

# HIGH SPEED STEELS

## Application Segments

Cutting Tools

## Available Product Variants

Long Products

## Product Description

### BÖHLER S401 – "The conventional"

This grade is part of 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 : high
- > Compressive strength : high
- > Edge Stability : high
- > Grindability : high
- > Hot Hardness (red hardness) : good

## Applications

- > Twist Drills and Taps
- > Thread rolling
- > Broaches and Reamers

## Technical data

Material designation		Standards	
1.3346	SEL	A600	ASTM
HS2-9-1	EN		
T11301	UNS		
M1	AISI		

## Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V	W
0.84	0.4	0.3	3.8	8.6	1.2	1.8

## Material characteristics

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

## Delivery condition

### Annealed

Hardness (HB)	max. 280
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## Heat treatment

### Annealing

Temperature	770 to 840 °C	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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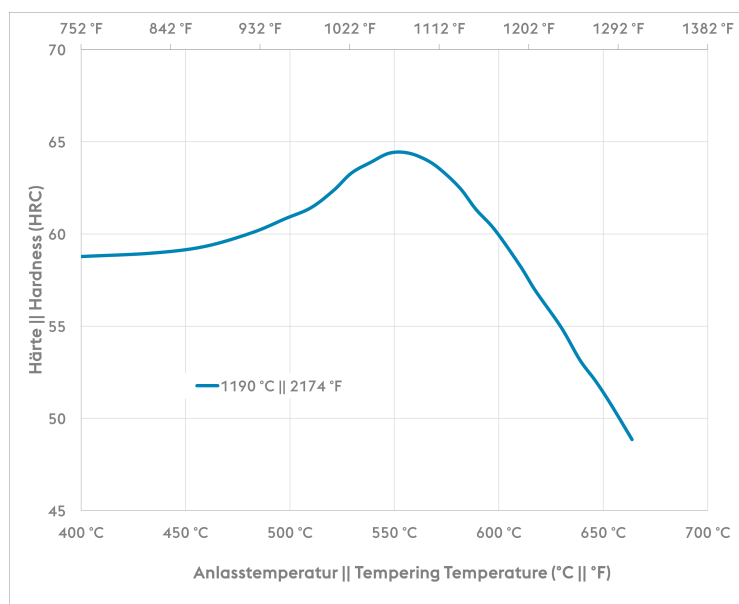
### Stress relieving

Temperature	600 to 650 °C	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	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	550 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    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)	20
Density (kg/dm <sup>3</sup> )	8
Thermal conductivity (W/(m.K))	19
Specific heat (kJ/kg K)	0.46
Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)	0.6
Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> )	217

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

Temperature (°C)	100	200	300	400	500	600	700
Thermal expansion (10 <sup>-6</sup> m/(m.K))	11	11.5	11.9	12.3	12.4	12.5	12.5

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.