

P20 Tool Steel Heat Treatment

The hardening card, the tempering response, the gas carburizing cycle and the case depth by time for P20, from the reference page on aobosteel.com. A reference summary of published practice and not an Aobo Steel specification.

Reference only. The hardening card, the tempering response, the carburizing cycle, the case and core hardness and the case depths are reproduced from the source named at the foot of this sheet. The figures are shop reference values rather than a specification, and the card carries no tolerances. Run a trial part before committing a mold block to this cycle.

Chemistry of P20

Source, heat treating reference information for P20, printed page 195.

Element	Percent
Carbon	0.30
Manganese	0.75
Silicon	0.50
Chromium	1.65
Molybdenum	0.40

Carbon, manganese, silicon, chromium and molybdenum are the five elements the card lists with a figure against them. Vanadium, tungsten, cobalt and sulfur appear on the card with no figure and are left out of the table rather than shown as a zero. Every figure is a single value and not a specification range.

Hardening P20

Source, heat treating reference information for P20, printed page 195.

Step	P20
Preheat	1200 °F (650 °C) *
Harden	1525 °F (830 °C)
Quench	Oil quench and carburize

* = if used on larger mass parts. The card gives one hardening temperature for the grade and an oil quench. Another chart on this site puts P20 hardening in the 1600 to 1650 °F (870 to 900 °C) band, and the card gives that higher 1600 °F (870 °C) figure for the carburizing route set out below.

Tempering response of P20

Source, heat treating reference information for P20, printed page 195.

Temper, °F	°C	P20, HRC
As quenched	No temper	51
400	205	49
600	315	47
800	425	44
1000	540	39
1100	595	33
1200	650	26
1250	675	21

The card steps the tempering temperatures by 200 °F to 1000 °F and then by 100 °F and 50 °F. It prints one Rockwell C figure for each temperature with no range. P20 falls in hardness as the tempering temperature rises, from 51 HRC as quenched to 21 HRC at 1250 °F (675 °C). Carburized, the case holds 52 to 58 HRC while the core stays at 40 to 47 HRC.

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Carburizing P20

Source, heat treating reference information for P20, printed page 195.

Step	P20
Gas carburize	1600 °F (870 °C)
Furnace cool to	1475 °F (800 °C)
Quench and temper	Oil quench and temper

The card places the carburizing block immediately under the hardening card and gives it its own austenitizing temperature, its own cooling step and its own quench.

Hardness of the case and the core after tempering

Source, heat treating reference information for P20, printed page 195.

Temper, °F	°C	Case, HRC	Core, HRC
600	315	58	47
650	343	57	46
700	370	56	45
750	400	55	44
800	425	54	43
900	480	52	40

The source prints the second row as 650 °F/354 °C. The Fahrenheit figures above and below it step by 50 °F and 650 °F converts to 343 °C, so the Celsius figure is printed here as 343 °C and the source value is recorded so the row can be checked against the book.

Carburizing time and the case depth it gives

Source, heat treating reference information for P20, printed page 195.

Time, hours	Case depth
4	0.030 in (0.762 mm)
8	0.042 in (1.0668 mm)
12	0.055 in (1.397 mm)
16	0.062 in (1.5748 mm)

The depths are printed on the card as average values, with no tolerance stated. The inch and millimetre figures are reproduced as the card gives them.

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 or pre-hardened, cut to your sizes, with test certificates.

Reference data compiled from Heat Treatment, Selection, and Application of Tool Steels (William E. Bryson, second edition, Hanser). The hardening card, the tempering response, the carburizing cycle, the case and core hardness and the case depths for P20 come from the heat treating reference information on printed page 195.

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