

# COLD WORK TOOL STEELS

## Application Segments

Cold Work

## 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 K390 MICROCLEAN is a high-alloyed, high-performance cold work tool steel manufactured using powder metallurgy. This material has the highest alloy content in the group of cold work tool steels with high vanadium content. The high alloy content gives this material outstanding wear resistance. At the same time, the powder metallurgical manufacturing process creates a uniform matrix with finely distributed primary carbides. Among other things, this leads to good material toughness. BÖHLER K390 MICROCLEAN is a problem solver for applications requiring extremely high wear resistance and compressive strength.

## Process Melting

Powder metallurgy

## Properties

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

## Applications

- > Machine knife (for producers)
- > Coining
- > Screws and Barrels
- > Rolls
- > Pill punching dies
- > Rolling
- > Fine Blanking, Stamping, Blanking
- > Thread rolling
- > Components for underground construction (drilling, shafts, etc.)
- > Glasfibre reinforced plastics
- > Cold Forming
- > Powder Pressing
- > General Components for Mechanical Engineering
- > Components for the recycling industry

## Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V	W	Co
2.47	0.55	0.40	4.20	3.80	9.00	1.00	2.00

## Material characteristics

	Compressive strength	Dimensional stability during heat treatment	Toughness	Wear resistance abrasive	Wear resistance adhesive
<b>BÖHLER K390</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 K490</b> MICROCLEAN	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
<b>BÖHLER K497</b> MICROCLEAN	★★★★★	★★★★★	★★★★	★★★★★	★★★★★
<b>BÖHLER K888</b> MATRIX	★★★★★	★★★★★	★★★★★	★★	★★
<b>BÖHLER K890</b> MICROCLEAN	★★★★★	★★★★★	★★★★★	★★★	★★★

## Delivery condition

### Annealed

Hardness (HB)	max. 280
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## Heat treatment

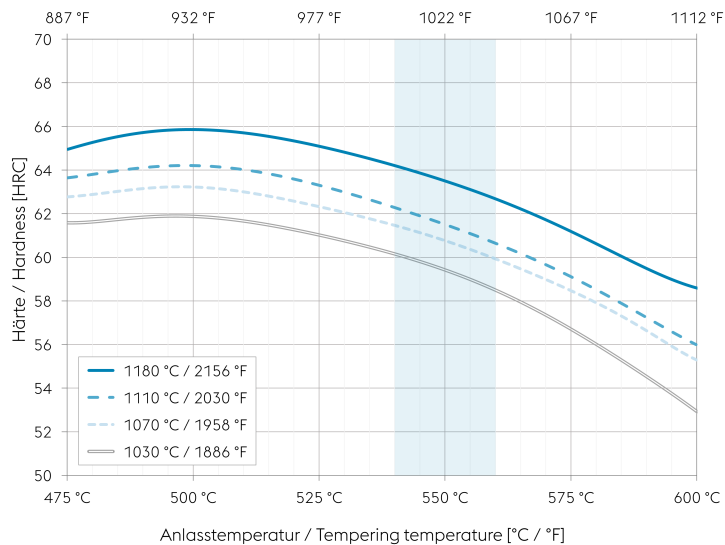
### Stress relieving

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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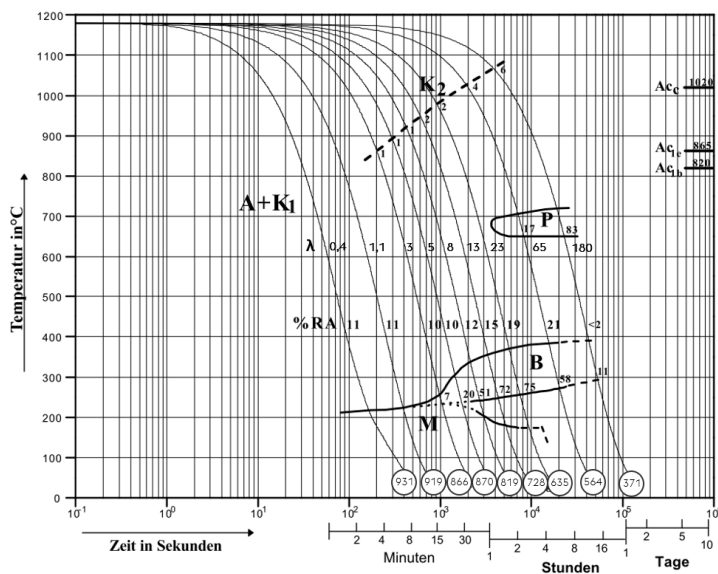
### Hardening and Tempering

Temperature	1,030 to 1,180 °C	Quenching: Oil, gas (N <sub>2</sub> ).    Holding time after temperature equalization: 20 to 30 minutes (hardening temperature 1030 - 1150 °C   1886 - 2102 °F) and 10 min (hardening temperature 1180 °C   2156 °F)    Low hardening temperature for high toughness. High hardening temperature for high wear resistance.    After hardening, tempering to the desired working hardness according to the tempering chart.
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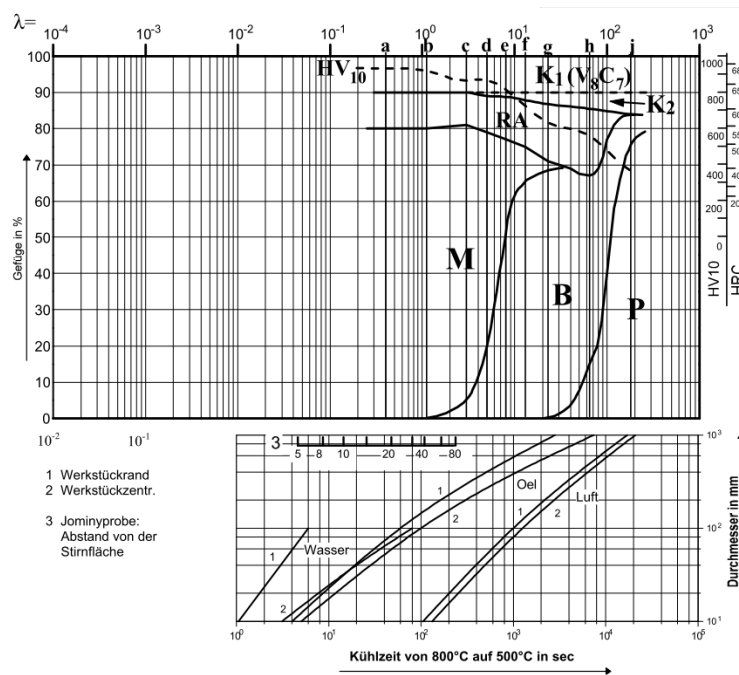
## Tempering chart



## Continuous cooling CCT curves



## 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 the quenched end

## Physical Properties

Temperature (°C)	20
Density (kg/dm <sup>3</sup> )	7.6
Thermal conductivity (W/(m.K))	21.5
Specific heat (kJ/kg K)	0.464
Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)	0.59
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
Thermal expansion (10 <sup>-6</sup> m/(m.K))	10.3	10.67	11.03	11.38	11.7	11.97

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.