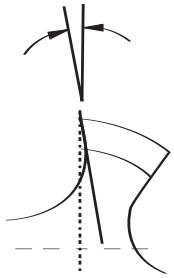
Con-Eccentric Relief



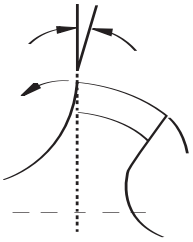
Negative Hook



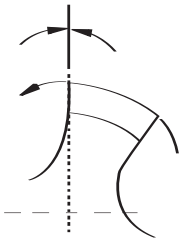
0° Hook



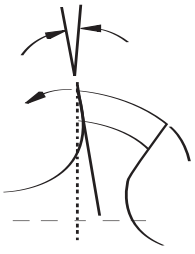
Positive Hook



Negative Rake



Radial Rake



Positive Rake

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Surface Treatments and Coatings for HSS Ground Thread Taps

Coating	Properties and Application	Precautions
Titanium Nitride (TiN)	Proprietary TiN coating (hardness 2300 Vickers) offers significantly improved wear life and thread finish, often at higher tapping speeds, in a broad range of materials, especially steels, irons, and plastics. Golden color.	Use with caution in non-ferrous materials such as aluminum because of tendency to gall.
Titanium Carbonitride (TiCN)	Proprietary TiCN coating (hardness 3000 Vickers) is harder, tougher, and more wear resistant than TiN under conditions of moderate cutting temperatures. Like TiN, TiCN may be used at higher cutting speeds in a broad range of materials, especially steels and irons. Blue-gray color.	Use with caution in non-ferrous materials such as aluminum because of tendency to gall. TiAlN is a better choice when used at extreme temperatures.
Titanium Nitride + Chromium Carbide Carbon (TiN + CrC/C)	Proprietary coating (hardness 2300 Vickers) that combines the wear resistance of smooth TiN coating with a lubricous top layer of chromium carbide carbon. Effective in stainless steel and non-ferrous materials including aluminum and titanium. Ideal choice for 300 series stainless steels, wrought and diecast aluminums. Black-gray color.	Effective in both ferrous and non-ferrous materials.
Titanium Aluminum Nitride (TiAlN)	Nanolayer TiAlN coating (hardness 3300 Vickers) offers improved wear life and thread finish, especially in conditions where high temperatures can be generated. Use for PH stainless steels and nickel-based alloys like inconel. Violet-gray color.	Use with caution in non-ferrous materials because of tendency to gall.
Chromium Nitride (CrN)	CrN is medium hard (hardness 1800 Vickers) and has a lower wear resistance than TiN, TiCN, and TiAlN. However, unlike these coatings, CrN does not gall when used in some non-ferrous work materials. Use for brass, bronze, zinc alloys, and magnesium alloys. Silver color.	Ineffective in ferrous materials.
Nitride (MAXI #1)	Hardened case extends wear life in abrasive materials. Use for aluminum and other non-ferrous materials.	Avoid on taper pipe, fast spiral, and small diameter (<#6) or fine pitch taps due to tendency for thread chipping.
Oxide (SH-50)	Helps prevent galling in ferrous (iron-based) materials. For free machining steel. Use for steels, stainless steels, and irons.	Has a tendency to cause galling in non-ferrous materials such as aluminum.
Nitride and Oxide (SH-47)	Combines the benefits of nitride and oxide surface treatments. For steels, stainless steels, and nickel alloys.	See precautions for nitride and oxide surface treatments.

Alternate Coatings Available.
(Full package quantities only)

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HSS Tap Coating & Surface Treatment Guide

Material Class	Material Type	Examples	TiN	TiCN	TiN + CrC/C	TiAlN	CrN	Nitride MAXI#1	Oxide SH-50	Nitride/Oxide SH-47
Speed compared to uncoated >			+50% Speed	+50% Speed	+50% Speed	+100% Speed	Same Speed	Same Speed	Same Speed	Same Speed
Steel	Carbon steels	1010, 1045	ALT	BEST	ALT	NR	NR	NR	POSS	POSS
	Alloy steels	4140, 8620	ALT	BEST	ALT	POSS	NR	NR	POSS	POSS
	Tool steels	A2, D2, H13	ALT	BEST	ALT	ALT	NR	NR	POSS	POSS
Stainless	Martensitic stainless	414, 440	ALT	BEST	ALT	ALT	NR	NR	POSS	POSS
	PH stainless	15-5PH, 17-4PH	ALT	ALT	ALT	BEST	NR	NR	POSS	POSS
	Austenitic stainless	304, 316	ALT	ALT	BEST	ALT	NR	NR	POSS	POSS
Cast iron	Cast irons, ductile		ALT	BEST	ALT	ALT	NR	POSS	POSS	POSS
	Cast irons, gray	Class 20 -50	ALT	BEST	ALT	ALT	NR	POSS	POSS	POSS
Non-ferrous	Aluminum, wrought	1100, 2024	NR	NR	BEST	NR	ALT	ALT	NR	NR
	Aluminum silicon, cast	319, 360, 380	POSS	ALT	BEST	NR	POSS	ALT	NR	NR
	Copper and alloys		NR	NR	POSS	NR	ALT	ALT	NR	NR
	Brass		NR	NR	POSS	NR	ALT	ALT	NR	NR
	Bronze		NR	NR	POSS	NR	ALT	ALT	NR	NR
	Zinc		NR	NR	POSS	NR	ALT	ALT	NR	NR
	Magnesium and alloys		NR	NR	POSS	NR	ALT	ALT	NR	NR
High-temp	Titaniums, pure	CP Ti	NR	NR	BEST	NR	POSS	ALT	NR	NR
	Titanium, alloys	Ti-6Al-4V	POSS	POSS	BEST	POSS	POSS	ALT	NR	NR
	Nickel-based alloys	Monel, Inconel	ALT	ALT	ALT	BEST	ALT	POSS	POSS	POSS
	Iron-based alloys	A-286, Incoloy	ALT	ALT	ALT	BEST	NR	POSS	POSS	POSS
	Cobalt-based alloys	Haynes	ALT	ALT	ALT	BEST	NR	POSS	POSS	POSS
Other	Plastics, soft		BEST	ALT	POSS	NR	POSS	ALT	NR	NR
	Plastics, abrasive		ALT	BEST	POSS	NR	POSS	ALT	NR	NR
	Graphite		ALT	BEST	POSS	NR	POSS	ALT	NR	NR

BEST: First choice among all commercially available coatings. Should provide superior results in the proper application.

