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
- Machinability : very high
- Hot Hardness (red hardness) : high
- Polishability : very high
- Thermal conductivity : good
- Micro-cleanliness : high

Applications

- High Pressure Die-Casting
- Progressive Forging (Hatebur)
- Injection Molding
- Industrial Knives
- Screws and Barrels
- Rolls
- Glasfibre reinforced plastics
- Mineral Processing
- Pumps
- Forging (Hot / Semi-hot)
- Hot Extrusion
- Press Hardening / Hot Stamping
- Tool Holders
- Blow Molding
- Mechanical Engineering
- Grinding
- Wear Applications
- Roll Forming
- Gravity / Low Pressure Die-Casting
- Fasteners, Bolts, Nuts
- Rolling
- Standard Parts (Molds, Plates, Pins, Punches)
- Machine knife (for producers)
- Hotrunner systems
- Drilling
- Injection Components
- Cold Rolling incl. Sendzimir Rolls

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	Machinability in as supplied condition	Polishability
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.

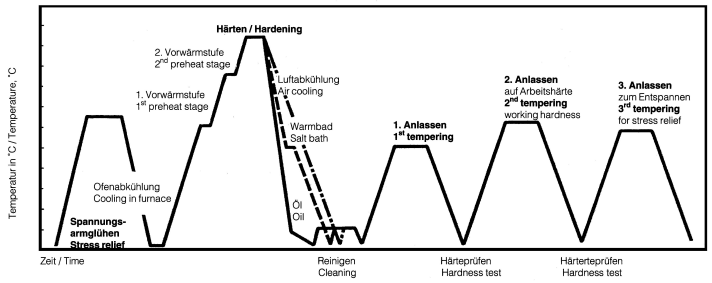
Stress relieving

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.

