

# HIGH SPEED STEELS

## Application Segments

Cutting Tools

## Available Product Variants

Long Products\*

Plates

\* Presented data refer exclusively to long products. Please observe the detailed explanations at the end of the data sheet (pdf).

## Product Description

### BÖHLER S500 – "The fireproof one"

In the family of conventional high-speed steels, this alloy combines excellent cutting properties with very high hot hardness.

## Process Melting

Airmelted

## Properties

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

## Applications

- > Blades for Sawing Machines
- > End Mills
- > Twist Drills and Taps
- > Broaches and Reamers
- > Gear Cutting, Shaving and Shaping Tools
- > Thread rolling
- > Cold Forming / Coining
- > Special Cutting Tools

## Technical data

| Material designation |     | Standards |        |
|----------------------|-----|-----------|--------|
| 1.3247               | SEL | 4957      | EN ISO |
| HS2-9-1-8            | EN  |           |        |

## Chemical composition (wt. %)

| C   | Si  | Mn  | Cr  | Mo  | V   | W   | Co  |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 1.1 | 0.5 | 0.2 | 3.9 | 9.2 | 1.1 | 1.5 | 7.8 |

## Material characteristics

|             | Compressive strength | Grindability | Red hardness | Toughness | Wear resistance | Edge Stability |
|-------------|----------------------|--------------|--------------|-----------|-----------------|----------------|
| BÖHLER S500 | ★★★★                 | ★★★          | ★★★★★        | ★★        | ★★★             | ★★★            |
| BÖHLER S200 | ★★★                  | ★★           | ★★★          | ★★        | ★★★             | ★★             |
| BÖHLER S400 | ★★★                  | ★★★          | ★★★          | ★★★       | ★★              | ★★             |
| BÖHLER S401 | ★★                   | ★★★          | ★★           | ★★★       | ★★              | ★★★            |
| BÖHLER S404 | ★★                   | ★★★          | ★★           | ★★★       | ★★              | ★★             |
| BÖHLER S405 | ★★★                  | ★★★          | ★★           | ★★★       | ★★              | ★★             |
| BÖHLER S430 | ★★                   | ★★★          | ★★           | ★★★       | ★★              | ★★             |
| BÖHLER S600 | ★★★                  | ★★★          | ★★★          | ★★        | ★★              | ★★★            |
| BÖHLER S601 | ★★★                  | ★★★          | ★★★          | ★★        | ★★              | ★★★            |
| BÖHLER S607 | ★★★                  | ★★★          | ★★★          | ★★        | ★★★             | ★★★            |
| BÖHLER S630 | ★★★                  | ★★★          | ★★★          | ★★        | ★★              | ★★★            |
| BÖHLER S705 | ★★★                  | ★★★          | ★★★★★        | ★★        | ★★              | ★★★★★          |
| BÖHLER S730 | ★★★                  | ★★★          | ★★★★★        | ★★        | ★★              | ★★★★★          |

## Delivery condition

### Annealed

|                        |                             |
|------------------------|-----------------------------|
| Hardness (HB)          | max. 280   Drawn max 300 HB |
| Tensile Strength (MPa) | max. 1,010                  |

## Heat treatment

### Annealing

|             |               |   |
|-------------|---------------|---|
| Temperature | 770 to 840 °C | Controlled slow cooling in furnace (10 to 20°C / h) to approx. 600°C (1110°F), air cooling. |
|-------------|---------------|---|

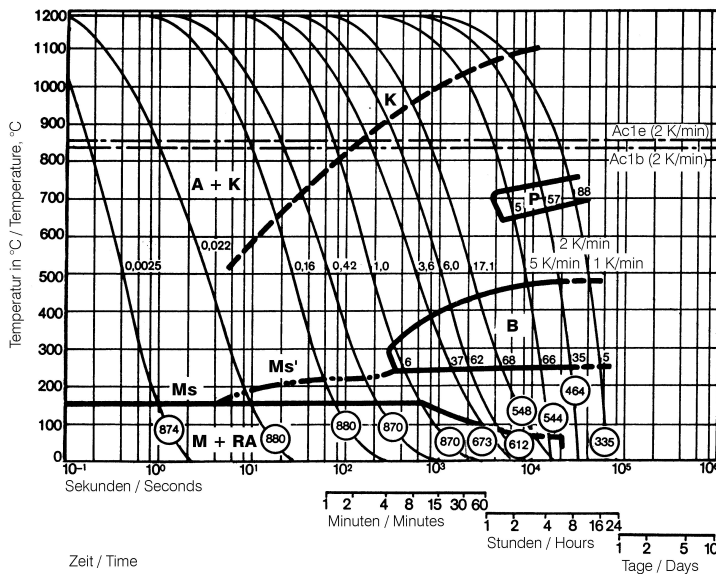
### Stress relieving

|             |               |   |
|-------------|---------------|---|
| 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. |
|-------------|---------------|---|

