Aobo Steel
Tool steel supplier, Huangshi, China
sales@aobosteel.com

AISI 4140 Alloy Steel Properties

Tempering response, hardness by section size, equivalent grades, welding and machining for 4140, 42CrMo4 and SCM440. Reference summary of published 4140 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.

4140 Steel at a Glance

Property	Typical 4140	Practical meaning
Steel type	Medium-carbon chromium-molybdenum alloy steel	Load and fatigue parts, not cutting tools
Main designations	4140 / 42CrMo4 / 1.7225 / SCM440 / 42CrMo	One family, different chemistry limits
Annealed hardness	197 HB	The condition bar is normally machined in
As-quenched hardness	57 HRC at 13 mm, 49 HRC at 50 mm	Hardness falls as the section grows
Working hardness	22 to 55 HRC after tempering	Tempering temperature sets the level
Hardenability	Moderate, not through-hardening past 75 to 100 mm	Section size decides the grade and the process

Tempering Response and Mechanical Properties

Tempering	Tensile, MPa	Yield, MPa	Hardness, HB	Izod, J
205 °C	1965	1740	578	15
260 °C	1860	1650	534	11
315 °C	1720	1570	495	9
370 °C	1590	1460	461	15
425 °C	1450	1340	429	28
480 °C	1300	1210	388	46
540 °C	1150	1050	341	65
595 °C	1020	910	311	93
650 °C	900	790	277	112
705 °C	810	690	235	136

25 mm round bar oil quenched from 845 to 870 C, then tempered. Tensile, yield and hardness as printed in the source. Tempering between 230 and 370 C is avoided because of blue brittleness.

Hardness by Section Size

Bar diameter	HRC	HB, approx.	Condition
13 mm (0.5 in.)	57	596	As quenched
25 mm (1 in.)	55	560	As quenched
50 mm (2 in.)	49	469	As quenched
25 mm (1 in.)	—	335	Tempered at 540 C
50 mm (2 in.)	—	202	Tempered at 540 C

At the same temper, the core of a 50 mm bar lands more than 130 HB below a 25 mm bar.

Equivalent Grades

Standard	Grade	C / Mn / Si / Cr / Mo, percent
ASTM A29/A29M-03	4140 (G41400)	0.38-0.43 / 0.75-1.00 / 0.15-0.35 / 0.80-1.10 / 0.15-0.25
SAE J404 JUN00	4140 (G41400)	0.38-0.43 / 0.75-1.00 / 0.15-0.35 / 0.80-1.10 / 0.15-0.25
JIS G4053:2003	SCM 440	0.38-0.43 / 0.60-0.85 / 0.15-0.35 / 0.90-1.20 / 0.15-0.30
EN 10083-1:1991	42CrMo4 (1.7225)	0.38-0.45 / 0.60-0.90 / 0.40 max / 0.90-1.20 / 0.15-0.30
EN 10083-1:1991	42CrMoS4 (1.7227)	0.38-0.45 / 0.60-0.90 / 0.40 max / 0.90-1.20 / 0.15-0.30
GB (China)	42CrMo	0.38-0.45 / 0.50-0.80 / 0.17-0.37 / 0.90-1.20 / 0.15-0.25

Phosphorus 0.030 to 0.035 and sulphur 0.030 to 0.040 depending on the standard, 42CrMoS4 carries sulphur 0.020 to 0.040 for machinability. Nearest grade, not interchangeable, because the manganese range and the hardenability band differ.

Welding 4140

Control	Requirement
Preheat	Above the martensite start temperature, 290 C (550 F), so the heat affected zone forms bainite rather than untempered martensite
Interpass	Hold the preheat as the interpass temperature and reheat if the part drops below it
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 4140

Condition	Machinability and note
Annealed, 187 to 229 HB	About 65 percent of AISI 1212 taken as 100 percent, the fastest condition to machine in
Quenched and tempered, 229 to 341 HB	Lower speeds and more tool wear, but no distortion from a later heat treatment
Typical parts	Connecting rods, crankshafts, axles, gears, studs, high-strength bolts, tool holders and shanks

Heat Treatment Practice

Step	Temperature and note
Normalizing	845 to 925 C, air cool
Annealing	830 to 870 C, furnace cool at about 15 C per hour to 480 C
Hardening	830 to 870 C, oil quench. Water quench from 815 to 845 C is rarely used because of cracking risk
Tempering	175 to 230 C for maximum strength, or 385 to 705 C for lower strength levels

Table notes. Hardness is printed in HB in the sources, HRC figures are conversions. Values are typical rather than guaranteed minimums, and certified properties must be tied to a standard, a section size and a test location. 4140 is not a tool steel, it cannot hold a cutting edge or resist abrasive die wear.

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.

CONTACT

EMAIL sales@aobosteel.com

WHATSAPP +86 180 6294 5370

WEB www.aobosteel.com

Reference data compiled from published 4140 data and the Aobo Steel 4140 properties page.

Scan to open the full 4140 page with all five tables.