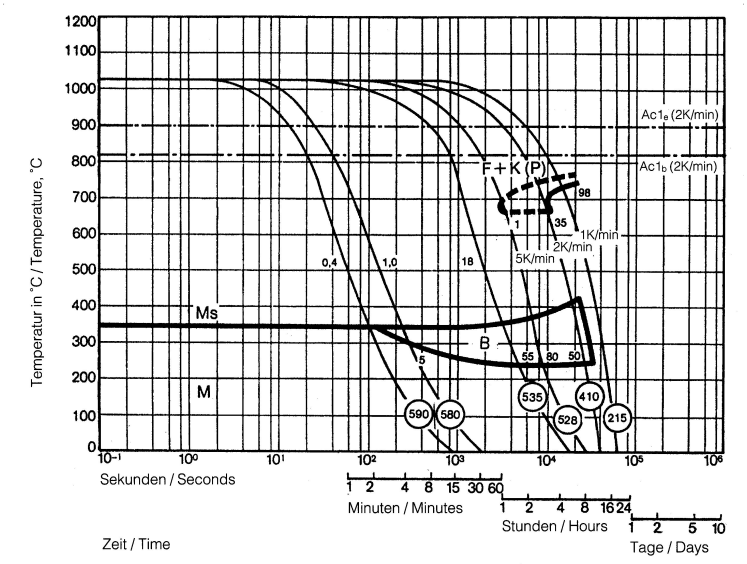
Hardening and Tempering

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



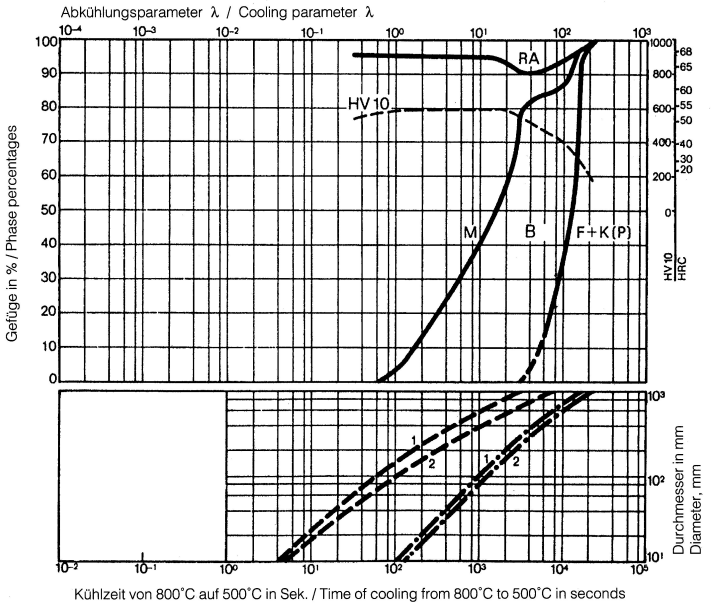
Continuous cooling CCT curves



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

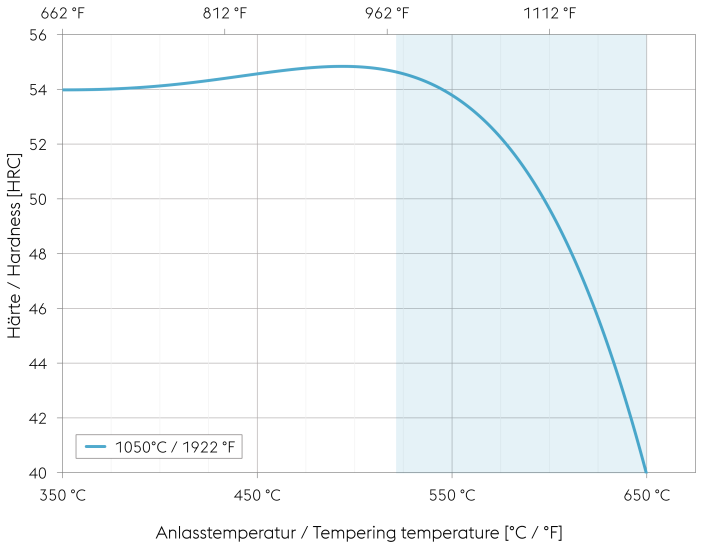


B... Bainite
F... Ferrite
K... Carbide
M... Martensite
P... Perlite
RA... Retained austenite

- - - - - - 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.

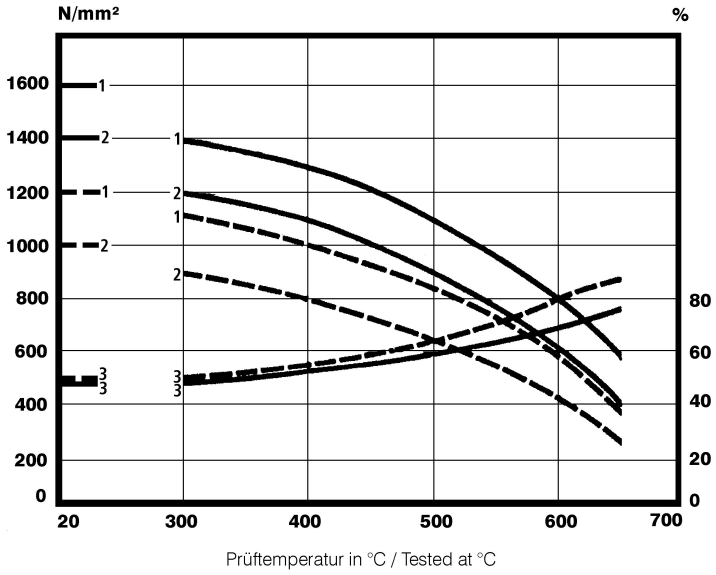
2nd tempering to desired working hardness. The tempering chart shows average tempered hardness values.

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.

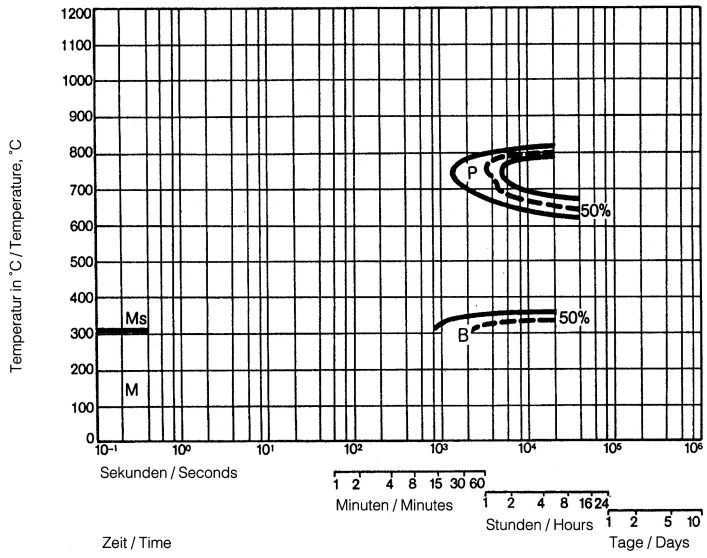
Hardening temperature: 1050°C (1922°F)
Specimen size: square 50 mm

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

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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