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AISI 4340 Alloy Steel Properties

Tempering response, hardness by section size, equivalent grades, welding and machining for 4340, E4340, SNCM439 and 40CrNiMoA. Reference summary of published 4340 data, not an Aobo Steel specification.

Reference only. Aobo Steel supplies tool steel in the annealed condition and does not specify heat treatment for customer parts. Verify the values below against the applicable standard, the mill certificate and the heat treater's own procedure.

4340 Steel at a Glance

Property	Typical 4340	Practical meaning
Steel type	Nickel-chromium-molybdenum alloy steel	Ultra-high strength in heavy sections
Main designations	4340 / E4340 / SNCM439 / 40CrNiMoA	Nickel at 1.65 to 2.00 percent sets it apart
Annealed hardness	217 HB	The condition bar is normally machined in
As-quenched hardness	58 HRC at 13 mm, 53 HRC at 100 mm	Holds hardness deep into the section
Working hardness	24 to 53 HRC after tempering	Tempering temperature sets the level
Through hardening	Oil quench to 75 mm, water for larger sections	Water quench raises cracking risk

Tempering Response and Mechanical Properties

Tempering	Tensile, MPa	Yield, MPa	Hardness, HB	Izod, J
205 °C	1980	1860	520 (HRC 53)	20
315 °C	1760	1620	490 (HRC 50)	14
425 °C	1500	1365	440 (HRC 46)	16
540 °C	1240	1160	360 (HRC 39)	47
650 °C	1020	860	290 (HRC 31)	100
705 °C	860	740	250 (HRC 24)	102

Oil quenched 4340, at least 2 h at temperature. Hardness and strength as printed in the source, HRC as published for this table. Tempering below 455 C is not recommended because of temper embrittlement, double tempering is recommended.

Hardness by Section Size

Bar diameter	HRC	HB, approx.	Condition
13 mm (0.5 in.)	58	614	As quenched, oil
25 mm (1 in.)	57	596	As quenched, oil
50 mm (2 in.)	56	577	As quenched, oil
100 mm (4 in.)	53	528	As quenched, oil

4340 loses about 5 HRC between a 13 mm and a 100 mm bar. Tempered at 540 C the same bars hold 1460, 1450 and 1420 MPa in 13, 38 and 75 mm sections, which is the practical meaning of deep hardenability.

4340 Against 4140

Property	4340	4140
Nickel	1.65 to 2.00 percent	None
Hardenability	Oil quench through-hardens to 75 mm	Softens in the core past 75 to 100 mm
Toughness at high strength	Excellent	Good
Relative cost	Higher, because of nickel	Lower

Equivalent Grades

Standard	Grade	C / Mn / Si / Cr / Ni / Mo, percent
ASTM A29/A29M-03	4340 (G43400)	0.38-0.43 / 0.60-0.80 / 0.15-0.35 / 0.70-0.90 / 1.65-2.00 / 0.20-0.30
ASTM A29/A29M-03	E4340 (G43406)	0.38-0.43 / 0.65-0.85 / 0.15-0.35 / 0.70-0.90 / 1.65-2.00 / 0.20-0.30
SAE J404 JUN00	4340 (G43400)	0.38-0.43 / 0.60-0.80 / 0.15-0.35 / 0.70-0.90 / 1.65-2.00 / 0.20-0.30
JIS G4053:2003	SNCM 439	0.36-0.43 / 0.60-0.90 / 0.15-0.35 / 0.60-1.00 / 1.60-2.00 / 0.15-0.30
GB (China)	40CrNiMoA	0.37-0.44 / 0.50-0.80 / 0.17-0.37 / 0.60-0.90 / 1.25-1.65 / 0.15-0.25

E4340 is the electric furnace version, with tighter phosphorus and sulphur at 0.025 max each. The Chinese grade sits lower in nickel, which matters in heavy sections. DIN 1.6565 / 40NiCrMo6 and BS 817M40 (EN24) belong to the same family.

Welding 4340

Control	Requirement
Preheat	Above the martensite start temperature, 290 C (550 F), so the heat affected zone forms bainite rather than untempered martensite
Consumables	Low-hydrogen process and consumables are mandatory
Post-heat	No higher than 28 C (50 F) below the tempering temperature the part was given
Procedure	Not a prequalified welding steel, the joint needs a qualified weld procedure

Machining 4340

Condition	Machinability and note
Annealed, 187 to 241 HB	About 50 percent of AISI 1212 taken as 100 percent, lower than 4140 because of the nickel
Quenched and tempered, 255 to 363 HB	Lower speeds and more tool wear, but no distortion from a later heat treatment
Typical parts	Piston pins, bearings, gears, machine tool arbors, die blocks, cutting tool shanks, aircraft fittings

Heat Treatment Practice

Step	Temperature and note
Normalizing	870 to 925 C, air cool
Annealing	830 to 860 C, furnace cool at about 15 C per hour to 480 C
Hardening	800 to 845 C, hold 15 min per 25 mm, quench in warm oil at 25 to 60 C
Tempering	455 to 650 C for at least 2 h, double tempering recommended, below 455 C not recommended
Stress relieving	650 to 675 C before hardening, never above the tempering temperature after

Table notes. Values are typical rather than guaranteed minimums, and certified properties must be tied to a standard, a section size and a test location. 4340 is not a tool steel, it cannot hold a cutting edge or resist abrasive die wear, so wear tooling needs a tool steel grade.

Aobo Steel, tool steel supplier

Aobo Steel supplies forged tool steel from Huangshi, Hubei, China, where the local supply chain covers ESR melting, vacuum degassing and LF refining, forging, rolling, turning, heat treatment and third party inspection. We have worked in tool steel since 2003 and supply to order in cold work grades such as D2, D3 and O1, hot work grades such as H13 and H10, and stainless grades 420, 440C and 4Cr13, annealed, with mill test certificates to EN 10204 3.1.

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Reference data compiled from published 4340 data and the Aobo Steel 4340 properties page.

Scan to open the full 4340 page with all five tables.