

# HOT WORK TOOL STEELS

## Application Segments

Hot Work

## Available Product Variants

Long Products

## Product Description

BÖHLER W320 ISODISC is a 3% chromium steel and corresponds to material number 1.2365 (32CrMoV12-28). This tool steel has good hot toughness as well as a very high hot hardness and resistance against heat-checkings. Compared to an X37CrMoV5-1 (material number 1.2343), the steel has an increased molybdenum content, which significantly increases its thermal resistance and thus makes it the ideal material in die closed- and open-die forging. Due to the lower chromium content, reduced through-hardening occurs which limits its applications to rather smaller tools.

## Process Melting

Airmelted

## Properties

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

## Applications

- > Extrusion
- > High Pressure Die-Casting
- > Forging (Hot / Semi-hot)
- > Progressive Forging (Hatebur)
- > Gravity / Low Pressure Die-Casting

## Technical data

Material designation		Standards	
1.2365	SEL	4957	EN ISO
32CrMoV12-28	EN	G4404	JIS
~T20810	UNS		
~H10	AISI		
SKD7	JIS		

## Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V
0.31	0.30	0.35	2.90	2.70	0.50

## Material characteristics

	High temperature strength	High temperature toughness	High temperature wear resistance
<b>BÖHLER W320</b> ISODISC	★ ★ ★	★ ★	★ ★ ★
<b>BÖHLER W300</b> ISODISC	★ ★	★ ★ ★	★ ★
<b>BÖHLER W300</b> ISOBLOC	★ ★	★ ★ ★ ★	★ ★
<b>BÖHLER W302</b> ISODISC	★ ★ ★	★ ★ ★	★ ★ ★
<b>BÖHLER W302</b> ISOBLOC	★ ★ ★	★ ★ ★ ★	★ ★ ★
<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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## 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.
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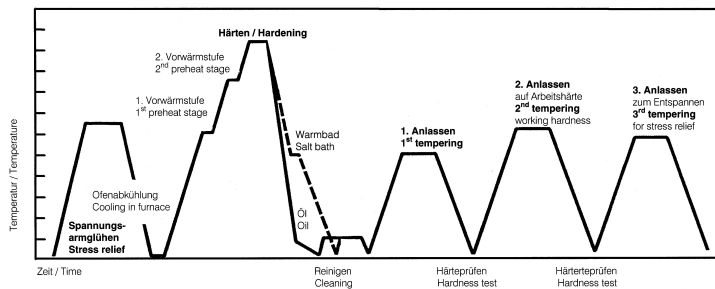
### Stress relieving

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.
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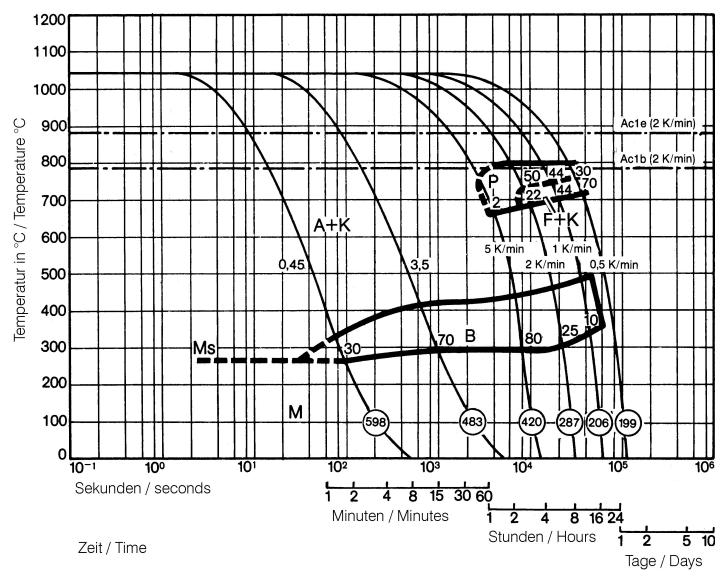
### Hardening and Tempering

Temperature	1,010 to 1,050 °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).
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## Heat treatment sequence



