HOT WORK TOOL STEELS

Application Segments

Hot Work

Available Product Variants

Long Products* | Open Die Forgings

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

Product Description

BÖHLER W303 ISODISC is a 5% chromium steel and corresponds to material number 1.2367 (X38CrMoV5-3). 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-die forging, open-die forging and extrusion.

Process Melting

Airmelted

Properties

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

Applications

- Hot Extrusion
- Gravity / Low Pressure Die-Casting
- Progressive Forging (Hatebur)
- Forging (Hot / Semi-hot)
- High Pressure Die-Casting
- Mechanical Engineering
- General Components for Mechanical Engineering
- Press Hardening / Hot Stamping

Technical data

Material designation	
1.2367	SEL
X38CrMoV5-3	EN

Standards	
4957	EN ISO

Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V
0.38	0.40	0.40	5.00	2.80	0.55

Material characteristics

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

Delivery condition

Annealed

Hardness (HB)	max. 229

Hardened and Tempered

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.

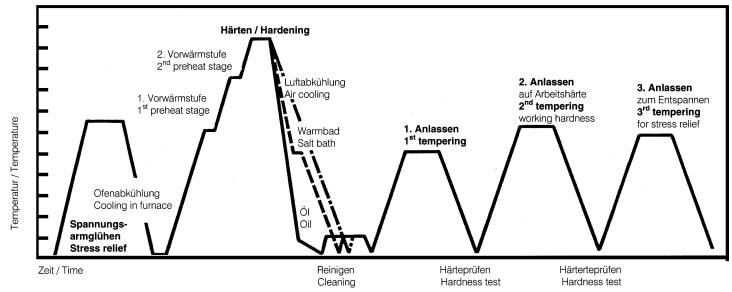
Stress relieving

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.

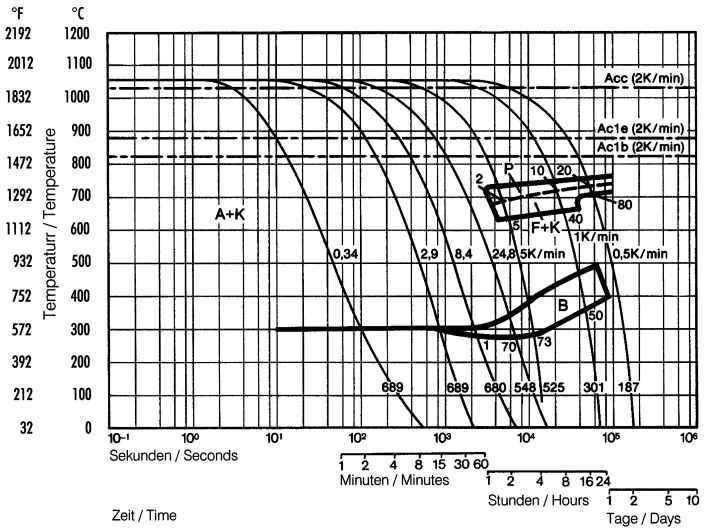
Hardening and Tempering

Temperature	1,030 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



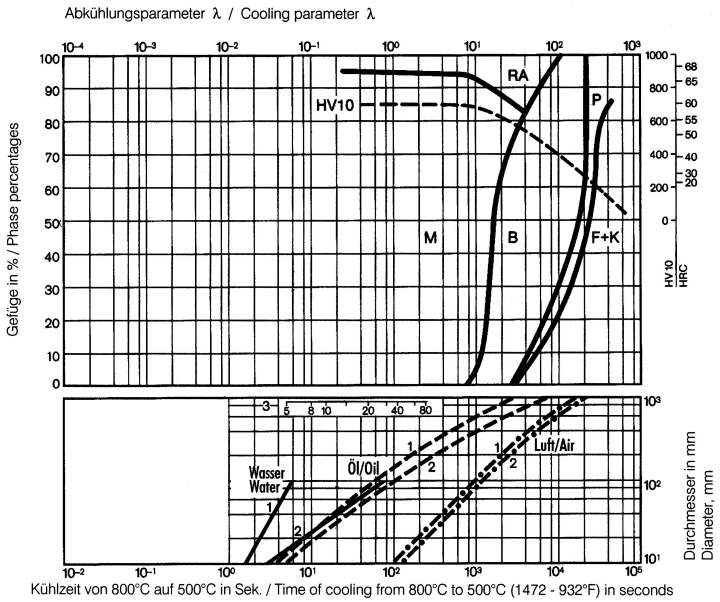
Continuous cooling CCT curves



Austenitising temperature: 1922°F (1050°C)
Holding time: 15 minutes

689 - 187 Vickers hardness
1...80 phase percentages
0.34...24.8 cooling parameter, i.e. duration of cooling from 1472 - 932°F (800-500°C) in s x 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

