

# HIGH SPEED STEELS

## Available Product Variants

Long Products

Round Bar

Plates

Round Ground Bar

## Product Description

### BÖHLER S390 MICROCLEAN – "The decathlete"

This grade is our PM steel with many positive usage properties. For twist drills, taps, mills, broaches, or cold-work applications, BÖHLER S390 MICROCLEAN is always a high performer.

## 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

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

## Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V	W	Co
1.64	0.6	0.3	4.8	2	4.8	10.4	8

### Material characteristics

	Compressive strength	Grindability	Red hardness	Toughness	Wear resistance	Edge Stability
<b>BÖHLER S390</b> MICROCLEAN®	★★★★	★★★	★★★★★	★★★★★	★★★★★	★★★★★
<b>BÖHLER S200</b>	★★★	★★	★★★	★★	★★★	★★
<b>BÖHLER S290</b> MICROCLEAN®	★★★★★	★	★★★★★	★★	★★★★★	★★★★★
<b>BÖHLER S400</b>	★★★	★★★	★★★	★★★	★★	★★
<b>BÖHLER S401</b>	★★	★★★	★★	★★★	★★	★★★
<b>BÖHLER S404</b>	★★	★★★	★★	★★★	★★	★★
<b>BÖHLER S500</b>	★★★★	★★★	★★★★★	★★	★★★	★★★
<b>BÖHLER S590</b> MICROCLEAN®	★★★★	★★★	★★★★★	★★★	★★★	★★★
<b>BÖHLER S600</b>	★★★	★★★	★★★	★★	★★	★★★
<b>BÖHLER S607</b>	★★★	★★★	★★★	★★	★★★	★★★
<b>BÖHLER S690</b> MICROCLEAN®	★★★	★★★	★★	★★★★★	★★★	★★
<b>BÖHLER S705</b>	★★★	★★★	★★★★★	★★	★★	★★★★★
<b>BÖHLER S790</b> MICROCLEAN®	★★★	★★★	★★	★★★★★	★★	★★★

### Delivery condition

#### Annealed

Hardness (HB)	max. 320   drawn execution max. 320 HB
Tensile Strength (N/mm <sup>2</sup>   ksi)	1,080   157

#### Hardened and Tempered

Hardness (HRC)	64 to 68
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### Heat treatment

#### Annealing

Temperature	770 to 840 °C   1418 to 1544 °F	4 h, controlled slow cooling in furnace ( 10 to 20°C/h / (50 to 68°F/h) to 740°C/2h (1364°F/2 h) cooling in furnace,
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#### Stress relieving

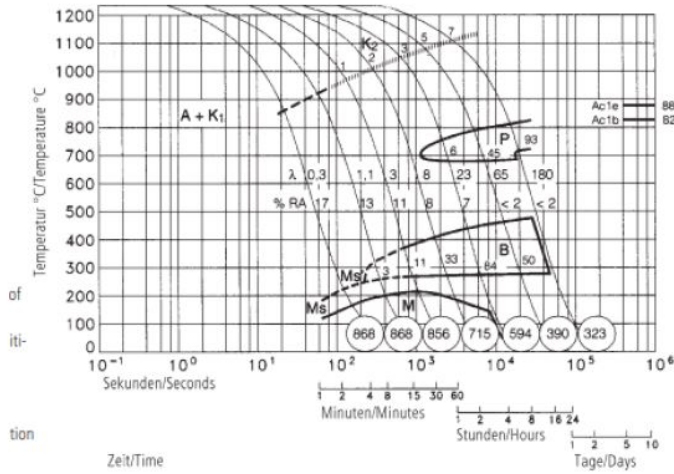
Temperature	600 to 650 °C   1112 to 1202 °F	Slow cooling in furnace. To relieve stresses set up by extensive machining or in tools of intricate shape. After through heating, hold in neutral atmosphere for 1 to 2 hours.
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#### Hardening and Tempering

