

# TOOL STEELS

## HARDENABLE CORROSION RESISTANT STEEL

### Application Segments

Plastic Mould

### Available Product Variants

Long Products

### Product Description

BÖHLER N685 is a corrosion-resistant, martensitic chromium steel with a high carbon content and molybdenum and vanadium additives.

### Process Melting

Airmelted

### Properties

- > Toughness & Ductility : good
- > Wear Resistance : very high
- > English (United Kingdom) : good
- > Dimensional stability : good
- > Polishability : good
- > Corrosion resistance : high

### Applications

- > Components for food processing and animal feed
- > Typical cutting instruments and knives
- > Glasfibre reinforced plastics
- > Screws and Barrels
- > Standard Parts (Molds, Plates, Pins, Punches)
- > General Components for Mechanical Engineering
- > Pill punching dies
- > Injection Molding
- > Hotrunner systems
- > Electronic industry
- > Plastic Extrusion

### Technical data

Material designation	
1.4112	SEL
~1.2361	
X90CrMoV18	EN
~X91CrMoV18	
~440B	AISI

## Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V
0.9	0.45	0.4	17.5	1.1	0.1

## Delivery condition

### Annealed

Hardness (Unit)	max. 265
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## Heat treatment

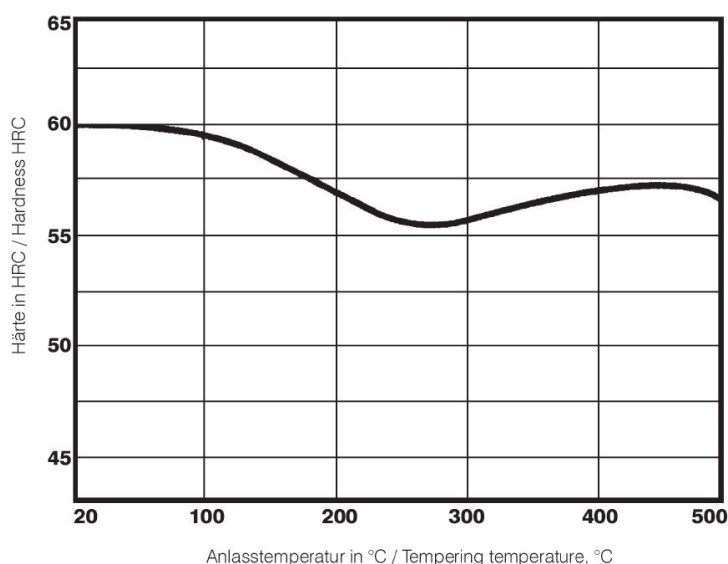
### Stress relieving

Temperature	max. 650 °C	Soft annealed material: For stress relief annealing after mechanical processing, hold the material at temperature in a neutral atmosphere for 1-2 hours after complete heating, then slowly cool the furnace at 20°C [68 °F]/hour to 200°C [392 °F], then cool in air.
Temperature		Hardened and tempered material: The temperature for stress relief annealing should be approx. 50°C [122 °F] below the previously selected tempering temperature. Other procedure as for stress relief annealing of soft annealed material.

### Hardening and Tempering

Temperature	1,000 to 1,050 °C	For hardening, hold the material at the specified temperature for 15-30 minutes after complete heating and quench quickly. Cool the material to approx. 30°C [86 °F]. Tempering should take place immediately.
Temperature	100 to 200 °C	Tempering treatment to the desired working hardness after hardening - see tempering diagram. Heat the material slowly and temper once for 1 hour/20mm material thickness, but at least 2 hours. After the heat treatment step, the material must be cooled to approx. 30°C[86 °F].

## Tempering chart



Hardening temperature: 1030°C / 1886°F  
Specimen size: square 20 mm

Hardness up to 57 - 59 HRC

## Physical Properties

Temperature (°C)	20
Density (kg/dm <sup>3</sup> )	7.7
Thermal conductivity (W/(m.K))	15
Specific heat (kJ/kg K)	0.43
Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)	0.8
Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> )	215

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

Temperature (°C)	100	200	300	400	500
Thermal expansion (10 <sup>-6</sup> m/(m.K))	10.4	10.8	11.2	11.6	11.9

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.