

# HOT WORK TOOL STEELS

## Application Segments

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Hot Work

## Available Product Variants

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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

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BÖHLER W302 ISODISC is a 5% chromium steel and corresponds to material number 1.2344 (X40CrMoV5-1). This common tool steel has good hot toughness as well as a high hot hardness and a high resistance against heat-checkings. The combination of these properties makes it a standard choice in extrusion, forging and low-pressure die casting. This material is also available as W302 ISOBLOC which is a remelted grade with improved cleanliness, homogeneity and toughness.

## Process Melting

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Airmelted

## Properties

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

## Applications

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|--|--|---|
| > Hot Extrusion                                      | > Forging (Hot / Semi-hot)   | > Gravity / Low Pressure Die-Casting    |
| > Blow Molding                                       | > High Pressure Die-Casting  | > Injection Moulding                    |
| > Machine knife (for producers)                      | > Press Hardening / Hot Stamping   | > Progressive Forging (Hatebur)         |
| > Tool Holders (milling, drilling, turning & chucks) | > Mechanical Engineering   | > Industrial Knives                     |
| > Grinding   | > Other Automotive Components (Sealing Rings, Sensors, Steering Systems) | > Components for the recycling industry |
| > Turbo Chargers                                     |  |   |

Technical data

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

Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V
0.39	1.10	0.40	5.20	1.30	0.95

Material characteristics

	High temperature strength	High temperature toughness	High temperature wear resistance	Machinability in as supplied condition	Polishability
<b>BÖHLER W302 ISODISC</b>	★★★	★★★	★★★	★★★★★	★★★
<b>BÖHLER W300 ISODISC</b>	★★	★★★	★★	★★★★★	★★★
<b>BÖHLER W300 ISOBLOC</b>	★★	★★★★★	★★	★★★★★	★★★★★
<b>BÖHLER W302 ISOBLOC</b>	★★★	★★★★★	★★★	★★★★★	★★★★★
<b>BÖHLER W303 ISODISC</b>	★★★★★	★★★	★★★★★	★★★★★	★★★
<b>BÖHLER W320 ISODISC</b>	★★★	★★	★★★	★★★★★	★★★
<b>BÖHLER W350 ISOBLOC</b>	★★★	★★★★★	★★★	★★★★★	★★★★★
<b>BÖHLER W360 ISOBLOC</b>	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
<b>BÖHLER W400 VMR</b>	★★	★★★★★	★★	★★★★	★★★★★
<b>BÖHLER W403 VMR</b>	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★

Delivery condition

<b>Annealed</b>	
Hardness (HB)	max. 229
<b>Hardened and Tempered</b>	
Hardness (HRC)	40 to 55   bars hardened and tempered (BHT)
<b>Hardened and Tempered</b>	
Hardness (HRC)	30 to 44

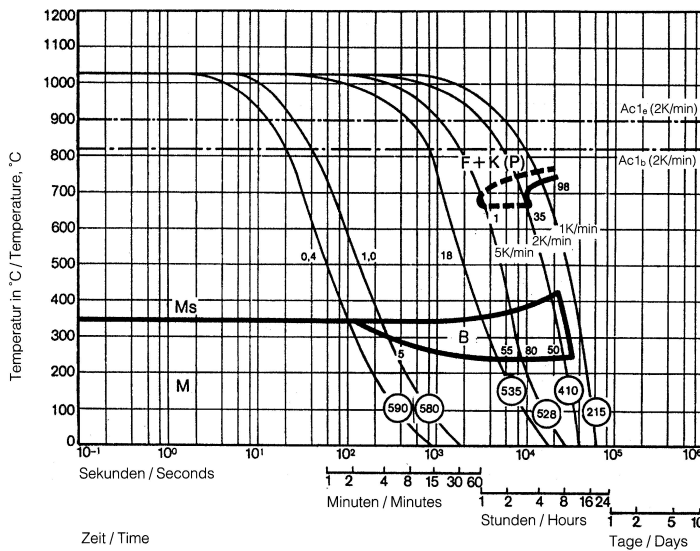
Heat treatment

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	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



