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Tapping Tool Steel by Hardness Range

Tapping stops first when a tool steel part gets hard, because a tap combines a cutting edge with a long thin body that has to carry the torque. The tables give the three published hardness ranges from 5 to 55 HRC and the nominal tapping speeds for carbon and low-alloy steel.

Reference only. This is a reference summary of published practice and it is not a specification of ours. The values are reproduced from the source tables, and tool material, machine rigidity, cutting fluid and workpiece condition will all move them. Final conditions are set on the job.

Three ranges from 5 to 55 HRC

Process variable	Hardness of steel tapped, HRC	5-30	30-40	40-55
Tap design	Standard	Modified standard, or special(a)	Special(a)	
Tap material(b)	T1, M1, M7, M10	M2, M3	T15, M3, M33, M42	
Tap hardness, minimum	62 HRC	64 HRC	66 HRC	
Surface treatment of tap	Steam oxide(c)	Nitride plus steam oxide	Nitride plus steam oxide	
Percentage of full thread	75%	60%	55%	
Speed, m/min (sfm)	30 max (100 max)	6-14 (20-45)	0.15-3.0 (0.5-10)	

Recommended practice for tapping steels in three ranges of hardness, reproduced from Table 2 of Tapping, in ASM Handbook, Volume 16, Machining. (a) A special tap should have four flutes, a 3 degree positive hook angle, thread relief and a 3 to 4 thread chamfer. (b) High-speed steels similar in total alloy content to the steels listed can be substituted. (c) Or another oxidizing process.

What each range changes

Nominal tapping speeds for carbon and low-alloy steel

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Typical steel	Condition	Hardness, HB	Speed, m/min (sfm)
1020	Annealed	85-125	17 (55)
1020	Annealed	125-175	14 (45)
1020	Annealed	175-225	12 (40)
1020	Annealed	225-275	9 (30)
1045	Annealed	125-175	14 (45)
1045	Annealed	175-225	12 (40)
1045	Annealed	225-275	11 (35)
1045	Annealed	275-325	8 (25)
1045	Quenched and tempered	325-375	6 (20)
1045	Quenched and tempered	375-425	3 (10)
1112	Annealed	100-150	18 (60)
1112	Cold drawn	150-200	20 (65)
1117	Annealed	100-150	15 (50)
1117	Cold drawn	150-200	17 (55)
1137	Annealed	175-225	15 (50)
1137	Quenched and tempered	275-325	11 (35)
1137	Quenched and tempered	325-375	6 (20)
1137	Quenched and tempered	375-425	3 (10)
12L14	Annealed	100-150	18 (60)
12L14	Annealed	150-200	17 (55)
12L14	Annealed	200-250	14 (45)
4140	Annealed	175-225	11 (35)
4140	Quenched and tempered	275-325	8 (25)
4140	Quenched and tempered	325-375	5 (15)
4140	Quenched and tempered	375-425	3 (10)
4140 + S	Quenched and tempered	45-48 HRC	2 (7)
41L40	Annealed	150-200	14 (45)
41L40	Quenched and tempered	275-325	6 (20)
41L40	Quenched and tempered	325-375	5 (15)
41L40	Quenched and tempered	45-48 HRC	2 (7)
8620	Annealed	125-175	14 (45)
8620	Annealed	175-225	12 (40)
8620	Cold drawn	225-275	11 (35)
8620	Cold drawn	275-325	8 (25)
8620	Quenched and tempered	325-375	6 (20)
8620	Quenched and tempered	375-425	3 (10)

Nominal speeds for tapping carbon and low-alloy steels with high speed steel taps, reproduced from Table 3 of Tapping, in ASM Handbook, Volume 16, Machining. Each steel listed stands for a group of similar steels. For steel up to 375 HB the source gives M1, M7 and M10 taps, and for steel of 375 HB and higher it gives M3 and M40. The 45 to 48 HRC rows are the hardened end of the table and they show how sharply the speed falls.

Grades and stock

Aobo Steel, tool steel supplier

Aobo Steel supplies tool steel to distributors and mold, tool and die shops, including D2, D3, DC53, A2, O1, H13, H11, H10, H21, S7, M2, M42, L6, P20 and 420 and 440C stainless. Forged or hot rolled, annealed or pre-hardened, cut to your sizes, with test certificates.
Source, ASM Handbook, Volume 16, Machining, ASM International, 1989.

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