

# 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 trabajo en frío, como herramientas de fijación (p. ej. pinzas, mandriles), cuchillas de corte, punzones de perforación, destornilladores, coladores, mandriles de expansión, espigas, expulsores, granetes, guías de clavos.

## Método de obtención

[Convencional](#)

## Propiedades

- > Dureza y Ductilidad : muy alta
- > Resistencia a la compresión : buena
- > Estabilidad dimensional : buena
- > Resistencia a la tracción / límite elástico : alto

## Aplicaciones

- > Conformado en frío
- > Componentes generales de ingeniería mecánica
- > Componentes estándar (moldes, placas, expulsores, punzones)
- > Componentes para la industria del reciclaje

## Datos técnicos

Designación		
1.2101	SEL	
62SiMnCr4	EN	

## Composición Química

C	Si	Mn	Cr
0,63	1,10	1,10	0,60

**Características**

	Resistencia a la compresión	Estabilidad dimensional durante el tratamiento térmico	Tenacidad	Resistencia al desgaste abrasivo
<b>BÖHLER K245</b>	★★	★	★★★★★	★
<b>BÖHLER K455</b>	★★★	★	★★★★★	★
<b>BÖHLER K460</b>	★★★★	★	★★★★	★★
<b>BÖHLER K720</b>	★★	★	★★★★	★

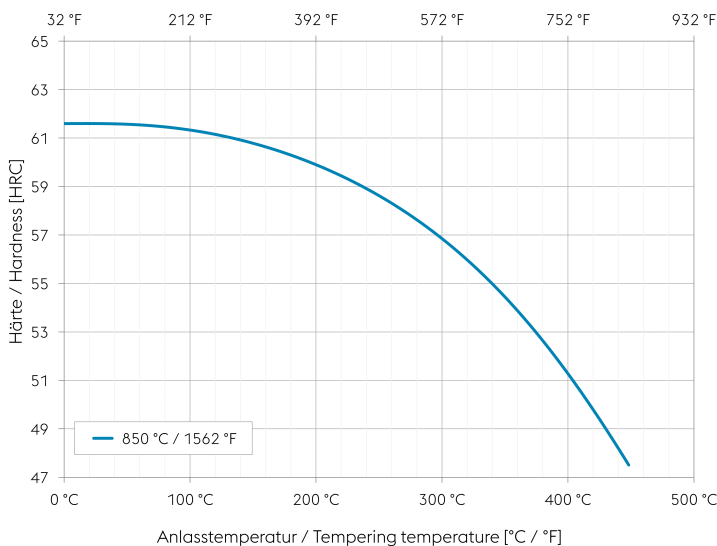
**Estado de suministro**

recocido	
Dureza (HB)	máx. 235

**Tratamiento térmico**

Recocido		
Temperatura	710 a 750 °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.
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 to 2 hours.
Temple y revenido		
Temperatura	830 a 860 °C	Oil, salt bath (for small sizes) Holding time at hardening temperature: 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.

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

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

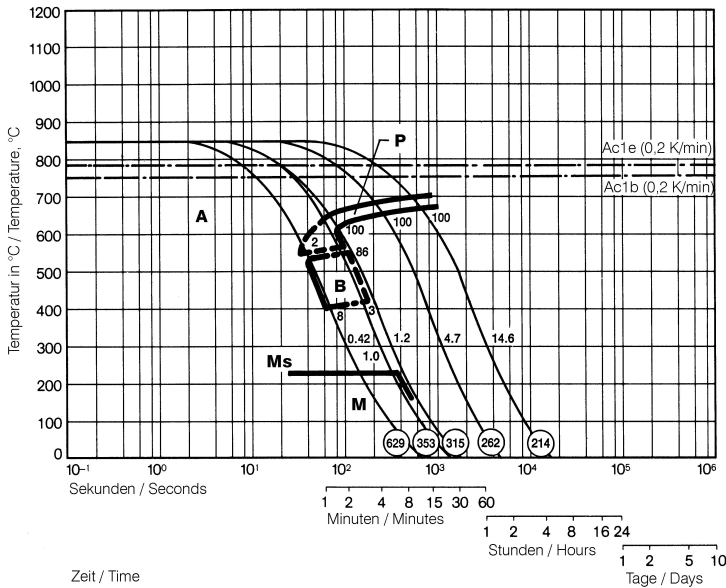
1. Tempering at 392 to 482 °F (200 to 250 °C) to working hardness

2. Partial tempering at 932 to 1022 °F (500 to 550 °C) to spring hardness

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.

