

# 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 K460 corresponds to the material 1.2510 (100MnCrW4, O1) and has comparable properties to the popular tool steel 1.2842. Additional alloying with tungsten achieves higher resistance to abrasive wear compared to the tool steel 1.2842. BÖHLER K460 offers the advantage of simple heat treatment with low hardening temperatures and single tempering. However, this characteristic tempering behaviour limits the use of advanced coatings. The material has a good hardening response, but only moderate through hardenability. BÖHLER K460 is used for punching and cutting tools, plastic molds, thread cutting tools and machine knives in the wood, paper and recycling industries.

## Process Melting

Airmelted

## Properties

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

## Applications

- > Cold Forming
- > Fine Blanking, Stamping, Blanking
- > Standard Parts (Molds, Plates, Pins, Punches)
- > Tool Holders (milling, drilling, turning & chucks)

## Technical data

| Material designation |      | Standards |        |
|----------------------|------|-----------|--------|
| 1.2510               | SEL  | 4957      | EN ISO |
| 100MnCrW4            | EN   | A681      | ASTM   |
| T31501               | UNS  |           |        |
| O1                   | AISI |           |        |
| ~SKS3                | JIS  |           |        |

## Chemical composition (wt. %)

| C    | Si   | Mn   | Cr   | V    | W    |
|------|------|------|------|------|------|
| 0.95 | 0.25 | 1.10 | 0.55 | 0.10 | 0.55 |

## Material characteristics

|             | Compressive strength | Dimensional stability during heat treatment | Toughness | Wear resistance abrasive |
|-------------|----------------------|---|-----------|--------------------------|
| BÖHLER K460 | ★★★★★                | ★   | ★★★★★     | ★★                       |
| BÖHLER K245 | ★★                   | ★   | ★★★★★     | ★                        |
| BÖHLER K455 | ★★★                  | ★   | ★★★★★     | ★                        |
| BÖHLER K720 | ★★                   | ★   | ★★★★★     | ★                        |

## Delivery condition

### Annealed

|               |          |
|---------------|----------|
| Hardness (HB) | max. 220 |
|---------------|----------|

## Heat treatment

### Annealing

|             |               |   |
|-------------|---------------|---|
| Temperature | 710 to 750 °C | Slow controlled cooling in furnace at a rate of 10 to 20 °C/hr (18 to 36 °F/hr) down to approximately 600 °C (1112 °F)    Further cooling in air. |
|-------------|---------------|---|

### Stress relieving

|             |        |   |
|-------------|--------|---|
| Temperature | 650 °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. |
|-------------|--------|---|

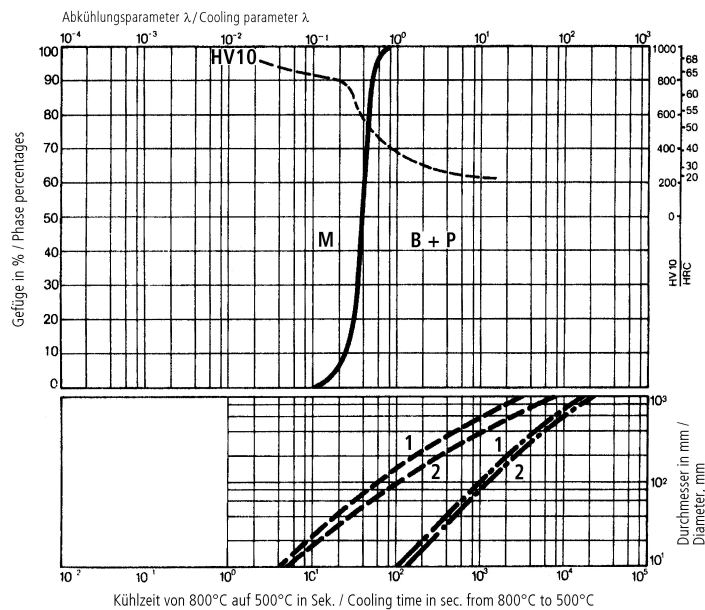
### Hardening and Tempering

|             |               |   |
|-------------|---------------|---|
| Temperature | 780 to 820 °C | Quenching: Oil, salt bath (200 to 250 °C   392 to 482 °F) up to 20 mm (0,787 inch) thickness.    Holding time after temperature equalization: 15 to 30 minutes.    After hardening, tempering to the desired working hardness according to the tempering chart. |
|-------------|---------------|---|

Cooling in air after each tempering step is recommended.

