

# ACIERS POUR TRAVAIL À FROID

## Variantes de produits disponibles

 Produit long\*

 Tôle

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

## Description du produit

Outils de coupe à hautes performances (matrices et poinçons), outils de découpage, outils de menuiserie, lames de cisailles pour produits à découper minces, outils de laminage des filets.  
Outils d'emboutissage, d'emboutissage profond et d'extrusion, outils de moulage par compression pour l'industrie céramique et pharmaceutique, laminage à froid (cylindres de travail) pour les bâtis à cylindres multiples, instruments de mesure, petits moules à matière plastique qui doivent présenter une résistance à l'usure élevée.

## Procédé d'élaboration

 Airmelted

## Propriétés

Acier au chrome à 12 % lédeburitique à faibles variations dimensionnelles. Convient particulièrement pour le durcissement à l'air. Bonne ténacité.

## Applications

- > Cisailages / couteaux pour machines
- > Découpage et emboutissage fins
- > Cylindres
- > Laminage
- > Eléments standards (carcasses, ejecteurs, bagues...)
- > Pièces d'usure
- > Formage à froid
- > Composants pour l'industrie du recyclage
- > Composants pour la mécanique générale

## Données techniques

Désignation normalisée	
1.2601	SEL
~T30402	UNS
X165CrMoV12	EN
~D2	AISI
~Ch12MF	GOST

## Composition chimique

C	Si	Mn	Cr	Mo	V	W
1,60	0,35	0,30	11,50	0,60	0,30	0,50

## Comparaison des caractéristiques

	Résistance à la compression	Stabilité dimensionnelle lors du traitement thermique	Ténacité	Résistance à l'usure abrasive	Résistance à l'usure adhésive
<b>BÖHLER K105</b>	★★	★★	★	★★	★★
<b>BÖHLER K100</b>	★★	★★	★	★★★	★★
<b>BÖHLER K107</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>	★★★★	★★★★★	★★★★★	★★★	★★★

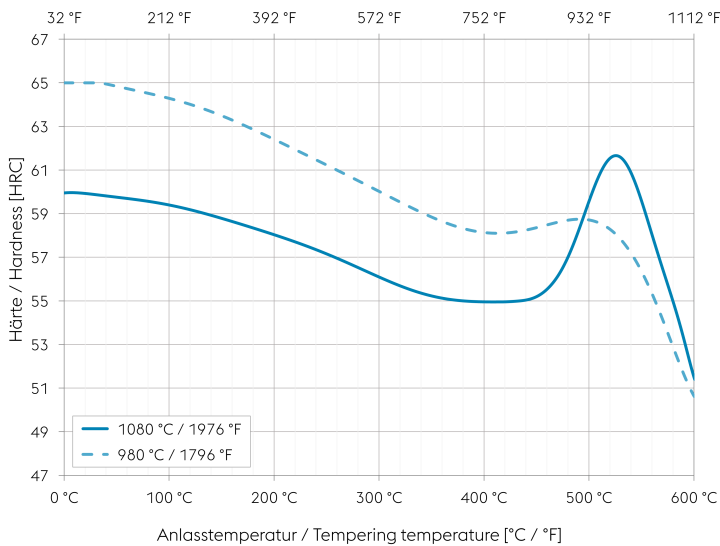
## Condition de livraison

Recuit	
Dureté (HB)	max. 250

## Traitement thermique

Recuit		
Température	800 jusqu'à 850 °C	Slow controlled cooling in furnace at a rate of 50 to 68°F/hr (10 to 20°C/hr) down to approx. 600°C, further cooling in air.
Recuit de détente		
Température	650 jusqu'à 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 to 2 hours..
Trempe et revenu		
Température	980 jusqu'à 1010 °C	Oil, salt bath from 428 to 482°F or 932 to 1022°F (220 to 250°C or 500 to 550°C), air, gas. Tools of intricate shape or with sharp edges should preferably be hardened in air or salt bath. Holding time after temperature equalization: 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/cooling in air.