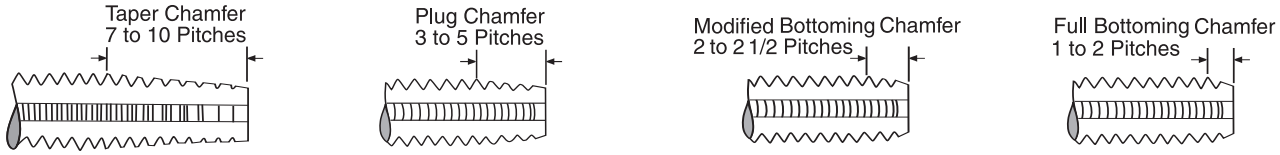
ALT (Alternate): Provides a significant performance benefit over uncoated tool. This may include improved life, productivity, size, finish, or any combination of these benefits.

POSS (Possible): Performance often application dependent. Results are difficult to predict and may be variable.

NR (Not Recommended): Not compatible with the selected material. Likely to perform worse than an uncoated tool and the benefit may not justify the cost.

Chart applies to non-heat-treated materials, generally with hardness levels less than 275 Bhn or 28 HRc.

Tap Chamfers



Hand Tap Chamfers

Taper (7 to 10 pitches)
The taper chamfer has the longest standard chamfer ensuring easier starting. It requires less tapping torque because of more working teeth.

Plug (3 to 5 pitches)
The most common chamfer for use by hand or machine in through or blind holes. This chamfer is more efficient than a bottoming or modified-bottoming chamfer.

Modified-Bottoming (2 to 2 1/2 pitches)
This short chamfer allows for threading close to the bottom of blind holes. Due to the slightly longer chamfer and more working teeth, this chamfer is more efficient than a bottoming chamfer.

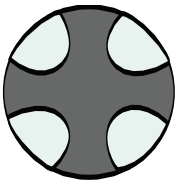
Bottoming (1 to 2 pitches)
For threading close to the bottom of blind holes, the bottoming chamfer is the least efficient chamfer available.

Hand Tap Optional Flutes

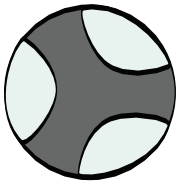
Many sizes of hand taps are available with optional fluting, or fewer flutes than standard. Having two or three fewer flutes provides more space for the storage of chips.

The selection of the proper tap depends entirely on the conditions under which the tap is to be used. Try a three-fluted tap first. Due to its construction, it is stronger than a two-fluted tap. The two-fluted tap, having wider flutes, has less total land width and therefore does not give as much support in tapping as the three-fluted tap. It is also more difficult to maintain the size of the tapped hole with a two-fluted tap than with taps having three flutes.

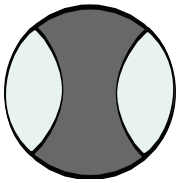
4-flute tap available chip storage space = 100%



3-flute tap available chip storage space = 127%



2-flute tap available chip storage space = 122%



Chip storage space shown in green

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Hardness Conversion Table

Knowing the hardness of the work material to be tapped is essential in the selection of the best tap for the job.

10 M/M Ball 3000 Kg	120° Cone 150 Kg	1/16" Ball 100 Kg	Model C	1000 Lb. Per Sq. In.	10 M/M Ball 3000 Kg	120° Cone 150 Kg	1/16" Ball 100 Kg	Model C	1000 Lb. Per Sq. In.
Brinell	Rockwell C	Rockwell B	Shore Scleroscope	Tensile Strength	Brinell	Rockwell C	Rockwell B	Shore Scleroscope	Tensile Strength
800	72	—	100	—	276	30	105	42	136
780	71	—	99	—	269	29	104	41	132
760	70	—	98	—	261	28	103	40	129
745	68	—	97	367	258	27	102	39	127
725	67	—	96	357	255	26	102	39	125
712	66	—	95	350	249	25	101	38	123
682	65	—	93	337	245	24	100	37	119
668	64	—	91	326	240	23	99	36	117
652	63	—	89	318	237	23	99	35	115
626	62	—	87	306	229	22	98	34	113
614	61	—	85	299	224	21	97	33	110
601	60	—	83	292	217	20	96	33	107
590	59	—	81	290	211	19	95	32	104
576	57	—	79	281	206	18	94	32	102
552	56	—	76	270	203	17	94	31	100
545	55	—	75	268	200	16	93	31	98
529	54	—	74	259	196	15	92	30	96
514	53	120	72	254	191	14	92	30	94
502	52	119	70	247	187	13	91	29	92
495	51	119	69	244	185	12	91	29	91
477	49	118	67	233	183	11	90	28	90
461	48	117	66	227	180	10	89	28	89
451	47	117	65	223	175	9	88	27	86
444	46	116	64	219	170	7	87	27	84
427	45	115	62	209	167	6	87	27	82
415	44	115	60	204	165	5	86	26	81
401	43	114	58	196	163	4	85	26	80
388	42	114	57	191	160	3	84	25	78
375	41	113	55	184	156	2	83	25	76
370	40	112	54	182	154	1	82	25	75
362	39	111	53	179	152	—	82	24	74
351	38	111	51	173	150	—	81	24	74
346	37	110	50	170	147	—	80	24	72
341	37	110	49	168	145	—	79	23	71
331	36	109	47	163	143	—	79	23	70
323	35	109	46	158	141	—	78	23	69
311	34	108	46	153	140	—	77	22	69
301	33	107	45	148	135	—	75	22	67
293	32	106	44	144	130	—	72	22	65
285	31	105	43	140	—	—	—	—	—

