

Through-Hardening Low Alloy Steel Bar 4340 Grade Data Sheet

Grade 4340

Grade 4340 is a nominally 1.8 percent Nickel Chromium Molybdenum low alloy steel of high hardenability, with high strength and toughness in relatively large sections achieved with a "quench-and-temper" heat treatment. A contemporary alternative to 4340 is grade 6582 through-hardening steel that has improved through-hardening characteristics and offers superior impact properties to 4340 at equivalent strength levels.

Related Specifications

Grade 4340 low-alloy steel bar complies with grade AS1444, Grade 4340 and/or ASTM A434(A29) Grade 4340. Grade 4340 is an alternative to grade 6582 through-hardening steel and to JIS SCNM447.

Chemical Composition (%)

C	Si	Mn	P	S	Cr	Mo	Ni
0.37 - 0.44	0.10 - 0.35	0.55 - 0.90	≤ 0.040	≤ 0.040	0.65 - 0.95	0.20 - 0.35	1.55 - 2.00

Conditions of Supply – Mechanical Properties

Grade 4340 is supplied in the hardened and tempered condition. The level of hardness is selected to give useful strength while still maintaining the ability to machine the material into finished components.

Diameter (mm)	Tensile Strength (MPa)	Approx. Mechanical Condition	0.2% Proof Stress (MPa)	Elongation (A%)	Impact Value Charpy (J)
≤ 60	1000 - 1150	V	835 min	12 min	42 min
> 60 ≤ 100	930 - 1080	U	740 min	12 min	42 min
> 100 ≤ 178	930 - 1080	U	720 min	14 min	50 min
> 178 ≤ 240	900 - 1000	T	690 min	14 min	35 min

Conditions of Supply – Surface Finish and Machining Allowance

Grade 4340 Black is supplied with +/- tolerance according to DIN 1013 or better. Grade 4340 Bright is supplied cold drawn with h10 tolerance for bars up to 25mm diameter. Bars with diameters 25 to 75mm are supplied cold drawn to h10 or peeled to k12. Bars 75 to 210 mm are supplied peeled to k12 and sizes 210mm and over are peeled to a -0/+2mm tolerance.

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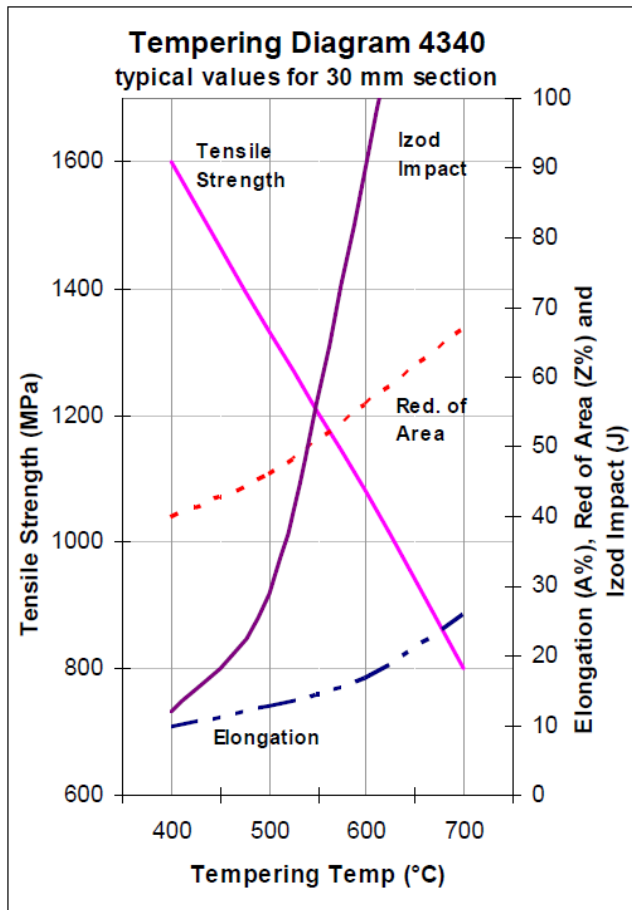
Machining Allowances for 4340 Round Bar (mm on diameter)

Bar Diameter (mm)	Black (Hot Rolled or Forged)		Bright (Drawn or Peeled Bar)	
	Part Length <120mm	Part Length >120mm	Part Length <120mm	Part Length >120mm
0 - 50	1.5mm	1.5 + 6mm/m	1.0mm	1.0 + 4mm/m
50 - 100	2.3mm	2.3 + 6mm/m	1.0mm	1.0 + 4mm/m
100 - 150	4.5mm	4.5 + 6mm/m	1.0mm	1.0 + 4mm/m
150 - 210	6.5mm	6.5 + 6mm/m	1.5mm	1.5 + 4mm/m
210 - 450	-	-	1.5mm	1.5 + 6mm/m

Hot-rolling surface defects are retained in cold drawing. For bright bar in the range of cold drawing (up to 50mm) it is essential to take machining allowance into account. Peeled bar is generally free of surface defects. A certain allowance for surface defects is recommended however, as minor defects are permitted by the various national standards (AS, EN, etc.).

Heat Treatment

Annealing	Normalising	Hardening	Quenching Medium	Tempering
850°C	850 - 920°C	850 - 860°C	Oil	450 - 650°C



Hardening

Heat components slowly to 850°C, hold until uniform then quench vigorously in oil (or polymer with an equivalent quench rate) to between 80 and 110°C.

