

HOT WORK TOOL STEELS

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-doe 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
- > Machinability : 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
~T20810	UNS	G4404	JIS
32CrMoV12-28	EN		
~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
BÖHLER W320 ISODISC®	★★★	★★	★★★
BÖHLER W300 ISODISC®	★★	★★★★	★★
BÖHLER W300 ISOBLOC®	★★	★★★★★	★★
BÖHLER W302 ISODISC®	★★★	★★★	★★★
BÖHLER W302 ISOBLOC®	★★★	★★★★★	★★★
BÖHLER W303 ISODISC®	★★★★★	★★★	★★★★★
BÖHLER W350 ISOBLOC®	★★★	★★★★★	★★★
BÖHLER W360 ISOBLOC®	★★★★★	★★★★★	★★★★★
BÖHLER W400 VMR®	★★	★★★★★	★★
BÖHLER W403 VMR®	★★★★	★★★★	★★★★

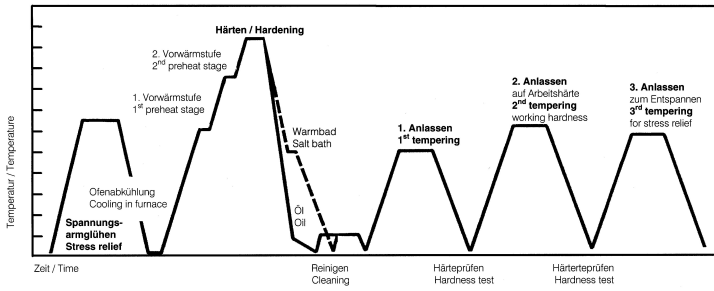
Delivery condition

Annealed	
Hardness (HB)	max. 229

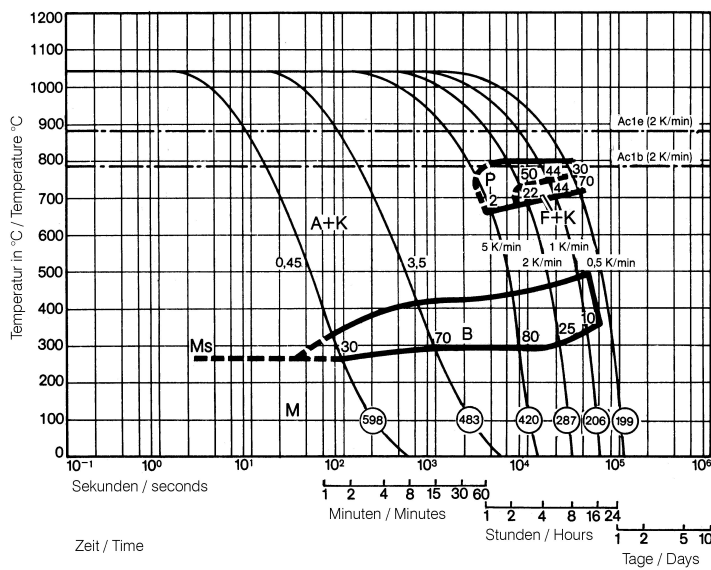
Heat treatment

Annealing		
Temperature	750 to 800 °C 1,382 to 1,472 °F	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 1,112 to 1,238 °F	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	1,010 to 1,050 °C 1,850 to 1,922 °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



