

COLD WORK STEELS

Available Product Variants

Long Products*

Plates

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

Product Description

BÖHLER K190 MICROCLEAN is a 12% ledeburitic chromium steel manufactured using powder metallurgy. This material has the highest alloy content of the group of 12% ledeburitic chromium steels. Due to its high vanadium content, BÖHLER K190 MICROCLEAN has a significantly better resistance to abrasive wear than the tool steels 1.2080, 1.2601, 1.2436 and 1.2379. At the same time, the powder metallurgical manufacturing process creates a uniform matrix with finely distributed primary carbides, which among other things contributes to the good toughness of the material. BÖHLER K190 MICROCLEAN is used in situations where tool steels like 1.2379 are insufficient in terms of wear resistance.

Process Melting

Powder metallurgy

Properties

- > Toughness & Ductility : high
- > Good toughness means safety against cracking of the molds in use : good
- > Uniformly high strength and toughness, even with large dimensions : good
- > Wear Resistance : high
- > Compressive strength : high
- > Dimensional stability : very high
- > Excellent homogeneity and isotropy : very high
- > Fine carbide structure : good
- > Homogeneous microstructure : good

Applications

- > Rolling
- > Screws and Barrels
- > Wear parts
- > Cold Forming
- > Components for Recycling Industry
- > General Components for Mechanical Engineering
- > Fine Blanking, Stamping, Blanking
- > Rolls

Technical data

Material designation	
~1.2380	SEL
~X230CrVMo13 4	EN

Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V
2.30	0.60	0.30	12.50	1.10	4.00

Material characteristics

	Compressive strength	Dimensional stability during heat treatment	Toughness	Wear resistance abrasive	Wear resistance adhesive
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®	★★★★★	★★★★★	★★★★★	★★★	★★★

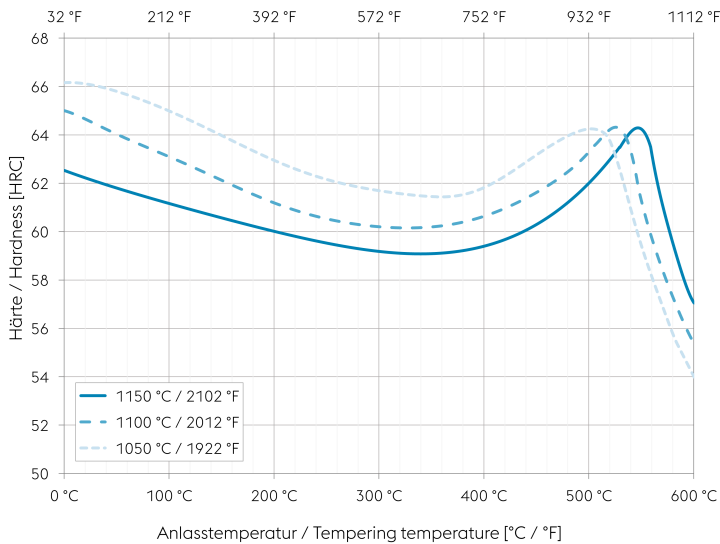
Delivery condition

Annealed	
Hardness (HB)	max. 260

Heat treatment

Annealing		
Temperature	800 to 850 °C 1,472 to 1,562 °F	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.
Stress relieving		
Temperature	650 to 700 °C 1,202 to 1,292 °F	After through-heating, soak for 1 to 2 hours in neutral atmosphere. Slow cooling in furnace
Hardening and Tempering		
Temperature	1,050 to 1,150 °C 1,922 to 2,102 °F	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.

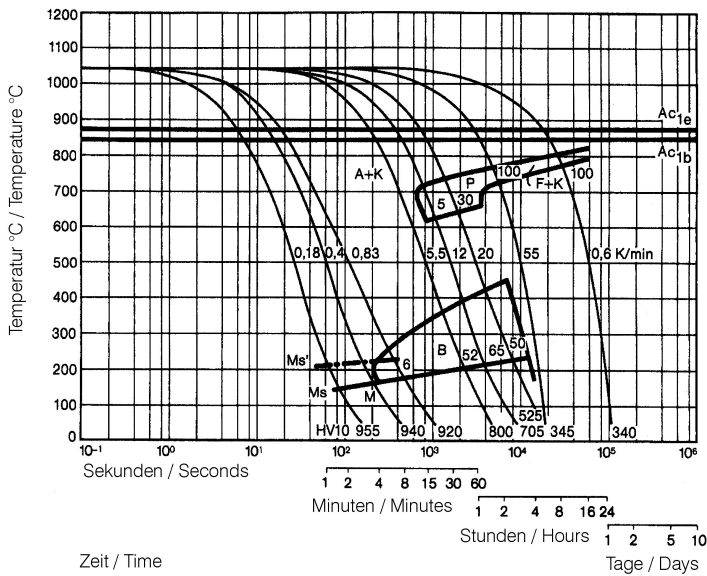
Slow cooling to room temperature after each tempering step is recommended.

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.

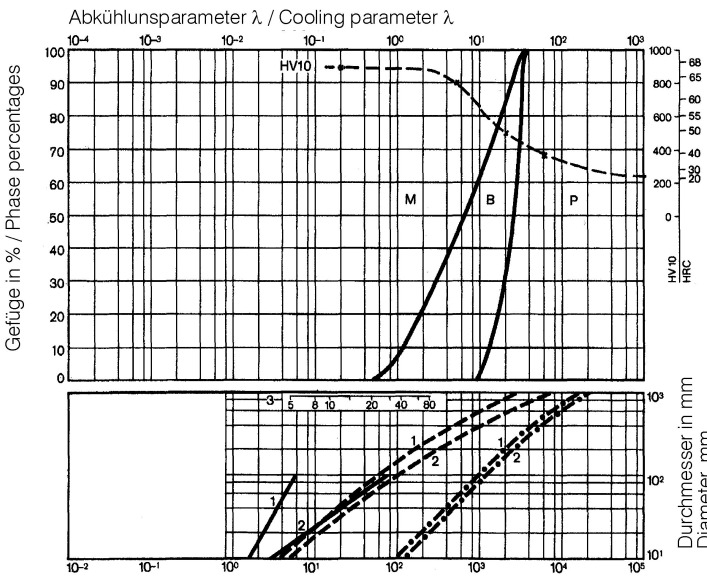
Continuous cooling CCT curves



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 $s \times 10^{-2}$
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

Physical Properties

Temperature (°C °F)	20 68
Density (kg/dm ³ lb/in ³)	7.6 0.27
Thermal conductivity (W/(m.K) BTU/ft h °F)	21.5 12.42
Specific heat (kJ/kg K BTU/lb °F)	-
Spec. electrical resistance (Ohm.mm ² /m 10 ⁻⁴ Ohm.inch ² /ft)	0.59 2.79
Modulus of elasticity (10 ³ N/mm ² 10 ³ ksi)	-

Thermal Expansions between 20°C | 68°F and ...

Temperature (°C °F)	100 212	200 392	300 572	400 752	500 932	600 1,112	700 1,292
Thermal expansion (10 ⁻⁶ m/(m.K) 10 ⁻⁶ inch/inch.°F)	12.2 6.8	12.5 6.9	13 7.2	13.2 7.3	13.7 7.6	14 7.8	13.7 7.6

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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