Drill Size	Decimal Inches	Drill Size	Decimal Inches	Drill Size	Decimal Inches	Drill Size	Decimal Inches	Drill Size	Decimal Inches	Drill Size	Decimal Inches
0,30 mm	.0118	54	.0550	3,10 mm	.1220	5,50 mm	.2165	8,50 mm	.3346	9/16	.5625
0,32 mm	.0126	1,40 mm	.0551	1/8	.1250	7/32	.2188	8,60 mm	.3386	14,50 mm	.5709
80	.0135	1,45 mm	.0571	3,20 mm	.1260	5,60 mm	.2205	R	.3390	37/64	.5781
0,35 mm	.0138	1,50 mm	.0591	30	.1285	2	.2210	8,70 mm	.3425	14,75 mm	.5807
79	.0145	53	.0595	3,30 mm	.1299	5,70 mm	.2244	11/32	.3438	15,00 mm	.5906
0,38 mm	.0150	1,55 mm	.0610	3,40 mm	.1339	1	.2280	8,80 mm	.3465	19/32	.5938
1/64	.0156	1/16	.0625	29	.1360	5,80 mm	.2283	S	.3480	15,25 mm	.6004
0,40 mm	.0157	1,60 mm	.0630	3,50 mm	.1378	5,90 mm	.2323	8,90 mm	.3504	39/64	.6094
78	.0160	52	.0635	28	.1405	A	.2340	9,00 mm	.3543	15,50 mm	.6102
0,42 mm	.0165	1,65 mm	.0650	9/64	.1406	15/64	.2344	T	.3580	15,75 mm	.6201
0,45 mm	.0177	1,70 mm	.0669	3,60 mm	.1417	6,00 mm	.2362	9,10 mm	.3583	5/8	.6250
77	.0180	51	.0670	27	.1440	B	.2380	23/64	.3594	16,00 mm	.6299
0,48 mm	.0189	1,75 mm	.0689	3,70 mm	.1457	6,10 mm	.2402	9,20 mm	.3622	16,25 mm	.6398
0,50 mm	.0197	50	.0700	26	.1470	C	.2420	9,30 mm	.3661	41/64	.6406
76	.0200	1,80 mm	.0709	25	.1495	6,20 mm	.2441	U	.3680	16,50 mm	.6496
75	.0210	1,85 mm	.0728	3,80 mm	.1496	D	.2460	9,40 mm	.3701	21/32	.6562
0,55 mm	.0217	49	.0730	24	.1520	6,30 mm	.2480	9,50 mm	.3740	16,75 mm	.6594
74	.0225	1,90 mm	.0748	3,90 mm	.1535	1/4, E	.2500	3/8	.3750	17,00 mm	.6693
0,60 mm	.0236	48	.0760	23	.1540	6,40 mm	.2520	V	.3770	43/64	.6719
73	.0240	1,95 mm	.0768	5/32	.1562	6,50 mm	.2559	9,60 mm	.3780	17,25 mm	.6791
0,62 mm	.0244	5/64	.0781	22	.1570	F	.2570	9,70 mm	.3819	11/16	.6875
72	.0250	47	.0785	4,00 mm	.1575	6,60 mm	.2598	9,80 mm	.3858	17,50 mm	.6890
0,65 mm	.0256	2,00 mm	.0787	21	.1590	G	.2610	W	.3860	45/64	.7031
71	.0260	2,05 mm	.0807	20	.1610	6,70 mm	.2638	9,90 mm	.3898	18,00 mm	.7087
0,70 mm	.0276	46	.0810	4,10 mm	.1614	17/64	.2656	25/64	.3906	23/32	.7188
70	.0280	45	.0820	4,20 mm	.1654	H	.2660	10,00 mm	.3937	18,50 mm	.7283
69	.0292	2,10 mm	.0827	19	.1660	6,80 mm	.2677	X	.3970	47/64	.7344
0,75 mm	.0295	2,15 mm	.0846	4,30 mm	.1693	6,90 mm	.2717	10,20 mm	.4016	19,00 mm	.7480
68	.0310	44	.0860	18	.1695	I	.2720	Y	.4040	3/4	.7500
1/32	.0312	2,20 mm	.0866	11/64	.1719	7,00 mm	.2756	13/32	.4062	49/64	.7656
0,80 mm	.0315	2,25 mm	.0886	17	.1730	J	.2770	Z	.4130	19,50 mm	.7677
67	.0320	43	.0890	4,40 mm	.1732	7,10 mm	.2795	10,50 mm	.4134	25/32	.7812
66	.0330	2,30 mm	.0906	16	.1770	K	.2810	27/64	.4219	20,00 mm	.7874
0,85 mm	.0335	2,35 mm	.0925	4,50 mm	.1772	9/32	.2812	10,80 mm	.4252	51/64	.7969
65	.0350	42	.0935	15	.1800	7,20 mm	.2835	11,00 mm	.4331	20,50 mm	.8071
0,90 mm	.0354	3/32	.0938	4,60 mm	.1811	7,30 mm	.2874	7/16	.4375	13/16	.8125
64	.0360	2,40 mm	.0945	14	.1820	L	.2900	11,20 mm	.4409	21,00 mm	.8268
63	.0370	41	.0960	4,70 mm,13	.1850	7,40 mm	.2913	11,50 mm	.4528	53/64	.8281
0,95 mm	.0374	2,45 mm	.0965	3/16	.1875	M	.2950	29/64	.4531	27/32	.8438
62	.0380	40	.0980	4,80 mm,12	.1890	7,50 mm	.2953	11,80 mm	.4646	21,50 mm	.8465
61	.0390	2,50 mm	.0984	11	.1910	19/64	.2969	15/32	.4688	55/64	.8594
1,00 mm	.0394	39	.0995	4,90 mm	.1929	7,60 mm	.2992	12,00 mm	.4724	22,00 mm	.8661
60	.0400	38	.1015	10	.1935	N	.3020	12,20 mm	.4803	7/8	.8750
59	.0410	2,60 mm	.1024	9	.1960	7,70 mm	.3031	31/64	.4844	22,50 mm	.8858
1,05 mm	.0413	37	.1040	5,00 mm	.1969	7,80 mm	.3071	12,50 mm	.4921	57/64	.8906
58	.0420	2,70 mm	.1063	8	.1990	7,90 mm	.3110	1/2	.5000	23,00 mm	.9055
57	.0430	36	.1065	5,10 mm	.2008	5/16	.3125	12,80 mm	.5039	29/32	.9062
1,10 mm	.0433	7/64	.1094	7	.2010	8,00 mm	.3150	13,00 mm	.5118	59/64	.9219
1,15 mm	.0453	35	.1100	13/64	.2031	O	.3160	33/64	.5156	23,50 mm	.9252
56	.0465	2,80 mm	.1102	6	.2040	8,10 mm	.3189	13,20 mm	.5197	15/16	.9375
3/64	.0469	34	.1110	5,20 mm	.2047	8,20 mm	.3228	17/32	.5312	24,00 mm	.9449
1,20 mm	.0472	33	.1130	5	.2055	P	.3230	13,50 mm	.5315	61/64	.9531
1,25 mm	.0492	2,90 mm	.1142	5,30 mm	.2087	8,30 mm	.3268	13,80 mm	.5433	24,50 mm	.9646
1,30 mm	.0512	32	.1160	4	.2090	21/64	.3281	35/64	.5469	31/32	.9688
55	.0520	3,00 mm	.1181	5,40 mm	.2126	8,40 mm	.3307	14,00 mm	.5512	25,00 mm	.9843
1,35 mm	.0531	31	.1200	3	.2130	Q	.3320	14,25 mm	.5610	63/64	.9844
										1"	1.0000

