

# COLD WORK TOOL STEELS

## Application Segments

Cold Work

## Available Product Variants

Long Products\*

Plates

Open Die Forgings

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

## Product Description

BÖHLER K490 MICROCLEAN is a high-performance cold work tool steel with a balanced property profile, manufactured using powder metallurgy. This powder metallurgical tool steel offers an outstanding combination of high wear resistance, compressive strength, toughness and very good machinability. Thanks to the resulting flexibility, BÖHLER K490 MICROCLEAN is used in virtually all cold work applications, and in many cases this material is the first choice for newly developed tools. The commonly used hardening temperatures of BÖHLER K490 MICROCLEAN also enable shared heat treatment with popular cold work tool steels (1.2379, D2), making it very economical in terms of heat treatment.

## Process Melting

Powder metallurgy

## Properties

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

## Applications

- |                                      |                                         |                                     |
|--------------------------------------|-----------------------------------------|-------------------------------------|
| > Machine knife (for producers)      | > Rolling                               | > Fine Blanking, Stamping, Blanking |
| > Powder Pressing                    | > Screws and Barrels                    | > Wear parts                        |
| > Rolls                              | > Components for the recycling industry | > Pill punching dies                |
| > Glasfibre reinforced plastics      | > Thread rolling                        | > Industrial Knives                 |
| > Cutting                            | > Grinding                              | > Extrusion                         |
| > Components                         | > Packaging                             | > Wear Applications                 |
| > Mineral Processing                 | > Mechanical Engineering                | > Roll Forming                      |
| > Cold Rolling incl. Sendzimir Rolls | > Packaging industry                    | > Cold Forming / Coining            |
| > Custom Hand Knives                 |                                         |                                     |

## Chemical composition (wt. %)

| C    | Cr   | Mo   | V    | W    | Nb |
|------|------|------|------|------|----|
| 1.40 | 6.40 | 1.50 | 3.70 | 3.50 | +  |

## Material characteristics

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

## Delivery condition

### Annealed

|               |          |
|---------------|----------|
| Hardness (HB) | max. 280 |
|---------------|----------|

