

## Medium Tensile Carbon Steel Bar 1045 Grade Data Sheet

### Grade 1045

Grade 1045 is a fully killed plain carbon steel product containing nominally 0.45% carbon. This grade was formerly designated as K1045. 1045 is supplied based on it meeting specified chemical composition requirements only.

### Related Specifications

Bar in grade 1045 is supplied in accordance with the requirements of JIS J4051 grade S45C and/or AS1442 grade 1045 in the case of black bar, and AS1443 grade 1045 in the case of bright (cold finished) bar.

### Chemical Composition (%)

C	Si	Mn	P	S
0.43 - 0.50	0.10 - 0.35	0.60 - 0.90	≤ 0.040	≤ 0.040

### Conditions of Supply – Typical Mechanical Properties

1045 is not guaranteed to meet any specified minimum mechanical properties and values in the table below reflect typical properties only. These values reflect grade D6 (AS 1443) for cold drawn sections, grade T6 (AS 1443) for turned and polished and grade 6 (AS 1442) for rolled (black) sections. Brinell Hardness (HB) is not specific in these standards.

Condition	Diameter (mm)	Tensile Strength (MPa)	Yield Stress (MPa)	Elongation (% in 50mm)	Hardness (HB)
Cold Drawn	Up to 16mm inclusive	690 min	540 min	8 min	207 min
	>16mm to 38mm inclusive	650 min	510 min	8 min	195 min
	>38mm to 80mm inclusive	640 min	500 min	9 min	190 min
As Rolled / Turned and Polished	All sizes to 260mm	600 min	300 min	14 min	179 min

1045 bright bar can be supplied as D6 or T6 (or equivalent) with guaranteed mechanical properties on special order request. 1045 black bar can be supplied in the normalised condition with guaranteed mechanical properties on special order request.

### Conditions of Supply – Finish, Dimensions and Tolerances

#### Finish

1045 is supplied in three different surface finish classes:

- Rolled/forged (black);
- Cold drawn or smooth-turned and polished; and
- Centreless ground.

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### Diameter and A/F Tolerances

1045 black round bar is supplied with max. dimensional tolerance on diameter of  $\pm 1.5\%$  (min. 0.4mm).

1045 cold drawn/turned round bar is supplied in tolerances h10 or h9.

1045 centreless ground round bar is supplied in tolerance h8 or better.

1045 square bar, hexagonal bar and flat bar are supplied in tolerance h11.

### Straightness – Maximum Deviation from a Straight Line

Rolled (black) round bar: 3mm in 1000mm.

Bright round bar: 2mm in 1000mm.

Centreless ground: 0.3mm in 1000mm.

Square, flat & hexagonal bar: 1mm in 375mm.

Other tolerances may be supplied for more critical applications upon enquiry.

### Length Tolerances for Bright Bars

Mill lengths (3.5 to 6.0m):  $\pm 250\text{mm}$  max.

Set lengths (3.0 to 7.0m):  $-0/+100\text{mm}$  max, better tolerance subject to enquiry.

### Machining Allowances for 1045 Round Bar (mm on diameter)

Bar Diameter (mm)	Black (Hot Rolled or Forged)		Bright (Drawn or Peeled Bar)	
	Part Length <120mm	Part Length >120mm	Part Length <120mm	Part Length >120mm
Up to 50 incl.	2.8mm	2.8 + 6mm/m	1.0mm	1.0 + 4mm/m
>50 to 100 incl.	4.5mm	4.5 + 6mm/m	1.0mm	1.0 + 4mm/m
>100 to 150 incl.	5.3mm	5.3 + 6mm/m	1.0mm	1.0 + 4mm/m
>150 to 200 incl.	9.0mm	9.0 + 6mm/m	1.5mm	1.5 + 4mm/m
>200 to 500 incl.	-	-	1.5mm	1.5 + 6mm/m

Hot-rolling surface defects are retained in cold drawing. For bright bar in the range of cold drawing (up to 50mm) it is essential to take machining allowance into account. Peeled bar is generally free of surface defects. A certain allowance for surface defects is recommended however, as minor defects are permitted by the various national standards (AS, JIS, EN etc.).

### Heat Treatment

The following temperature ranges are applicable for the respective heat treatment operations.

