

# COLD WORK TOOL STEEL

<b>Standards</b>	1.2379	(DIN)	<b>Properties</b> Dimensionally stable, ledeburitic 12% chromium steel with very good wear resistance and acceptable toughness.
	X153CrMoV12	(EN)	
	D2	(AISI)	
	~ SKD11	(JIS)	
<b>Delivery condition</b>	annealed		<b>Application</b> High-performance cutting tools (dies and punches), die-cutting tools, woodworking tools, shear knives for thin items, thread rolling tools. Drawing, deep drawing and extrusion press tools, pressing tools for the ceramic and pharmaceutical industry, cold rolling (work rolls) for multi-roll stands, gauges, smaller plastic molds, which require high wear resistance.

## Chemical Composition (%)

C	Si	Mn	Cr	Mo	V
1.55	0.30	0.30	11.30	0.75	0.75

## Material Characteristics

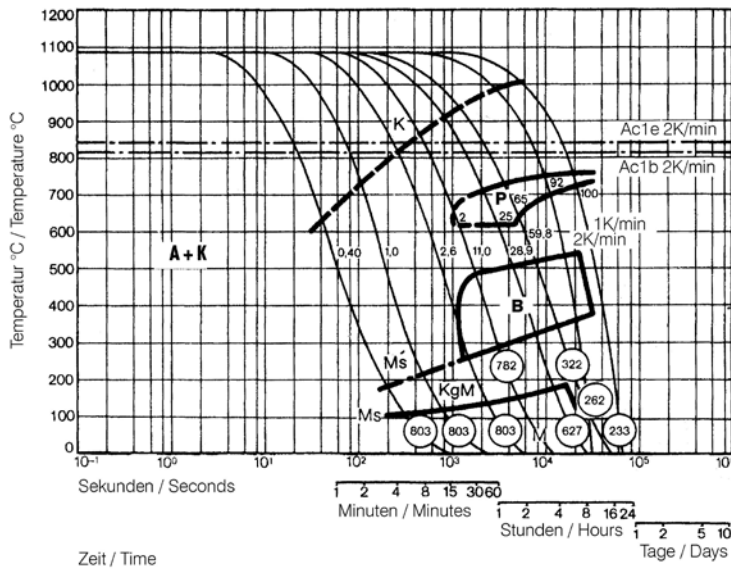
	Wear resistance abrasive	Wear resistance adhesive	Toughness	Compressive strength	Dimensional stability during heat treatment
<b>BÖHLER K110</b>	★★★	★	★	★★	★★
<b>BÖHLER K100</b>	★★★	★	★	★	★★
<b>BÖHLER K340 ISODUR®</b>	★★★	★★★★	★★★	★★★	★★★
<b>BÖHLER K353</b>	★★	★★★	★★★★★	★★	★★
<b>BÖHLER K360 ISODUR®</b>	★★★★	★★★★	★★	★★★	★★★
<b>BÖHLER K390 MICROCLEAN®</b>	★★★★★	★★★★★	★★★★	★★★★	★★★★
<b>BÖHLER K490 MICROCLEAN®</b>	★★★★	★★★★	★★★★★	★★★	★★★★
<b>BÖHLER K890 MICROCLEAN®</b>	★★★	★★★	★★★★★	★★★	★★★★

\* The evaluation of the characteristics refers **only** to the brands considered here.  
Cross-comparisons with other reviews are discouraged due to different framework conditions.

## Heat treatment

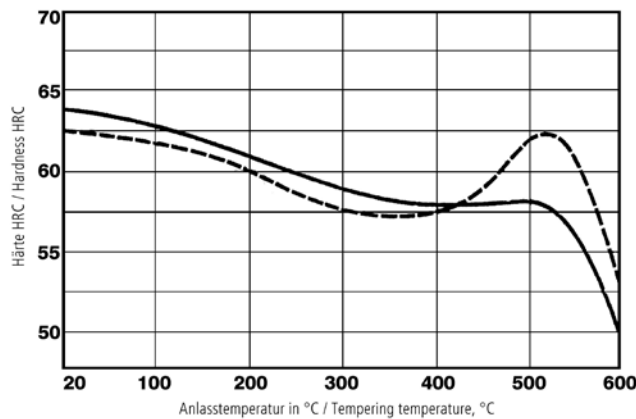
Annealing		
Temperature	800 - 850°C 1472 - 1562°F	Controlled slow oven cooling with 10 to 20°C/h (50 to 68°F/h) up to ca. 600°C/1112°F, further cooling in air. Supplied hardness max.: 250 HB
Stress relieving		
Temperature	650 - 700°C 1202 - 1292°F	Slow oven cooling. For stress relief after extensive machining or at complicated tools. Holding time after complete through heating 1 - 2 hours in neutral atmosphere.
Hardening		
Temperature	1030 - 1070°C 1886 - 1958°F	Difficultly shaped tools in air, simply shaped tools in compressed air, oil, hot bath (220 to 250°C/428 to 482°F or 500 to 550°C/932 to 1022°F) or gas. Holding time after complete soaking: 15 to 30 minutes. Achievable hardness: 58 - 61 HRC.

**Continuous cooling CCT curves**



Austenitising temperature: 1080°C/1976°F  
 Holding time: 30 minutes  
 O Hardness in HV  
 2 ... 100 phase percentages  
 0,40 ... 59,8 cooling parameters, i. e.  
 Cooling from 800 - 500°C (1472 - 932°F) in  $s \times 10^{-2}$   
 2 ... 1 K/min cooling rate in  
 K/min in the 800 - 500°C (1472 - 932°F) range  
 Range of grain boundary martensite formation  
 KgM ... Grain boundary martensite

**Tempering chart**



**Tempering**

Slow heating to tempering temperature immediately after hardening/time in furnace 1 hour for each 20 mm of workpiece thickness but at least 2 hours/cooling in air.

Please refer to the tempering chart for obtainable hardness after tempering.

Tempering after the secondary hardness maximum is recommended.

**Hardening temperature**

— 1030°C / 1886°F  
 - - - 1070°C / 1958°F

**Physical properties at 20°C/68°F**

Density	7.67	[kg/dm <sup>3</sup> ]
Thermal conductivity	23.90	[W/(m.K)]
Specific heat	470	[J/(kg.K)]
spec. electrical resistance	0.65	[Ohm.mm <sup>2</sup> /m]
Modulus of elasticity	200	[GPa]

Temperature [°C/°F]	100/212	200/392	300/572	400/752	500/932	600/1112	700/1292
Thermal expansion [10 <sup>-6</sup> m/(m.K)]	11.0	11.4	11.9	12.2	12.7	12.8	12.1

For more information visit [www.voestalpine.com/bohler-edelstahl](http://www.voestalpine.com/bohler-edelstahl)

**voestalpine BÖHLER Edelstahl GmbH & Co KG**

Mariazeller Straße 25  
 8605 Kapfenberg, Austria  
 T. +43/50304/20-6066  
 E. [info@bohler-edelstahl.at](mailto:info@bohler-edelstahl.at)  
[www.voestalpine.com/bohler-edelstahl](http://www.voestalpine.com/bohler-edelstahl)