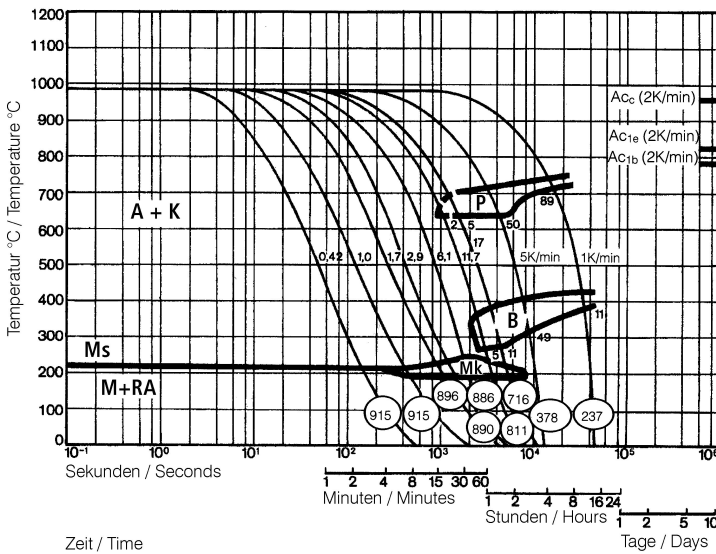
Slow cooling to room temperature after each tempering step is recommended.

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.

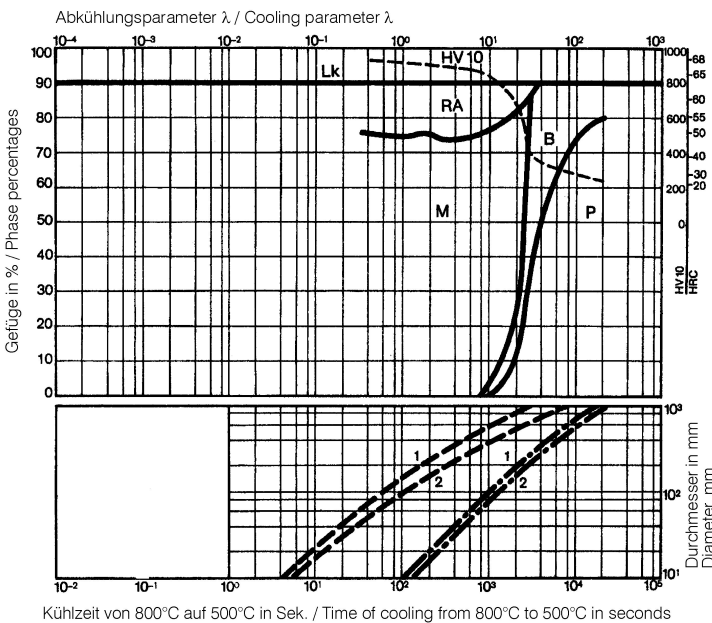
Continuous cooling CCT curves



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

O Vickers hardness  
2...50 phase percentages  
0.42...17 cooling parameter ( $\lambda$ ), i.e. duration of cooling from 1472 to 932°F (800 to 500°C) in  $s \times 10^{-2}$   
41...33,8°F/min (5...1K/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

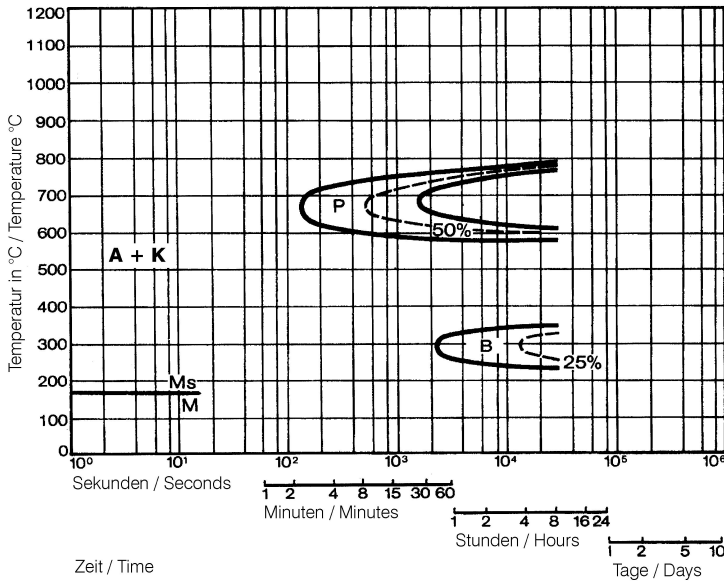


Lk... Ledeburite carbide  
RA... Residual austenite  
A... Austenite  
B... Bainite  
P... Pearlite  
K... Carbide  
M... Martensite

