

# HIGH SPEED STEELS

## Available Product Variants

Long Products

## Product Description

### BÖHLER S400 – "The fast one"

This class comes from the family of molybdenum-alloyed high-speed steels and its winning performance is matched by its good cost effectiveness.

## Process Melting

Airmelted

## Properties

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

## Applications

- > Twist Drills and Taps
- > Gear Cutting, Shaving and Shaping Tools
- > Broaches and Reamers

## Technical data

Material designation		Standards	
1.3348	SEL	4957	EN ISO
HS2-9-2	EN	A600	ASTM
T11307	UNS		
M7	AISI		

## Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V	W
1.02	0.4	0.3	3.8	8.6	1.9	1.8

**Material characteristics**

	Compressive strength	Grindability	Red hardness	Toughness	Wear resistance	Edge Stability
<b>BÖHLER S400</b>	★★★	★★★	★★★	★★★	★★	★★
<b>BÖHLER S200</b>	★★★	★★	★★★	★★	★★★★	★★
<b>BÖHLER S401</b>	★★	★★★	★★	★★★	★★	★★★★
<b>BÖHLER S404</b>	★★	★★★	★★	★★★	★★	★★
<b>BÖHLER S405</b>	★★★	★★★	★★	★★★	★★	★★
<b>BÖHLER S430</b>	★★	★★★	★★	★★★	★★	★★
<b>BÖHLER S500</b>	★★★★	★★★	★★★★	★★	★★★★	★★★★
<b>BÖHLER S600</b>	★★★	★★★	★★★	★★	★★	★★★★
<b>BÖHLER S607</b>	★★★	★★★	★★★	★★	★★★★	★★★★
<b>BÖHLER S630</b>	★★★	★★★	★★★	★★	★★	★★★★
<b>BÖHLER S705</b>	★★★	★★★	★★★★	★★	★★	★★★★
<b>BÖHLER S730</b>	★★★	★★★	★★★★	★★	★★	★★★★

**Delivery condition**

**Annealed**

Hardness (HB)	max. 280   Drawn max 300 HB
Tensile Strength (N/mm <sup>2</sup>   ksi)	max. 1,020   148

**Heat treatment**

**Annealing**

Temperature	770 to 840 °C   1,418 to 1,544 °F	Controlled slow cooling in furnace (10 - 20°C / h (50 - 68°F / h) to approx. 600°C (1110°F), air cooling.
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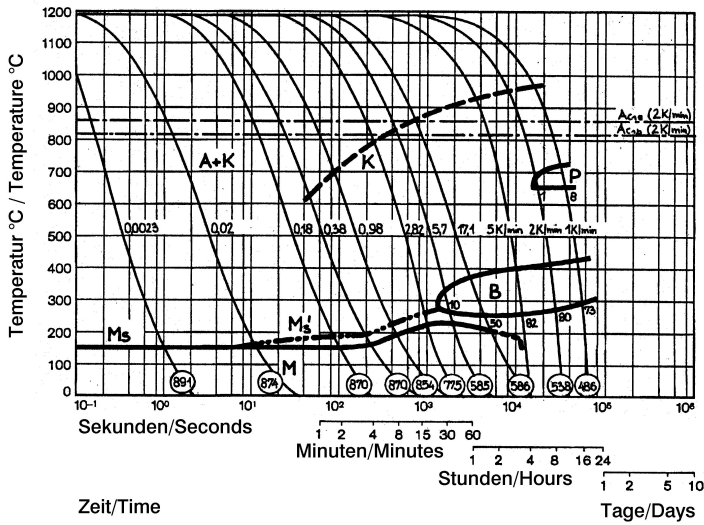
**Stress relieving**

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.
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**Hardening and Tempering**

Temperature	1,170 to 1,210 °C   2,138 to 2,210 °F	Salt bath, vacuum    Preheating: 1st stage ~ 500 °C, 2nd stage ~ 850 °C, 3rd stage ~1050 °C    Austenitising: 1170 - 1210 °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    3 tempering cycles recommended    Hardness see tempering chart

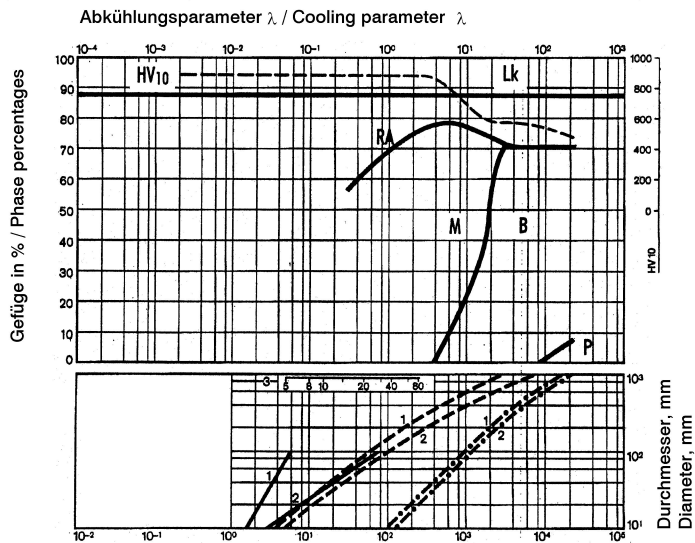
Continuous cooling CCT curves



Austenitising temperature: 1190°C (2174°F)  
Holding time: 180 seconds

- A....Austenite
- B....Bainite
- K....Carbide
- P....Pearlite
- M....Martensite
- RA...Retained Austenite

Quantitative phase diagram



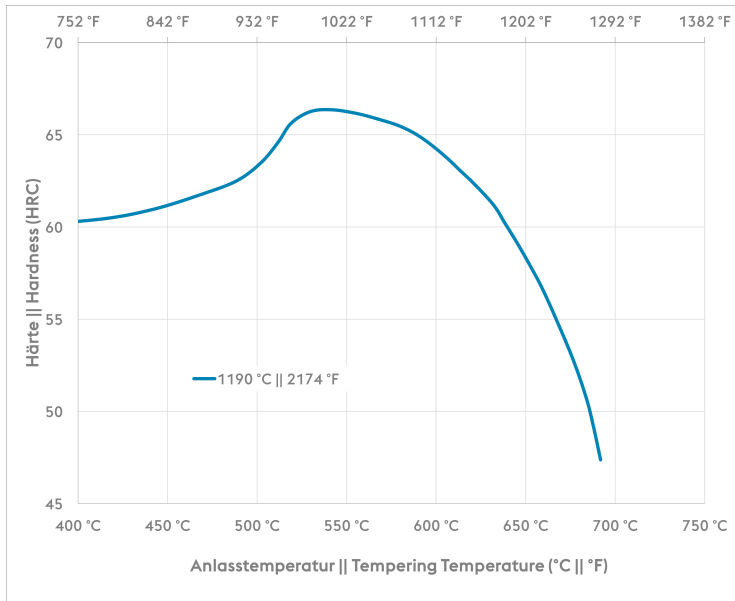
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1....Edge or Face  
2....Core  
3....Jominy test: distance from quenched end

- watercooling
- - oilcooling
- · - aircooling

Kühlzeit von 800°C auf 500°C in Sek. / Cooling time in sec. from 800°C to 500°C

### Tempering Chart



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

### 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)	0.65   3.07
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)	11   6.1	11.5   6.4	11.9   6.6	12.3   6.8	12.4   6.9	12.5   6.9	12.5   6.9

For additional specifications and technical requirements, 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.