

# COLD WORK STEELS

## 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 Recycling Industry
- > Rolling
- > Fine Blanking, Stamping, Blanking
- > Wear parts
- > Rolls
- > Pill punching dies
- > Cold Forming
- > Powder Pressing
- > Thread rolling
- > Comps. for Equip. Below Ground (Boring, 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</b> <b>ISODUR®</b>	★★★	★★★★	★★★	★★★★	★★★★
<b>BÖHLER K100</b>	★★	★★	★	★★★	★★
<b>BÖHLER K105</b>	★★	★★	★	★★	★★
<b>BÖHLER K107</b>	★★	★★	★	★★★	★★
<b>BÖHLER K110</b>	★★	★★★	★	★★★	★★
<b>BÖHLER K190</b> <b>MICROCLEAN®</b>	★★★★	★★★★★	★★★★	★★★★	★★★★
<b>BÖHLER K294</b> <b>MICROCLEAN®</b>	★★★★★	★★★★★	★★★	★★★★★	★★★★★
<b>BÖHLER K340</b> <b>ECOSTAR®</b>	★★★	★★★	★★	★★	★★
<b>BÖHLER K340</b> <b>ISODUR®</b>	★★★	★★★★	★★★	★★★	★★★★
<b>BÖHLER K346</b>	★★★	★★★	★★★	★★★★	★★
<b>BÖHLER K353</b>	★★	★★★	★★	★★	★★
<b>BÖHLER K390</b> <b>MICROCLEAN®</b>	★★★★★	★★★★★	★★★★	★★★★★	★★★★★
<b>BÖHLER K490</b> <b>MICROCLEAN®</b>	★★★★	★★★★★	★★★★	★★★★	★★★★
<b>BÖHLER K497</b> <b>MICROCLEAN®</b>	★★★★★	★★★★★	★★★	★★★★★	★★★★★
<b>BÖHLER K888</b> <b>MATRIX</b>	★★★★	★★★★★	★★★★★	★★	★★
<b>BÖHLER K890</b> <b>MICROCLEAN®</b>	★★★★	★★★★★	★★★★★	★★★	★★★

**Delivery condition**

**Annealed**

Hardness (HB)	max. 250
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**Heat treatment**

**Annealing**

Temperature	800 to 850 °C   1,472 to 1,562 °F	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.
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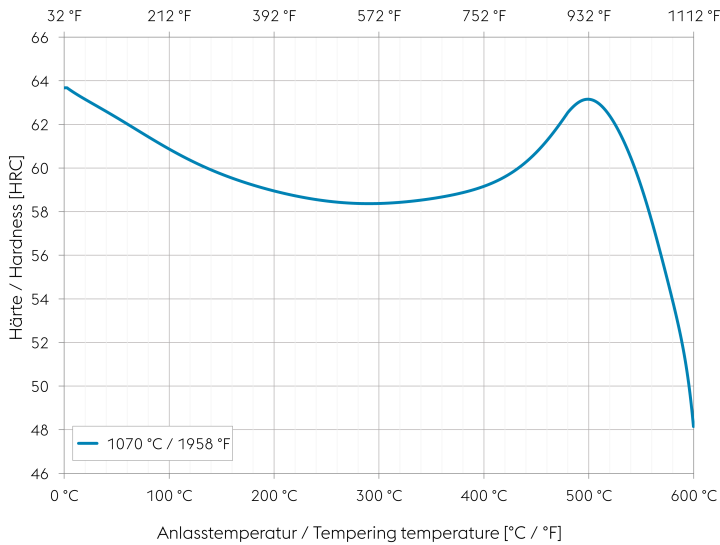
**Stress relieving**

Temperature	560 to 650 °C   1,040 to 1,202 °F	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	1,040 to 1,080 °C   1,904 to 1,976 °F	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.
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### 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.

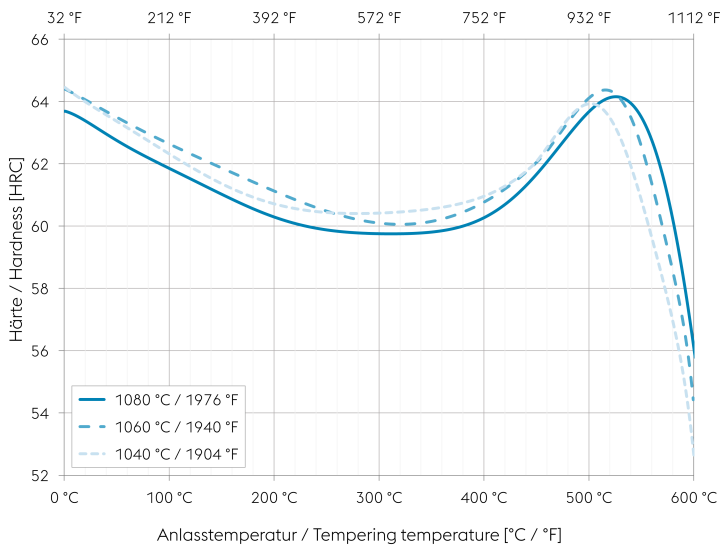
Please refer to the tempering chart for guide values for the achievable hardness after tempering.