metric fractional wire gage letter size

Technical Data

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

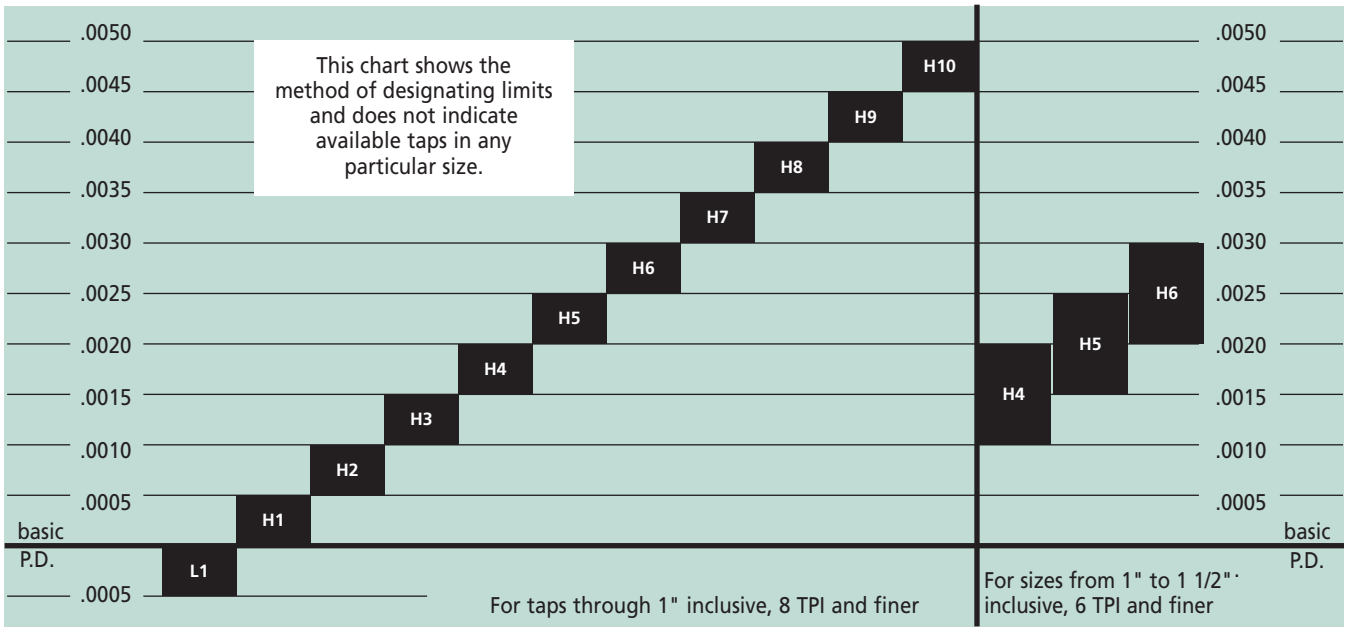
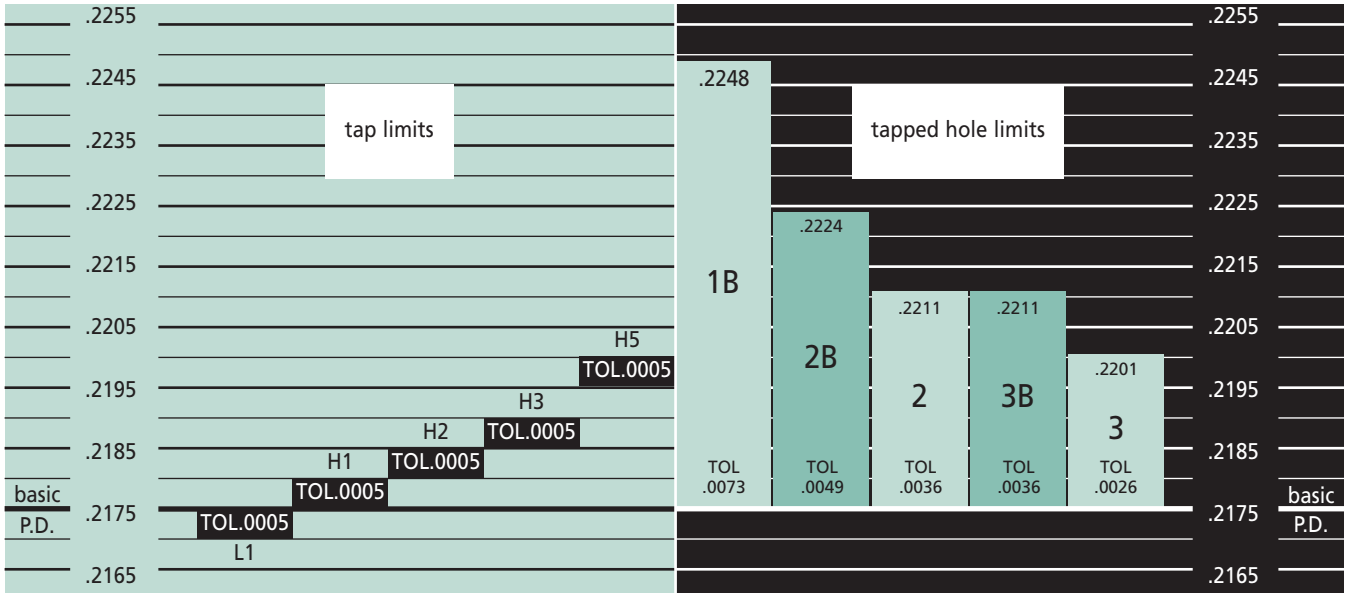


