

416 Stainless Steel Heat Treatment

The chemistry, the hardening cycle and the tempering response of type 416 free machining martensitic stainless steel, from the reference page on aobosteel.com. A reference summary of published practice and not an Aobo Steel specification.

Reference only. The chemistry, the hardening cycle and the tempering response 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 production work to this cycle.

Chemistry of 416

Source, heat treating reference information for type 416 stainless steel, printed page 200.

Element	Percent
Carbon	0.15
Manganese	1.25
Silicon	1.00
Chromium	13.00
Molybdenum	0.60
Phosphorus	0.06 max
Sulfur	0.15 max

The card prints sulfur as a maximum of 0.15 percent. Sulfur is the deliberate free machining addition in this grade, and the ASTM range writes the same figure as 0.15 min, which is the form the stainless steel composition chart on this site carries. Vanadium and tungsten are listed on the card with no figure, so those rows are left out rather than printed blank. Composition data is for general reference only, actual values vary by standard, mill and heat number, so confirm against the material test certificate of the heat or ask Aobo Steel.

Hardening 416

Source, heat treating reference information for type 416 stainless steel, printed page 200.

Step	416
Preheat	1200 °F (650 °C)
Harden	1850 °F (1010 °C)
Quench	Air or oil quench

The card prints one preheat step, one hardening temperature and two quench media for the grade, with no section size condition against any of them, so the figures stand for the load as written.

Tempering response of 416

Source, heat treating reference information for type 416 stainless steel, printed page 200.

Temper, °F	°C	416, BHN
As quenched	—	210
300	150	210
400	205	215
500	260	220
600	315	225
700	370	230
800	425	230
900	480	230
1000	540	178

The card prints 210 BHN for the as quenched condition and 210 BHN again after a 300 °F (150 °C) temper, so the first step of the line is flat. The hardness is printed in Brinell on the card rather than in Rockwell C, and no tolerance band appears against any row.

The card is the free machining grade of the martensitic stainless family, carrying 0.15% carbon with 13.00% chromium, 0.60% molybdenum and sulfur at 0.15% as the deliberate addition that breaks the chip. It hardens in air or oil from 1850 °F (1010 °C) after a 1200 °F (650 °C) preheat, the cycle the card prints for 410 as well. The tempering line runs from 210 BHN as quenched to a peak of 230 BHN between 700 °F (370 °C) and 900 °F (480 °C), then falls to 178 BHN at 1000 °F (540 °C), with the hardness printed in Brinell and no tolerance band on any row.

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, M2, L6, P20 and 420 and 440C 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, Carl Hanser Verlag, 2009). The chemistry, the hardening cycle and the tempering response for type 416 come from the heat treating reference information on printed page 200.

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