Full Annealing	Normalising	Hardening	Quenching Medium	Tempering
800 - 850°C	840 - 880°C	820 - 860°C	Water or Oil	550 - 660°C

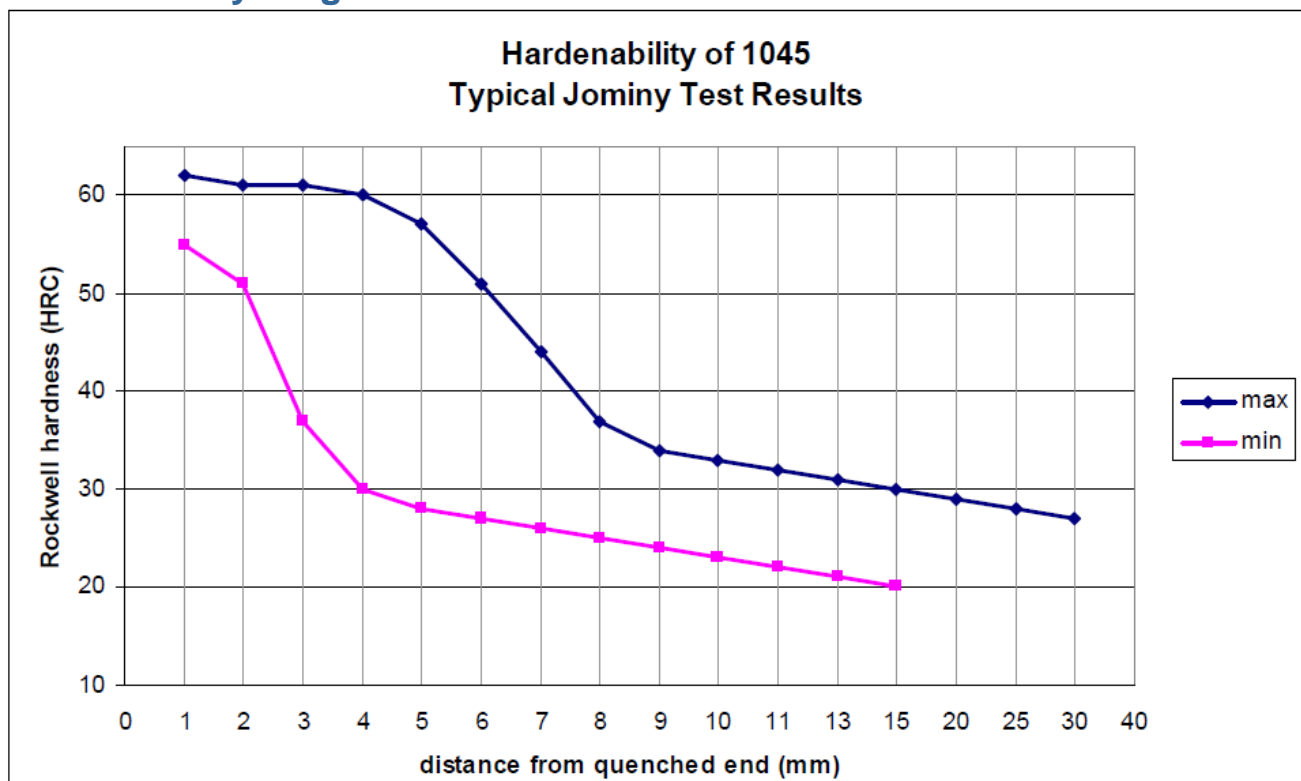
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### Typical Mechanical Properties in Heat Treated Condition

After quenching and tempering 1045 achieves typically the following mechanical properties.

Diameter (mm)	Tensile Strength (MPa)	0.2% Proof Stress (MPa)	Elongation (%)	Reduction of Area (%)	Impact Charpy (J)
Up to 40 incl.	650 - 800	430 min	16 min	40 min	25 min
>40 to 100 incl.	630 - 780	370 min	17 min	45 min	25 min
>100 to 250 incl.	590 - 740	340 min	18 min	-	22 min
>250 to 500 incl.	590 - 740	320 min	17 min	-	20 min

### Hardenability Diagram



### Surface Hardening

Grade 1045 is suitable for induction hardening and flame hardening.

### Welding

Grade 1045 can be welded by all conventional welding processes, MIG, TIG, MMAW etc. Pre-and post-heating (also in light sections) are required as part of the welding procedure to avoid cracking.

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### Applications of Grade 1045

Grade 1045 is used in general engineering applications. This grade is used in engineering applications where better strength that is offered by either M1020 or M1030 is a requirement. Typical applications include hydraulic rams, shafts and medium to higher strength threaded fasteners. Grade 1045 is generally not recommended for critical applications, particularly those where high strength is required in combination with ductility or toughness. For these applications low-alloy steels are generally recommended (or in certain cases micro-alloy steels).

### Possible Alternative Grades

Grade	Why it might be chosen instead of 1045
M1030	Where a lower tensile and yield strength grade is acceptable. If grade M1030 is used as an alternative then pre-and post-heat would normally still need to be used, particularly in heavier sections.
4140	Further increase in strength required, plus guaranteed tensile properties are a requirement. Better impact properties are required. Higher core strength required. Welding of grade 4140 would normally be recommended. In case of attempting to weld this grade guidance from an experienced and qualified welding engineer must be sought.

#### **Limitation of Liability**

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