Figure 2

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 0,40	1,60	.0630	1,80	.0709
2-56		50	.0700	5/64	.0781
2-64		50	.0700	47	.0785
	M2,2 x 0,45	1,75	.0689	2,00	.0787
	M2,5 x 0,45	2,05	.0807	2,30	.0906
3-48		47	.0785	43	.0890
3-56		46	.0810	2,30	.0905
4-40		43	.0890	38	.1015
4-48		42	.0935	2,60	.1024
	M3 x 0,50	2,50	.0984	7/64	.1094
5-40		38	.1015	33	.1130
5-44		37	.1040	2,90	.1142
	M3,5 x 0,60	2,90	.1142	3,20	.1260
6-32		36	.1065	1/8	.1250
6-40		33	.1130	3,25	.1280
	M4 x 0,70	3,30	.1299	3,70	.1476
8-32		29	.1360	25	.1495
8-36		29	.1360	24	.1520
	M4,5 x 0,75	3,70	.1476	4,10	.1614
10-24		26	.1470	11/64	.1719
10-32		21	.1590	16	.1770
	M5 x 0,80	4,20	.1654	14	.1820
12-24		16	.1770	8	.1990
12-28		15	.1800	7	.2010
	M6 x 1,00	5,00	.1969	7/32	.2188
1/4-20		7	.2010	1	.2280
1/4-28		3	.2130	15/64	.2340
	M7 x 1,00	6,00	.2362	F	.2570
5/16-18		F	.2570	L	.2900
5/16-24		I	.2720	M	.2950
	M8 x 1,25	6,70	.2638	7,40	.2913
	M8 x 1,00	7,00	.2756	19/64	.2969
3/8-16		5/16	.3125	S	.3480
3/8-24		Q	.3320	T	.3580
	M10 x 1,50	8,50	.3346	U	.3680
	M10 x 1,25	8,70	.3425	9,40	.3701
7/16-14		U	.3680	Y	.4040
7/16-20		25/64	.3906	Z	.4130
	M12 x 1,75	10,20	.4016	11,20	.4409
	M12 x 1,25	10,80	.4252	11,50	.4528
1/2-13		27/64	.4219	15/32	.4682
1/2-20		29/64	.4531	12,25	.4823
	M14 x 2,00	12,00	.4724	33/64	.5156
9/16-12		31/64	.4844	17/32	.5312
9/16-18		33/64	.5156	13,50	.5315
5/8-11		17/32	.5312	14,75	.5807
5/8-18		37/64	.5781	15,25	.6004
	M16 x 2,00	14,00	.5512	19/32	.5938
	M16 x 1,50	14,50	.5709	15,25	.6004
	M18 x 2,50	15,50	.6102	39/64	.6094
	M18 x 1,50	16,50	.6496	17,25	.6791
3/4-10		21/32	.6562	45/64	.7031
3/4-16		11/16	.6875	23/32	.7188
	M20 x 2,50	17,50	.6890	*	*
	M20 x 1,50	18,50	.7283	*	*
	M22 x 2,50	19,50	.7677	*	*
	M22 x 1,50	20,50	.8071	*	*
7/8-9		49/64	.7656	*	*
7/8-14		13/16	.8125	*	*
	M24 x 3,00	21,00	.8268	*	*
	M24 x 2,00	22,00	.8661	*	*
1-8		7/8	.8750	*	*
1-12		59/64	.9219	*	*
	M27 x 3,00	24,00	.9449	*	*
	M27 x 2,00	25,00	.9843	*	*
1 1/8-7		63/64	.9844	*	*
1 1/8-12		1 3/64	1.0469	*	*
	M30 x 3,50	26,50	1.0433	*	*
	M30 x 2,00	28,00	1.1024	*	*
1 1/4-7		1 7/64	1.1094	*	*
1 1/4-12		1 11/64	1.1719	*	*
	M33 x 3,50	29,50	1.1614	*	*
	M33 x 2,00	31,00	1.2205	*	*
1 3/8-6		1 7/32	1.2188	*	*
1 3/8-12		1 19/64	1.2969	*	*
	M36 x 4,00	32,00	1.2598	*	*
	M36 x 3,00	33,00	1.2992	*	*
1 1/2-6		1 11/32	1.3438	*	*
1 1/2-12		1 27/64	1.4219	*	*
	M39 x 4,00	35,00	1.3780	*	*
	M39 x 3,00	36,00	1.4173	*	*

