DiyVT's Omnium Gatherum

U.S Threads with Tapping & Clearance Drills

Thread	Tap Drill	Clearance Drill
0000-160	78	73
000-120	71	63
00-90	62	55
1-56	54	48
1-64, 1-72	53	48
2-56, 2-64	50	43
3-48	47	38
3-56	45	38
4-32	45	33
4-36	44	33
4-40	43	33
4-48	42	33
5-40	38	30
5-44	37	30
6-32	36	28
6-36	34	28
6-40	33	28
8-32, 8-36	29	19
8-40	28	19
10-24	25	10
10-32	21	10
12-24	16	2
12-28	14	2
12-32	13	2
1/4-20	7	G
1/4-28	3	G
5/16-18	F	P
5/16-24	I	P
3/8-16	5/16	W
3/8-24	Q	W
7/16-14	U	29/64
7/16-20	25/64	29/64
1/2-13	27/64	33/64
1/2-20	29/64	33/64
9/16-12	31/64	37/64
9/16-18	33/64	37/64
5/8-11	17/32	41/64
5/8-18	37/64	41/64
11/16-11	19/32	45/64
11/16-16	5/8	45/64
3/4-10	21/32	49/64
3/4-16	11/16	49/64
7/8-9	49/64	57/64
7/8-14	13/16	57/64
1-8	7/8	1-1/32
1-12, 1-14	15/16	1-1/32

In every tool there's a hammer.
Perfect is the enemy of done.
Adam Savage

Tom Sachs's Ten Bullets
1. Work to code (work within the system)
2. Sacred Space (the studio is sacred)
3. Be on Time
4. Be Thorough
5. I Understand (give/get feedback)
6. Sent Does Not Mean Received (confirm)
7. Keep a List
8. Always B Knolling
9. Sacrifice to Leatherface (own mistakes)
10. Persistence
(copied from every tool's a hammer by Adam Savage)

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Everywhere on this chart, the tap drills are chosen to result, as closely as possible, in 75% of a full depth of thread. This is because:

a. A 100% depth of thread is only 5% stronger than a 75% depth of thread, but requires three times the power to tap. The resultant tap breakage is utter waste.

b. A threaded engagement as long as the diameter of the bolt and with as little as 53% depth of thread will break the bolt before it strips the threads.
To help you in your engineering choice among the various thread series, consider that for any given bolt diameter.

a. The fine series of thread pitches are much stronger, require less tapping power, and are generally better looking, while.

b. The coarse series of thread pitches are used when the female member is of greatly softer material than the bolt, and when a fast run-up is required, as in scaffold and manhole assemblies.
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U.S. Pipe Thread

Thread	Drill
1/8-27	R
1/4-18	7/16
3/8-18	37/64
1/2-14	23/32
3/4-14	59/64
1 - 11 1/2	1-5/32
1 1/4 - 11 1/2	1 1/2
1 1/2 - 11 1/2	1 47/64
2 - 11 1/2	2 7/32
2 1/2 - 8	2 5/8
3 - 8	3 1/4
3 1/2 - 8	3 3/4
4 - 8	4 1/4

Sheet Metal is 3/16" thick or less: metal plate is thicker than 3/16".

Calculating the Diameter of a U.S. Number-Screw: (Pitch makes no difference in diameter; all No. 8 screws are the same diameter.)
The formula is : O.D. = .060" + N(.013"), where N is the number size of the screw.
Thus, the diameter of a No. 8 screw is .060" + 8(.013") = .164"
The diameter of a No.0 screw is .060" + 0(.013") = .060"
For 00, 000, and 0000 screws each zero more than one counts, in N as a minus one in the formula.
Thus, the diameter of a No. 00 screw is .060" + -1(.013") = .060" - .013" = .047"
And, the Diameter of a No. 000 is .060" + -2(.013") = .060" - .026" = .034"
Getting small, the diameter of a No. 0000 screw is .060" + -3(.013") = .060" - .039" = .021"

If you will study the information above, you will discover three handy accidents:
No. 0 screw threads go nicely on 1/16" diameter rod.
No. 5 screw threads go nicely on 1/8" diameter rod.
No. 10 screw threads go nicely on 3/16"diameter rod.

