Decimal Equivalent & Tap Drill Sizes Chart

Drill Size	Decimal	Drill Size	Decimal	Drill Size	Decimal	Drill Size	Decimal	Drill Size	Decimal
0.10	.0039	54	.0550	26	.1470	17/64	.2656	11.50	.4528
97	.0059	1.40	.0551	25	.1495	H	.2660	29/64	.4531
96	.0063	1.45	.0571	3.80	.1496	6.80	.2677	11.80	.4646
95	.0067	1.50	.0591	24	.1520	6.90	.2717	15/32	.4688
94	.0071	53	.0595	3.90	.1535	I	.2720	12.00	.4724
93	.0075	1.55	.0610	23	.1540	7.00	.2756	12.20	.4803
92	.0079	1/16	.0625	5/32	.1562	J	.2770	31/64	.4844
0.20	.0079	1.60	.0630	22	.1570	7.10	.2795	12.50	.4921
91	.0083	52	.0635	4.00	.1575	K	.2810	1/2	.5000
90	.0087	1.65	.0650	21	.1590	9/32	.2812	13.00	.5118
89	.0091	1.70	.0669	20	.1610	7.20	.2835	33/64	.5156
88	.0095	51	.0670	4.10	.1614	7.30	.2874	17/32	.5312
87	.0100	1.75	.0689	4.20	.1654	L	.2900	13.50	.5315
86	.0105	50	.0700	19	.1660	7.40	.2913	35/64	.5469
85	.0110	1.80	.0709	4.30	.1693	M	.2950	14.00	.5512
84	.0115	1.85	.0728	18	.1695	7.50	.2953	9/16	.5625
0.30	.0118	49	.0730	11/64	.1719	19/64	.2969	14.50	.5709
83	.0120	1.90	.0748	17	.1730	7.60	.2992	37/64	.5781
82	.0125	48	.0760	4.40	.1732	N	.3020	15.00	.5906
81	.0130	1.95	.0768	16	.1770	7.70	.3031	19/32	.5938
80	.0135	5/64	.0781	4.50	.1772	7.80	.3071	39/64	.6094
0.35	.0138	47	.0785	15	.1800	7.90	.3110	15.50	.6102
79	.0145	2.00	.0787	4.60	.1811	5/16	.3125	5/8	.6250
1/64	.0156	2.05	.0807	14	.1820	8.00	.3150	16.00	.6299
0.40	.0157	46	.0810	13	.1850	O	.3160	41/64	.6406
78	.0160	45	.0820	4.70	.1850	8.10	.3189	16.50	.6496
0.45	.0177	2.10	.0827	3/16	.1875	8.20	.3228	21/32	.6562
77	.0180	2.15	.0846	12	.1890	P	.3230	17.00	.6693
0.50	.0197	44	.0860	4.80	.1890	8.30	.3268	43/64	.6719
76	.0200	2.20	.0866	11	.1910	21/64	.3281	11/16	.6875
75	.0210	2.25	.0886	4.90	.1929	8.40	.3307	17.50	.6890
0.55	.0217	43	.0890	10	.1935	Q	.3320	45/64	.7031
74	.0225	2.30	.0906	9	.1960	8.50	.3346	18.00	.7087
0.60	.0236	2.35	.0925	5.00	.1969	8.60	.3386	23/32	.7188
73	.0240	42	.0935	8	.1990	R	.3390	18.50	.7283
72	.0250	3/32	.0938	5.10	.2008	8.70	.3425	47/64	.7344
0.65	.0256	2.40	.0945	7	.2010	11/32	.3438	19.00	.7480
71	.0260	41	.0960	13/64	.2031	8.80	.3465	3/4	.7500
0.70	.0276	2.45	.0965	6	.2040	S	.3480	49/64	.7656
70	.0280	40	.0980	5.20	.2047	8.90	.3504	19.50	.7677
69	.0292	2.50	.0984	5	.2055	9.00	.3543	25/32	.7812
0.75	.0295	39	.0995	5.30	.2087	T	.3580	20.00	.7874
68	.0310	38	.1015	4	.2090	9.10	.3583	51/64	.7969
1/32	.0312	2.60	.1024	5.40	.2126	23/64	.3594	20.50	.8071
0.80	.0315	37	.1040	3	.2130	9.20	.3622	13/16	.8125
67	.0320	2.70	.1063	5.50	.2165	9.30	.3661	21.00	.8268
66	.0330	36	.1065	7/32	.2188	U	.3680	53/64	.8281
0.85	.0335	7/64	.1094	5.60	.2205	9.40	.3701	27/32	.8438
65	.0350	35	.1100	2	.2210	9.50	.3740	21.50	.8465
0.90	.0354	2.80	.1102	5.70	.2244	3/8	.3750	55/64	.8594
64	.0360	34	.1110	1	.2280	V	.3770	22.00	.8661
63	.0370	33	.1130	5.80	.2283	9.60	.3780	7/8	.8750
0.95	.0374	2.90	.1142	5.90	.2323	9.70	.3819	22.50	.8858
62	.0380	32	.1160	A	.2340	9.80	.3858	57/64	.8906
61	.0390	3.00	.1181	15/64	.2344	W	.3860	23.00	.9055
1.00	.0394	31	.1200	6.00	.2362	9.90	.3898	29/32	.9062
60	.0400	3.10	.1220	B	.2380	25/64	.3906	59/64	.9219
59	.0410	1/8	.1250	6.10	.2402	10.00	.3937	23.50	.9252
1.05	.0413	3.20	.1260	C	.2420	X	.3970	15/16	.9375
58	.0420	3.25	.1280	6.20	.2441	10.20	.4016	24.00	.9449
57	.0430	30	.1285	D	.2460	Y	.4040	61/64	.9531
1.10	.0433	3.30	.1299	6.30	.2480	10.30	.4058	24.50	.9646
1.15	.0453	3.40	.1339	1/4	.2500	13/32	.4062	31/32	.9688
56	.0465	29	.1360	E	.2500	Z	.4130	25.00	.9843
3/64	.0469	3.50	.1378	6.40	.2520	10.50	.4134	63/64	.9844
1.20	.0472	28	.1405	6.50	.2559	27/64	.4219	1"	1.0000
1.25	.0492	9/64	.1406	F	.2570	10.80	.4252		
1.30	.0512	3.60	.1417	6.60	.2598	11.00	.4331		
55	.0520	27	.1440	G	.2610	7/16	.4375		
1.35	.0531	3.70	.1457	6.70	.2638	11.20	.4409		