Temperature	1100 to 1200 °C   2012 to 2192 °F	Oil, air, salt bath (500 - 550°C (930 - 1020°F)), gas.
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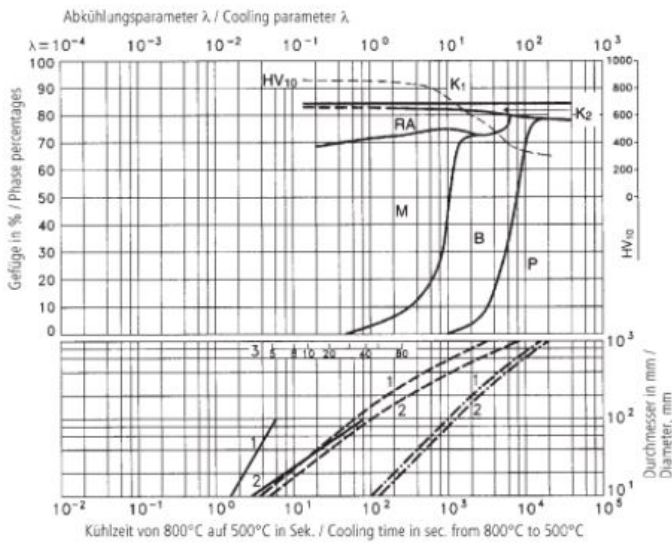
**Continuous cooling CCT curves**

Austenitising temperature: 1230°C      Austenitising temperature: 1230°C (2246°F)  
Haltedauer: 180 Sekunden                      Holding time: 180 seconds

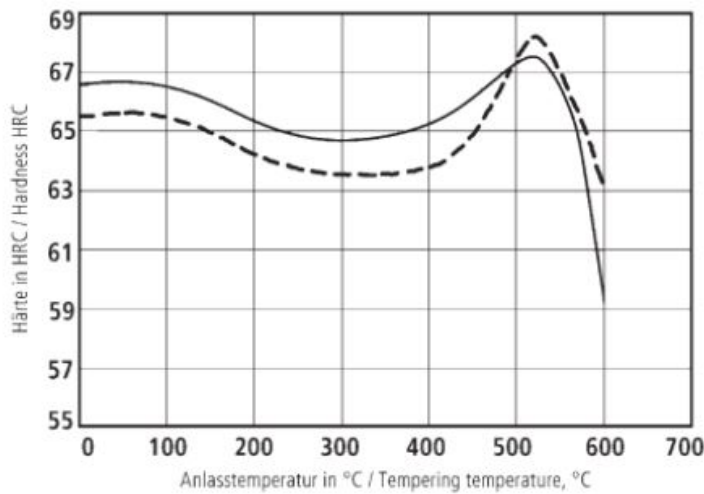


**Quantitative phase diagram**

Austenitising temperature: 1230°C      Austenitising temperature: 1230°C (2246°F)  
Haltedauer: 180 Sekunden                      Holding time: 180 seconds



### Tempering Chart



Holdingtime 3x2 hours  
 Specimensize: square 25mm  
 Austenitising in saltbath  
 Hardeningtemperature:  
 ---- 1150°C(2102°F)  
 ----- 1210°C(2210°F)

### Physical Properties

Temperature (°C   °F)	20   68
Density (kg/dm <sup>3</sup>   lb/in <sup>3</sup> )	8.1   0.29
Thermal conductivity (W/(m.K)   BTU (IT) ft/hr/ft <sup>2</sup> /F)	17   9.82
Specific heat (J/(kg.K)   BTU (IT) lb/F)	420   100.32
Spec. electrical resistance (Ohm.mm <sup>2</sup> /m   10 <sup>-4</sup> Ohm.inch <sup>2</sup> /ft)	0.61   2.88
Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup>   10 <sup>3</sup> ksi)	231   33.5

### Thermal Expansions

Temperature (°C   °F)	100   212	200   392	300   572	400   752	500   932	600   1112	700   1292
Thermal expansion (10 <sup>-6</sup> m/(m.K)   10 <sup>-6</sup> inch/(inch.F))	10   5.6	10.5   5.8	10.8   6	11.2   6.2	11.3   6.3	11.4   6.3	11.6   6.4

For more information see <https://www.voestalpine.com/boehler-edelstahl/de/>

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.