HOT WORK TOOL STEELS

Application Segments

Hot Work

Available Product Variants

Long Products* | Plates | 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 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
- English (United Kingdom) : very high
- Hot Hardness (red hardness) : high
- Polishability : very high
- Thermal conductivity : good
- Micro-cleanliness : high

Applications

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

Technical data

Material designation	
1.2344	SEL
X40CrMoV5-1	EN
T20813	UNS
H13	AISI
B1885	NADCA
SKD61	JIS

Standards	
4957	EN ISO
#207	NADCA
G4404	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
BÖHLER W302 ISOBLOC	★★★	★★★★	★★★
BÖHLER W300 ISODISC	★★	★★★	★★
BÖHLER W300 ISOBLOC	★★	★★★★	★★
BÖHLER W302 ISODISC	★★★	★★★	★★★
BÖHLER W303 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)	40 to 55 | bars hardened and tempered (BHT)

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.

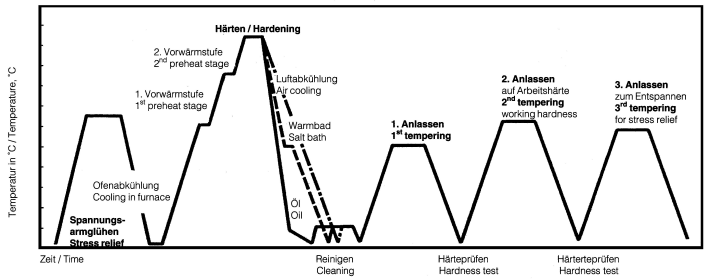
Stress relieving

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.

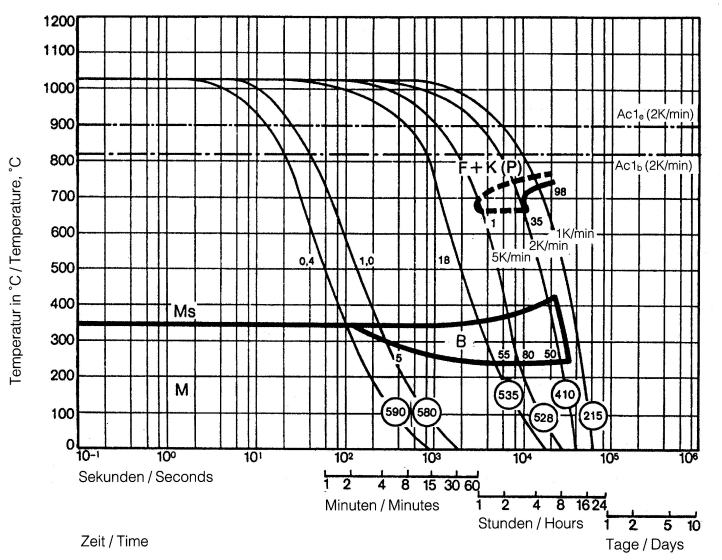
Hardening and Tempering

Temperature	1,020 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



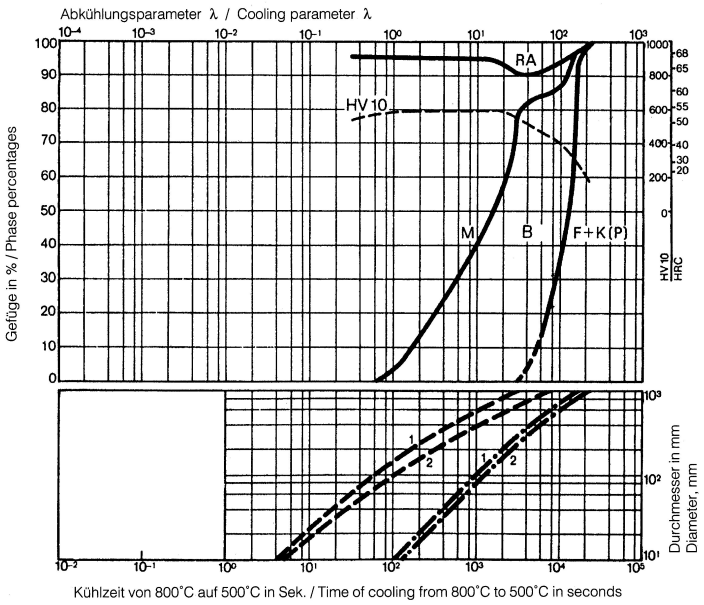
Continuous cooling CCT curves



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

○ 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^{-2}
5...1 K/min cooling rate in K/min in the 800 - 500°C (1472-932°F) range