TAP DRILL SIZES

Thread	Drill	Thread	Drill	Thread	Drill	Thread	Drill	Thread	Drill
0-80	3/64	M3.0-.5	2.50M	12-28	14	7/16-20	25/64	M18-1.5	16.5M
M1.6-.35	1.25M	5-40	38	M6.0-1	5.0M	M12-1.75	Y	3/4-10	21/32
1-64	54	5-44	37	1/4-20	7	1/2-13	27/64	3/4-16	11/16
M1.8-.35	1.45M	6-32	36	1/4-28	3	M12-1.25	10.8M	M20-2.5	17.5M
1-72	53	6-40	33	M7.0-1	6.0M	1/2-20	29/64	M20-1.5	18.5M
M2.0-.4	1.60M	M3.5-.6	2.90M	5/16-18	F	M14-2	12.0M	7/8-9	49/64
2-56	51	M4.0-.7	3.30M	M8.0-1.25	H	9/16-12	31/64	M22-2.5	19.5M
M2.2-.45	1.75M	8-32	29	5/16-24	I	M14-1.5	12.5M	M22-1.5	20.5M
2-64	50	8-36	29	M8.0-1	7.0M	9/16-18	33/64	7/8-14	13/16
3-48	47	M4.5-.75	26	3/8-16	5/16	M16-2	14.0M	M24-3	21.0M
M2.5-.45	2.05M	10-24	25	3/8-24	Q	5/8-11	17/32	M24-2	22.0M
3-56	45	10-32	21	M10-1.5	8.5M	M16-1.5	14.5M	1-8	7/8
4-40	43	M5.0-.8	4.20M	M10-1.25	11/32	5/8-18	37/64	1-12	59/64
4-48	42	12-24	16	7/16-14	U	M18-2.5	15.5M	1-14	15/16

Technical Reference

Drill Feed & Speeds

Different drilling conditions make it impossible to develop any rigid rules for feeds and speeds. The following tables contain guidelines which can be utilized when drilling standard materials. Also, the following "rules of thumb" can be used to determine proper feeds and speeds for drilling ferrous materials (note: varying conditions can easily require adjustments).

Feed equals .001" per revolution for every 1/16" of drill diameter, plus or minus .001" on the total.

Speed equals 80 surface feet per minute in 100 Brinell hardness material and the speed should be reduced 10 surface feet per minute for each additional 50 points Brinell hardness.

Feed and speed rates should be reduced up to 45-50 % when drilling holes deeper than 4 drill diameters.

Recommended Feeds

RECOMMENDED FEEDS
FOR VARIOUS DIAMETER DRILLS

Diameter of Drill—Inches	Feed Inches per Revolution
Under 1/8	.001 to .003
1/8 to 1/4	.002 to .006
1/4 to 1/2	.004 to .010
1/2 to 1	.007 to .015
1 inch and over	.015 to .025

NOTE: It is best to start with a moderate speed and feed, increasing either one, or both, after observing the action and condition of the drill.