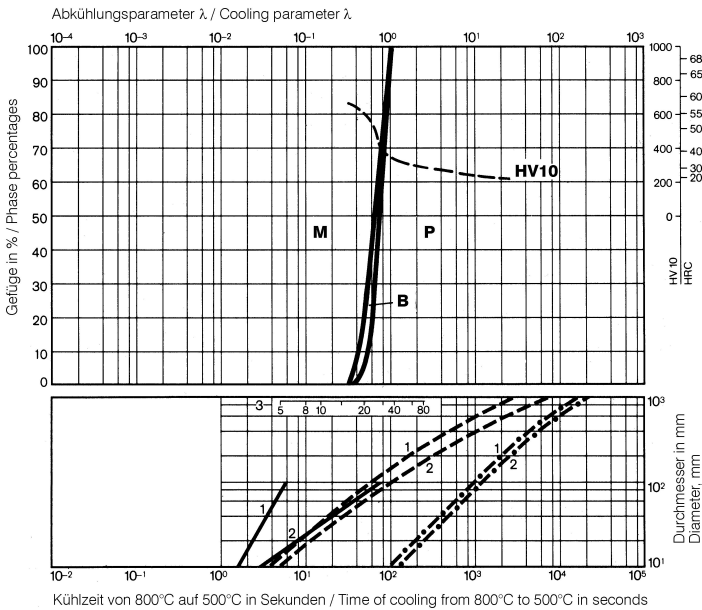
Continuous cooling CCT curves



Austenitising temperature: 845°C / 1553°F  
Holding time: 15 minutes

O Vickers hardness  
2...100 phase percentages  
0.42...14.6 cooling parameter, i.e. duration of cooling from 800°C to 500°C (1472°F to 932°F) in  $s \times 10^{-2}$

Quantitative phase diagram

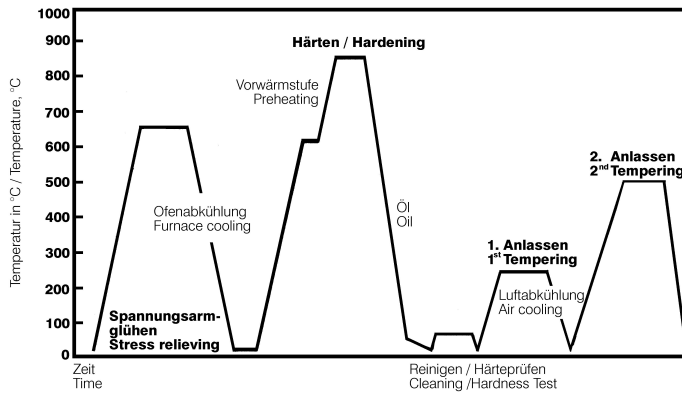


A... Austenite  
B... Bainite  
P... Pearlite  
M... Martensite

— Watercooling  
- - - Oil cooling  
- · - Air cooling

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

## Heat treatment sequence



## Propiedades físicas

Temperatura (°C)	<b>20</b>
Densidad (kg/dm <sup>3</sup> )	7,7
Conductividad térmica (W/(m.K))	30
Calor específico (kJ/kg K)	0,46
Resistencia eléctrica específica (Ohm.mm <sup>2</sup> /m)	0,35
Módulo de elasticidad (10 <sup>3</sup> N/mm <sup>2</sup> )	210

## Expansión térmica

Temperatura (°C)	100	200	300	400	500
Expansión térmica ( $10^{-6}$ m/(m.K))	12,4	12,1	12,6	12,8	13

**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.

*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.*