

# Sanbar® 61

## Hollow drill steel

### Datasheet

Sanbar® 61 is a high strength silicon steel with good toughness and impact resistance in the as-rolled condition.

### Chemical composition (nominal)

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C	Si	Mn	P	S	Cr	Ni	Mo
0.41	1.5	0.9	≤0.025	≤0.020	0.7	0.5	0.2

### Applications

Sanbar® 61 is used for tapered rods, pilot rods and integral drill steels.

### Forms of supply

Hollow drill steel is supplied as hollow, hot-rolled, round or hexagon bar. The ends are trimmed square to within 0.15 mm (0.006 in.) maximum.

### Surface condition and protection

Both the outer and inner surfaces are free from harmful slag marks, cracks and scratches. The maximum depth of defects is 0.20 mm (0.008 in.) on the outer surface and 0.15 mm (0.006 in.) on the inner surface.

The outer surface can be supplied dry or oiled for protection against corrosion during transportation. The flushing holes are normally sealed with plastic caps.

### Straightness

Maximum deviation is 1 mm per 1000 mm (0.04 in. per 39.4 in.).

### Fixed lengths

Fixed lengths can be supplied upon request. The length tolerance for fixed lengths are:

Lengths, mm (in.)	Tolerance, mm (in.)
≤ 3375 (132.87)	+/- 2 (0.0787)
3376–5750 (132.91–226.38)	+/- 3 (0.1181)
> 5750 (226.38)	+/- 4 (0.1575)

Bars are supplied in standard bundles containing max 1500 kg (3300 lbs).

## Mechanical properties

### As-delivered condition, typical values

Proof strength	Tensile strength	Hardness
R <sub>p0.2</sub>	R <sub>m</sub>	HRC
MPa (ksi)	MPa (ksi)	
820 (119)	1350 (196)	38–44

## Decarburization

The maximum permissible decarburization depth is 0.30 mm (0.012 in.) on the outer surface and 0.10 mm (0.004 in.) on the inner surface.

## Machining

Machining may require prior annealing.

## Forging

Induction heating to 1000–1100°C (1830–2010°F), 10–20 seconds, cooling in air. Forging range 1100–850°C (2010–560°F).

Read more about forging of Sanbar<sup>®</sup> 61 under Fabrication.

## Heat treatment

Annealing (induction heating) 730–780°C (1350–1440°F), cooling in air.

Read more about heat treatment of Sanbar<sup>®</sup> 61 under Fabrication.

## Normalizing (induction heating)

1000–1050°C (1830–1920°F), cooling in air. Shank end hardening (case hardening). Read more about shank end hardening of Sanbar<sup>®</sup> 61 under Fabrication.

Hardening: Induction heating to 900–1000°C (1650–1830°F), 2–5 seconds.

Quenching in water or oil.

## Tempering

Recommended surface hardness 55–60 HRC, temperature appr. 150–250°C (300–480°F).

## Fabrication

### Forging

Sanbar<sup>®</sup> 61 requires rapid heating to the forging temperature and, above all, the soaking time at full temperature should be as short as possible. This will minimize grain growth and decarburization, both of which drastically impair the fatigue strength.

The design of the shank and the forging of the collar are very important to the properties and performance of the drill rod. Abrupt changes in cross-section and forging defects cause stress concentrations that can severely diminish the performance of the rod and give rise to fracture. It is therefore vital that the radius between the collar and the rod is generous and defects such as laps, folds and cracks are to be avoided.

Heat the rod end locally to the correct forging temperature. Forge within the temperature range specified for Sanbar<sup>®</sup> 61, and terminate at the lower end of the temperature range. This will restrict grain growth. Forge the collar using a mandrel in the flushing hole, so that the flushing tube will not close up during forging.

### Shank end hardening

The shank must be hardened after forging and machining to obtain the strength necessary for robust service. Sanbar<sup>®</sup> 61 has been developed primarily for surface induction hardening. A normalizing process is recommended in order to eliminate prior transition zones and create optimum mechanical properties. This process will decrease the grain size and result in a microstructure with high strength and good toughness. Normalize within the temperature range specified for Sanbar<sup>®</sup> 61. Recommended hardness range: 38–44 HRC. The heated zone should overlap the previously heated zone by about 25 mm.

After the above treatment, surface induction harden the shank by heating and quenching according to the recommendations above. Temper for 0.5 hour in the range of 150–250°C (300–480°F) to obtain a hardness of 55–60 HRC.

### Brazing

The minimum hardness value in the transition zone resulting from the brazing operation should be as high as possible. It is very important to avoid interaction between transition zones and geometrical notches.

### Shot peening

Shot peening of an adequate intensity and coverage is recommended. It improves fatigue strength due to:

- Introduced compressive stresses
- Increased hardness
- Smoother surface defects

### Corrosion protection

Corrosion of a material subjected to fluctuating loads accelerates the fatigue process. In underground applications particularly, products should be protected to avoid premature fatigue breakages starting from the hole surface.

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**Disclaimer:** Recommendations are for guidance only, and the suitability of a material for a specific application can be confirmed only when we know the actual service conditions. Continuous development may necessitate changes in technical data without notice. This datasheet is only valid for Alleima materials.