

# HOT WORK TOOL STEELS

## Application Segments

Hot Work

## Available Product Variants

Long Products\*

Plates

Open Die Forgings

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

## Product Description

BÖHLER W302 ISOBLOC is a 5% chromium steel and corresponds to material number 1.2344 (X40CrMoV5-1). Produced via the electroslag remelting process (ESR), this tool steel has very high hot toughness as well as very high hot hardness and a very good resistance against heat-checkings. The combination of these properties makes it a top performer in closed- and open-die forging as well as in high- and low-pressure die casting. In addition, this material has very good polishability and is therefore also often used as a molding material for plastic injection molds.

## Process Melting

Airmelted + Remelted

## Properties

- > Toughness & Ductility : high
- > Wear Resistance : high
- > Machinability : very high
- > Hot Hardness (red hardness) : high
- > Polishability : very high
- > Thermal conductivity : good
- > Micro-cleanliness : high

## Applications

- |   |                                 |  |
|---|---------------------------------|--|
| > High Pressure Die-Casting                     | > Forging (Hot / Semi-hot)      | > Gravity / Low Pressure Die-Casting                 |
| > Progressive Forging (Hatebur)                 | > Extrusion                     | > Fasteners, Bolts, Nuts                             |
| > General Components for Mechanical Engineering | > Injection Molding             | > Press Hardening / Hot Stamping                     |
| > Rolling                                       | > Shearing / Machine Knives     | > Tool Holders (milling, drilling, turning & chucks) |
| > Standard Parts (Molds, Plates, Pins, Punches) | > Screws and Barrels            | > Blow Molding                                       |
| > Machine knife (for producers)                 | > Rolls                         | > Mechanical Engineering                             |
| > Hotrunner systems                             | > Glasfibre reinforced plastics |  |

## Technical data

Material designation		Standards	
1.2344	SEL	4957	EN ISO
X40CrMoV5-1	EN	#207	NADCA
T20813	UNS	G4404	JIS
H13	AISI		
B1885	NADCA		
SKD61	JIS		

## Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V
0.39	0.90	0.40	5.20	1.40	0.95

## Material characteristics

	High temperature strength	High temperature toughness	High temperature wear resistance
<b>BÖHLER W302</b> ISOBLOC	★ ★ ★	★ ★ ★ ★	★ ★ ★
<b>BÖHLER W300</b> ISODISC	★ ★	★ ★ ★	★ ★
<b>BÖHLER W300</b> ISOBLOC	★ ★	★ ★ ★ ★	★ ★
<b>BÖHLER W302</b> ISODISC	★ ★ ★	★ ★ ★	★ ★ ★
<b>BÖHLER W303</b> ISODISC	★ ★ ★ ★	★ ★ ★	★ ★ ★ ★
<b>BÖHLER W350</b> ISOBLOC	★ ★ ★	★ ★ ★ ★ ★	★ ★ ★
<b>BÖHLER W360</b> ISOBLOC	★ ★ ★ ★ ★	★ ★ ★ ★	★ ★ ★ ★ ★
<b>BÖHLER W400</b> VMR	★ ★	★ ★ ★ ★ ★	★ ★
<b>BÖHLER W403</b> VMR	★ ★ ★ ★	★ ★ ★ ★	★ ★ ★ ★

## Delivery condition

### Annealed

Hardness (HB)	max. 229
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### Hardened and Tempered

Hardness (HRC)	40 to 55   bars hardened and tempered (BHT)
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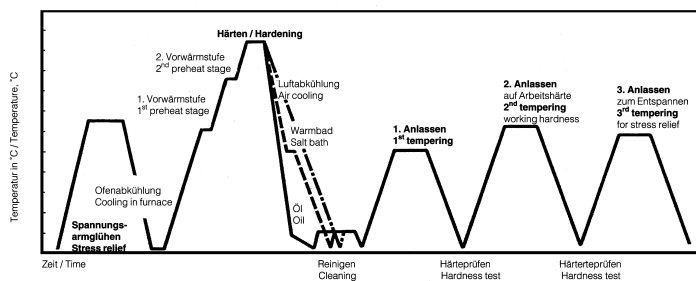
### Hardened and Tempered

