

# HIGH SPEED STEELS

## Available Product Variants

Long Products

## Product Description

Heavy-duty machining tools

Not only for the machining of steels but also for nonferrous metals such as nickel-base and titanium alloys.

- turning tools
- milling cutters
- woodworking tools
- bimetal strips for saw blades

Tools used under extreme compressive stresses

e. g. precision blanking tools for high-strength materials

- shaping punches
- dies

## Process Melting

Powder metallurgy

## Properties

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

## Applications

- > End Mills
- > Fine Blanking, Stamping, Blanking
- > Gear Cutting, Shaving and Shaping Tools
- > Special Cutting Tools
- > Blades for Sawing Machines
- > Broaches and Reamers

## Technical data

Material designation	
~1.3207	SEL
HS10-4-3-10	EN

## Chemical composition (wt. %)

C	Cr	Mo	V	W	Co
1.3	4	3.2	3.1	9.3	10

### Material characteristics

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

### Delivery condition

#### Annealed

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

### Heat treatment

#### Annealing

Temperature	870 to 900 °C   1,598 to 1,652 °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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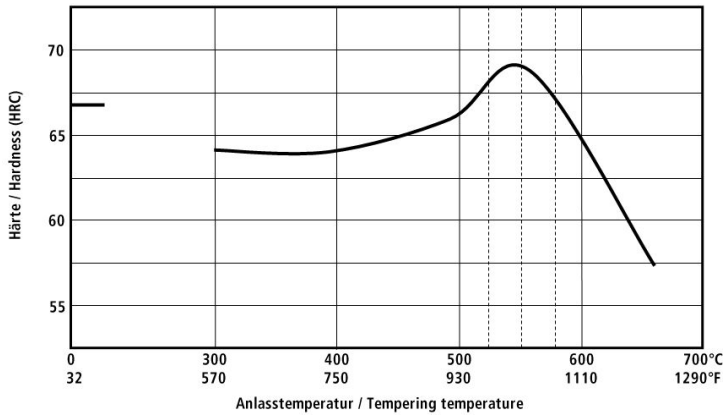
#### Stress relieving

Temperature	600 to 650 °C   1,112 to 1,202 °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	1,220 to 1,240 °C   2,228 to 2,264 °F	Salt bath, vacuum Preheating: 1st stage ~ 500 °C, 2nd stage ~ 850 °C, 3rd stage ~1050 °C Austenitising: 1220 - 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	550 to 570 °C   1,022 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



Hardening temperature: 1230°C (2246°F)

### Physical Properties

Temperature (°C   °F)	20   68
Density (kg/dm <sup>3</sup>   lb/in <sup>3</sup> )	8.3   0.3
Thermal conductivity (W/(m.K)   BTU/ft h °F)	19   10.98
Specific heat (kJ/kg K   BTU/lb °F)	0.46   0.1099
Spec. electrical resistance (Ohm.mm <sup>2</sup> /m   10 <sup>-4</sup> Ohm.inch <sup>2</sup> /ft)	0.8   3.78
Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup>   10 <sup>3</sup> ksi)	217   31.47

**Thermal Expansions between 20°C | 68°F and ...**

Temperature (°C   °F)	100   212	200   392	300   572	400   752	500   932	600   1,112	700   1,292
Thermal expansion (10 <sup>-6</sup> m/(m.K)   10 <sup>-6</sup> inch/inch.°F)	9.6   5.3	10   5.6	10.1   5.6	10.3   5.7	10.5   5.8	10.7   5.9	10.7   5.9

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

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