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

metric fractional wire 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

Calculating Tap Drill Sizes

Simplified Tap-Drill Formulas for Taps That Cut Threads

(for 60° Threads)

INCH TAP-DRILL SIZES

BASIC MAJOR DIAMETER	–	PITCH	=	HOLE SIZE
either decimal equivalent or fraction		either decimal equivalent or fraction		where hole size is expressed as a decimal size, convert to nearest standard tap-drill size; the probable hole size results in approximately 70-75% thread height due to the drill normally cutting larger than itself

Examples:

	BASIC MAJOR DIAMETER	–	PITCH	=	HOLE SIZE	RECOMMENDED DRILL SIZE
1/4-20 NC	250"	–	.050" 1/20 =.050"	=	.200"	#7 (.201")
1/4-64 NS	16/64" convert 1/4 to 64ths	–	1/64"	=	15/64"	15/64"
.860-32 NS	.860"	–	.031" (1/32 = .03125)	=	.829"	53/64" (.8261") (nearest standard drill size)

METRIC TAP-DRILL SIZES

	BASIC MAJOR DIAMETER	–	PITCH	=	HOLE SIZE
M6X1	6mm	–	1mm	=	5mm

Tap-Drill Formulas for TRU-LEDE® Thread Forming Tap

In tapping with forming taps there is no method of predicting the percent of thread that will be obtained because of the many variables involved. However, 55% for maximum drill size and 75% for minimum drill size may be used as a guide, and any desired percent of thread may be approximated by using drill sizes in between. If percent of thread is critical, the user must experiment to establish the desired hole size. Minor diameter of formed threads should be within specified limits. The formulas for determining theoretical maximum and minimum drill sizes for average conditions are illustrated below.

UNIFIED INCH THREADS

BASIC MAJOR DIAMETER – $\frac{3}{8N}$ = MAXIMUM DRILL SIZE

BASIC MAJOR DIAMETER – $\frac{1}{2N}$ = MINIMUM DRILL SIZE

N = Number of threads per inch

60° METRIC THREADS

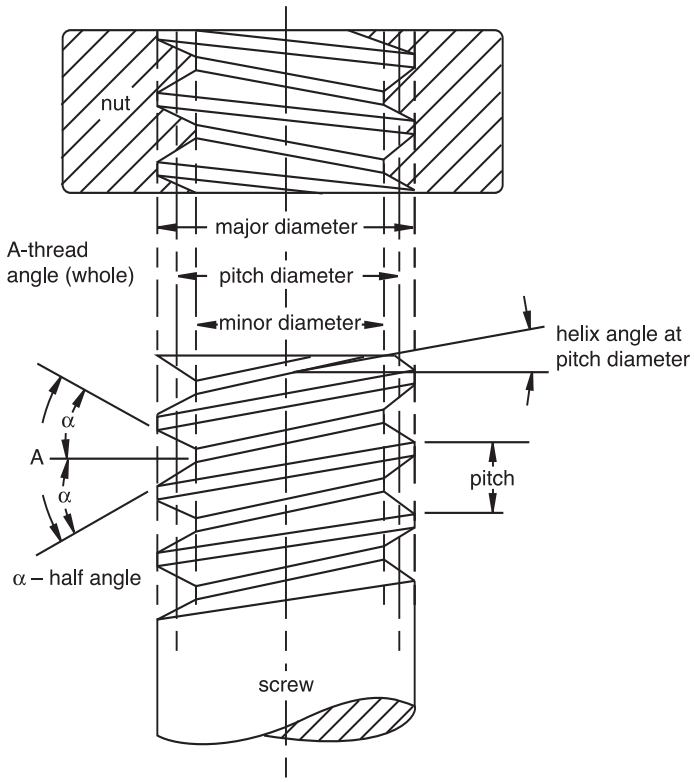
BASIC MAJOR DIAMETER – 0.375P = MAXIMUM DRILL SIZE

BASIC MAJOR DIAMETER – 0.5P = MINIMUM DRILL SIZE

P = Pitch (mm)

Note: Use millimeter value for Basic Major Diameter and Pitch, and the drill size will be in millimeters

Definition of Screw Thread Tolerances



It is generally recognized that, in mass production, it is impossible to reproduce in exact detail the theoretically perfect product as laid out on the drawing board. The allowed slight variation between the theoretically perfect product and each unit of the actual product is called the **TOLERANCE**.

Allowance

An intentional difference in correlated dimensions of mating parts. It is the minimum clearance or maximum interference between such parts.

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 the thread and the normal (90°) to the axis, measured in an axial plane.

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 2X pitch; on a triple thread, the lead is 3X pitch, etc.

Major Diameter

The largest diameter of a straight screw thread.

Minor Diameter

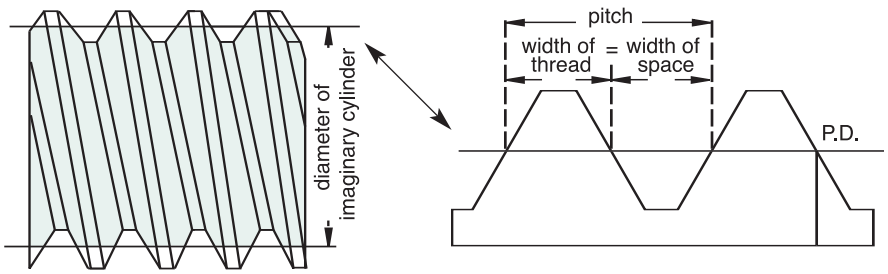
The smallest diameter of a straight screw thread.

