

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

Alcanzar los estándares más altos de rendimiento y productividad sólo es posible cuando en la fabricación de la herramienta se han utilizado aceros PM (pulvimetalúrgicos) de alta resistencia al desgaste.

Las características clave que estas herramientas deben tener son tenacidad, resistencia al desgaste, resistencia a la compresión y capacidad para mantener los bordes de la herramienta. BÖHLER K190 MICROCLEAN reúne todas estas propiedades de una forma impresionante.

Método de obtención

[Pulvimetalurgia](#)

Propiedades

- > Dureza y Ductilidad : alto
- > Una buena tenacidad significa seguridad contra el agrietamiento de los moldes en uso : buena
- > Resistencia y tenacidad uniformemente altas, incluso con grandes dimensiones : buena
- > Resistencia al desgaste : alto
- > Resistencia a la compresión : alto
- > Estabilidad dimensional : muy alta
- > Excelente homogeneidad e isotropía : muy alta
- > Estructura fina de carburo : buena
- > Microestructura homogénea : buena

Aplicaciones

- > Laminación
- > Tornillos y cilindros
- > Componentes de desgaste
- > Conformado en frío
- > Componentes para la industria del reciclaje
- > Componentes generales de ingeniería mecánica
- > Corte fino / Troquelado / Estampado
- > Rodillos

Datos técnicos

Designación		
	~1.2380	SEL
	~X230CrVMo13 4	EN

Composición Química

C	Si	Mn	Cr	Mo	V
2,30	0,60	0,30	12,50	1,10	4,00

Características

	Resistencia a la compresión	Estabilidad dimensional durante el tratamiento térmico	Tenacidad	Resistencia al desgaste abrasivo	Resistencia al desgaste adhesivo
BÖHLER K190 MICROCLEAN®	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
BÖHLER K100	★★	★★	★	★★★	★★
BÖHLER K105	★★	★★	★	★★	★★
BÖHLER K107	★★	★★	★	★★★	★★
BÖHLER K110	★★	★★★	★	★★★	★★
BÖHLER K294 MICROCLEAN®	★★★★★	★★★★★	★★★	★★★★★	★★★★★
BÖHLER K340 ECOSTAR®	★★★	★★★	★★	★★	★★
BÖHLER K340 ISODUR®	★★★	★★★★★	★★★	★★★	★★★★★
BÖHLER K346	★★★	★★★	★★★	★★★★★	★★
BÖHLER K353	★★	★★★	★★	★★	★★
BÖHLER K360 ISODUR®	★★★	★★★★★	★★★	★★★★★	★★★★★
BÖHLER K390 MICROCLEAN®	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
BÖHLER K490 MICROCLEAN®	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
BÖHLER K497 MICROCLEAN®	★★★★★	★★★★★	★★★	★★★★★	★★★★★
BÖHLER K888 MATRIX	★★★★★	★★★★★	★★★★★	★★	★★
BÖHLER K890 MICROCLEAN®	★★★★★	★★★★★	★★★★★	★★★	★★★

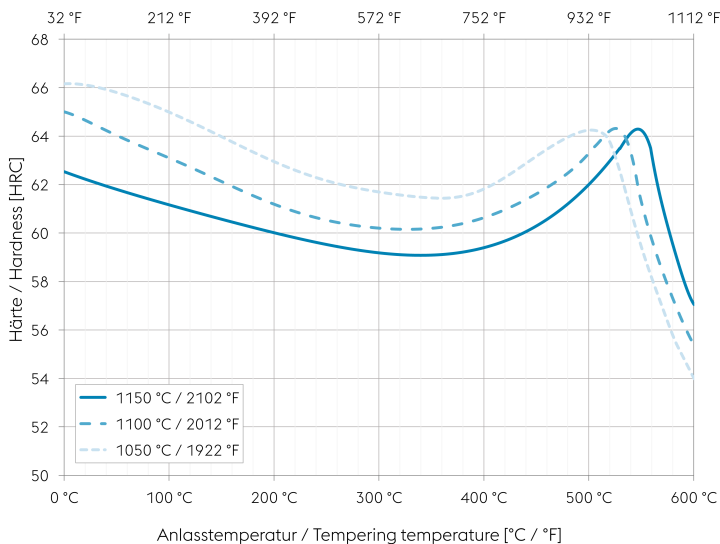
Estado de suministro

recocido	
Dureza (HB)	máx. 260

Tratamiento térmico

Recocido		
Temperatura	800 a 850 °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 a 700 °C	After through-heating, soak for 1 to 2 hours in neutral atmosphere. Slow cooling in furnace
Temple y revenido		
Temperatura	1.050 a 1.150 °C	From a neutral atmosphere at 1050 – 1150°C / quench in oil, salt-bath at 200 – 250 °C or at 500 – 550 °C, in air or in gas. A sufficiently high cooling rate must be ensured. Holding time after through-heating: 20 to 30 minutes, soaking time depends on the size of the work-piece and furnace parameters. Vacuum hardening is recommended. Average hardness after quenching prior to tempering see austenitising chart. We recommend hardening from the lower end of the hardening temperature range where high toughness is required and/or where the tool is of complicated geometry. Where high wear resistance is of the utmost importance we recommend hardening from the top end of the hardening temperature range given. 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.

