

# COLD WORK TOOL STEELS

## Application Segments

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Cold Work

## Available Product Variants

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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

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BÖHLER K890 MICROCLEAN is a high-performance cold work tool steel manufactured using powder metallurgy. It features good toughness, very high compressive strength and excellent fatigue strength. This favorable combination of properties can avoid chipping damages to tools. BÖHLER K890 MICROCLEAN is not only used in cold work applications, but also in mold making.

## Process Melting

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Powder metallurgy

## Properties

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- > Toughness & Ductility : very high
- > Wear Resistance : good
- > Compressive strength : high
- > Dimensional stability : very high

## Applications

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- > Machine knife (for producers)
- > Coining
- > General Components for Mechanical Engineering
- > Fine Blanking, Stamping, Blanking
- > Rolling
- > Powder Pressing
- > Components for the recycling industry
- > Cold Forming
- > Wear parts
- > Pill punching dies

## Chemical composition (wt. %)

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C	Si	Mn	Cr	Mo	V	W	Co
0.85	0.55	0.40	4.35	2.80	2.10	2.55	4.50

### Material characteristics

	Compressive strength	Dimensional stability during heat treatment	Toughness	Wear resistance abrasive	Wear resistance adhesive
<b>BÖHLER K890</b> MICROCLEAN	★★★★	★★★★★	★★★★★	★★★	★★★
<b>BÖHLER K100</b>	★★	★★	★	★★★	★★
<b>BÖHLER K105</b>	★★	★★	★	★★	★★
<b>BÖHLER K107</b>	★★	★★	★	★★★	★★
<b>BÖHLER K110</b>	★★	★★★	★	★★★	★★
<b>BÖHLER K190</b> MICROCLEAN	★★★★	★★★★★	★★★★	★★★★	★★★★
<b>BÖHLER K294</b> MICROCLEAN	★★★★★	★★★★★	★★★	★★★★★	★★★★★
<b>BÖHLER K340</b> ECOSTAR	★★★	★★★	★★	★★	★★
<b>BÖHLER K340</b> ISODUR	★★★	★★★★	★★★	★★★	★★★★
<b>BÖHLER K346</b>	★★★	★★★	★★★	★★★★	★★
<b>BÖHLER K353</b>	★★	★★★	★★	★★	★★
<b>BÖHLER K360</b> ISODUR	★★★	★★★★	★★★	★★★★	★★★★
<b>BÖHLER K390</b> MICROCLEAN	★★★★★	★★★★★	★★★★	★★★★★	★★★★★
<b>BÖHLER K490</b> MICROCLEAN	★★★★	★★★★★	★★★★	★★★★	★★★★
<b>BÖHLER K497</b> MICROCLEAN	★★★★★	★★★★★	★★★	★★★★★	★★★★★
<b>BÖHLER K888</b> MATRIX	★★★★	★★★★★	★★★★★	★★	★★

### Delivery condition

#### Annealed

Hardness (HB)	max. 280
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### Heat treatment

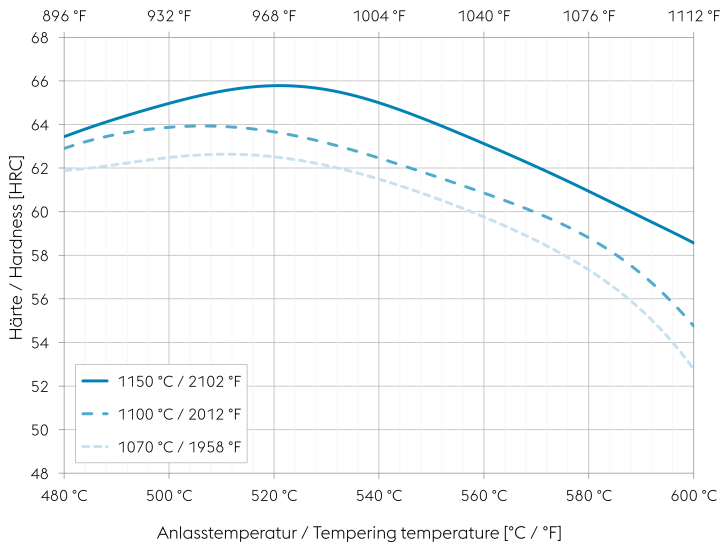
#### Stress relieving

Temperature	650 to 700 °C	After through heating, hold in neutral atmosphere for 1-2 hours.    Slow cooling in furnace    Intended to relieve stresses caused by extensive machining or in complex shapes.
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#### Hardening and Tempering

Temperature	1,070 to 1,150 °C	Quenching: Oil, gas (N <sub>2</sub> )    Holding time after temperature equalization: 20-30 minutes (hardening temperature 1070 to 1100 °C   1958 to 2012 °F) or 6 minutes (hardening temperature 1150 °C (2102 °F)    After hardening, tempering to the desired working hardness according to the tempering chart.
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### Tempering chart



Specimen size: square 20 mm (0,787 inch)

Slow heating to tempering temperature immediately after hardening.