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

## Quantitative phase diagram



HV10... Vickers Hardness

M... Martensite

B... Bainite

P... Pearlite

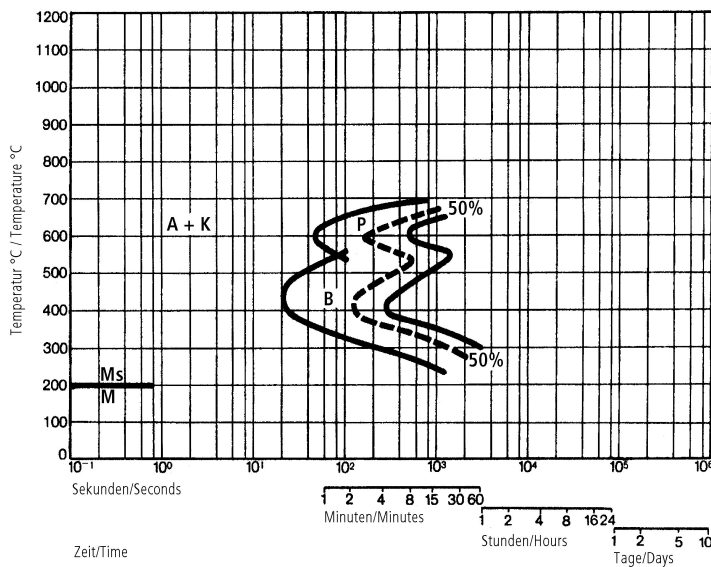
--- Oil cooling

- · - Air cooling

1... Edge or face

2... Core

## Isothermal TTT curves



Austenitising temperature: 810 °C / 1490 °F  
Holding time: 15 minutes

A... Austenite

K... Carbide

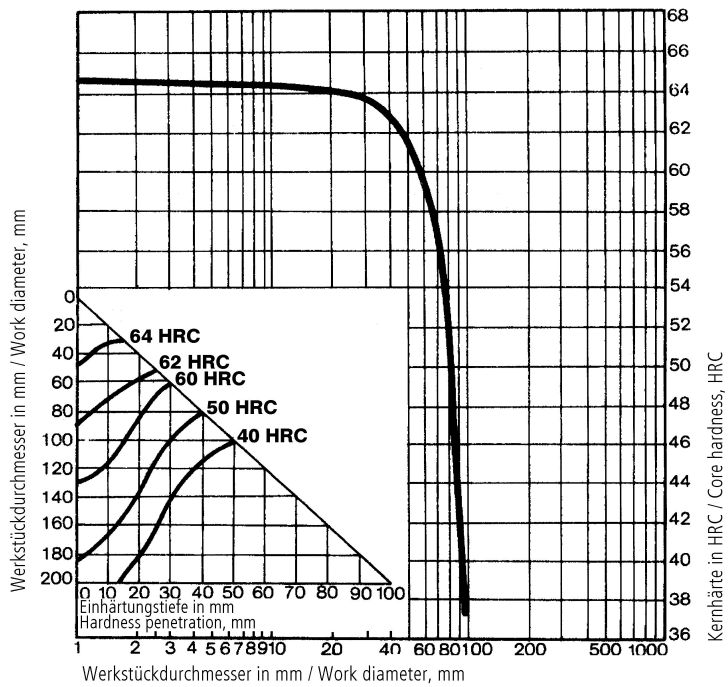
P... Pearlite

B... Bainite

M... Martensite

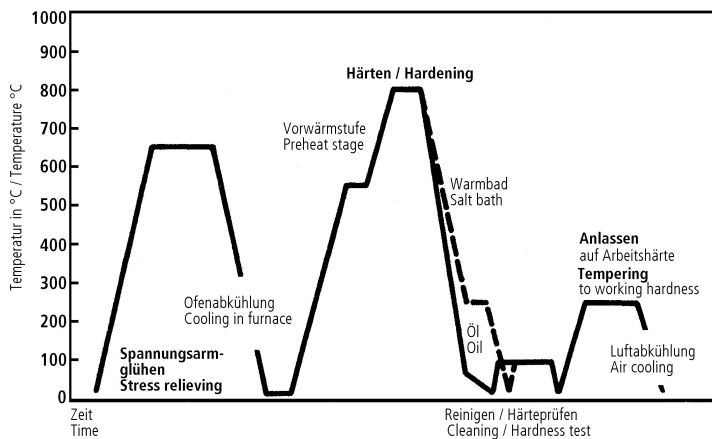
Ms... Martensite starting temperature

## Influence of work diameter on core hardness and hardness penetration



Quenched from: 800 °C / 1472 °F  
Agent: Oil

## Heat treatment sequence



## Physical Properties

| Temperature (°C)   | 20   |
|--|------|
| Density (kg/dm <sup>3</sup> )                              | 7.85 |
| Thermal conductivity (W/(m.K))                             | 30   |
| Specific heat (kJ/kg K)                                    | 0.46 |
| Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)       | 0.35 |
| Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> ) | 210  |

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

| Temperature (°C)                             | 100  | 200 | 300  | 400  | 500  |
|--|------|-----|------|------|------|
| Thermal expansion (10 <sup>-6</sup> m/(m.K)) | 11.5 | 12  | 12.2 | 12.5 | 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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**voestalpine**

ONE STEP AHEAD.