

# ACEROS PARA TRABAJO EN FRÍO

## Formatos disponibles

Productos largos\*

Chapas

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

## Descripción

BÖHLER K110 - Es el estándar de acero ledeburítico con 12 % de cromo de estabilidad dimensional.

- Especialmente adecuado para templar al aire.
- Buena tenacidad.
- Alta resistencia al desgaste.
- Permite la nitruración al baño.

Para herramientas de corte (matrices y punzones), herramientas para estampación, para trabajar madera, cizallas para cortar chapa de poco espesor, herramientas para laminar roscas, herramientas para estirar, para embutición profunda y extrusión en frío. Para la industria farmacéutica y cerámica, para cilindros de laminación en frío, para trenes de laminación de cajas múltiples, herramientas de medición y moldes de plástico pequeños que requieran gran resistencia al desgaste.

## Método de obtención

Convencional

## Propiedades

- > Resistencia al desgaste : buena
- > Estabilidad dimensional : buena
- > Acero para trabajo en frío de endurecimiento secundario con bajo cambio dimensional : buena

## Aplicaciones

- |  |                                       |   |
|--|---------------------------------------|---|
| > Cuchillas de máquinas (fabricantes)                            | > Laminación                          | > Conformado en frío                          |
| > Acuñado  | > Corte fino / Troquelado / Estampado | > Compactación de polvo                       |
| > Componentes estándar (moldes, placas, expulsores, punzones)    | > Tornillos y cilindros               | > Componentes para la industria del reciclaje |
| > Componentes para equipos bajo tierra (perforación, ejes, etc.) | > Rodillos                            | > Componentes de desgaste                     |
| > Componentes generales de ingeniería mecánica                   | > Thread rolling (ES)                 |   |

**Datos técnicos**

Designación		Estándares	
1.2379	SEL	4957	EN ISO
~T30402	UNS		
X153CrMoV12	EN		
D2	AISI		

**Composición Química**

C	Si	Mn	Cr	Mo	V
1,55	0,30	0,30	11,30	0,75	0,75

**Características**

	Resistencia a la compresión	Estabilidad dimensional durante el tratamiento térmico	Tenacidad	Resistencia al desgaste abrasivo	Resistencia al desgaste adhesivo
<b>BÖHLER K110</b>	★★	★★★	★	★★★	★★
<b>BÖHLER K100</b>	★★	★★	★	★★★	★★
<b>BÖHLER K105</b>	★★	★★	★	★★	★★
<b>BÖHLER K107</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 K360 ISODUR®</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>	★★★★	★★★★★	★★★★★	★★★	★★★

### Estado de suministro

<b>recocido</b>	
Dureza (HB)	máx. 250

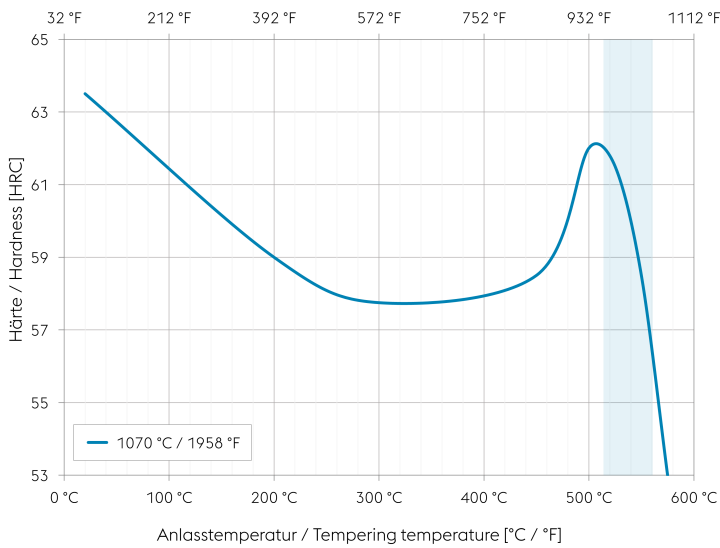
### Tratamiento térmico

<b>Recocido</b>		
Temperatura	800 a 850 °C	Slow controlled cooling in furnace at a rate of 10 to 20°C/hr down to approx. 600°C, further cooling in air.

<b>Alivio de tensiones</b>		
Temperatura	650 a 700 °C	Slow cooling in furnace. Intended to relieve stresses set up by extensive machining, or in complex shapes. After through heating, hold in neutral atmosphere for 1 to 2 hours.

<b>Temple y revenido</b>		
Temperatura	1.030 a 1.070 °C	Complex shapes / air, simple shapes / air blast, oil, salt bath from (220 to 250°C or 500 to 550°C) or gas. Holding time after temperature equalization: 15 to 30 minutes. After hardening, tempering to the desired working hardness, see tempering chart.