FRAC	DEC	DRILL	FRAC	DEC	DRILL	FRAC	DEC	DRILL	FRAC	DEC	DRILL
	.0135	80		.1110	34		.2660	H	43/64	.6719	
	.0145	79		.1130	33		.2720	I	11/16	.6875	
1/64	.0156			.1160	32		.2756	7mm	45/64	.7031	
	.0160	78		.1181	3mm		.2770	J		.7087	18mm
	.0180	77		.1200	31		.2810	K	23/32	.7188	
	.0200	76	1/8	.1250		9/32	.2813		47/64	.7344	
	.0210	75		.1285	30		.2900	L		.7480	19mm
	.0225	74		.1360	29		.2950	M	3/4	.7500	
	.0240	73		.1405	28	19/64	.2969		49/64	.7656	
	.0250	72	9/64	.1406			.3020	N	25/32	.7813	
	.0260	71		.1440	27	5/16	.3125			.7874	20mm
	.0280	70		.1470	26		.3150	8mm	51/64	.7969	
	.0292	69		.1495	25		.3160	O	13/16	.8125	
	.0310	68		.1520	24		.3230	P		.8268	21mm
1/32	.0313			.1540	23	21/64	.3281		53/63	.8281	
	.0320	67	5/32	.1563			.3320	Q	27/32	.8438	
	.0330	66		.1570	22		.3390	R	55/64	.8594	
	.0350	65		.1575	4mm	11/32	.3438			.8661	22mm
	.0360	64		.1590	21		.3480	S	7/8	.8750	
	.0370	63		.1610	20		.3543	9mm	57/64	.8906	
	.0380	62		.1660	19		.3580	T		.9055	23mm
	.0390	61		.1695	18	23/64	.3594		29/32	.9063	
	.0394	1mm	11/64	.1719			.3680	U	59/64	.9219	
	.0400	60		.1730	17	3/8	.3750		15/16	.9375	
	.0410	59		.1770	16		.3770	V		.9449	24mm
	.0420	58		.1800	15		.3860	W	61/64	.9531	
	.0430	57		.1820	14	25/64	.3906		31/32	.9688	
	.0465	56		.1850	13		.3937	10mm		.9843	25mm
3/64	.0469		3/16	.1875			.3970	X	63/64	.9844	
	.0520	55		.1890	12		.4040	Y	1	1.0000	25.4mm
	.0550	54		.1910	11	13/32	.4063				
	.0595	53		.1935	10		.4130	Z			
1/16	.0625			.1960	9	27/64	.4219				
	.0635	52		.1969	5mm		.4331	11mm			
	.0670	51		.1990	8	7/16	.4375				
	.0700	50		.2010	7	29/64	.4531				
	.0730	49	13/64	.2031		15/32	.4688				
	.0760	48		.2040	6		.4724	12mm			
5/64	.0781			.2055	5	31/64	.4844				
	.0785	47		.2090	4	1/2	.5000				
	.0787	2mm		.2130	3		.5118	13mm			
	.0810	46	7/32	.2188		33/64	.5156				
	.0820	45		.2210	2	17/32	.5313				
	.0860	44		.2280	1	35/64	.5469				
	.0890	43		.2340	A		.5512	14mm			
	.0935	42	15/64	.2344		9/16	.5625				
3/32	.0938			.2362	6mm	37/64	.5781				
	.0960	41		.2380	B		.5906	15mm			
	.0980	40		.2420	C	19/32	.5938				
	.0995	39		.2460	D	39/64	.6094				
	.1015	38		.2500	E	5/8	.6250				
	.1040	37	1/4	.2500			.6299	16mm			
	.1065	36		.2570	F	41/64	.6406				
7/64	.1094			.2610	G	21/32	.6563				
	.1100	35	17/64	.2656			.6693	17mm			