Tempering

While still warm, re-heat to 450 to 650°C, hold one hour per 25mm of section (2 hours minimum) and cool in air. Select tempering temperatures according to the required mechanical properties – refer to tempering curve.

Stress relieving

For pre-hardened steel stress relieving is achieved by heating to between 500 to 550°C. Retreated bars or forgings heat to 25°C below tempering temperature. Annealed components, 600 to 650°C. Hold in this temperature range for 1 to 2 hours, furnace cool to 450°C, then air cool.

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Surface Hardening

Nitriding

Nitride at approximately 510°C for 10 to 60 hours, depending upon required case. Surface hardness achievable is 600 to 650HV.

Induction or Flame Hardening

Grade 4340 can be surface hardened to 58HRC (water quench) or surface hardened to between 53 to 55HRC (oil quench). Tempering at 200°C.

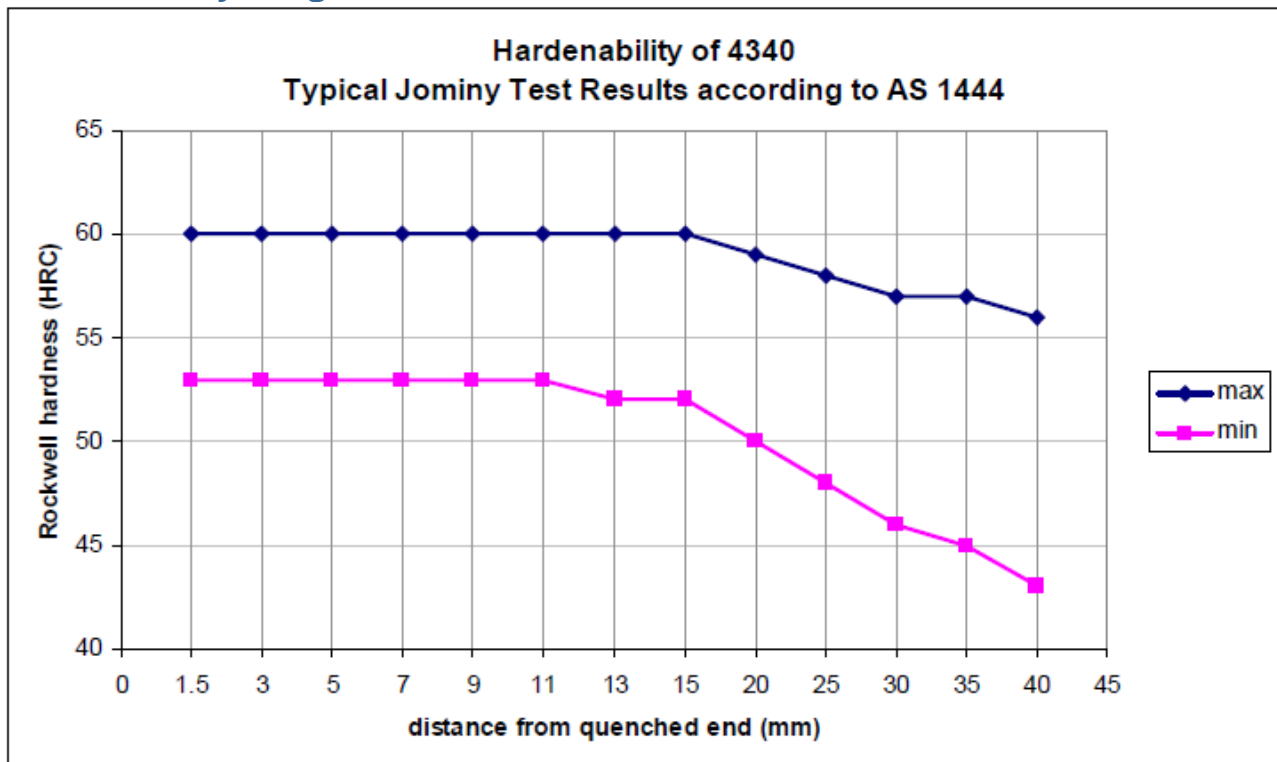
Welding

Welding is not recommended because of the danger of quench cracking. If welding must be carried out, pre-heat to 200 to 300°C and maintain this while welding. Immediately after welding stress relieve at 550 to 650°C.

Applications of Grade 4340

Parts exposed to high permanent and fluctuating stresses. Applications where excellent fatigue and toughness properties of the material are required. Typical components include gears, planetary gears, axles, pinions, shafts, bushes and sleeves.

Hardenability Diagram



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Possible Alternative Grades

Grade	Why it might be chosen instead of 4340
4140	Lower cost and better availability in a range of sizes. However, in general slightly lower impact properties achieved when heat-treated to similar strength levels as 4340.
6582	Superior impact properties and through-hardening when heat-treated to similar strength levels as 4340.
6580	Substantially higher yield strength achievable, especially in larger sections, when heat treated to similar impact properties as 4340. Higher toughness is also achieved in 6580.

Limitation of Liability

The information contained in this Atlas Steels Through-Hardening Low Alloy Steel Bar 4340 Grade Data Sheet document is not an exhaustive statement of all relevant information. It is a general guide for customers to the products and services available from Atlas Steels and no representation is made or warranty given in relation to this information or the products or processes it describes.