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 hardnasses 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

<table>
<thead>
<tr>
<th>Stocked Sizes</th>
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<tbody>
<tr>
<td>Metric 10 mm - 150 mm Dia</td>
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<tr>
<td>Imperial 3/8&quot; - 6&quot; Dia</td>
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<tr>
<td>3/4&quot; - 100 mm</td>
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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

<table>
<thead>
<tr>
<th>Min. %</th>
<th>Max. %</th>
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<tbody>
<tr>
<td>Carbon</td>
<td>0.43</td>
</tr>
<tr>
<td>Silicon</td>
<td>0.10</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.60</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>0</td>
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<tr>
<td>Sulphur</td>
<td>0</td>
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Typical Mechanical Properties - Cold Drawn, Turned and Polished, or Centreless Ground Condition
| Tensile Strength Mpa | Min | 690 | 650 | 640 | 600 |
| Tensile Strength Mpa | Max | 950 | 830 | 800 | 730 |
| Yield Strength Mpa | Min | 540 | 510 | 500 | 300 |
| Yield Strength Mpa | Max | 760 | 650 | 630 | 450 |
| Elongation in 50mm % | Min | 8  | 8  | 9  | 14 |
| Elongation in 50mm % | Max | 205 | 195 | 190 | 179 |
| Hardness HB | Min | 205 | 195 | 190 | 179 |
| Hardness HB | Max | 280 | 245 | 235 | 215 |

**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**

**Cold Drawn Size mm**

| Cold Drawn Size mm | up to 16mm | 17 - 40mm | 41 - 63mm |
| Cold Drawn Size mm | Min | 700 | 660 | 620 |
| Cold Drawn Size mm | Max | 840 | 800 | 760 |

**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-heating Temperature

<table>
<thead>
<tr>
<th>Section</th>
<th>25mm</th>
<th>50mm</th>
<th>75mm</th>
<th>150mm +</th>
</tr>
</thead>
<tbody>
<tr>
<td>°C</td>
<td>100</td>
<td>140</td>
<td>200</td>
<td>300</td>
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</table>

Post Welding

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

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