Metric Threads with Tap Drills & Inch Equivalents

Thread	Tap Drill	Decimal Inch
M1.6 x 0.35	1.25	.0492
M1.8 x 0.35	1.45	.0571
M2 x 0.4	1.6	.0630
M2.2 x 0.45	1.75	.0689
M2.5 x 0.45	2.05	.0807
M3 x 0.5	2.5	.0984
M3.5 x 0.6	2.9	.1142
M4 x 0.7	3.3	.1299
M4.5 x 0.75	3.7	.1457
M5 x 0.8	4.2	.1654
M6 x 1	5.0	.1969
M7 x 1	6.0	.2362
M8 x 1.25	6.8	.2638
M8 x 1	7.0	.2756
M10 x 1.5	8.5	.3346
M10 x 1.25	8.7	.3425
M12 x 1.75	10.2	.4016
M12 x 1.25	10.8	.4528
M14 x 2	12.0	.4724
M16 x 2	14.0	.5512
M16 x 1.5	14.5	.5709
M18 x 2.5	15.5	.6102
M18 x 1.5	16.5	.6496
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

1. Do the easiest thing first
2. Don't rely on the people that tried and failed prior
3. 90% of problems are between the driver's seat and the steering wheel
Bonus: If it can go wrong, it WILL go wrong. (Murphy's Law)
(AVE)

You are lucky if the lathe you work on is your own. Its height off the floor should suit you, not some person who modeled it for the photograph fifty years ago. With your arms hanging normally, raise one forearm to the horizontal Your elbow should be at about the height of the cross slide crank. This is the posture of least fatigue. (The same principle applies to the height of your bench vise: the top of its jaws should be a about elbow height. This makes most accurate work because it makes the best use of the geometry of the human shoulder and upper arm movement.)

To use one of those Desmond grinding wheel dressers that have steel star wheels mounted on a handle:

a. Wear coveralls, a hat, and wraparound safety goggles, and

b. Force the dresser against the turning wheel so hard that no sparks fly, the star wheels spin madly, and you are standing in a shower of grit. This takes courage the first time. It helps if you clamp a guide rail to the grinder rest to hook the dresser heel onto.

The Machinist that never made a mistake never did anything.

Err and err and err again
but less and less and less.
- Piet Hein

Material	Cutter HSS	Cutter Carbide
Mild Steel	100	300
Annealed HC Steel	80	200
Aluminum	300	850
Brass	175	500
Cast Iron	100	250
Annealed SS	90	225

Cutting Speed SFM

Dia in	Cutting Speed SFM 100	300	900
.25	1529	4586	13758
.375	1019	3057	9172
.5	764	2293	6879
.75	510	1529	4586
1	382	1146	3439
1.5	255	764	2293
2	191	573	1720
3	127	382	1146
4	96	287	860
6	64	191	573
8	48	143	430
10	38	115	344

RPM

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(AVE)

Never wear gloves when using machine tools. If one catches in something, it generally takes some hand with it as it leaves you.

Good machinist make very few mistakes. The best machinists seem to make none at all, because they are artists at retrieval and salvage, and are quiet about it.

If you see a machinist in a hurry he just made a mistake or is about to.

Skilled labor isn't cheap, cheap labor isn't skilled.

Don't work to tolerances that aren't there.

Commitment is what transforms a promise into reality. It is the words that speak boldly of your intentions. And the actions which speak louder than the words.

It is reported on the best authority that a very painful way to amputate a finger is to stick it in the spindle taper of the lathe or milling machine before the machine has stopped.

It's physics, math and engineering, machine it, draft it, built it, test it, break it, every time some new gets built the entire world advances.
Mike Patey

Fast, Cheap, Good (Pick 2)

If you leave the key in place in the Jacobs chuck of your drill press, you are dangerously silly, but if you leave the tee-wrench in the chuck of your lathe, you are feloniously negligent, and ought to spend the night in jail. If the lathe is started accidentally, it will injure the chuck, the chuck wrench, the bedways of the lathe, and, with luck, no-body but you. This is called the Grand Slam of negligence.

Any one in this shop found using compressed air in horseplay will be fired instantly, without discussion, and will wait for their check out in the parking lot.

One signal that you are doing your job right is that the chips in the pan under your lathe are razor sharp. Never clean any of this away while your lathe is running, use paper towels to protect your hands. If the stuff is stringy and inter-coiled, use a hook with a hand on it to pull it out.

Never confuse Tight with Dry

When very fine cuts need to be made on a lathe, set your compound to 6 degrees. Moving the compound in 0.001 will move the cutter in 0.0001.

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Many of the sayings and information here was copied from The Chester River Machine Tool Company's Omnium Gatherum.