### Tempering chart



#### Tempering:

Specimen size: square 0,787 inch (20 mm)

Slow heating to tempering temperature immediately after hardening. Recommended tempering temperature is indicated by the blue area in the chart.

Time in furnace 1 hour for each 0,787 inch (20 mm) of workpiece thickness but at least 2 hours/cooling in air.

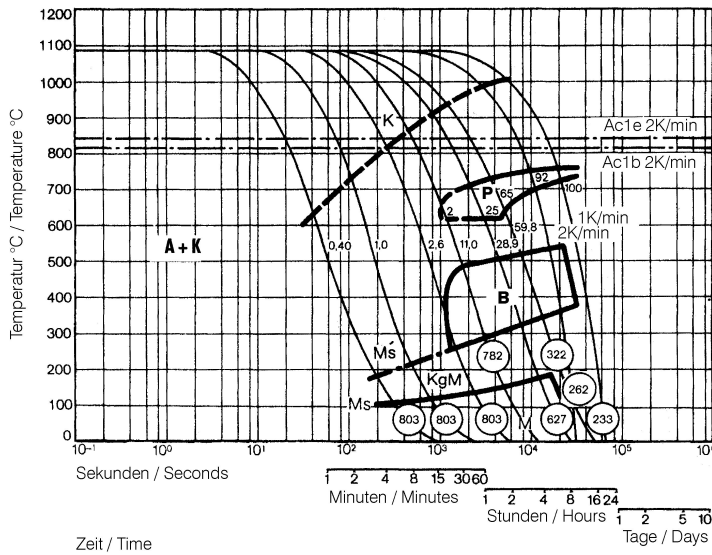
Slow cooling to room temperature after each tempering step is recommended.

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

It is recommended to temper at least three times above the secondary hardness maximum.

Tempering for stress relieving 86 to 122 °F (30 to 50 °C) below the highest tempering temperature.

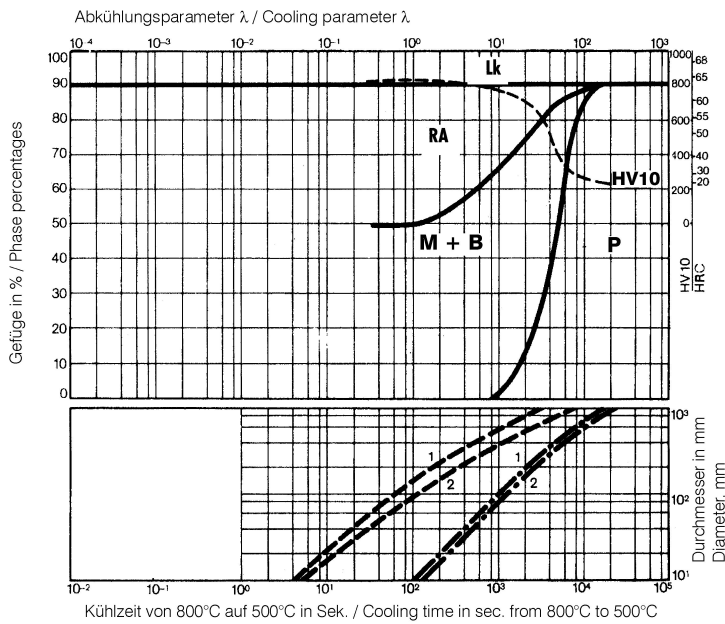
Continuous cooling CCT curves



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

O Hardness in HV  
2...100 phase percentages  
0,40...59,8 cooling parameters, i. e. Cooling from 800 - 500°C (1472 - 932°F) in  $s \times 10^{-2}$   
2...1 K/min cooling rate in K/min in the 800 - 500°C (1472 - 932°F) range  
Range of grain boundary martensite formation  
KgM... Grain boundary martensite

