

# 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 ledeburítico con 12% de Cromo, con buena estabilidad dimensional y resistencia al desgaste superior. Apto para temple al aire.

## Método de obtención

 Convencional

## Propiedades

> Resistencia al desgaste : buena

## Aplicaciones

- > Cuchillas de máquinas (fabricantes)  
 > Corte fino / Troquelado / Estampado  
 > Componentes de desgaste
- > Laminación  
 > Componentes estándar (moldes, placas, expulsores, punzones)  
 > Componentes generales de ingeniería mecánica
- > Conformado en frío  
 > Componentes para la industria del reciclaje

## Datos técnicos

Designación		Estándares	
1.2436	SEL	4957	EN ISO
X210CrW12	EN		
~ D6	AISI		

## Composición Química

C	Si	Mn	Cr	W
2,10	0,25	0,40	11,50	0,70

**Características**

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

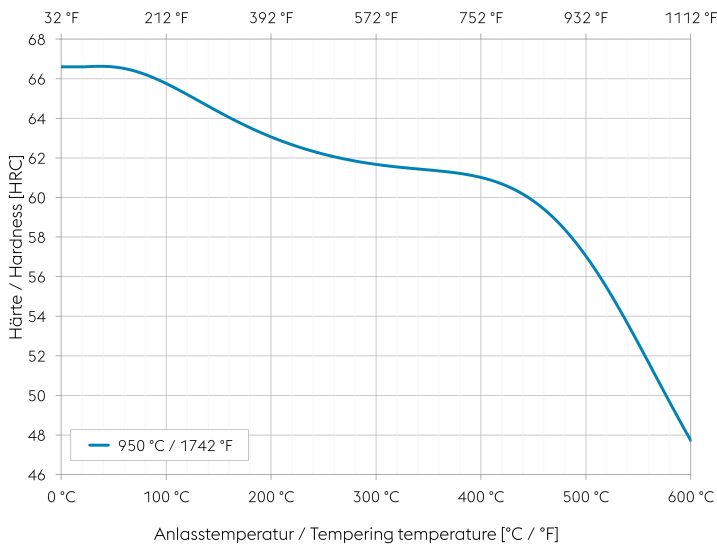
**Estado de suministro**

recocido	
Dureza (HB)	máx. 250

## Tratamiento térmico

Recocido		
Temperatura	800 a 850 °C	Slow controlled cooling in furnace at a rate of 50 - 68°F/hr (10 to 20°C/hr) down to approx. 1112°F (600°C), further cooling in air.
Alivio de tensiones		
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 - 2 hours
Temple y revenido		
Temperatura	950 a 980 °C	Oil, salt bath 428 to 482°F or 932 to 1022°F (220 to 250°C or 500 to 550°C), air, oil, still air, gas; Holding time after temperature equalization: 15 to 30 minutes. Special treatment: Hardening 1868°F (1020°C) and tempering at 932°F (500°C). 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.

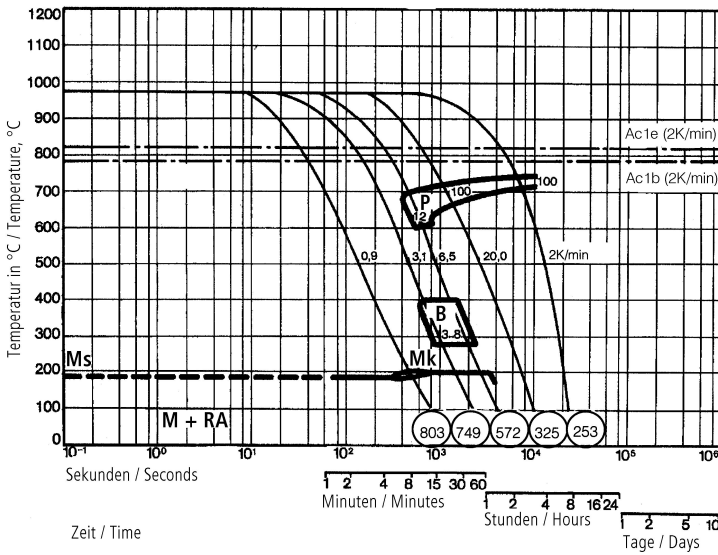
Time in furnace 1 hour for each 0,787 inch (20 mm) of workpiece thickness but at least 2 hours/cooling in air.