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.

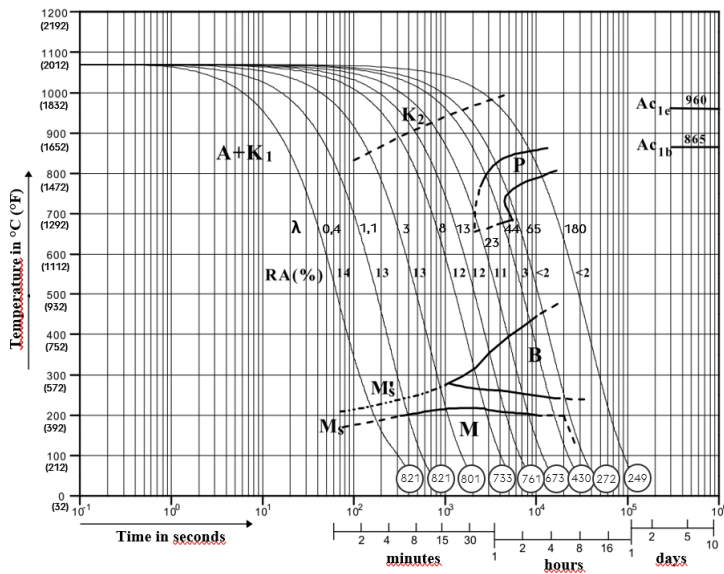
Please refer to the tempering chart for guide values for the achievable hardness after tempering.

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



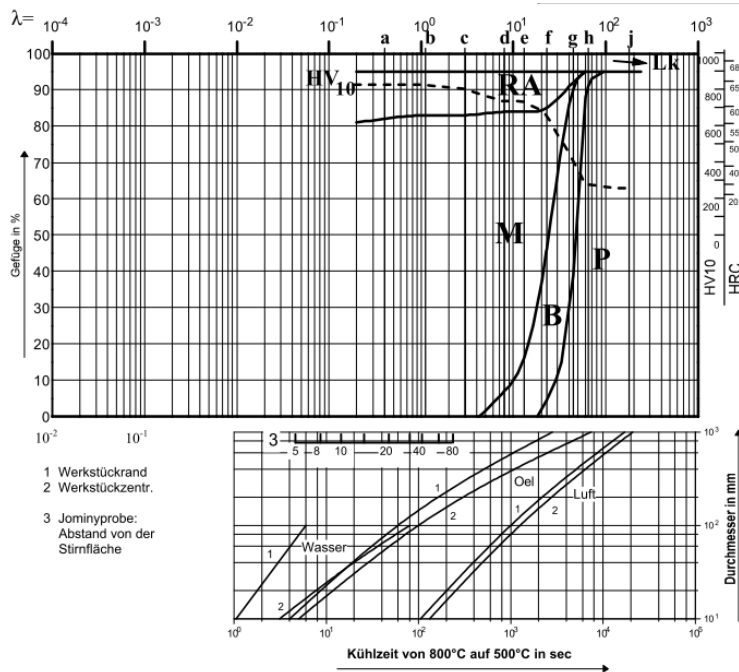
Austenitising temperature: 1070 °C (1958 °F)  
Holding time: 30 minutes

O Vickers hardness

0.4...59.8 cooling parameter λ, i.e. duration of cooling from 800 to 500 °C (1472 to 932 °F) in s x 10<sup>-2</sup>

- 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   °F)	20   68
Density (kg/dm <sup>3</sup>   lb/in <sup>3</sup> )	7.7   0.28
Thermal conductivity (W/(m.K)   BTU/ft h °F)	16.3   9.42
Specific heat (kJ/kg K   BTU/lb °F)	0.46   0.1099
Spec. electrical resistance (Ohm.mm <sup>2</sup> /m   10 <sup>-4</sup> Ohm.inch <sup>2</sup> /ft)	0.64   3.02
Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup>   10 <sup>3</sup> ksi)	212   30.75

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

Temperature (°C   °F)	100   212	200   392	300   572	400   752	500   932
Thermal expansion (10 <sup>-6</sup> m/(m.K)   10 <sup>-6</sup> inch/inch.°F)	11.2   6.2	11.5   6.4	11.8   6.6	12.3   6.8	12.7   7.1

**Long Products:** For additional specification and technical requirements, please contact our regional voestalpine BÖHLER sales companies.

**Sheet & Plates:** Product Variant may differ in terms of melting process, technical data, delivery, and surface condition as well as available product dimensions. Please contact voestalpine BÖHLER Bleche GmbH & Co KG.

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