

# HIGH SPEED STEELS

## 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 S600 – "The high-speed steel"

Ideal for mills, twist drills, and taps, broaches, cold-work tools. BÖHLER S600 is the most commonly used high-speed steel and is the starting material for our customers who deal with high-speed steel.

## Process Melting

Airmelted or Airmelted + ESR (ISORAPID)

## Properties

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

## Applications

- > Broaches and Reamers
- > Gear Cutting, Shaving and Shaping Tools
- > Powder Pressing
- > Special Cutting Tools
- > Wear parts
- > Cold Forming / Coining
- > Injection Components
- > Rolling
- > Standard Parts (Molds, Plates, Pins, Punches)
- > Thread rolling
- > Fine Blanking, Stamping, Blanking
- > Other Automotive Components (Turbochargers, Piston Rings, Sensors, etc.)
- > Shearing / Machine Knives
- > Twist Drills and Taps
- > Blades for Sawing Machines

## Technical data

| Material designation |     | Standards |        |
|----------------------|-----|-----------|--------|
| 1.3343               | SEL | 4957      | EN ISO |
| HS6-5-2C             | EN  |           |        |

## Chemical composition (wt. %)

| C   | Cr  | Mo | V   | W   |
|-----|-----|----|-----|-----|
| 0.9 | 4.1 | 5  | 1.8 | 6.2 |

**Material characteristics**

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

**Delivery condition**

**Annealed**

|                                       |          |
|---------------------------------------|----------|
| Hardness (HB)                         | max. 280 |
| Ultimate tensile strength (UTS) (MPa) | max. 950 |
| Tensile Strength (MPa)                | max. 950 |

**Hardened and Tempered**

|                |  |
|----------------|--|
| Hardness (HRC) | min. 62   bars hardened and tempered (BHT) |
|----------------|--|

**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. |
|-------------|---------------|--|

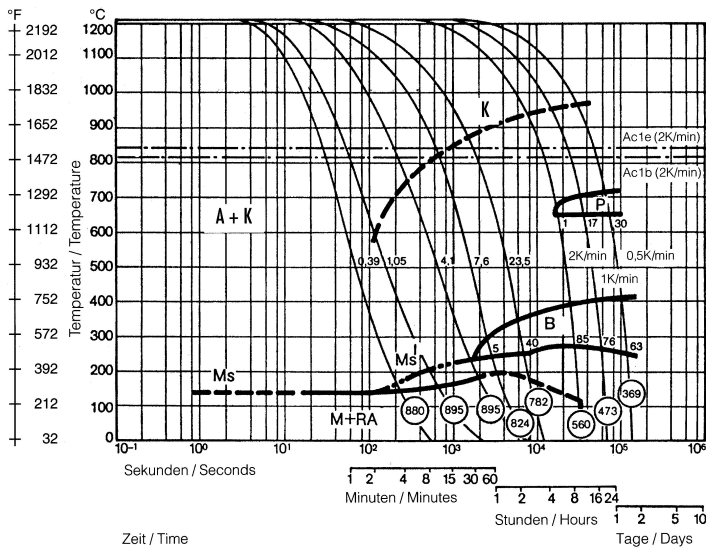
**Stress relieving**

|             |               |   |
|-------------|---------------|---|
| 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 | 1,100 to 1,210 °C | Salt bath, vacuum    Preheating: 1st stage ~ 500 °C, 2nd stage ~ 850 °C, 3rd stage ~1050 °C    Austenitising: 1100 - 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                                 |