### Hardening and Tempering

|             |                   |  |
|-------------|-------------------|--|
| Temperature | 1,130 to 1,180 °C | Salt bath, vacuum    Preheating: 1st stage ~ 500 °C, 2nd stage ~ 850 °C, 3rd stage ~1050 °C    Austenitising: 1130 - 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     | 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                                  |

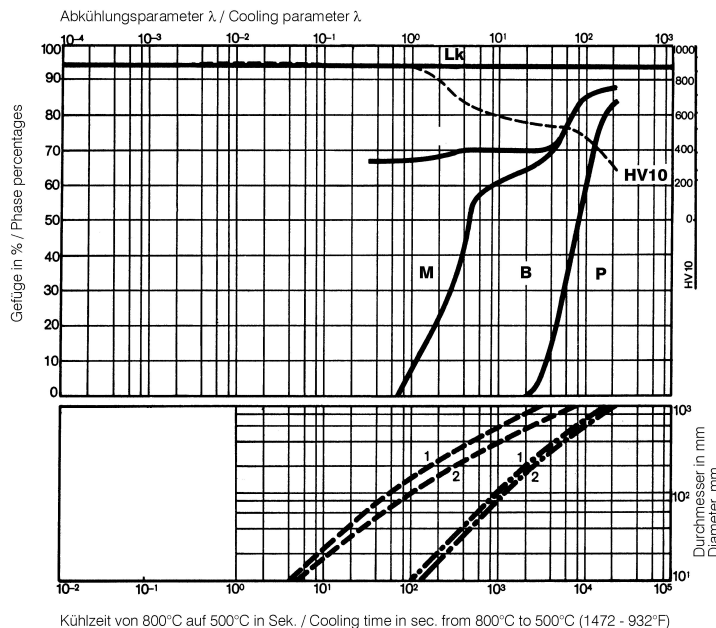
## Continuous cooling CCT curves



Austenitising temperature: 1180°C (2156°F)  
Holding time: 180 seconds

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

## Quantitative phase diagram

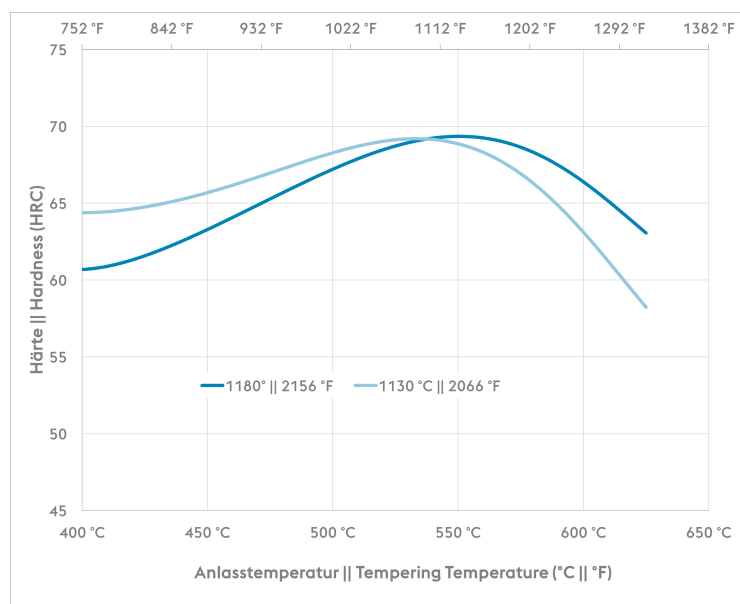


A....Austenite  
B....Bainite  
K....Carbide  
P....Pearlite  
M....Martensite  
RA...Retained Austenite

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

— oilcooling  
- - - aircooling

## Tempering Chart



## Physical Properties

| Temperature (°C)   | 20    |
|--|-------|
| Density (kg/dm <sup>3</sup> )                              | 8.1   |
| Thermal conductivity (W/(m.K))                             | 20    |
| Specific heat (kJ/kg K)                                    | 0.429 |
| Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)       | 0.52  |
| Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> ) | 220   |

## 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.