

Tool Steel Soak Time Chart

Soak time for the grades used in mold, tool and die work, by grade and by smallest cross section, with the per inch rates and the rule of thumb tables printed for each grade. Printed from the reference page on aobosteel.com. This is a reference summary of published practice and not an Aobo Steel specification.

Reference only. This card is a reference summary of published practice, not an Aobo Steel specification. It gives the hold times printed for each grade in the source. The hold time for your part also depends on your furnace, your load and how the part is supported, so confirm the cycle with your heat treater and with the mill data sheet for the grade before running production.

Rule of thumb soak time for sections up to 1 in

Source, printed pages 35, 51, 59, 66 and 72.

Section size	D2	A2	A6	H13	S7
1/8 in (3.175 mm)	30 minutes	30 minutes	10-15 minutes	10-15 minutes	30 minutes
1/4 in (6.350 mm)	40 minutes	40 minutes	15 minutes	15 minutes	40 minutes
1/2 in (12.70 mm)	50 minutes	50 minutes	30 minutes	20 minutes	45-50 minutes
3/4 in (19.05 mm)	55-60 minutes	55-60 minutes	45-60 minutes	25-30 minutes	50-55 minutes
1 in (25 mm)	1 hour (a)	60 minutes	1 hour (a)	30 minutes	1 hour (a)

For D2, A6 and S7 the source prints the per inch rate above 1 in and a worked example of 1 1/2 in at 90 minutes or 1 1/2 hours. The 1 in figure follows that rate and the source uses 1 hour for a 1 in section in the D2 example.

Hold time and air hardening limits for D2, A2, A6, H13 and S7

Source, printed pages 35, 42, 51, 53, 59, 60, 66, 67, 72 and 73.

Grade	Austenitizing temperature	Hold time above 1 in	Largest section that still hardens in air
D2	1850°F / 1010°C	1 hour per inch of smallest cross section	6 in (150 mm)
A2	1750°F / 955°C	1 hour per inch	5 in (127 mm)
A6	1550°F / 845°C	1 hour per inch	8 in (200 mm)
H13	1850°F / 1010°C	30 minutes per inch	12 in (305 mm)
S7	1725°F / 940°C	1 hour per inch	2 1/2 in (63 mm)

Tool steel soak time chart, continued

Hold time for the oil, water and high speed grades

Source, printed pages 78, 79, 85, 91 and 95.

Grade	Austenitizing temperature	Hold time	Quench
O1	1500°F / 815°C	5 minutes per inch of smallest cross section, timed from the moment the part reaches temperature	Oil
W1	1425°F / 775°C	5 minutes per inch of smallest cross section, timed from the moment the part reaches temperature	Water with 10% salt
4140	1575°F / 855°C	5 minutes per inch of smallest cross section, timed from the moment the part reaches temperature	Oil
M2 (high speed)	2150-2275°F / 1175-1245°C	No hold at a 1 in section or less, at most a brief 1 minute hold, and a maximum of 5 to 6 minutes at a 6 in section	Oil up to 1 to 1 1/2 in, flash oil quench above

CPM 10V soak time by target hardness

Source, printed page 101.

Condition	Hardness, HRC	Hardening temperature	Tempering temperature	Tempers	Minimum soak per inch
Optimum toughness	58 to 60	1950°F / 1065°C	1000°F / 540°C	2 tempers	30 minutes
Good toughness	60 to 62	2050°F / 1120°C	1000°F / 540°C	2 tempers	20 minutes
Adequate toughness	63 to 65	2150°F / 1175°C	1000°F / 540°C	3 tempers	10 minutes

Rates are quoted per inch of the smallest cross section. The rule of thumb tables cover parts smaller than 1 in, where the per inch rate overstates the hold. Timing starts when the part has reached the furnace temperature, not when the furnace reaches the set point.

Aobo Steel, tool steel supplier

Aobo Steel supplies tool steel to distributors and mold, tool and die shops, including D2, D3, O1, A2, H13, H11, M2, L6, P20 and 420 stainless. Forged or hot rolled, annealed, cut to your sizes, with test certificates.

Reference data compiled from Heat Treatment, Selection, and Application of Tool Steels (William E. Bryson, 2nd edition, Hanser), soak time sections of chapters 5 to 14 and 21.

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