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## 1045 Medium Tensile Carbon Steel Bar

1045 is a medium tensile low hardenability carbon steel generally supplied in the black hot rolled or occasionally in the normalised condition, with a typical tensile strength range 570 - 700 Mpa and Brinell hardness range 170 - 210 in either condition.

Characterised by fairly good strength and impact properties, plus good machinability and reasonable weldability in the hot rolled or normalised condition.

1045 has a low through hardening capability with sections up to around 60mm only generally recommended as suitable for through hardening and tempering. It can however be successfully flame or induction hardened in the as rolled or normalised condition resulting in surface hardnesses of up to Rc 54 - Rc 60 depending upon quenching medium employed, type of set up, section size etc. Core strengths will remain as supplied.

It does not however respond satisfactorily to nitriding due to a lack of suitable alloying elements.

1045 is used extensively by all industry sectors for applications requiring more strength and wear resistance than the low carbon mild steels can provide and the higher strength of the low alloy high tensile steels is not necessary, plus those applications requiring flame or induction hardening.

Typical applications are: Axles Various, Bolts, Connecting Rods, Hydraulic Clamps and Rams, Pins Various, Rolls Various, Studs, Shafts, Spindles etc.

Colour Code



Serpentine  
(Bar End)

[Stocked Sizes](#)

Rounds 24mm - 690 mm Dia

Squares 22 - 100mm

## Related Specifications

Australia	AS 1442 - 1992 1045
Germany	W.Nr 1.0503 C45 W.Nr 1.1191 CK45
Great Britain	BS970 - Part 3 - 1991 080A47 BS970 - Part 1 - 1972 080M46 BS970 - 1955 EN43B
Japan	JIS G 4051 S45C
USA	AISI C1045 ASTM A29/A29M - 91 1045 SAE 1045 UNS G 10450

## Chemical Composition

	Min. %	Max. %
Carbon	0.43	0.50
Silicon	0.10	0.35
Manganese	0.60	0.90

## Typical Mechanical Properties - Hot Rolled Condition

Tensile Strength Mpa	Yield Strength Mpa	Elongation In 50mm %	Hardness Brinell HB
570 - 700	300 - 450	14 - 30	170 - 210

## Typical Mechanical Properties - Normalised Condition

Tensile Strength Mpa	Yield Strength Mpa	Elongation in 50mm %	Impact Izod J	Hardness	
				HB	Rc
640	410	22	54	187	10

\*Material stocked generally in the hot rolled condition but can occasionally be in the normalised condition.

NB. Check the mill certificate if critical for end use.

**Typical Mechanical Properties - Hardened by Water Quench at 820 °C - 850 °C or oil quench at 830 °C - 860 °C and Tempered Between 540 °C - 680 °C**

Section Size mm	Tensile Strength Mpa Min Max	Yield Strength Mpa Min	Elongation in 50mm % Min	Impact Charpy J Average	Hardness HB	
					Min	Max
up to 16mm	700 850	500	14	30	210	245
17 - 40mm	650 800	430	16	30	195	235
41 - 100mm	630 780	370	17	30	185	230

**Forging**

Pre heat to 750 °C - 800 °C, then continue heating to 1100 °C - 1200 °C maximum, hold until temperature is uniform throughout the section and commence forging immediately.

Do not forge below 850 °C

Finished forgings may be air cooled.

**Heat Treatment**

**Annealing**

Heat to 800 °C - 850 °C hold until temperature is uniform throughout the section, and cool in furnace.

**Flame or Induction Hardening**

Heat as quickly as possible to the austenitic temperature range (820 °C - 860 °C) and required case depth followed by an immediate water or oil quench, depending upon hardness required, workpiece size/shape and quenching arrangements.

The black hot rolled/normalised surface will first require to be machined sufficiently to remove any de carburised layer, otherwise less than satisfactory results will be obtained.

Following quenching to hand warm, most components should be tempered at 150 °C - 200 °C to remove quenching stresses in the case. This will have little effect on case hardness.

**Hardening**

Heat to 820 °C - 850 °C hold until temperature is uniform throughout the section, soak for 10 - 15 minutes per 25mm of section, and quench in water or brine.

or:

Heat to 830 °C - 860 °C soak as above and quench in oil.

Temper immediately while still hand warm.

**Normalising**

Heat to 870 °C - 920 °C hold until temperature is uniform throughout the section, soak for 10 - 15 minutes.

Cool in still air.

**Stress Relieving**

Heat to 550 °C - 660 °C hold until temperature is uniform throughout the section, soak for 1 hour per 25mm of section, and cool in still air.

**Tempering**

Re heat to 400 °C - 650 °C as required, hold until temperature is uniform throughout the section, soak for 1 hour per 25mm of section, and cool in still air.

**Notes on Heat Treatment**

Heating temperatures, rate of heating, cooling and soaking times will vary due to factors such as work piece size/shape, also furnace type employed, quenching medium and work piece transfer facilities etc.

Please consult your heat treater for best results.

**Machining**

1045 in the hot rolled and normalised condition has very good machinability and all operations such as sawing, turning, drilling, broaching, milling and tapping etc. can be carried out satisfactorily using machine manufacturers recommendations for suitable tool type, feeds and speeds.

**Welding**

1045 is readily weldable in the as rolled and normalised condition providing the correct procedure is employed.

Following welding the work piece immediately upon cooling to hand warm should be stress relieved at 550 °C - 660 °C if possible.

NB. Welding in the hardened and tempered, flame or induction hardened condition is not recommended.

**Welding Procedure**

Welding of 1045 should always be carried out using low hydrogen electrodes.

Please consult your welding consumables supplier.

**Suggested pre-heat temperature**

Section	°C
25 mm	100
50 mm	140
75 mm	200
150 mm +	300

**Post Welding**

Cool as slowly as possible in dry lime, sand etc.

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