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.

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

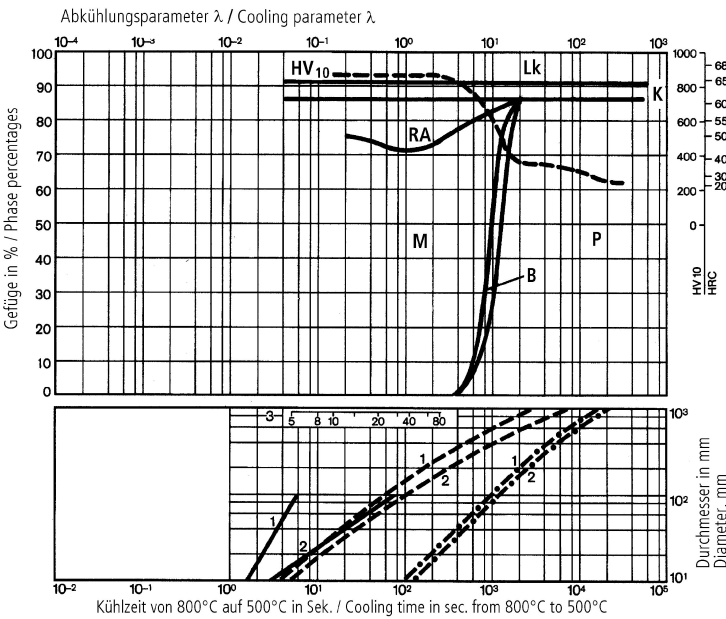
Continuous cooling CCT curves



Austenitising temperature: 1796°F (980°C)  
Holding time: 30 minutes

O Vickers hardness  
3...100 phase percentages  
0.9...20.0 cooling parameter, i.e. duration of cooling from 1472 to 932°F (800 to 500°C) in  $s \times 10^{-2}$   
35.6°F/min (2 K/min) cooling rate in °F/min (K/min) in the 1472 to 932°F (800 to 500°C) range  
Mk... Grain boundary martensite

Quantitative phase diagram

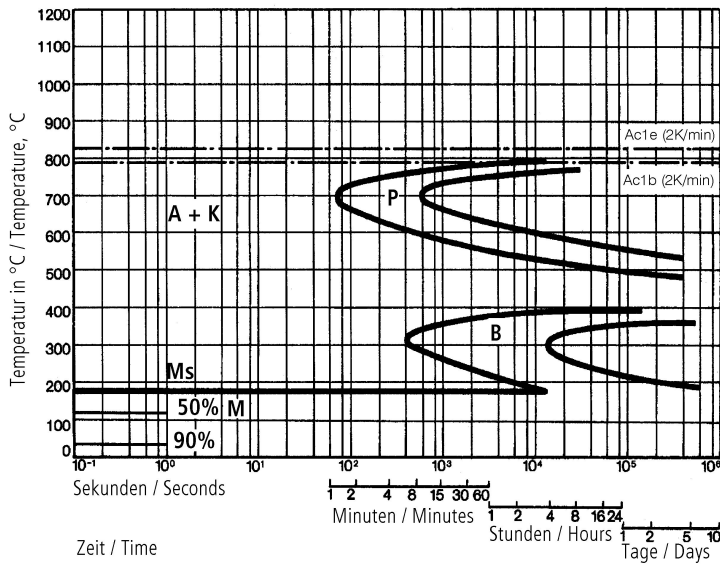


Lk... Ledeburite carbide  
RA... Residual austenite  
A... Austenite  
B... Bainite  
P... Pearlite  
K... Carbide  
M... Martensite

