

# HIGH SPEED STEELS

## Application Segments

Cutting Tools

## Available Product Variants

Long Products

## Product Description

The cost-effectiveness of high speed steels is strongly dependent on their alloy components. Strong fluctuations in the raw materials market and resulting price variations have compelled voestalpine BÖHLER Edelstahl to rethink the basic alloy concepts of the high speed steels in our product portfolio. The result is the patented BÖHLER S730 material, which is an economical alternative to the generally applicable standard sort 1.3243 or M35 (BÖHLER S705). Despite its economic advantage, BÖHLER S730 is fully equivalent to the standard 1.3243 in terms of performance.

## Process Melting

Airmelted

## Properties

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

## Applications

- > Broaches and Reamers
- > End Mills
- > Gear Cutting, Shaving and Shaping Tools
- > Twist Drills and Taps
- > Special Cutting Tools
- > Blades for Sawing Machines

## Technical data

Material designation	
1.3230	SEL
HS-4-4-2-5 Al	EN

## Chemical composition (wt. %)

C	Cr	Mo	V	W	Co	Al
0.95	4.1	4.15	1.95	4.25	4.75	+

**Material characteristics**

	Compressive strength	Grindability	Red hardness	Toughness	Wear resistance	Edge Stability
BÖHLER S730	★★★	★★★	★★★★★	★★	★★	★★★★★
BÖHLER S400	★★★	★★★	★★★★	★★★★	★★	★★
BÖHLER S401	★★	★★★	★★	★★★★	★★	★★★
BÖHLER S404	★★	★★★	★★	★★★★	★★	★★
BÖHLER S405	★★★	★★★	★★	★★★★	★★	★★
BÖHLER S430	★★	★★★	★★	★★★★	★★	★★
BÖHLER S500	★★★★★	★★★	★★★★★	★★	★★★★	★★★
BÖHLER S600	★★★	★★★	★★★★	★★	★★	★★★
BÖHLER S601	★★★	★★★	★★★★	★★	★★	★★★
BÖHLER S607	★★★	★★★	★★★★	★★	★★★★	★★★
BÖHLER S630	★★★	★★★	★★★★	★★	★★	★★★
BÖHLER S705	★★★	★★★	★★★★★	★★	★★	★★★★★

**Delivery condition**

**Annealed**

Hardness (HB)	max. 280   Drawn max 290 HB
Tensile Strength (N/mm <sup>2</sup> )	max. 980

**Heat treatment**

**Annealing**

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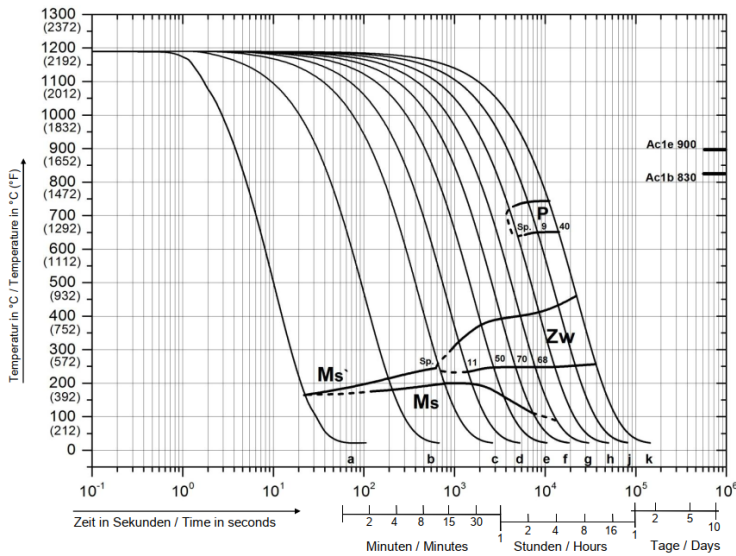
**Stress relieving**

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

Temperature	1,150 to 1,190 °C	Salt bath, vacuum    Preheating: 1st stage ~ 500 °C, 2nd stage ~ 850 °C, 3rd stage ~ 1050 °C (for higher austenitising temperature)    Austenitising: for cutting applications at higher austenitising temperatures (> 1130 °C), holding time after complete heating 80 seconds, maximum 150 seconds, to avoid material damage due to overtime.    Austenitising: for cold work applications at lower austenitising temperatures (< 1100°C). Holding time after complete heating 15 to 30 min    Quenching: oil, warm bath (500 - 550 °C), gas.
Temperature	520 to 560 °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 temperature depending on Austenitising temperature