----- Oil cooling  
- · - Air cooling

1... Edge or face  
2... Core

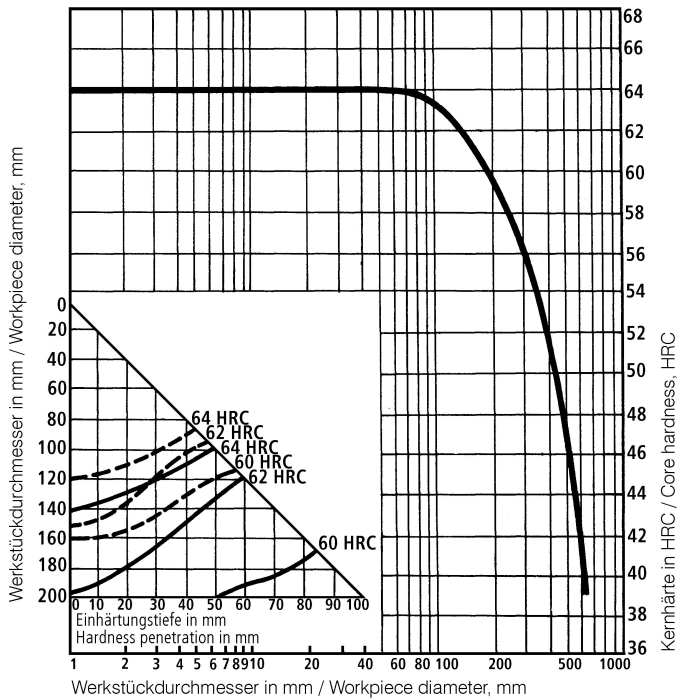
**Isothermal TTT curves**



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

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

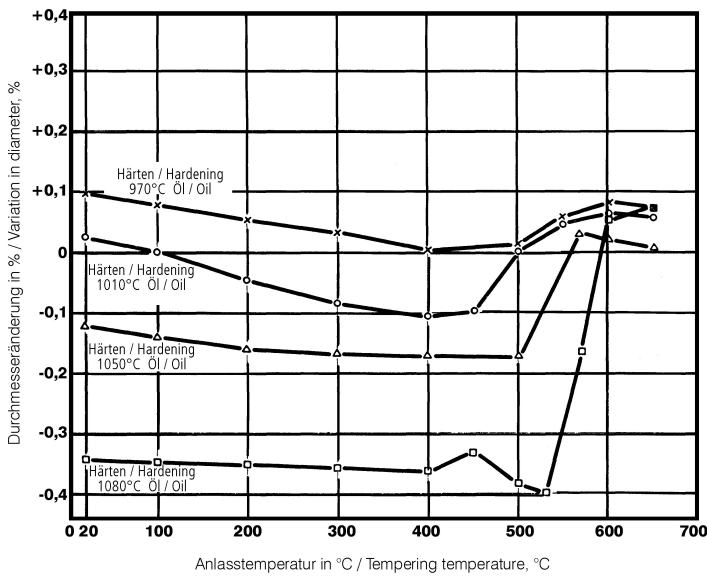
**Influence of work diameter on core hardness and hardness penetration**



Quenched from: 980°C / 1796°F

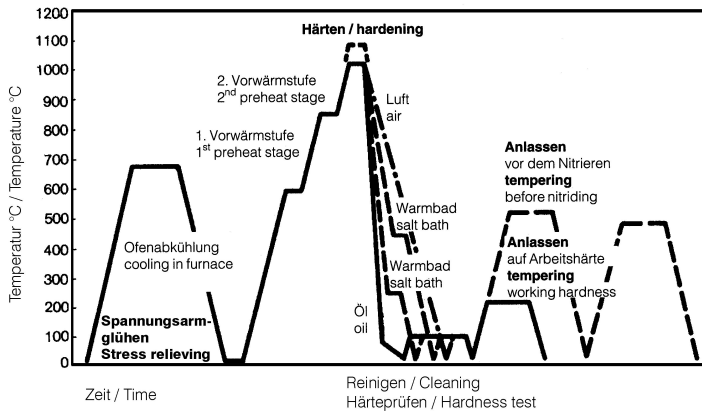
- Quenchant:
- Oil
- - - - Air

Variation in size as a function of tempering temperature after hardening



Specimen size: Ø 22 x 5 mm

Heat treatment sequence



## Propriétés physiques

Température (°C)	20
Densité (kg/dm <sup>3</sup> )	7,7
Conductivité thermique (W/(m.K))	20
Chaleur spécifique (kJ/kg K)	0,46
Résistivité électrique (Ohm.mm <sup>2</sup> /m)	0,65
Module d'élasticité (10 <sup>3</sup> N/mm <sup>2</sup> )	210

## Dilatation thermique

Température (°C)	100	200	300	400	500	600
Dilatation thermique (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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