Quantitative phase diagram

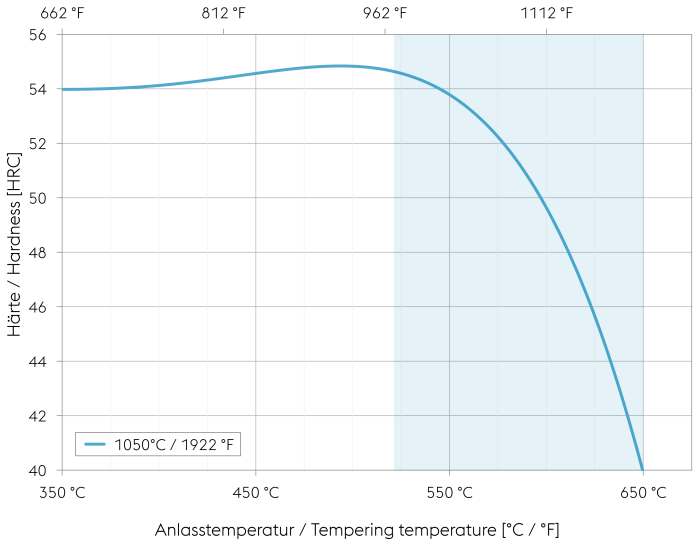


B... Bainite
F... Ferrite
K... Carbide
M... Martensite
P... Perlite
RA... Retained austenite

- - - - - - 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.

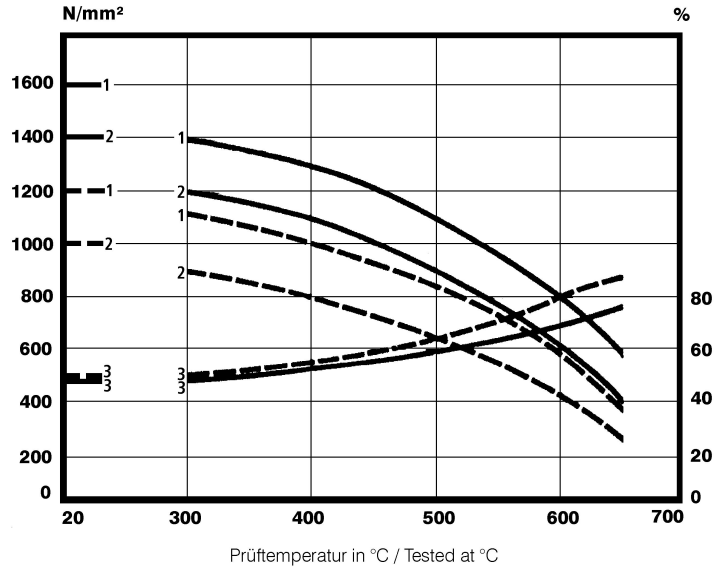
2nd tempering to desired working hardness. The tempering chart shows average tempered hardness values.

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.

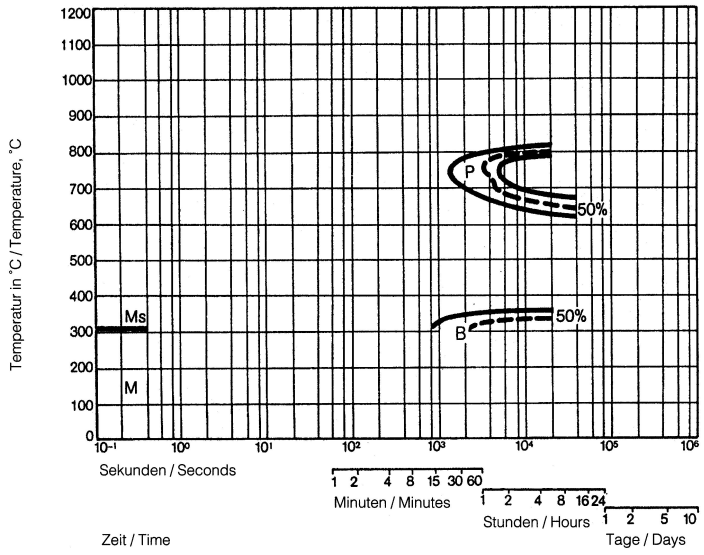
Hardening temperature: 1050°C (1922°F)
Specimen size: square 50 mm

Hot strength chart



——— 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 %

Isothermal TTT curves



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

Physical Properties

Temperature (°C)	20
Density (kg/dm³)	7.8
Thermal conductivity (W/(m.K))	22.8
Specific heat (kJ/kg K)	0.47
Spec. electrical resistance (Ohm.mm²/m)	0.52
Modulus of elasticity (10³N/mm²)	213

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

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

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ONE STEP AHEAD.