

HIGH SPEED STEELS

Available Product Variants

Long Products*

Plates

*) Presented data refer exclusively to long products. Please observe the detailed explanations at the end of the data sheet (pdf).

Product Description

BÖHLER S393 MICROCLEAN – "Standardized"

This grade complies with the ASTM A600 AISI T15 material standard. With MICROCLEAN technology, this material shows excellent reliability in many cutting and cold-work applications.

Process Melting

Powder metallurgy

Properties

- > Toughness & Ductility : high
- > Wear Resistance : high
- > Compressive strength : very high
- > Edge Stability : very high
- > Grindability : high
- > Hot Hardness (red hardness) : very high

Applications

- > Broaches and Reamers
- > Fine Blanking, Stamping, Blanking
- > Rolling
- > Twist Drills and Taps
- > Cold Forming / Coining
- > Gear Cutting, Shaving and Shaping Tools
- > Shearing / Machine Knives
- > End Mills
- > Powder Pressing
- > Wear parts

Technical data

| Material designation | | Standards | |
|----------------------|------|-----------|------|
| AISI: T15 | AISI | A600 | ASTM |

Chemical composition (wt. %)

| C | Cr | Mo | V | W | Co |
|------|-----|-----|------|-------|-----|
| 1.63 | 4.0 | 0.5 | 4.75 | 12.10 | 5.0 |

Material characteristics

| | Compressive strength | Grindability | Red hardness | Toughness | Wear resistance | Edge Stability |
|-----------------------------------|----------------------|--------------|--------------|-----------|-----------------|----------------|
| BÖHLER S393 MICROCLEAN® | ★★★★ | ★★★ | ★★★★ | ★★★★ | ★★★★ | ★★★★ |
| BÖHLER S290 MICROCLEAN® | ★★★★★ | ★ | ★★★★ | ★★ | ★★★★★ | ★★★★ |
| BÖHLER S390 MICROCLEAN® | ★★★★ | ★★★ | ★★★★ | ★★★★ | ★★★★ | ★★★★ |
| BÖHLER S590 MICROCLEAN® | ★★★★ | ★★★ | ★★★★ | ★★★ | ★★★ | ★★★ |
| BÖHLER S592 MICROCLEAN® | ★★★★ | ★★★ | ★★★★ | ★★★ | ★★★ | ★★★ |
| BÖHLER S690 MICROCLEAN® | ★★★ | ★★★ | ★★ | ★★★★★ | ★★★ | ★★ |
| BÖHLER S692 MICROCLEAN® | ★★★ | ★★★ | ★★ | ★★★★★ | ★★★ | ★★ |
| BÖHLER S790 MICROCLEAN® | ★★★ | ★★★ | ★★ | ★★★★ | ★★ | ★★★ |
| BÖHLER S792 MICROCLEAN® | ★★★ | ★★★ | ★★ | ★★★★ | ★★ | ★★★ |
| BÖHLER S793 MICROCLEAN® | ★★★ | ★★★ | ★★★★ | ★★★ | ★★★ | ★★★ |

Delivery condition

Annealed

| | |
|------------------------------|--|
| Hardness (HB) | max. 300 drawn execution max. 320 HB |
| Tensile Strength (MPa ksi) | max. 1,080 157 |

Heat treatment

Annealing

| | | |
|-------------|-----------------------------------|--|
| Temperature | 770 to 840 °C 1,418 to 1,544 °F | 4 h controlled slow cooling in furnace (10 - 20°C / (50 - 68°F) to 550°C / 2 h (1022°F / 2 h) cooling in furnace. |
|-------------|-----------------------------------|--|

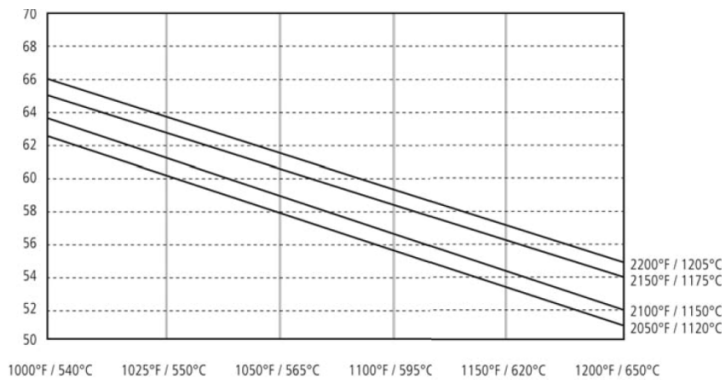
Stress relieving

| | | |
|-------------|-----------------------------------|---|
| Temperature | 600 to 650 °C 1,112 to 1,202 °F | Slow cooling furnace. To relieve stresses set up by extensive machining or in tools of intricate shape. After through heating, hold in neutral atmosphere for 1 to 2 hours. |
|-------------|-----------------------------------|---|

Hardening and Tempering

| | | |
|-------------|---------------------------------------|---|
| Temperature | 1,180 to 1,240 °C 2,156 to 2,264 °F | Salt bath, vacuum Preheating: 1st stage ~ 500 °C, 2nd stage ~ 850 °C, 3rd stage ~1050 °C Austenitising: 1180 - 1240 °C, holding time after complete heating 80 seconds, maximum 150 seconds, to avoid material damage due to overheating. Quenching: oil, warm bath (500 - 550 °C), gas |
| Temperature | 540 to 570 °C 1,004 to 1,058 °F | Slow heating to tempering temperature immediately after austenitising. Dwell time in the furnace 1 hour per 20 mm material thickness (at least 1 hour) Slow cooling to room temperature between each tempering step 3 tempering cycles recommended Hardness see tempering chart |

Tempering Chart



Holding time 3 x 2 hours
Specimen size: square 25 mm

Physical Properties

| | |
|---|-------------|
| Temperature (°C °F) | 20 68 |
| Density (kg/dm ³ lb/in ³) | 8.19 0.3 |
| Thermal conductivity (W/(m.K) BTU/ft h °F) | - |
| Specific heat (kJ/kg K BTU/lb °F) | - |
| Spec. electrical resistance (Ohm.mm ² /m 10 ⁻⁴ Ohm.inch ² /ft) | - |
| Modulus of elasticity (10 ³ N/mm ² 10 ³ ksi) | 218 31.62 |

Long Products: For additional specifications and technical requirements, please contact our regional voestalpine BÖHLER sales companies.

Open Die Forgings: Product Variant may differ in terms of melting process, technical data, delivery, and surface condition as well as available product dimensions. Please contact the business unit Open Die Forgings of voestalpine BÖHLER Edelstahl GmbH & Co KG.

Sheet & Plates: Product Variant may differ in terms of melting process, technical data, delivery, and surface condition as well as available product dimensions. Please contact voestalpine BÖHLER Bleche GmbH & Co KG.

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voestalpine

ONE STEP AHEAD.