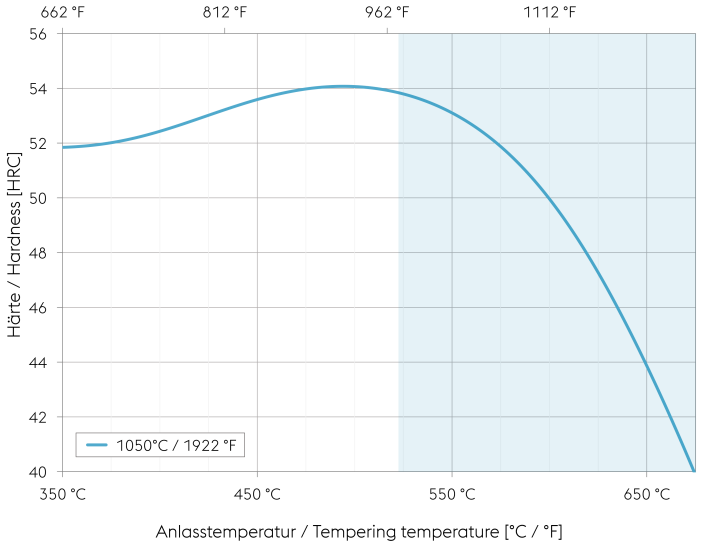


A... Austenite
B... Bainite
F... Ferrite
K... Carbide
M... Martensite
P... Perlite
RA... Retained austenite

- - - - - - Oil cooling
- • - Air cooling

1... Edge or face
2... Core
3... Jominy test: distance from end

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.

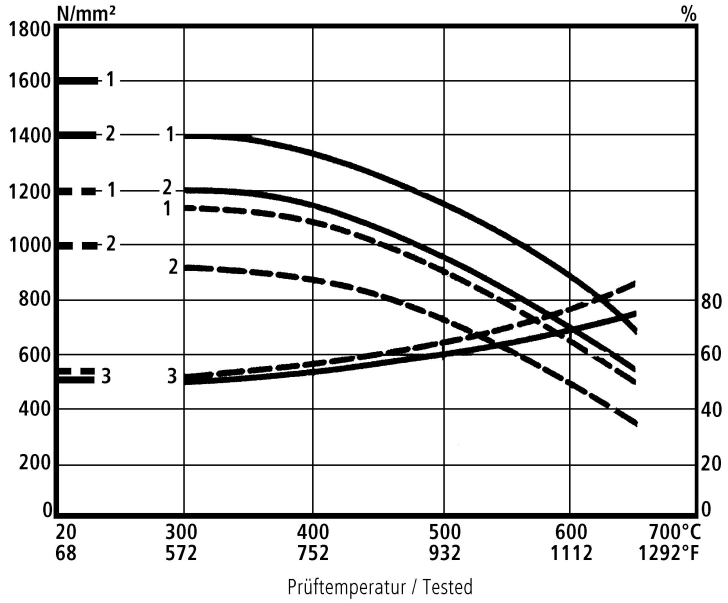
The tempering chart shows average tempered hardness values.

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

Hot strength chart



———— heat treated 1600 N/mm²
- - - - - - heat treated 1200 N/mm²
1... Tensile strength N/mm²
2... 0.2% proof stress N/mm²
3... Reduction of area %

Physical Properties

Temperature (°C)	**20**
Density (kg/dm³)	7.9
Thermal conductivity (W/(m.K))	-
Specific heat (kJ/kg K)	0.46
Spec. electrical resistance (Ohm.mm²/m)	0.5
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^{-6} m/(m.K))	11.5	12	12.2	12.5	12.9	13	13.2

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ONE STEP AHEAD.