

# 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 K360 ISODUR belongs to the group of 8% chromium steels. This tool steel is produced using the electro-slag remelting (ESR) process developed by BÖHLER. This re-melting technology ensures the lowest micro and macro segregation as well as excellent purity and uniformity of the material. The alloy composition with higher molybdenum and vanadium content makes BÖHLER K360 ISODUR even more wear resistant than BÖHLER K340 ISODUR. Compared to tool steels like 1.2379 (D2), this combination of better toughness and wear resistance offers significant advantages for punching and cutting tools.

## Process Melting

Airmelted + Remelted

## Properties

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

## Applications

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

## Chemical composition (wt. %)

| C    | Si   | Mn   | Cr   | Mo   | V    | Al | Nb |
|------|------|------|------|------|------|----|----|
| 1.25 | 0.90 | 0.35 | 8.75 | 2.70 | 1.18 | +  | +  |

## Material characteristics

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

## Delivery condition

### Annealed

|               |          |
|---------------|----------|
| Hardness (HB) | max. 250 |
|---------------|----------|

## Heat treatment

### Annealing

|             |               |   |
|-------------|---------------|---|
| Temperature | 800 to 850 °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. |
|-------------|---------------|---|

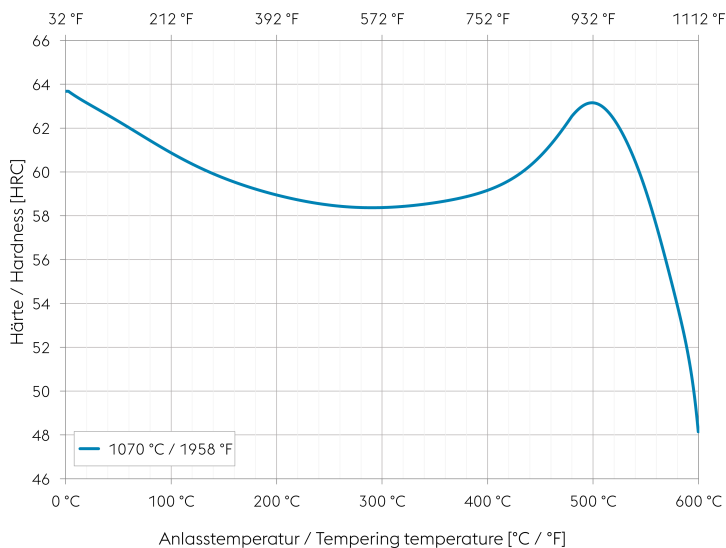
### Stress relieving

|             |               |   |
|-------------|---------------|---|
| Temperature | 560 to 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 | 1,040 to 1,080 °C | Quenching: Oil, salt bath, gas, compressed or still air.    Holding time after temperature equalization: 15 to 30 minutes.    After hardening, tempering to the desired working hardness according to the tempering chart. |
|-------------|-------------------|--|

## Tempering chart - Tempering curve in the vacuum furnace



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.

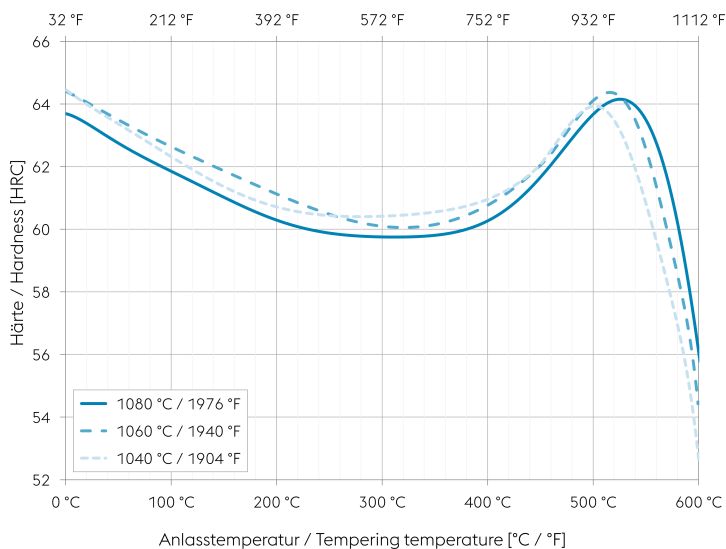
Please refer to the tempering chart for guide values for the achievable hardness after tempering.

