

Automated Heat Treating of Tool Steels

Production heat treating of tool steel is done on automated salt bath lines rather than one tool at a time. The line carries the parts through preheat, high heat and quench on a fixed cycle, and the cycle time is set by the workpiece rather than by the operator.

Reference only. This is a reference summary of published practice and it is not a specification of ours. The stages and times are the published figures for the tools named, and a different line, fixture load or section size will move them. Final cycle parameters are set by the heat treater.

Process stages and operating temperatures

The stages run in a fixed order from the first preheat to the rinse.

Process stage	Operating temperature, °C	Operating temperature, °F	Total time in furnace
First preheat	650-870	1200-1600	X
Second preheat	760-1040	1400-1900	X
High heat	1010-1290	1850-2350	X
Isothermal quench	540-705	1000-1300	X
Air cool	Room temperature	Room temperature	6X, 12X or 24X
Wash, hot water	80-95	180-200	6X
Rinse, hot water	80-95	180-200	X

Relative process times and temperatures for an automated tool steel heat treating line. The time column is expressed as a multiple of the time at the high-heat temperature, which is set by the part and listed in the table below, so an X is one multiple of that time. Source, Table 2 of Automatic Heat Treating of Tool Steels, in ASM Handbook, Volume 4, Heat Treating.

Cycle times for twist drills and other tools

The published times for twist drills are given to the second and banded by diameter, so a shop can read the high-heat time straight off the diameter.

Workpiece	Time in high heat
2.54-4.78 mm (0.100-0.188 in.) twist drills	1 min 30 s
4.80-8.08 mm (0.189-0.318 in.) twist drills	1 min 40 s
8.10-12.90 mm (0.319-0.508 in.) twist drills	1 min 50 s
12.93-18.24 mm (0.509-0.718 in.) twist drills	2 min 0 s
18.26-23.32 mm (0.719-0.918 in.) twist drills	2 min 20 s
23.34-38.10 mm (0.919-1.500 in.) twist drills	2 min 40 s
102 mm (4 in.) diameter cups	6 min
64 mm (2½ in.) diameter end mills	7 min
76 mm (3 in.) diameter end mills	10 min

Cycle times for twist drills and other tools in the high-heat stage. The diameters are the bands used by the source, and the times are the scheduled times at temperature. Source, Table 3 of Automatic Heat Treating of Tool Steels, in ASM Handbook, Volume 4, Heat Treating.

Why the nitrate quench is kept away from the high heat furnace

If as little as 600 ppm of nitrate salts is allowed to enter the high heat furnace, extreme surface damage can be done to the tool being treated.

Aobo Steel, tool steel supplier

Aobo Steel supplies tool steel to distributors and mold, tool and die shops, including D2, D3, O1, O2, A2, S7, H13, H11, H10, H21, M2, M42, L6, P20, P20+Ni and 420 and 440C stainless. Forged or hot rolled, annealed or pre-hardened, cut to your sizes, with test certificates. Source, Tables 2 and 3 of Automatic Heat Treating of Tool Steels, in ASM Handbook, Volume 4, Heat Treating.

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