— Water cooling  
- - - Oil cooling  
- · - Air cooling

1... Edge or face  
2... Core  
3... Jominy test: distance from end

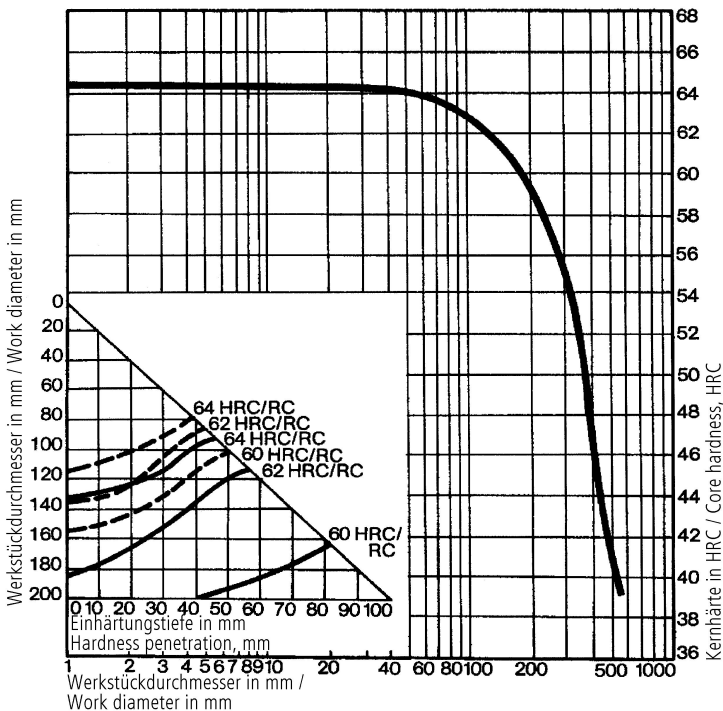
**Isothermal TTT curves**



Austenitising temperature: 980°C / 1796°F  
Holding time: 30 minutes

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

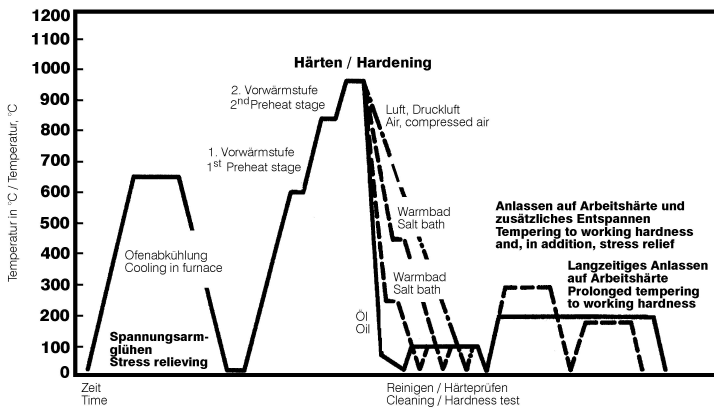
**Influence of work diameter on core hardness and hardness penetration**



Quenched from: 950°C / 1742°F  
Agent:

- Oil
- - - - Air

## Heat treatment sequence



## Propiedades físicas

Temperatura (°C)	20
Densidad (kg/dm <sup>3</sup> )	7,7
Conductividad térmica (W/(m.K))	20
Calor específico (kJ/kg K)	0,46
Resistencia eléctrica específica (Ohm.mm <sup>2</sup> /m)	0,65
Módulo de elasticidad (10 <sup>3</sup> N/mm <sup>2</sup> )	210

## Expansión térmica

Temperatura (°C)	100	200	300	400	500	600
Expansión térmica (10 <sup>-6</sup> m/(m.K))	10,5	11	11	11,5	12	12

**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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