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.

## Tempering chart - Comparison of different austenitising temperatures (salt-bath / oil)



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.

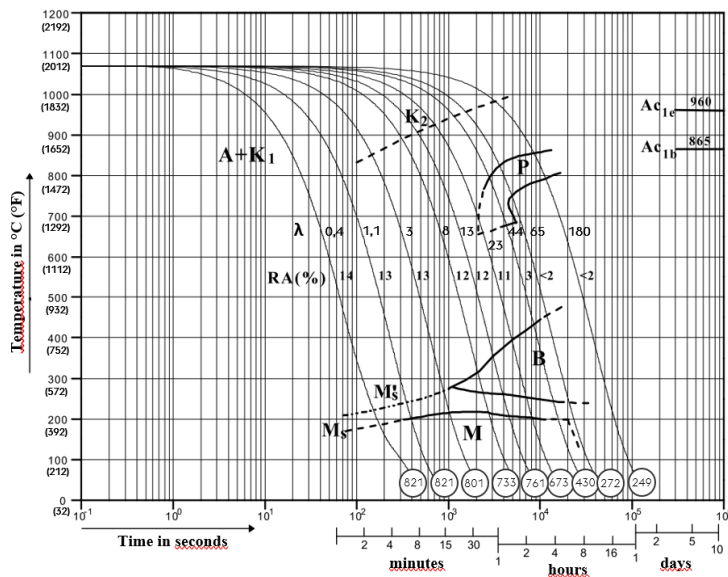
Please refer to the tempering chart for guide values for the achievable hardness after tempering.

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.

## Continuous cooling CCT curves



Austenitising temperature: 1070 °C (1958 °F)  
Holding time: 30 minutes

○ Vickers hardness

0.4...59.8 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

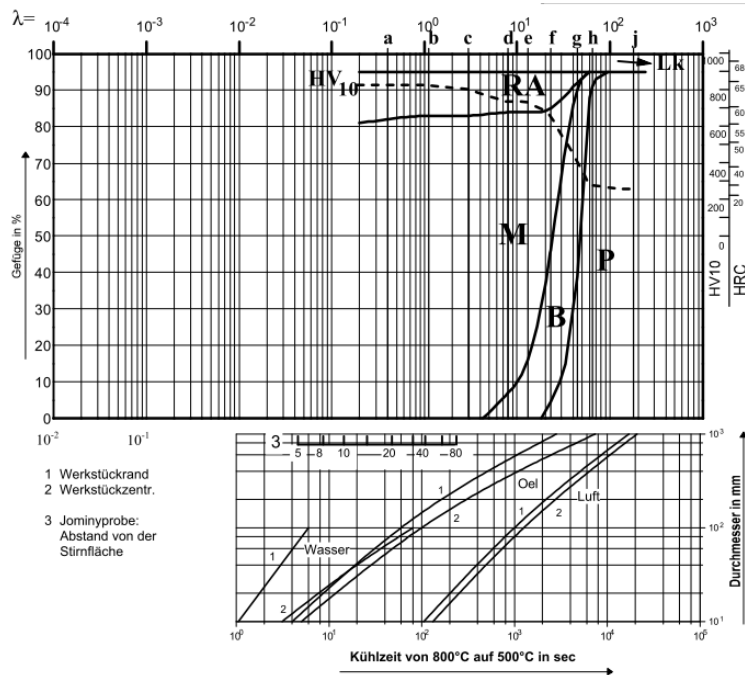
P... Pearlite

B... Bainite

M... Martensite

Ms... Martensite starting temperature

## Quantitative phase diagram



HV10... Vickers Hardness

Lk... Ledeburite 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> )                              | 7.7  |
| Thermal conductivity (W/(m.K))                             | 16.3 |
| Specific heat (kJ/kg K)                                    | 0.46 |
| Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)       | 0.64 |
| Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> ) | 212  |

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

| Temperature (°C)                             | 100  | 200  | 300  | 400  | 500  |
|--|------|------|------|------|------|
| Thermal expansion (10 <sup>-6</sup> m/(m.K)) | 11.2 | 11.5 | 11.8 | 12.3 | 12.7 |

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.