Time in furnace 1 hour for each 20 mm (0,787 inch) of workpiece thickness but at least 2 hours.

Please refer to the tempering chart for guide values for the achievable hardness after tempering.

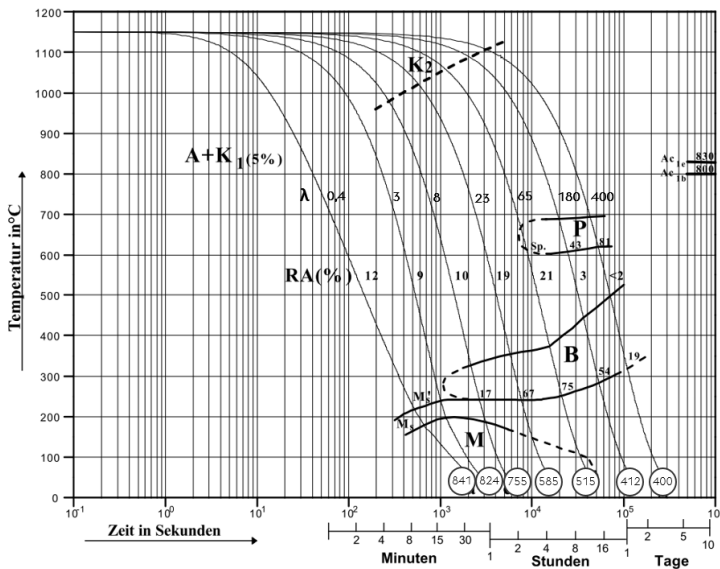
It is recommended to temper at least three times above the secondary hardness maximum.

Cooling in air to room temperature after each tempering step is recommended.

Tempering for stress relieving 30 to 50 °C (86 to 122 °F) below the highest tempering temperature.

Recommended tempering temperature range is indicated by the grey area in the chart.

### Continuous cooling CCT curves



Austenitising temperature: 1150 °C (2102 °F)  
Holding time: 30 minutes

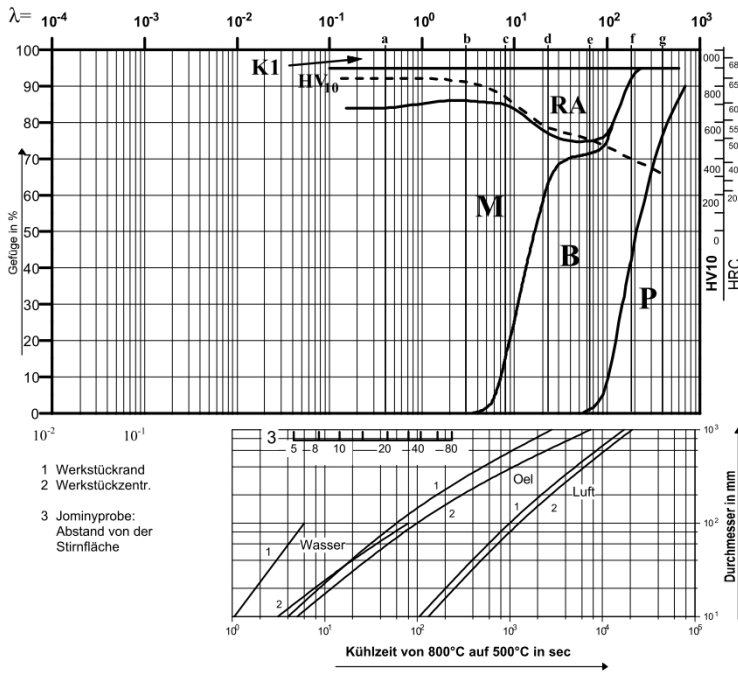
O Vickers hardness

17...81 phase percentages

0.4...400 cooling parameter  $\lambda$ , i.e. duration of cooling from 800 to 500 °C (1472 to 932 °F) in  $s \times 10^{-2}$

- A... Austenite
- K... Carbide
- P... Pearlite
- B... Bainite
- M... Martensite
- Ms... Martensite starting temperature

Quantitative phase diagram



HV10... Vickers Hardness

K... Carbide

RA... Residual austenite

M... Martensite

B... Bainite

P... Pearlite

1... Edge or face

2... Core

3... Jominy test: distance from quenched face

Physical Properties

Temperature (°C)	20
Density (kg/dm <sup>3</sup> )	7.85
Thermal conductivity (W/(m.K))	22.5
Specific heat (kJ/kg K)	0.45
Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)	0.5
Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> )	218

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))	10.5	11	11.3	11.7	12.1	12.4	12.9

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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