Quantitative phase diagram

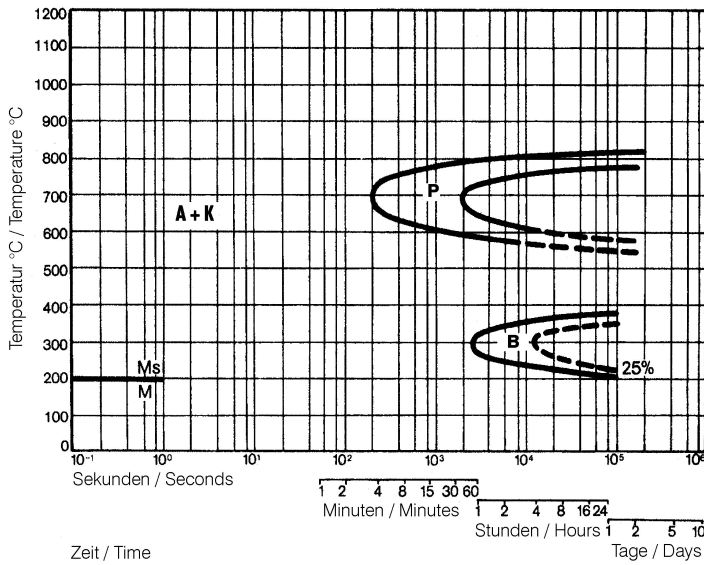


Lk... Ledeburite carbide  
RA... Residual austenite  
A... Austenite  
B... Bainite  
P... Pearlite  
K... Carbide  
M... Martensite

----- Oil cooling  
- · - Air cooling

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

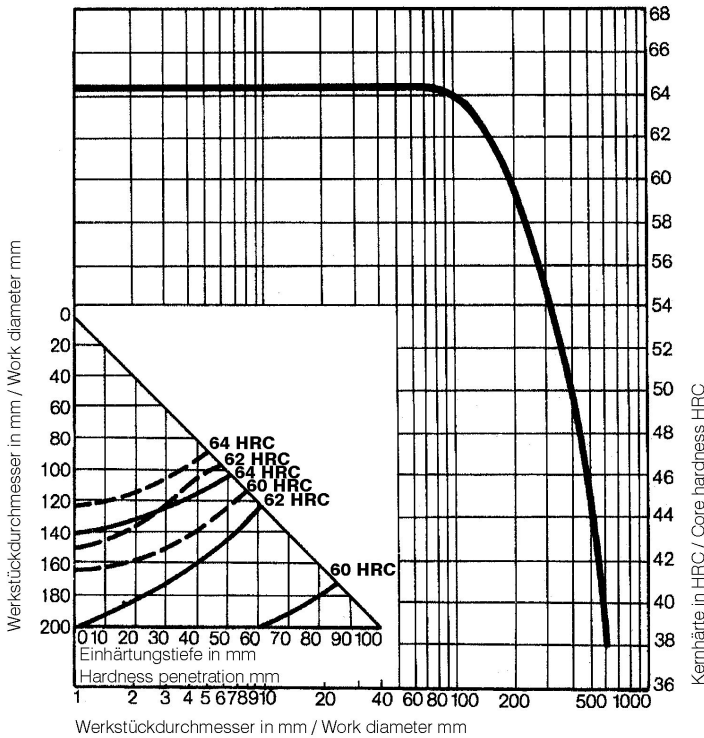
**Isothermal TTT curves**



Austenitising temperature: 1020°C / 1868°F  
Holding time: 30 minutes

- A... Austenite
- B... Bainite
- P... Pearlite
- K... Carbide
- M... Martensite

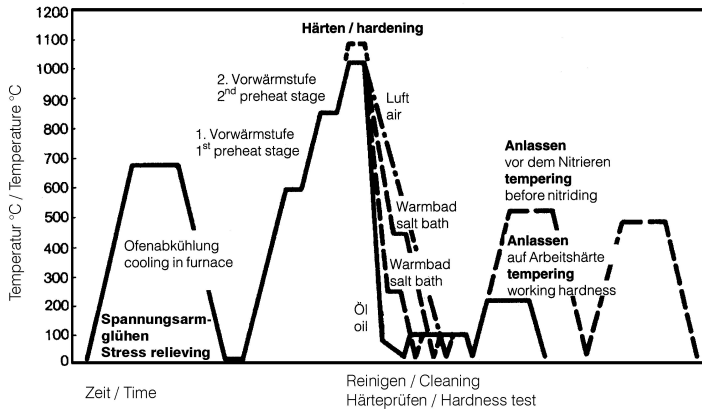
**Influence of work diameter on core hardness and hardness penetration**



Hardening temperature: 1030°C / 1886°F

- Quenchant:
- Oil
  - - - Air

Heat treatment sequence



Propiedades físicas

Temperatura (°C)	20
Densidad (kg/dm <sup>3</sup> )	7,67
Conductividad térmica (W/(m.K))	23,9
Calor específico (kJ/kg K)	0,47
Resistencia eléctrica específica (Ohm.mm <sup>2</sup> /m)	0,65
Módulo de elasticidad (10 <sup>3</sup> N/mm <sup>2</sup> )	200

## Expansión térmica

Temperatura (°C)	100	200	300	400	500	600	700
Expansión térmica (10 <sup>-6</sup> m/(m.K))	11	11,4	11,9	12,2	12,7	12,8	12,1

**Long Products:** For additional specifications 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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