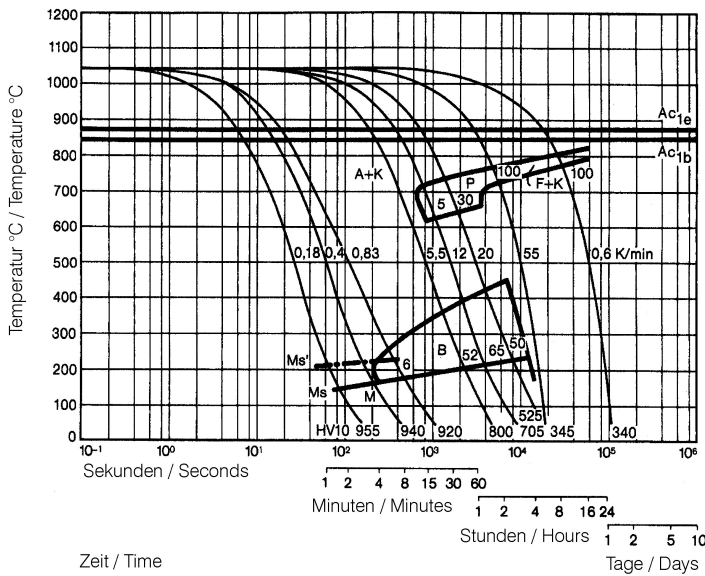
Slow cooling to room temperature after each tempering step is recommended.

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

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.

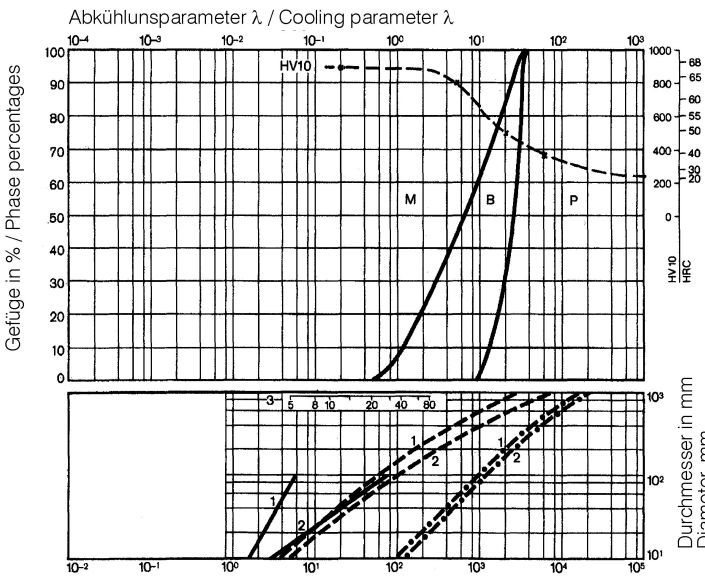
Continuous cooling CCT curves



Austenitizing temperature: 1050°C / 1922°F
 Holding time: 10 minutes

5...100 phase percentages
 0,18...50 cooling parameter, i.e. duration of cooling from 800 - 500° C (1472°F - 932°F) in s x 10⁻²
 0.6 K/min. cooling rate in the 800 - 500° C (1472°F - 932°F) range

Quantitative phase diagram



Ms'... range of grain boundary martensite
 LK... Ledeburitic carbides
 A... Austenite
 M... Martensite
 P... Pearlite
 B... Bainite

— Water
 - - - Oil
 ····· Air

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

Kühlzeit von 800°C auf 500°C in Sek. / Cooling time in sec. from 800°C to 500°C

Propiedades físicas

Temperatura (°C)	20
Densidad (kg/dm ³)	7,6
Conductividad térmica (W/(m.K))	21,5
Calor específico (kJ/kg K)	-
Resistencia eléctrica específica (Ohm.mm ² /m)	0,59
Módulo de elasticidad (10 ³ N/mm ²)	-

Expansión térmica

Temperatura (°C)	100	200	300	400	500	600	700
Expansión térmica (10 ⁻⁶ m/(m.K))	12,2	12,5	13	13,2	13,7	14	13,7

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

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