

# 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

Acero para herramientas de estampación, herramientas de laminado en frío en tren pilger, cuchillas de corte, máquinas de corte para la industria de celulosa, papelera y de tableros de fibra, estampación de cubiertos y herramientas de trabajo en caliente.

## Método de obtención

[Convencional](#)

## Propiedades

- > Dureza y Ductilidad : alto
- > Resistencia al desgaste : buena
- > Resistencia a la compresión : alto
- > Estabilidad dimensional : buena

## Aplicaciones

- > Conformado en frío
- > Corte fino / Troquelado / Estampado

## Datos técnicos

Designación	
~1.2345	SEL
~X50CrMoV5-1	EN

## Composición Química

C	Si	Mn	Cr	Mo	V
0,51	0,95	0,30	5,00	1,40	1,40

## Características

	Resistencia a la compresión	Estabilidad dimensional durante el tratamiento térmico	Tenacidad	Resistencia al desgaste abrasivo
<b>BÖHLER K306</b>	★★★★	★★★	★★★★	★★★
<b>BÖHLER K305</b>	★★★★★	★★★	★★	★★★★★
<b>BÖHLER K313</b>	★★★★	★★★	★★★	★★★
<b>BÖHLER K320</b>	★★★	★★★	★★★	★★★
<b>BÖHLER K329</b>	★★★	★★★	★★★★★	★★★★★
<b>BÖHLER K600</b>	★	★★★	★★★★★	★
<b>BÖHLER K601</b>	★	★★★	★★★★★	★★
<b>BÖHLER K605</b>	★★	★★★	★★★★★	★

## Estado de suministro

### recocido

Dureza (HB)	máx. 240
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## Tratamiento térmico

### Recocido

Temperatura	750 a 800 °C	Slow controlled cooling in furnace at a rate of 50 to 68°F/hr (10 to 20°C/hr) down to approx. 1112°F (600°C), further cooling in air.
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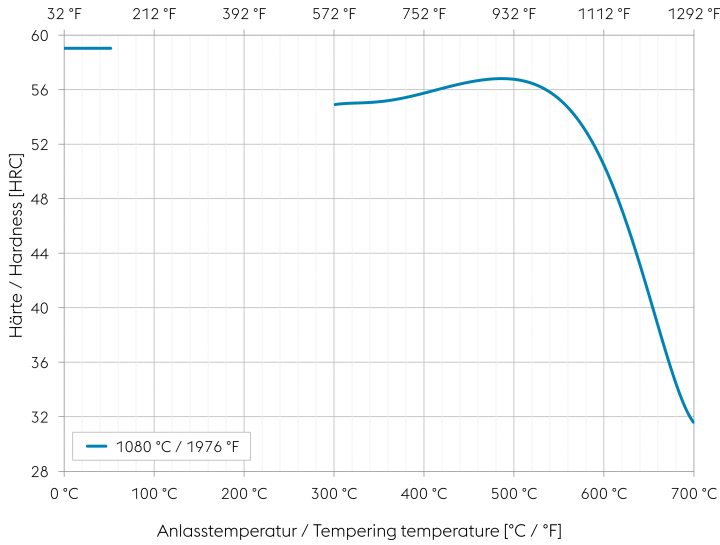
### Alivio de tensiones

Temperatura	650 °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 1-2 hours.
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### Temple y revenido

Temperatura	1.050 a 1.100 °C	Oil, salt bath 932 to 1022°F (500 - 550°C), air. (For maximum toughness, lower hardening temperature range) Holding time after temperature equalization: 15 to 30 minutes. After hardening, tempering to the desired working hardness, see tempering chart.
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### Tempering chart



**Tempering:**

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

Slow heating to tempering temperature immediately after hardening.

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

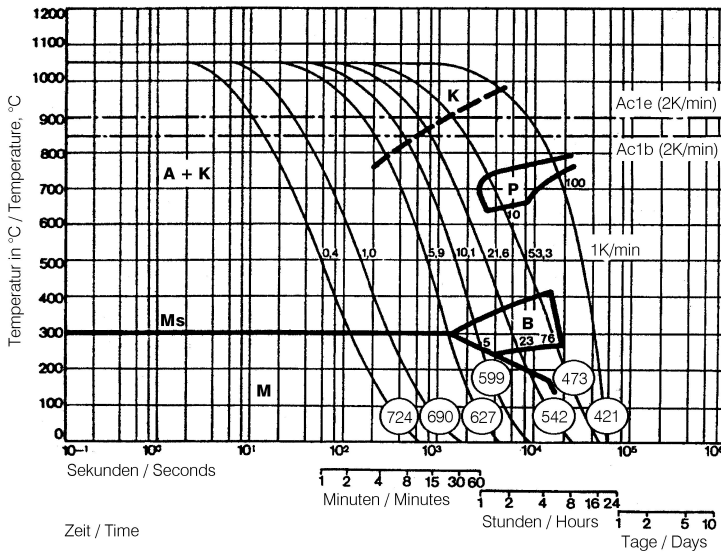
Please refer to the tempering chart for guide values for the hardness achievable after tempering.

