

# HIGH SPEED STEELS

## Available Product Variants

Long Products

## Product Description

### BÖHLER S404 – "The discounter"

This very economical class is primarily used for spiral drill bits and has a nearly unbeatable ratio of price to performance.

## Process Melting

Airmelted

## Properties

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

## Applications

- > Twist Drills and Taps

## Technical data

Material designation		Standards	
1.3326	SEL	4957	EN ISO
HS1-4-2	EN	A600	ASTM
M52	AISI		

## Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V	W
0.89	0.3	0.3	3.8	4.3	1.8	1

**Material characteristics**

	Compressive strength	Grindability	Red hardness	Toughness	Wear resistance	Edge Stability
<b>BÖHLER S404</b>	★★	★★★	★★	★★★	★★	★★
<b>BÖHLER S200</b>	★★★	★★	★★★	★★	★★★	★★
<b>BÖHLER S400</b>	★★★	★★★	★★★	★★★	★★	★★
<b>BÖHLER S401</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
Tensile Strength (MPa   ksi)	max. 950   138

**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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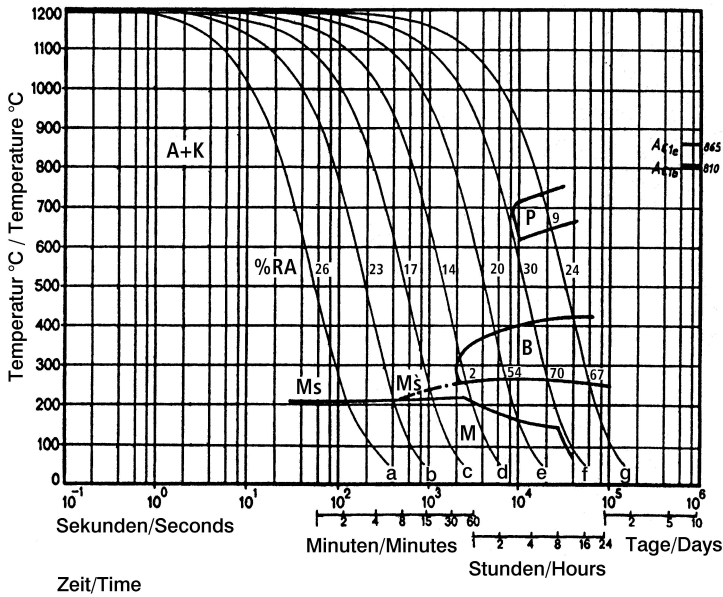
**Stress relieving**

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	1,140 to 1,180 °C   2,084 to 2,156 °F	Salt bath, vacuum    Preheating: 1st stage ~ 500 °C, 2nd stage ~ 850 °C, 3rd stage ~ 1050 °C    Austenitising: 1140 - 1180 °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    3 tempering cycles recommended    Hardness see tempering chart

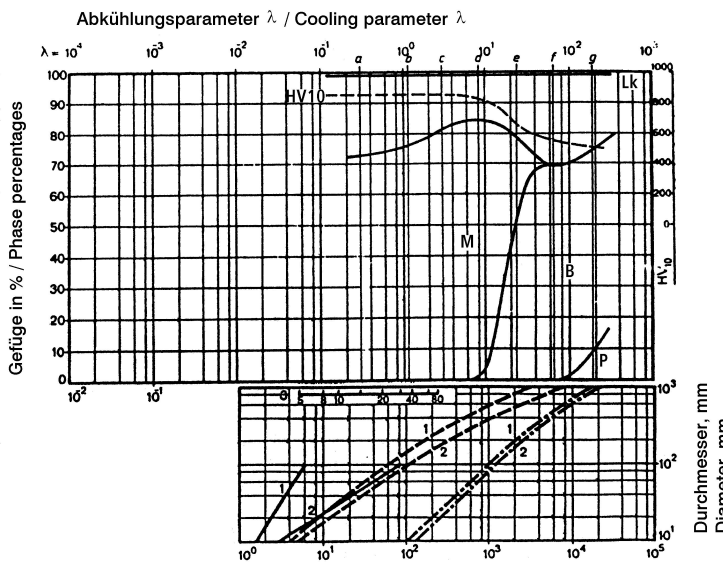
Continuous cooling CCT curves



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

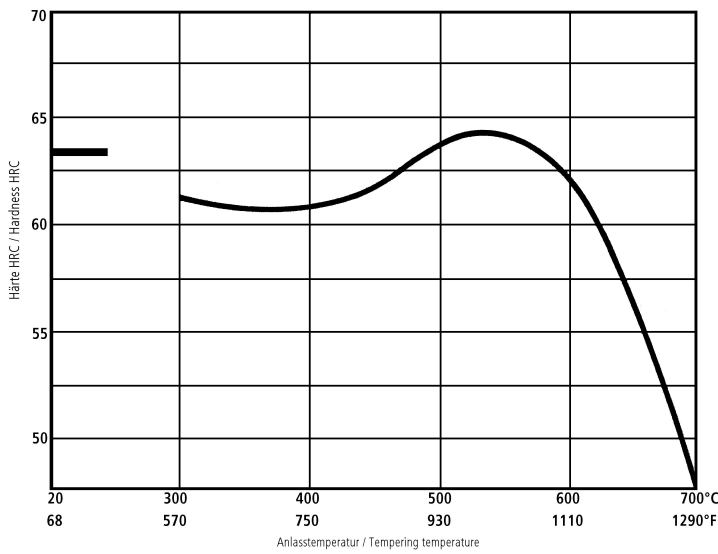


- A....Austenite
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- 1....Edge or Face
- 2....Core
- 3....Jominy test: distance from quenched end

Kühlzeit von 800°C auf 500°C in Sek. / Time of cooling from 800°C to 500°C (1472 - 932°F) in seconds

### Tempering Chart



Hardening temperature: 1160°C (2120°F)

### Physical Properties

Temperature (°C   °F)	20   68
Density (kg/dm <sup>3</sup>   lb/in <sup>3</sup> )	7.9   0.29
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)	0.5   2.36
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 ( $10^{-6}$ m/(m.K)   $10^{-6}$ inch/inch.°F)	11.5   6.4	11.7   6.5	12.2   6.8	12.4   6.9	12.7   7.1	13   7.2	13   7.2

Für weitere Spezifikationen und technische Anforderungen kontaktieren Sie bitte unsere regionalen voestalpine BÖHLER Vertriebsgesellschaften.

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ONE STEP AHEAD.