## Heat treatment

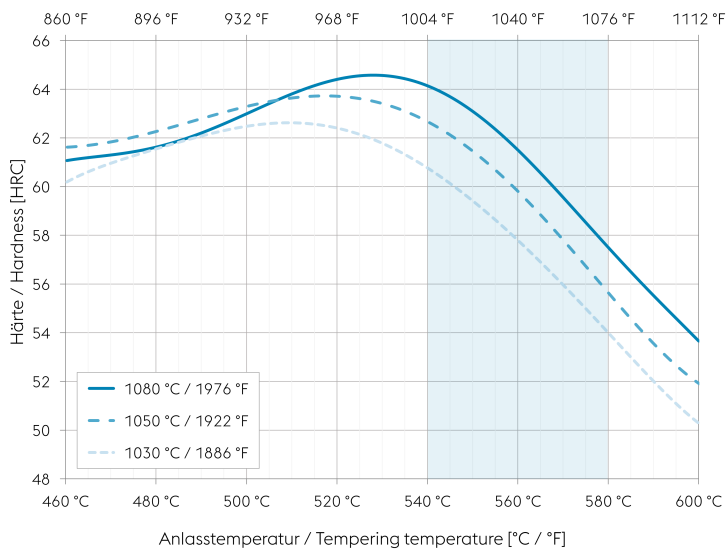
### Stress relieving

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

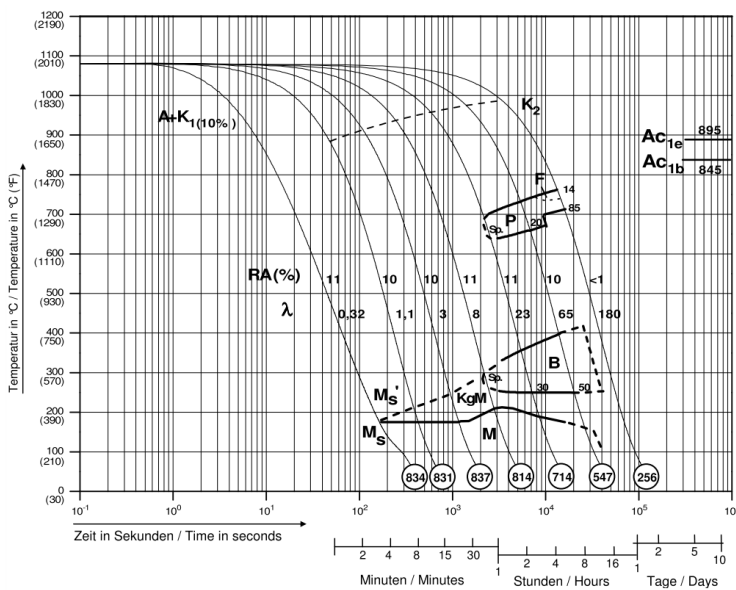
### Hardening and Tempering

|             |                   |                                                                                                                                                                                                          |
|-------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature | 1,030 to 1,080 °C | Quenching: Oil, gas (N <sub>2</sub> ).    Holding time after temperature equalization: 20 to 30 minutes.    After hardening, tempering to the desired working hardness according to the tempering chart. |
|-------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Tempering chart



## Continuous cooling CCT curves



Austenitising temperature: 1080 °C (1976 °F)  
Holding time: 30 minutes

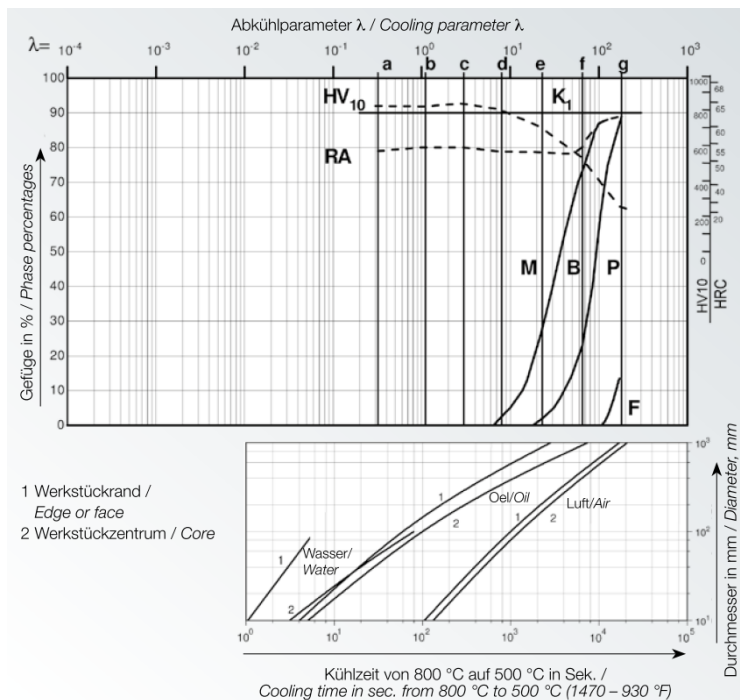
○ Vickers hardness

14...85 phase percentages

0.32...180 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  
F... Ferrite  
B... Bainite  
M... Martensite  
KgM... Grain boundary martensite  
Ms... Martensite starting temperature

## Quantitative phase diagram



HV10... Vickers Hardness  
K... Carbide  
RA... Residual austenite  
M... Martensite  
B... Bainite  
P... Pearlite  
F... Ferrite

1... Edge or face  
2... Core

## Physical Properties

|                                                            |           |
|------------------------------------------------------------|-----------|
| <b>Temperature (°C)</b>                                    | <b>20</b> |
| Density (kg/dm <sup>3</sup> )                              | 7.79      |
| Thermal conductivity (W/(m.K))                             | 19.6      |
| Specific heat (kJ/kg K)                                    | 0.45      |
| Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)       | 0.55      |
| Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> ) | 223       |

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

|                                              |            |            |            |            |            |            |            |
|----------------------------------------------|------------|------------|------------|------------|------------|------------|------------|
| <b>Temperature (°C)</b>                      | <b>100</b> | <b>200</b> | <b>300</b> | <b>400</b> | <b>500</b> | <b>600</b> | <b>700</b> |
| Thermal expansion (10 <sup>-6</sup> m/(m.K)) | 10.6       | 11.1       | 11.6       | 11.9       | 12.3       | 12.6       | 12.8       |

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.