Hardness (HRC)	30 to 44
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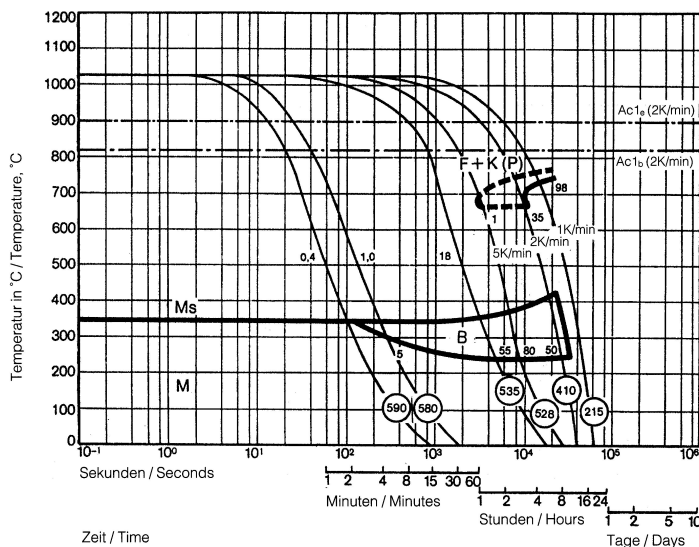
## Heat treatment

Annealing		
Temperature	750 to 800 °C	Holding time 6 to 8 hours. Slow, controlled furnace cooling at 10 to 20°C/h (50 to 68 °F/hr) to approx. 600°C (1112°F), further cooling in air.
Stress relieving		
Temperature	600 to 670 °C	For stress relief after extensive machining or for complicated tools. Holding time depending on tool size after complete heating 2 - 6 hours in neutral atmosphere. Slow furnace cooling.
Hardening and Tempering		
Temperature	1,020 to 1,080 °C	(Die casting equipment: 1020 - 1030 °C [1868 - 1886°F]) Holding time after temperature equalization: 15 to 30 minutes; Quenching: Oil, salt bath (500 - 550°C [932-1022°F]), air, vacuum; After hardening, tempering to the desired working hardness (see tempering chart).

## Heat treatment sequence



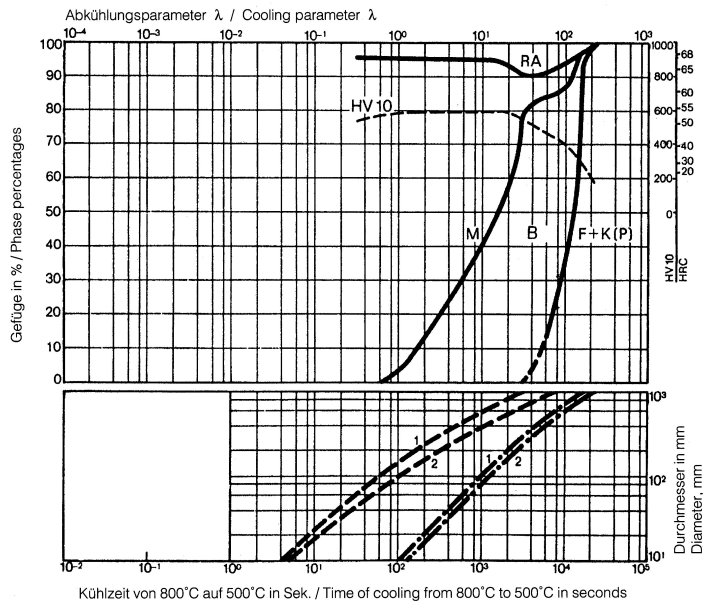
## Continuous cooling CCT curves



Austenitising temperature: 1020°C (1868°F)  
Holding time: 15 minutes

O Vickers hardness  
1...35 phase percentages  
0.4...18 cooling parameter, i.e. duration of cooling from 800 - 500°C (1472-932°F) in s x 10<sup>-2</sup>  
5...1 K/min cooling rate in K/min in the 800 - 500°C (1472-932°F) range

## Quantitative phase diagram

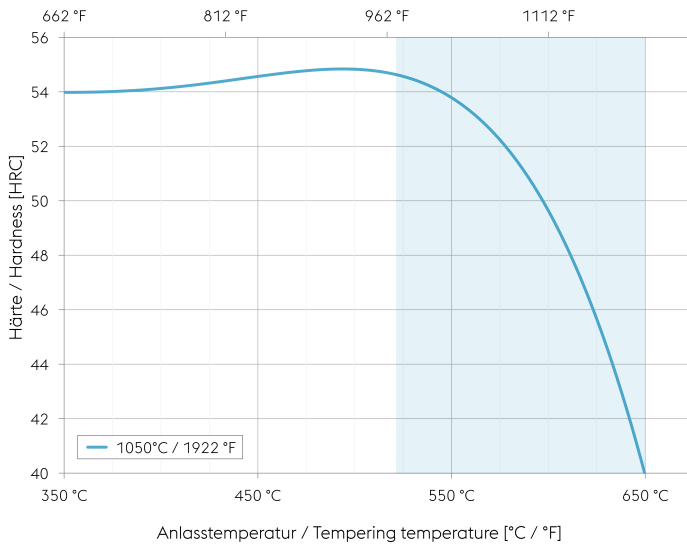


B... Bainite  
F... Ferrite  
K... Carbide  
M... Martensite  
P... Perlite  
RA... Retained austenite

----- Oil cooling  
- · - Air cooling

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

## Tempering chart



### Tempering:

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. It is recommended to temper at least twice.

