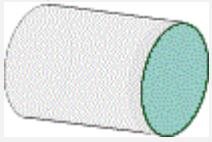
1045 MEDIUM TENSILE CARBON STEEL BAR

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	Stocked Sizes	
Serpentine (Bar End) 	Rounds	16 mm - 690 mm Dia
	Squares	25 mm - 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	570 - 700
Yield Strength Mpa	300 - 450
Elongation in 50mm %	14 - 30

Hardness Brinell HB	170 - 210			
Typical Mechanical Properties - Normalised Condition				
Tensile Strength Mpa		640		
Yield Strength Mpa		410		
Elongation in 50mm %		22		
Impact Izod J		54		
Hardness	HB	187		
	Rc	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		up to 16mm	17 - 40mm	41 - 100mm
Tensile Strength Mpa	Min	700	650	630
	Max	850	800	780
Yield Strength Mpa	Min	500	430	370
Elongation in 50mm %	Min	14	16	17
Impact Charpy J	Average	30	30	30
Hardness HB	Min	210	195	185
	Max	245	235	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 Harderning				
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.				
Normalizing				
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	25mm	50mm	75mm	150mm +
°C	100	140	200	300

Post Welding

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