

# HIGH SPEED STEELS

## Application Segments

Cutting Tools

## 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 higher carbon content. 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	
~ 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
<b>BÖHLER S393 MICROCLEAN</b>	★★★★	★★★	★★★★★	★★★★★	★★★★★	★★★★★
<b>BÖHLER S290 MICROCLEAN</b>	★★★★★	★	★★★★★	★★	★★★★★	★★★★★
<b>BÖHLER S390 MICROCLEAN</b>	★★★★★	★★★	★★★★★	★★★★★	★★★★★	★★★★★
<b>BÖHLER S590 MICROCLEAN</b>	★★★★★	★★★	★★★★★	★★★★	★★★★	★★★★
<b>BÖHLER S690 MICROCLEAN</b>	★★★★	★★★	★★	★★★★★	★★★★	★★
<b>BÖHLER S790 MICROCLEAN</b>	★★★★	★★★	★★	★★★★★	★★	★★★★
<b>BÖHLER S792 MICROCLEAN</b>	★★★★	★★★	★★	★★★★★	★★	★★★★
<b>BÖHLER S793 MICROCLEAN</b>	★★★★	★★★	★★★★★	★★★★	★★★★	★★★★

## Delivery condition

### Annealed

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

## Heat treatment

### Annealing

Temperature	770 to 840 °C	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.
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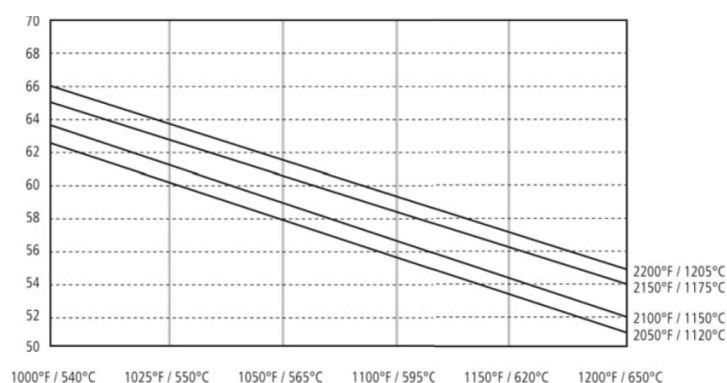
### Stress relieving

Temperature	600 to 650 °C	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.
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### Hardening and Tempering

Temperature	1,180 to 1,240 °C	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	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



## Physical Properties

Temperature (°C)	20
Density (kg/dm <sup>3</sup> )	8.19
Thermal conductivity (W/(m.K))	-
Specific heat (kJ/kg K)	-
Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)	-
Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> )	218

If other available product variants are listed in addition to long products, please note that these may differ in terms of melting process, technical data, delivery and surface condition as well as available product dimensions. For mandatory technical specifications, other requirements and dimensions, please contact our regional voestalpine BÖHLER sales companies. The data contained in this brochure is merely for general information and therefore shall not be binding on the company. We may be bound only through a contract explicitly stipulating such data as binding. Measurement data are laboratory values and can deviate from practical analyses. The manufacture of our products does not involve the use of substances detrimental to health or to the ozone layer.

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ONE STEP AHEAD.