A third tempering cycle for the purpose of stress relieving may be advantageous.

1st tempering approx. 86°F (30°C) above maximum secondary hardness.

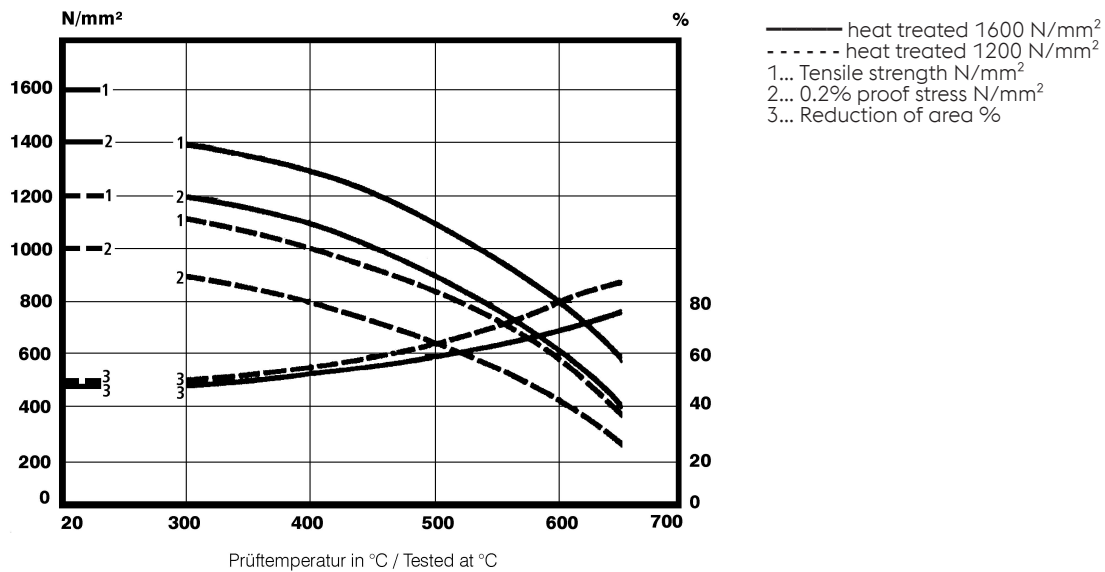
2nd tempering to desired working hardness. The tempering chart shows average tempered hardness values.

3rd for stress relieving at a temperature 86 to 122 °F (30 to 50°C) below highest tempering temperature.

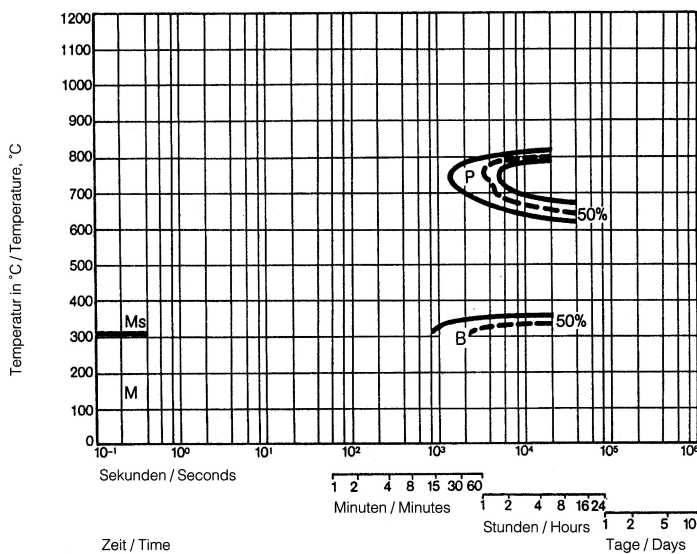
Recommended tempering temperature range is indicated by the blue area in the chart.

Hardening temperature: 1050°C (1922°F)  
Specimen size: square 50 mm

## Hot strength chart



## Isothermal TTT curves



Austenitising temperature: 1020 °C (1868 °F)  
 Holding time: 15 minutes

## Physical Properties

Temperature (°C)	20
Density (kg/dm <sup>3</sup> )	7.8
Thermal conductivity (W/(m.K))	22.8
Specific heat (kJ/kg K)	0.47
Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)	0.52
Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> )	213

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

Temperature (°C)	100	200	300	400	500	600
Thermal expansion (10 <sup>-6</sup> m/(m.K))	10.8	11	12.1	12.7	14.2	14.3

If other available product variants are listed in addition to long products, please note that these may differ in terms of melting process, technical data, delivery and surface condition as well as available product dimensions. For mandatory technical specifications, other requirements and dimensions, please contact our regional voestalpine BÖHLER sales companies. 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.