

Drilling Hardened Tool Steel

A hole is the cheapest feature to put in while the steel is soft and the most expensive one to put in after hardening. The data below give the twist drill parameters for tool steel, the hardness step at 50 HRC on H11 die steel, the carbide grade selection at 54 HRC and the nitrided high speed steel drill results.

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.

Drill it soft whenever the job allows

Material drilled	Hardness, HB	Hardness, HR	Cutting tool material	Peripheral speed, m/min (sfm)	Feed rate code	Helix angle, deg	Point angle, deg
Tool steel	196	94 HRB	HSS	18 (60)	Y	25-35	118
Tool steel	241	24 HRC	HSS	15 (50)	Y	25-35	118

Recommended operating parameters for producing holes in tool steel with twist drills, reproduced from Table 6(a) of Drilling, in ASM Handbook, Volume 16, Machining. The two rows are the two hardness levels at which tool steel is listed in the source. HSS is high-speed tool steel. The feed rate is given by the code in the next table, and 118 degrees is the included point angle.

Feed code	Feed rate, mm/rev (in./rev), at a drill diameter of:	3.2 mm (1/8 in.)	6.4 mm (1/4 in.)	12.7 mm (1/2 in.)	19.1 mm (3/4 in.)	25.4 mm (1 in.)
Y	0.08 (0.003)	0.13 (0.005)	0.20 (0.008)	0.267 (0.0105)	0.317 (0.0125)	

Feed rate for the tool steel rows, reproduced from Table 6(b) of Drilling, in ASM Handbook, Volume 16, Machining. The feed is given per revolution for a two lip drill and rises with the diameter. Where rigidity is low or the cutting fluid is restricted, the source advises lower speeds and lower feeds than these.

The hardness step at 50 HRC on H11 die steel

Choosing a carbide grade for a 54 HRC sheet

Grade	Composition, %	Hardness, HRA	Grain size, μm ($\mu\text{in.}$)	W	Ta	C	Co
C-1	88.25	...	5.75	6.0	91.2	3 (120)	
C-2	88.25	...	5.75	6.0	91.8	1-2 (40-80)	
C-3	87.00	4.0	6.00	3.0	92.2	1-3 (40-120)	

Composition, hardness and grain size of the three carbide grades tested in drilling H11 steel sheet at 54 HRC, reproduced from the drilling example in Drilling, in ASM Handbook, Volume 16, Machining. C-1 and C-2 carry the same 6 percent cobalt and the same tungsten and carbon levels, and C-2 is the harder of the two because its finer grain size leaves smaller cobalt lakes between the grains.

Nitrided high-speed steel drills

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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