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

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

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

### Continuous cooling CCT curves



Austenitising temperature: 1050°C  
Holding time: 15 minutes

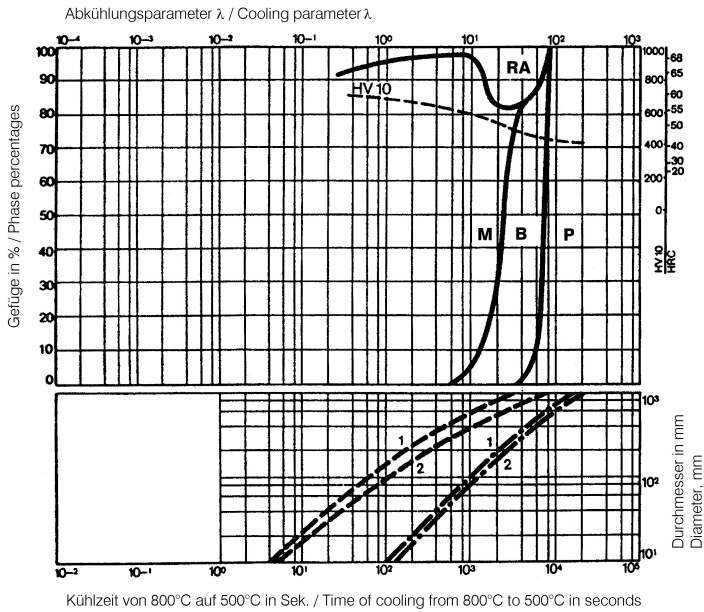
O Vickers hardness

10...100 phase percentages

0.4...53.3 cooling parameter, i.e. duration of cooling from 800°C to 500°C in s x 10<sup>-2</sup>

1K/min...cooling rate in K/min in the 800°C to 500°C range

**Quantitative phase diagram**

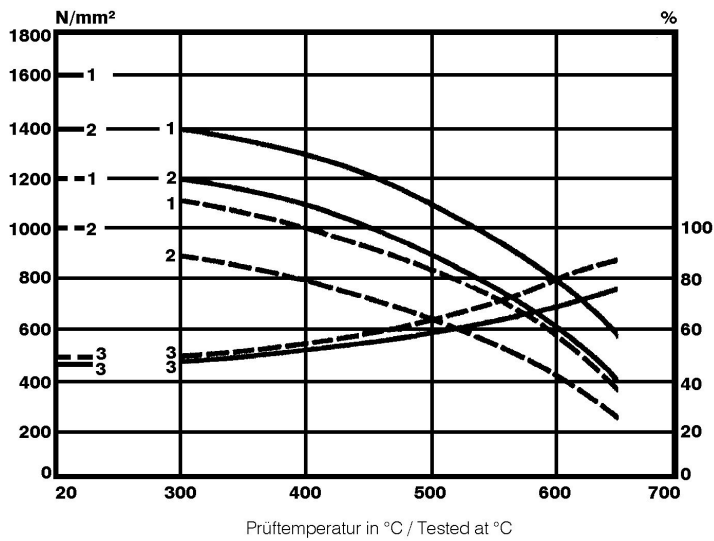


A... Austenite  
B... Bainite  
K... Carbide  
M... Martensite  
P... Perlite  
RA... Residual austenite

----- Oil cooling  
- · - Air cooling

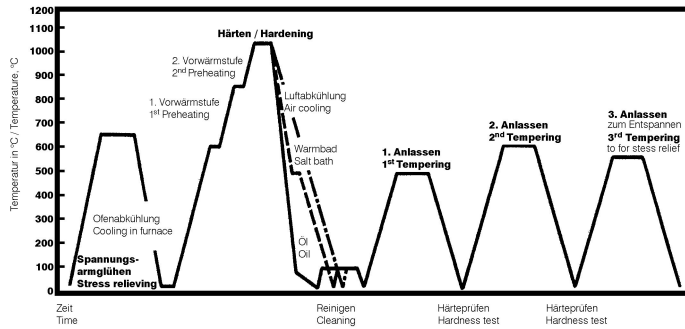
1... Edge or face  
2... Core

**Hot strength chart**



— heat treated 1600 N/mm<sup>2</sup>  
- - - - - heat treated 1200 N/mm<sup>2</sup>  
1... Tensile strength N/mm<sup>2</sup>  
2... 0.2 proof stress N/mm<sup>2</sup>  
3... Reduction of area %

## Heat treatment sequence



## Propiedades físicas

Temperatura (°C)	20
Densidad (kg/dm <sup>3</sup> )	7,8
Conductividad térmica (W/(m.K))	25
Calor específico (kJ/kg K)	0,46
Resistencia eléctrica específica (Ohm.mm <sup>2</sup> /m)	0,52
Módulo de elasticidad (10 <sup>3</sup> N/mm <sup>2</sup> )	215

## Expansión térmica

Temperatura (°C)	100	200	300	400	500
Expansión térmica (10 <sup>-6</sup> m/(m.K))	11,5	12	12,2	12,5	12,9

**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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