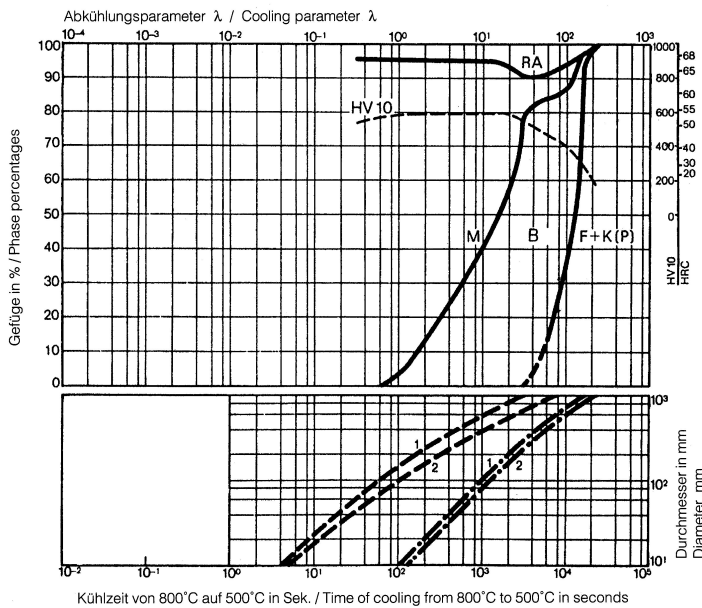
Continuous cooling CCT curves



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

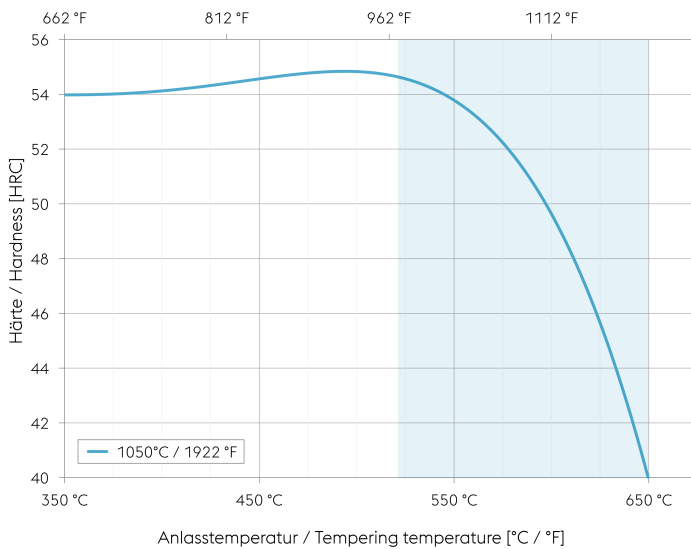
- Vickers hardness
- 1...35 phase percentages
- 0.4...18 cooling parameter, i.e. duration of cooling from 800 - 500°C (1472-932°F) in s x 10<sup>-2</sup>
- 5...1 K/min cooling rate in K/min in the 800 - 500°C (1472-932°F) range

Quantitative phase diagram



- B... Bainite
  - F... Ferrite
  - K... Carbide
  - M... Martensite
  - P... Pearlite
  - 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.

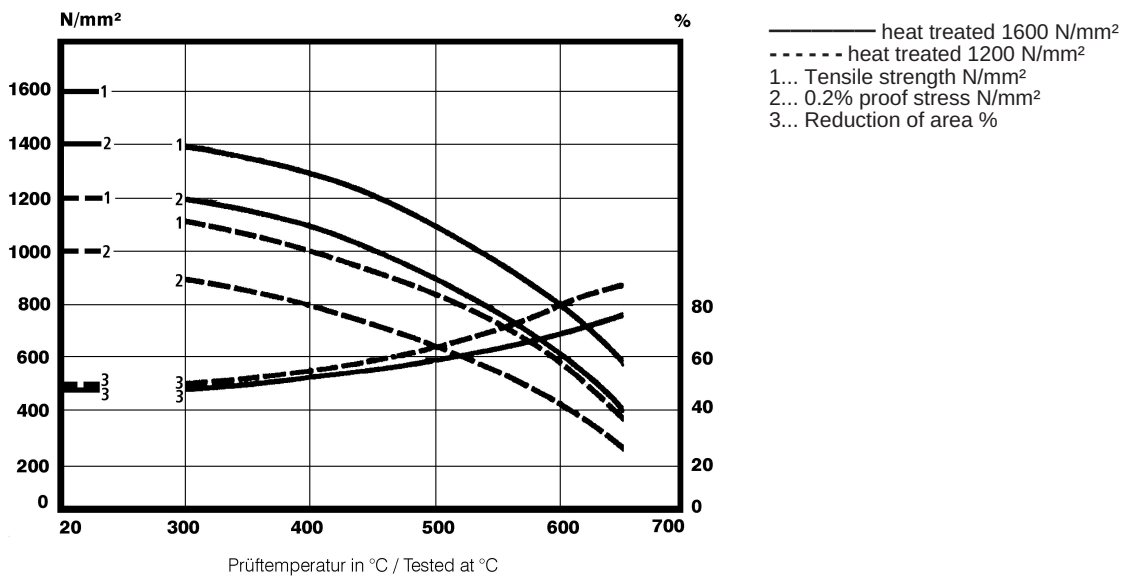
2nd tempering to desired working hardness. The tempering chart shows average tempered hardness values.

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



## Physical Properties

Temperature (°C)	20
Density (kg/dm <sup>3</sup> )	7.8
Thermal conductivity (W/(m.K))	24.3
Specific heat (kJ/kg K)	0.46
Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)	0.52
Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> )	215

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

Temperature (°C)	100	200	300	400	500	600	700
Thermal expansion (10 <sup>-6</sup> m/(m.K))	11.5	12	12.2	12.5	12.9	13	13.2

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.

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