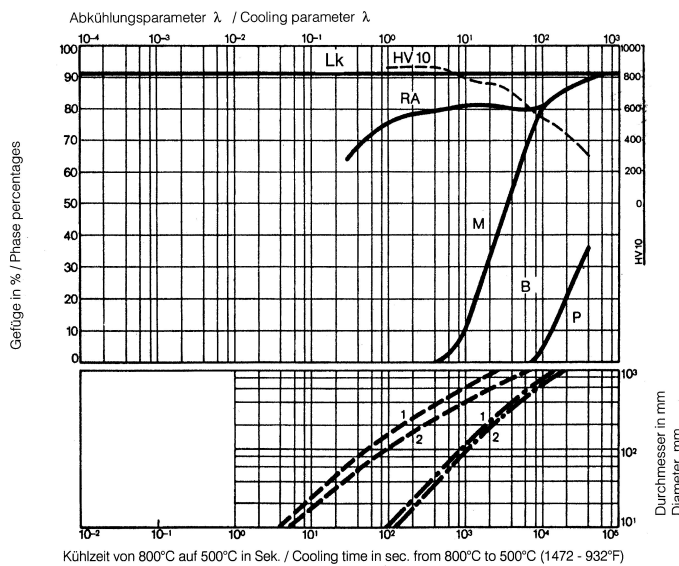
**Continuous cooling CCT curves**



Austenitising temperature: 1210°C (2210°F)  
Holding time: 180 seconds

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

**Quantitative phase diagram**

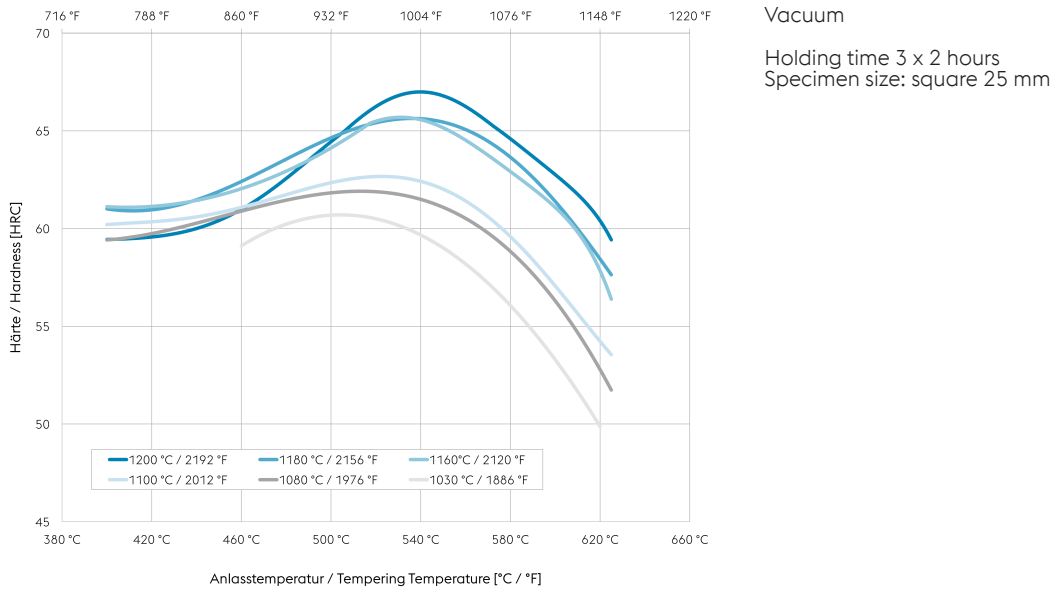


- A....Austenite
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- M....Martensite
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- 1....Edge or Face
- 2....Core
- 3....Jominy test: distance from quenched end

- oilcooling
- .- aircooling

### Tempering Chart



### Physical Properties

|  |       |
|--|-------|
| Temperature (°C)   | 20    |
| Density (kg/dm <sup>3</sup> )                              | 8.07  |
| Thermal conductivity (W/(m.K))                             | 21.8  |
| Specific heat (kJ/kg K)                                    | 0.433 |
| Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)       | 0.47  |
| Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> ) | 219   |

### 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)) | 11.5 | 11.7 | 12.2 | 12.4 | 12.7 | 13  | 12.9 |

**Long Products:** For additional specifications and technical requirements, please contact our regional voestalpine BÖHLER sales companies.

**Sheet & Plates:** Product Variant may differ in terms of melting process, technical data, delivery, and surface condition as well as available product dimensions. Please contact voestalpine BÖHLER Bleche GmbH & Co KG.

*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.