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1045 Bright Carbon Steel Bar

1045 is a medium tensile low hardenability carbon steel generally supplied in the cold drawn or turned and polished condition, with a typical tensile strength range 600 - 950 Mpa and Brinell hardness range 179 - 280. in either condition.


Characterised by good strength and impact properties, with good machinability and reasonable weldability in the as supplied 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 supplied 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	Metric 12m - 120 mm Dia Imperial 3/8" - 5-1/2"Dia
		Hexagons	3/4" - 1-1/8"

Related Specifications

Australia	AS 1443 - 1994 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
Phosphorous	0	0.04
Sulphur	0	0.04

Typical Mechanical Properties - Cold Drawn and Turned and Polished Condition

Cold Drawn Size mm	Tensile Mpa Strength		Yield Strength Mpa		Elongation in 50mm % Min	Hardness HB	
	Min	Max	Min	Max		Min	Max
up to 16mm	690	950	540	760	8	205	280
17 - 38mm	650	830	510	650	8	195	245
39 - 63mm	640	800	500	630	9	190	235
Turned & Polished							

All Sizes	600 730	300 450	14	179	215
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Typical Mechanical Properties - Cold Drawn or Turned and Polished - 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	Hardness HB	
				Min	Max
up to 16mm	700 840	480	11	210	245
17 - 40mm	660 800	410	13	195	235
41 - 63mm	620 760	375	14	185	225

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.

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 cold drawn or turned and polished condition has very good machinability and all operations such as 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 cold drawn or turned and polished 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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