Pitch

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

The pitch in inches =

$$\frac{1}{\text{Number of threads per inch}}$$



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.

Tapping Speeds

The factors considered when trying to determine the best tapping speeds are:

- Material to be tapped
- Length of chamfer on tap
- Percentage of full thread to be cut
- Length of hole (depth of thread)
- Pitch of thread
- Cutting fluids
- Machine equipment
- Horizontal or vertical tapping

The best and most efficient operating speeds for taps cannot be calculated with the same certainty as for many other metalcutting tools.

With other tools, the feed per revolution can be set at any desired point and can be varied as conditions demand. Taps, on the other hand, must always be advanced at a rate equal to one pitch for every revolution. The style of tap may vary the conditions. For example, with a bottoming tap, the first thread on each land cuts the full height of thread, while, with a taper or starting tap, a number of threads do their share of the cutting before the full height of thread is reached.

The depth of thread also varies, depending on the pitch. The coarser the thread, the greater the advance of the tap per revolution and the greater the amount of material removed.

The method of feeding the tap, and the type of equipment for driving, also influence the permissible speeds. If taps are mechanically fed at the proper rate of advance, they can be operated at higher speeds than if they are required to feed themselves and pull some part of the machine along with them.

Speeds may be modified to take into account any or all of the factors listed to the left.

Speeds must be lowered as length of thread increases because, in deep thread holes, the accumulated chips increase friction and interfere with lubrication.

Bottoming taps must be run slower than plug taps.

Tapping of full height of thread calls for slower speed than if the commercial 75% height only is required.

Coarse-thread taps in the larger diameters should be run more slowly than fine-thread taps of the same diameters.

The quantity and quality of cutting fluid may affect the permissible speeds as much as 100%.

Taper threaded taps, such as pipe taps, should be operated at from 1/2 to 3/4 the speed of a straight thread tap of comparable major diameter.

RPM Formulas

SFM = Surface Feet per Minute

RPM = Revolutions Per Minute

IPM = Inches Per Minute

TPI = Threads Per Inch

S m/m = Surface Meters per Minute

$\pi = 3.1416$

mm/m = Millimeters per Minute

P = Pitch (1/ No of Threads Per Inch)

INCH SIZES

$$SFM = \frac{RPM \times TOOL\ DIAMETER}{3.82} \quad \text{or} \quad 0.26 \times RPM \times TOOL\ DIAMETER$$

$$RPM = \frac{3.82 \times SFM}{TOOL\ DIAMETER}$$

$$IPM = \frac{RPM}{TPI^*} \quad \text{or} \quad {}^*P \times RPM$$

METRIC SIZES

$$S\ m/m = \frac{\pi \times TOOL\ DIAMETER \times RPM}{1000}$$

$$RPM = \frac{m/m \times 1000}{\pi \times TOOL\ DIAMETER}$$

$$mm/m = mm\ P \times RPM$$

UNC/UNF and NPT/NPTF

Tap Size	Taper Pipe Taps	Surface Feet Per Minute (SFM) 5'	10'	15'	20'	25'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'
		Revolutions Per Minute (RPM)																	
0		318	637	955	1273	1592	1910	2546	3183	3820	4456	5093	5729	6366	7003	7639	8276	8913	9549
1		273	546	819	1046	1308	1570	2093	2617	3140	3663	4186	4710	5233	5756	6279	6805	7326	1849
2		212	424	637	888	1110	1333	1777	2221	2665	3109	3554	3999	4442	4886	5330	5774	6218	6662
3		191	382	573	772	964	1157	1543	1929	2315	2701	3086	3472	3858	4244	4629	5015	5401	5787
4		174	347	521	682	853	1023	1364	1705	2046	2387	2728	3069	3411	3751	4092	4434	4775	5115
5		147	294	441	611	764	917	1222	1528	1833	2139	2445	2750	3056	3361	3667	3973	4278	4584
6		136	273	409	553	691	829	1106	1382	1859	1935	2212	2488	2766	3042	3318	3595	3871	4148
8		119	239	358	466	583	699	932	1165	1398	1631	1864	2097	2330	2563	2796	3029	3262	3495
10		101	201	302	402	502	603	804	1005	1205	1406	1607	1808	2009	2210	2411	2612	2813	3014
12		87	174	260	354	442	531	707	884	1061	1238	1415	1592	1769	1945	2122	2300	2476	2653
1/4		76	153	229	306	382	458	611	764	917	1070	1222	1375	1528	1681	1833	1986	2139	2292
5/16		62	123	185	245	306	367	489	611	733	856	978	1100	1222	1345	1467	1589	1711	1833
3/8		50	101	151	204	255	305	407	509	611	713	815	917	1019	1120	1222	1324	1426	1528
7/16	1/8	43	87	130	175	219	262	349	437	524	611	698	786	873	960	1048	1135	1222	1310
1/2	—	38	76	115	153	191	229	305	382	458	535	611	688	764	840	917	993	1070	1146
9/16	1/4	34	68	102	137	172	206	274	342	410	478	547	616	683	752	820	888	952	1020
5/8	—	32	64	96	122	153	183	244	306	367	428	489	550	611	672	733	794	856	917
11/16	3/8	28	55	83	111	138	167	222	278	333	389	444	500	556	611	667	722	778	833
3/4	—	25	51	76	102	128	153	203	255	305	357	407	458	509	560	611	662	713	764
7/8	1/2	22	43	65	87	109	131	175	218	262	306	350	392	437	480	524	568	611	655
1	—	19	38	57	76	96	115	153	191	230	268	305	344	382	420	458	497	535	573
1 1/8	3/4	17	34	51	68	84	102	136	170	204	238	272	306	340	373	407	441	475	509
1 1/4	—	15	31	46	61	76	92	122	153	183	214	244	275	305	336	367	397	428	458
1 3/8	1	14	28	42	56	69	83	111	139	167	194	222	250	278	306	333	361	389	417
1 1/2	—	13	25	38	51	63	76	102	127	153	178	204	229	255	280	305	331	356	382
1 5/8		12	23	35	47	59	71	94	118	141	165	188	212	235	259	282	306	329	353
1 3/4		11	22	33	44	55	65	87	109	131	153	175	196	218	240	262	284	306	327
1 7/8		10	20	30	41	51	61	81	102	122	143	163	183	204	224	244	265	285	306
2		9	19	29	38	48	57	76	96	115	134	153	172	191	210	229	248	267	287

