

Cycle Annealing of O1, A2, A6 and D2 Tool Steels

Cycle annealing replaces a single long soak with a series of stepped holds, so the load spends less total time in the furnace for the same softened structure. The published schedules for four cold work grades are below, together with the stress relieving treatment that goes with them.

Reference only. This is a reference summary of published practice and it is not a specification of ours. The schedules are the published treatments for the grades named, and a different furnace, load weight or section size will move the hold times. Final cycle parameters are set by the heat treater.

Cycle annealing treatments for four tool steel grades

Steel	Treatment
O1	Heat to 730 °C (1350 °F), hold 4 h; heat to 780 °C (1440 °F), hold 2 h; cool to 690 °C (1275 °F), hold 6 h; air cool
A2	Heat to 900 °C (1650 °F), hold 2 h; cool to 760 °C (1400 °F), hold 6 h; air cool
A6	Heat to 815 °C (1500 °F), hold 2 h; cool to 650 °C (1200 °F), hold 6 h; air cool
D2	Heat to 900 °C (1650 °F), hold 2 h; cool to 775 °C (1425 °F), hold 6 h; air cool

Cycle annealing treatments published for four tool steel grades. Each hold is timed from the moment the load reaches the temperature. Source, Table 5 of Heat Treating of Tool Steels, in ASM Handbook, Volume 4, Heat Treating.

When the cycle is worth the time

For a large furnace load the published guidance is that the cycle offers little advantage, because the load itself sets the heating and cooling times. For individual tools that can be handled in a salt bath or a conventional furnace, the same source describes the saving in time as substantial.

Stress relieving before final hardening

Stress relieving a finished tool before final hardening does not noticeably reduce distortion in most cases. Where dimensional accuracy after hardening is critical, the published order is to rough machine, stress relieve, and then take the final light cut.

The recommended treatment is a heat to 650 to 675 °C (1200 to 1250 °F), a hold of 1 h per 25 mm (1 in.) of thickness, and an air cool.

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, Table 5 of Heat Treating of Tool Steels, in ASM Handbook, Volume 4, Heat Treating.

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