

H13 Austenitizing Temperature Chart

Austenitizing temperature sets three things at once in H13. It decides how much of the carbide goes back into solution, how much the austenite grain grows, and how hard the steel is when it leaves the quench. Measured values at 1024, 1066 and 1107 °C, held for 25, 50 and 80 minutes.

Reference only. Values are reproduced from the source named under each table and are a reference summary of published practice rather than a specification of ours. They come from one study on one heat of H13 and the 1107 °C rows sit above normal practice, so confirm the figures for a particular die against the material test certificate and the heat treatment specification before ordering.

Grain size after austenitizing

ASTM grain size against temperature and soak time

Temperature (°C)	Soak time (min)	Average ASTM grain size	Standard deviation	95% confidence interval
1024	25	10.1	0.31	9.9 to 10.3
1024	50	9.7	0.21	9.5 to 9.9
1024	80	9.8	0.47	9.5 to 10.1
1066	25	8.8	0.37	8.5 to 9.1
1066	50	8.8	0.27	8.6 to 9.0
1066	80	8.2	0.64	7.7 to 8.7
1107	25	7.1	1.24	6.2 to 7.9
1107	50	6.8	1.31	6.1 to 7.5
1107	80	5.9	2.15	4.4 to 7.4

Source, Table V, Results of the Grain Size Ratings, printed page 129 of Tool Materials for Molds and Dies, Application and Performance, edited by G. Krauss and H. Nordberg, PDF page 136 of the copy consulted. The figures were read from the page image rather than from the scanned text layer.

Specimens were austenitized in neutral salt, step-quenched to 760 °C in salt for 10 minutes and air cooled. The grain size numbers were converted from the Snyder-Graft intercept grain size and the interval is calculated with the Student t test statistic. A higher ASTM number means a finer grain.

Carbide taken into solution

Volume per cent primary carbide after austenitizing

Temperature (°C)	Soak time (min)	Cooling	Average volume %	Standard deviation	95% confidence interval
1024	25	Air cooled	2.24	0.65	2.06 to 2.42
1024	50	152 mm round, simulated	1.97	0.63	1.80 to 2.14
1024	80	305 mm round, simulated	2.00	0.65	1.83 to 2.17
1066	25	Air cooled	1.60	0.29	1.47 to 1.73
1066	50	152 mm round, simulated	1.42	0.34	1.27 to 1.57
1066	80	305 mm round, simulated	1.35	0.44	1.14 to 1.55
1107	25	Air cooled	1.30	0.26	1.18 to 1.42
1107	50	152 mm round, simulated	0.88	0.28	0.74 to 1.02
1107	80	305 mm round, simulated	0.92	0.35	0.80 to 1.00

Source, Table VI, Results of the Volume % Primary Carbide Determination, printed page 130 of the same book, PDF page 137 of the copy consulted. Read from the page image rather than from the scanned text layer.

The 25 minute specimens were treated in neutral salt and the 50 minute and 80 minute specimens in an electric resistance muffle furnace under argon. The interval uses the normal probability distribution. The figure is the volume fraction of primary carbide, that is the carbide still undissolved in the as-quenched structure.

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Hardness as quenched

Rockwell C hardness after quenching

Temperature (°C)	Soak time (min)	Cooling	Hardness (HRC)
1024	25	Air cooled	52.5
1024	50	152 mm round, simulated	48.5
1024	80	305 mm round, simulated	47.5
1066	25	Air cooled	53.5
1066	50	152 mm round, simulated	49.0
1066	80	305 mm round, simulated	48.0
1107	25	Air cooled	55.0
1107	50	152 mm round, simulated	50.0
1107	80	305 mm round, simulated	48.0

Source, Table VIII, As-Quenched Rockwell C Hardness, printed page 133 of the same book, PDF page 140 of the copy consulted. Read from the page image rather than from the scanned text layer.

Treatment conditions are those of Table VI. Each figure is the average of five tests rounded to the nearest 0.5 HRC and is the hardness straight out of the quench, before any tempering.

The three tables describe the trade at the heart of H13 heat treatment. A higher austenitizing temperature dissolves more carbon and alloy, which lifts the as-quenched hardness and the secondary hardening response after tempering, while the undissolved carbide that carries wear resistance is reduced and the grain coarsens. A lower temperature leaves more carbide for wear and a finer grain for toughness, at a lower as-quenched hardness. Grain size and carbide volume both fall close to a straight line as the temperature rises, and the soak time makes no statistically significant difference to either.

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 and 420 and 440C stainless. Forged or hot rolled, annealed or pre-hardened, cut to your sizes, with test certificates. Compiled from Tool Materials for Molds and Dies, Application and Performance (G. Krauss and H. Nordberg, eds.), Tables V, VI and VIII on printed pages 129, 130 and 133.

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