## Continuous cooling CCT curves



Austenitising temperature: 1886°F (1030°C)  
Holding time: 15 minutes

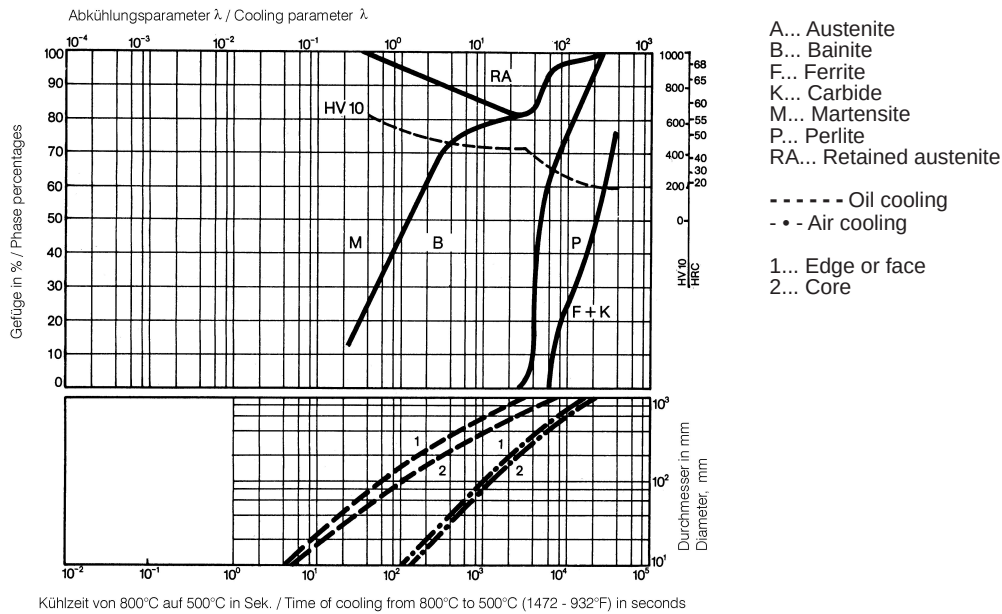
○ Vickers hardness

2...80 phase percentages

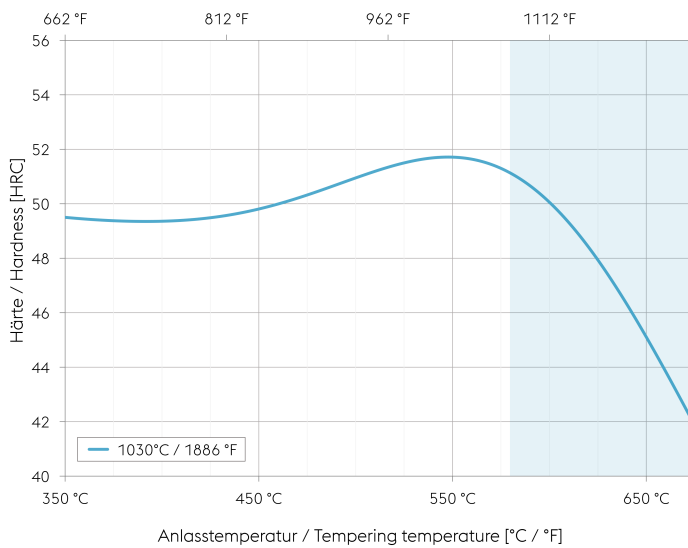
0.45...3.5 cooling parameter, i.e. duration of cooling from 1472-932°F (800 - 500°C) in  $s \times 10^{-2}$

41...32.9°F/min (5...0.5 K/min) cooling rate in °F/min (K/min) in the 1472-932°F (800 - 500°C) range

## Quantitative phase diagram



## Tempering chart



### Tempering:

Slow heating to tempering temperature immediately after hardening / time in furnace 1 hour for each 0,787 inch (20 mm) of work piece 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. 30°C (86°F) above maximum secondary hardness.

2nd tempering to desired working hardness.

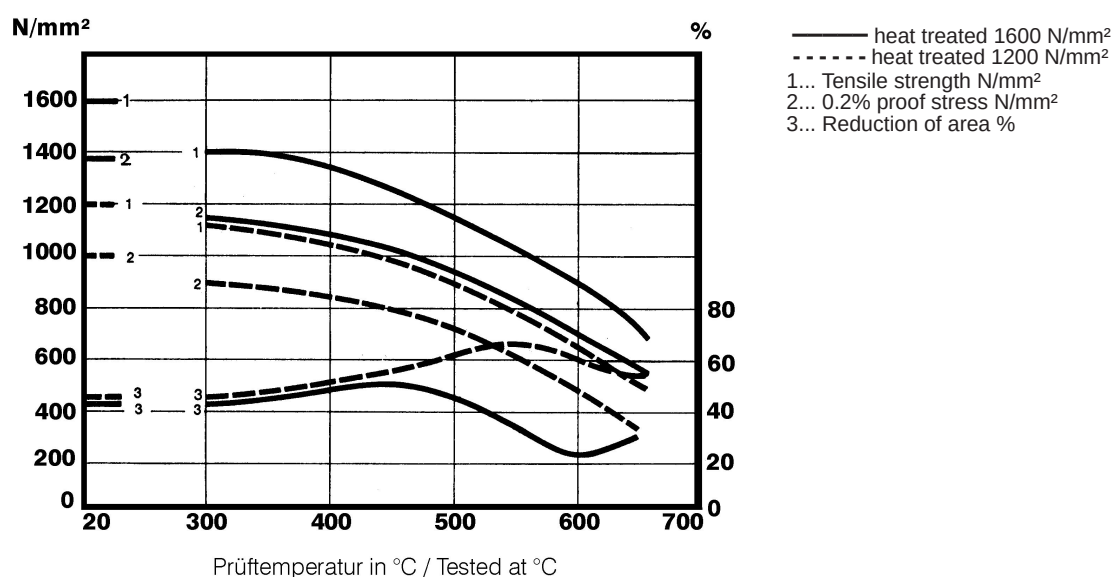
The tempering chart shows average tempered hardness values.

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

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

Hardening temperature: 1030°C (1886°F)  
Specimen size: square 50 mm

## Hot strength chart



## Physical Properties

Temperature (°C)	20
Density (kg/dm³)	7.9
Thermal conductivity (W/(m.K))	30
Specific heat (kJ/kg K)	0.46
Spec. electrical resistance (Ohm.mm²/m)	0.37
Modulus of elasticity (10³N/mm²)	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))	12	12.5	12.7	13	13.2	13.4	13.7

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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ONE STEP AHEAD.