Recommended Speeds

RECOMMENDED SPEEDS
FOR STANDARD MATERIALS WITH H.S.S. DRILLS

Material	Recommended Speed (sfm)
Aluminum and its Alloys	200—300
Brass and Bronze (ordinary)	150—300
Bronze (High Tensile)	70—150
Die Castings (Zinc Base)	300—400
Iron—Cast (soft)	75—125
Cast (medium hard)	50—100
Hard Chilled	10—20
Malleable	80—90
Magnesium and its Alloys	250—400
Monel Metal or High-Nickel Steel	30—50
Plastics or Similar Materials	100—300
Steel—	
Mild .2 carbon to .3 carbon	80—110
Steel .4 carbon to .5 carbon	70—80
Tool 1.2 carbon	50—60
Forgings	40—50
Alloy—300 to 400 Brinell	20—30
High Tensile (Heat Treated)	
35 to 40 Rockwell "C"	30—40
40 to 45 Rockwell "C"	25—35
45 to 50 Rockwell "C"	15—25
50 to 55 Rockwell "C"	7—15
Stainless Steel	
Free Machining Grades	30—80
Work Hardening Grades	15—50
Titanium Alloy Sheet	50—60
Titanium Alloys	
Ti-75A (Commercially Pure)	50—60
RS-120	40—60
Ti-150A	40—50
Ti-140A	30—40
RC-130B	30—40
MST 6A1-4 Va.	20—35
MST 3A1-5 Cr.	10—20

Formulas

1. **R.P.M.** = (3.8197 / Drill Diameter) x S.F.M.
2. **S.F.M.** = 0.2618 x Drill Diameter x R.P.M.
3. **I.P.M.** = I.P.R. (feed) x R.P.M. (speed)
4. Machine Time (seconds) = (60 x Feed minus Stroke) / I.P.M.

R.P.M. = Revolutions Per Minute
S.F.M. = Surface Feet Per Minute
I.P.M. = Inches Per Minute
I.P.R. = Inches Per Revolution
Feed Stroke = Drill Depth + 1/3
Car Reamer = 1/2 Speed of Drill

Cutting Speed

DRILL SIZE	CUTTING SPEED — FEET PER MINUTE 20	40	60	80	100
	REVOLUTIONS	PER	MINUTE		(000)
1/64	4.89	9.78	14.78	19.72	24.45
1/16	1.22	2.44	3.70	4.93	6.11
1/8	.61	1.22	1.83	2.44	3.06
3/16	.41	.82	1.23	1.63	2.04
1/4	.30	.61	.92	1.22	1.53
5/16	.24	.49	.74	.98	1.22
3/8	.20	.41	.61	.81	1.02
7/16	.18	.35	.52	.70	.87
1/2	.15	.31	.46	.61	.76
9/16	.14	.27	.41	.54	.68
5/8	.12	.24	.37	.49	.61
11/16	.11	.22	.34	.45	.56
3/4	.10	.20	.31	.41	.51
13/16	.09	.19	.28	.38	.47
7/8	.09	.18	.26	.35	.44
15/16	.08	.16	.25	.33	.41
1	.08	.15	.23	.30	.38

PROBLEM	CAUSE	CORRECTION
BROKEN DRILL	1. Flutes clogged with chips, drill binds in hole (common in deep holes)	—Use drill with wider flutes and/or faster helix angle —Consider polished flutes —Withdraw drill at regular intervals to clear chips —If chips are not broken up, consider heavier feeds—or a chip breaker design
	2. Drill binding due to worn outer corners	—Repoint or replace drill —Check for excessive speed, inadequate or incorrect coolant, excessive run out as drill enters work
	3. Work insecurely held	—Use adequate holding or clamping devices
	4. Excessive feed	—Reduce feed
	5. Improper point	—Check for correct lip clearance —Use proper type of drill and point for the application
	6. Drill is dull	—Replace before dulling occurs. Check feeds, speeds, and No. 5 for premature dulling
BROKEN TANG	1. Shank or socket damaged	—Repair or replace
	2. Drill not properly seated in socket	—Check for positive, secure fit
CHIPS NOT BREAKING UP	1. Insufficient feed	—Increase feed
	2. Improper style of drill and/or point	—Consider use of chip-breaker design drill and/or chip-breaker point grind
DAMAGED POINT	1. Using hard object to tap drill into tool holder	—Use soft lead, brass, plastic, etc. hammer
	2. Dropping, mishandling drill	—Handle with care
OVERSIZE HOLE	1. Drill point off center	—Repoint accurately or replace with properly pointed drill
	2. Machine spindle not rigid or not running true	—Repair if possible; consider use of bushing
	3. Work piece loose and/or vibrating	—Tighten and hold securely
ROUGH HOLE	1. Incorrect point grind and/or dull drill	—Repoint or replace with properly pointed drill
	2. Excessive feed	—Reduce feed
	3. Incorrect or insufficient coolant	—Correct and adjust
POOR TOOL LIFE	1. Coolant not reaching drill point or insufficient or incorrect coolant	—Correct and adjust
	2. Speed too high and/or feed too low	—Review and adjust
	3. Wrong type of point and/or drill for application	—Review requirements and conditions
WEB SPLITS	1. Insufficient lip clearance	—Repoint or replace with properly pointed drill
	2. Point thinned too much	—Repoint or replace with properly pointed drill
	3. Excessive feed	—Reduce feed
CHIPPED LIPS	1. Excessive lip clearance and/or heel relief	—Repoint or replace with properly pointed drill
BROKEN OUTER CORNERS	1. Insufficient or incorrect coolant	—Correct and adjust
	2. Excessive speed	—Reduce speed
	3. Scale, hard spots encountered in material	—No final remedy if this condition is prevalent; lower feeds and speeds may help