Metric

Metric Taps	Surface Feet Per Minute (SFM) 5'	10'	15'	20'	25'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'
	Revolutions Per Minute (RPM)																	
M1	490	979	1469	1959	2449	2938	3918	4897	5877	6856	7836	8815	9795	10774	11754	12733	13713	14692
M2	242	484	725	967	1209	1451	1934	2418	2901	3385	3868	4352	4835	5319	5803	6286	6770	7253
M3	162	324	486	347	809	971	1295	1619	1942	2266	2590	2914	3237	3561	3885	4208	4532	4856
M3.5	138	277	415	554	692	830	1107	1384	1661	1938	2214	1491	2768	3045	3322	3599	3875	4152
M4	122	243	365	487	608	730	973	1217	1460	1703	1946	2190	2433	2676	2920	3163	3406	3650
M5	97	194	291	388	485	582	776	970	1163	1357	1551	1745	1939	2133	2327	2521	2715	2905
M6	81	162	243	324	405	486	647	809	971	1133	1295	1457	1619	1781	1942	2104	2266	2428
M7	69	138	208	277	346	415	554	692	830	969	1107	1246	1384	1522	1661	1799	1938	2076
M8	61	121	182	243	303	364	485	606	728	849	970	1091	1213	1334	1455	1577	1698	1819
M10	48	97	145	194	242	291	388	485	582	679	776	873	970	1067	1163	1260	1357	1454
M12	40	81	121	162	202	243	324	405	486	567	647	728	809	890	971	1052	1133	1214
M14	35	69	104	139	173	208	277	347	416	485	555	624	693	763	832	901	971	1040
M16	30	61	91	121	152	182	243	303	364	424	485	546	606	667	728	788	849	910
M18	27	54	81	108	135	162	216	269	323	377	431	485	539	593	647	700	754	808
M20	24	49	73	97	121	146	194	243	291	340	388	437	485	534	582	631	680	728
M22	22	44	66	88	110	132	176	221	265	309	353	397	441	485	529	573	618	662
M24	20	40	61	81	101	121	162	202	243	283	323	364	404	445	485	526	566	606
M27	18	36	54	72	90	108	144	180	216	252	287	323	359	395	431	467	503	539
M30	16	32	49	65	81	97	129	162	194	226	259	291	323	356	388	420	453	485

Special Taps Order Form

Custom Solutions Improve Machining Productivity!

Greenfield Distributors: To address the special needs of your taps customers, fax this completed order form today!

Name _____ ☐ Purchase Order ☐ Quote

GTD Distributor _____

Ship to Address _____

Purchase Order No. _____

Quote No. _____

Customer _____

Contact _____

Ship Via _____

Phone _____

Tap Specifications

Tap Size (Diameter & TPI/Pitch mm) _____

Class of Fit, "H" Limit, or Metric "D" Limit _____ 2B ☐ 3B ☐

Quantity _____ Customer Drawing Number _____

Style of Tap:

- ☐ Hand
- ☐ GUN® (Spiral Point)
- ☐ NPT ☐ NPTF
- ☐ STI Hand
- ☐ STI GUN®
- ☐ 52° Fast Spiral
- ☐ TRU-LEDE® (Form Tap)
- ☐ With oil hole (specify)
- ☐ Other

Tap Surface Treatment:

- ☐ None
- ☐ Maxi (nitride)
- ☐ TiN (Titanium Nitride)
- ☐ Oxide (SH-50)
- ☐ Oxide & Maxi (SH-47)
- ☐ TiCN (Titanium Carbonitride)
- ☐ TiN + CrC/C (Titanium Nitride + Chromium Carbide Carbon)
- ☐ Other

Note: Surface treated taps take longer to manufacture.

Special Pipe Taps

For NPT or NPTF Pipe Taps:

Interrupted Thread Tap?

☐ Yes ☐ No

Is this a short projection application?

☐ Yes ☐ No

If you want GTD to determine tap projection, please provide:

Minimum Hole Depth _____

Minimum Full Thread Required _____

Greenfield LIGHTNING® SERVICE Available

For Special Engineering Design Help, Fill Out the Information Below This Line.

Material Being Tapped _____

Tap Size: (Diameter & TPI/Pitch mm) _____

Hole Condition: ☐ Blind ☐ Through

Drill Hole Depth _____ Full Thread Depth _____

Material Hardness:

- ☐ Unknown
- ☐ < 20 Rc
- ☐ 20-30 Rc
- ☐ 30-40 Rc
- ☐ > 40 Rc

Tap Chamfer (pitches):

- ☐ Taper (7-10)
- ☐ Plug (3-5)
- ☐ Semi-Bottoming (2-2 1/2)
- ☐ Bottoming (1-2)
- ☐ GTD to Specify

Fax This Form Toll Free (U.S.A. and Canada) 1-888-434-4313