**Continuous cooling CCT curves**

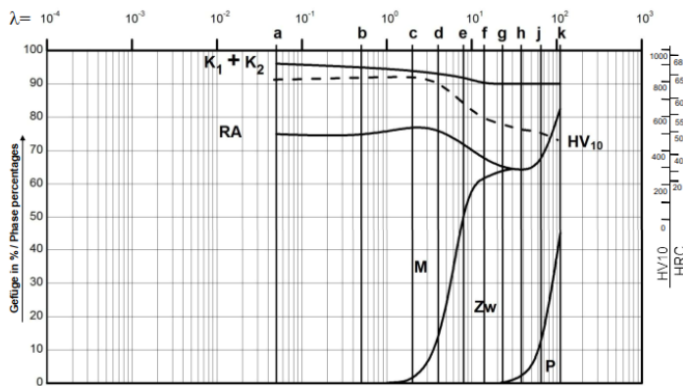


Austenitising temperature: 1190°C (2174°F)  
Holding time: 180 seconds

A....Austenite  
Zw....Bainite  
P....Pearlite  
M....Martensite

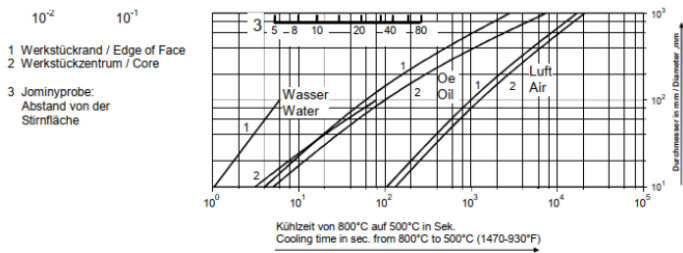
Sample	$\lambda$	HV10	Sample	$\lambda$	HV10
a	0,05	812	f	14,0	585
b	0,5	830	g	23,0	555
c	2,0	845	h	38,0	520
d	4,0	820	j	65,0	510
e	8,0	690	k	110,0	460

**Quantitative phase diagram**

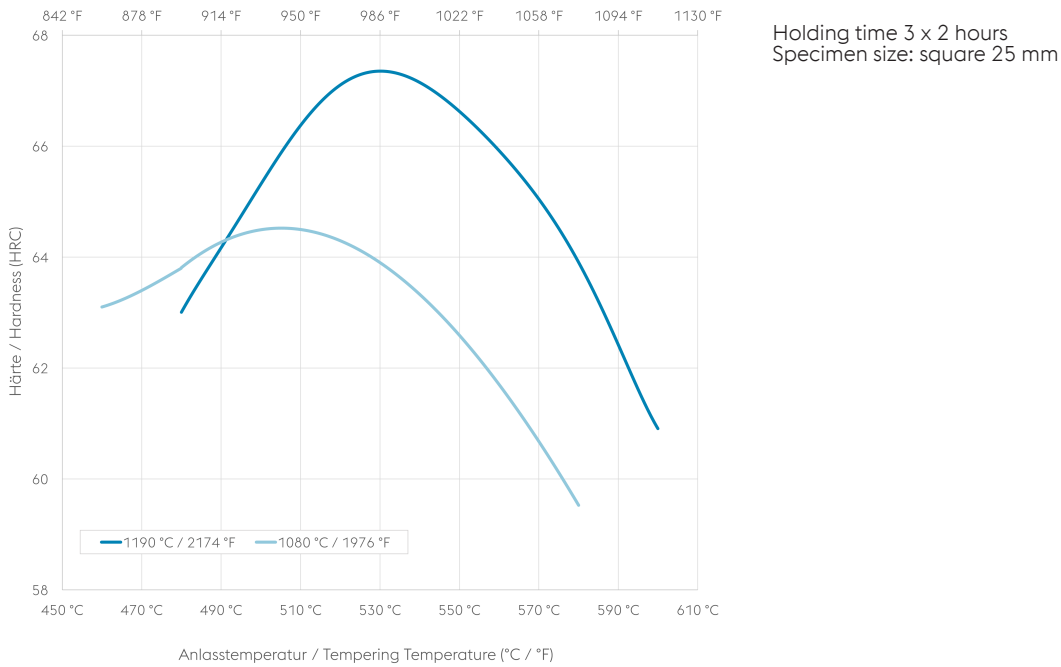


A....Austenite  
Zw....Bainite  
K....Carbide  
P....Pearlite  
M....Martensite  
RA...Retained Austenite

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



### Tempering Chart



### Physical Properties

<b>Temperature (°C)</b>	<b>20</b>
Density (kg/dm <sup>3</sup> )	7.93
Thermal conductivity (W/(m.K))	19
Specific heat (kJ/kg K)	0.43
Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)	0.57
Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> )	218

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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**voestalpine**

ONE STEP AHEAD.