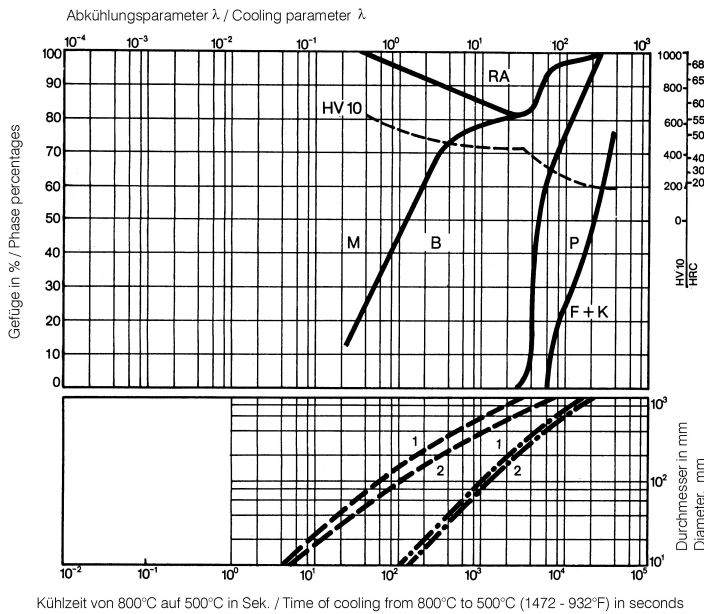
Continuous cooling CCT curves



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

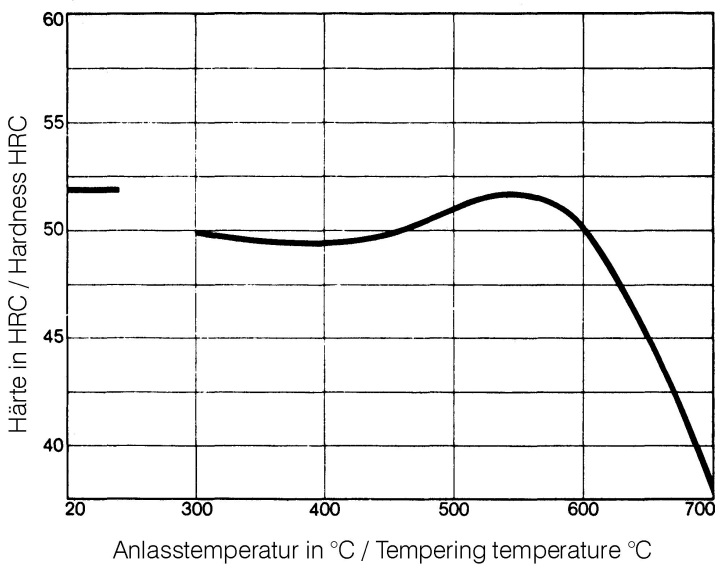
O Vickers hardness
 2...80 phase percentages
 0.45...3.5 cooling parameter, i.e. duration of cooling from 1472-932°F (800 - 500°C) in $s \times 10^{-2}$
 41...32.9°F/min (5...0.5 K/min) cooling rate in °F/min (K/min) in the 1472-932°F (800 - 500°C) range

Quantitative phase diagram



- A... Austenite
 - 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 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.

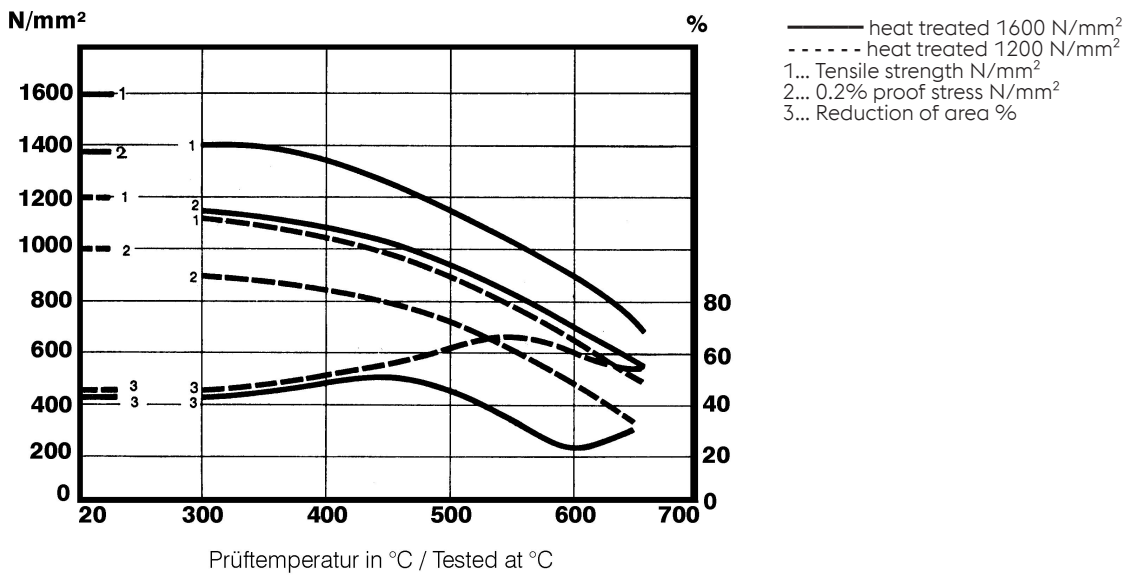
1st tempering approx. 30°C (86°F) above maximum secondary hardness.

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.

Hot strength chart



Physical Properties

Temperature (°C °F)	20 68
Density (kg/dm ³ lb/in ³)	7.85 0.28
Thermal conductivity (W/(m.K) BTU/ft h °F)	30 17.33
Specific heat (kJ/kg K BTU/lb °F)	0.46 0.1099
Spec. electrical resistance (Ohm.mm ² /m 10 ⁻⁴ Ohm.inch ² /ft)	0.37 1.75
Modulus of elasticity (10 ³ N/mm ² 10 ³ ksi)	215 31.18

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

Temperature (°C °F)	100 212	200 392	300 572	400 752	500 932	600 1,112	700 1,292
Thermal expansion (10 ⁻⁶ m/(m.K) 10 ⁻⁶ inch/inch.°F)	12 6.7	12.5 6.9	12.7 7.1	13 7.2	13.2 7.3	13.4 7.4	13.7 7.6

For additional specifications and technical requirements, 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.

voestalpine BÖHLER Edelstahl GmbH & Co KG
 Mariazeller Straße 25
 8605 Kapfenberg, AT
 T. +43/50304/20-0
 E. info@boehler-edelstahl.at
<https://www.voestalpine.com/boehler-edelstahl/de/>

voestalpine
ONE STEP AHEAD.