

## 1022 CARBON STEEL BAR

1022 is a general purpose low tensile low hardenability carbon steel generally supplied in the black hot rolled condition, with a typical tensile strength range 360 - 560 Mpa and Brinell hardness range 100 - 170. Characterised by excellent weldability, fairly good machinability with reasonable strength and good ductility.

1022 due to its very low hardenability will through harden only in very small sections to relatively moderate strength levels, and is therefore generally used in the as rolled condition. It can however be carburised achieving case hardnesses over Rc 65 with smaller sections, reducing as section size increases. Core strength will remain as supplied for all sections. Alternatively it can be carbonitrided offering some advantages over standard carburising.

It will not respond satisfactorily to flame or induction hardening due to its low carbon content, nor to nitriding due to a lack of suitable alloying elements.

1022 is used by all industry sectors for applications involving welding or when high strength is not necessary, plus lightly stressed carburised parts.

Typical applications are: General Engineering Parts and Components, Welded Structures etc. or Carburised: Camshafts, Light Duty Gears, Gudgon Pins, Ratchets, Spindles, Worm Gears etc.

Colour Code	Stocked Sizes
White (Bar End)	36 mm - 690 mm Dia
	<b>Bar Finish</b>
	Black Bar

### Related Specifications

Australia	AS 1442 - 1992 1022
Germany	W.Nr 1.0402 C22 W.Nr 1.1151 CK22
Great Britain	BS970 - Part 3 - 1991 070M20 BS970 - Part 1 - 1983 120M19 BS970 - 1955 EN3C
Japan	JIS G 4051 S20C
USA	AISI C1022 and C1522 ASTM A29/A29M - 91 1022 and 1522 SAE 1022 and 1522 UNS G 10220 UNS G 15220

### Chemical Composition

	Min. %	Max. %
Carbon	0.16	0.24
Silicon	0.10	0.40
Manganese	0.70	1.40
Phosphorous	0	0.05
Sulphur	0	0.05

### Typical Mechanical Properties - Hot Rolled Condition

Tensile Strength Mpa	550
Yield Strength Mpa	330
Elongation in 50mm %	27

Hardness Brinell HB	150		
<b>Typical Mechanical Properties - Hardened by Water Quench at 875 °C and Tempered Between 540 °C - 680°C</b>			
Section Size mm		up to 16mm	17 - 40mm
Tensile Strength Mpa	Min	550	500
	Max	700	650
Yield Strength Mpa	Min	350	300
Elongation in 50mm %	Min	20	22
Impact Charpy J	Average	55	55
Hardness HB	Min	165	150
	Max	210	190
<b>Forging</b>			
Heat to 1100 °C - 1200 °C maximum, hold until temperature is uniform throughout the section and commence forging. Do not forge below 900 °C Finished forgings may be air cooled.			
<b>Heat Treatment</b>			
<b>Annealing</b>			
Heat to 870 °C - 910 °C hold until temperature is uniform throughout the section, and cool in furnace.			
<b>Carburizing</b>			
Pack, salt or gas carburise at 880 °C - 920 °C, holding for sufficient time to develop the required case depth and carbon content, followed by a suitable refining/hardening and tempering cycle to optimise case and core properties.			
<b>Core Refine</b>			
Slow cool from Carburising temperature and re-heat to 870 °C - 900 °C, hold until temperature is uniform throughout the section and quench as required in oil, water or brine.			
<b>Case Hardening</b>			
Following core refining, re-heat to 760 °C - 780 °C, hold until temperature is uniform throughout the section and quench in water. Temper immediately while still hand warm.			
<b>Tempering - After Carburising, Core Refining and Case Hardening</b>			
Re-heat to 150 °C - 200 °C, hold until temperature is uniform throughout the section, soak for 1 hour per 25 mm of section and cool in still air. NB. Tempering will improve the toughness of the case with only slight reduction in case hardness. It will also reduce its susceptibility to grinding cracks.			
<b>Normalizing</b>			
Heat to 890 °C - 940 °C hold until temperature is uniform throughout the section, soak for 10 - 15 minutes and cool in still air.			
<b>Stress Relieving</b>			
Heat to 650 °C - 700 °C hold until temperature is uniform throughout the section, soak for 1 hour per 25mm of section, and cool in still air.			
<b>Through Hardening</b>			
Heat to 860 °C - 890 °C hold until temperature is uniform throughout the section, soak for 10 - 15 minutes per 25mm of section, and quench in water or brine. Temper immediately while still hand warm			
<b>Tempering - After Through Hardening</b>			
Re heat to 540 °C - 680 °C as required, hold until temperature is uniform throughout the section, soak for 1 hour per 25mm of section, and cool in still air.			
<b>Notes on Heat Treatment</b>			
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.			
<b>Machining</b>			

1022 in the black hot rolled as supplied condition has slightly lower machinability than a similar product such as M1020 bright steel. The hot rolled structure being softer tends to wrap around the cutting tool resulting in a less clean cut. All machining operations should be carried out as per machine manufacturers recommendations for suitable tool type, feeds and speeds.

### **Welding**

1022 has excellent weldability in the hot rolled as supplied condition, and can be readily welded by any of the standard welding processes.NB. Welding in the carburised or heat treated condition is not recommended.

### **Welding Procedure**

A pre-heat or post-heat is not generally required, however a post-weld stress relieve can be beneficial if possible as can pre-heating larger sections.please consult your welding consumables supplier for suitable electrodes etc.

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