

HOT WORK TOOL STEELS

Available Product Variants

Long Products*

Plates

Open Die Forgings

*) Presented data refer exclusively 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
- > Fasteners, Bolts, Nuts
- > General Components for Mechanical Engineering
- > Press Hardening / Hot Stamping
- > Shearing / Machine Knives
- > Glasfibre reinforced plastics
- > Extrusion
- > Gravity / Low Pressure Die-Casting
- > Injection Molding
- > Progressive Forging (Hatebur)
- > Tool Holders (milling, drilling, turning & chucks)
- > Forging (Hot / Semi-hot)
- > Blow Molding
- > Machine knife (for producers)
- > Rolling
- > Mechanical Engineering










Technical data

Material designation		Standards	
1.2344	SEL	4957	EN ISO
T20813	UNS	G4404	JIS
X40CrMoV5-1	EN	#207	NADCA
H13	AISI		
SKD61	JIS		
B1885	NADCA		

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
	★★★	★★★★★	★★★
	★★	★★★	★★
	★★	★★★★★	★★
	★★★	★★★	★★★
	★★★★★	★★★	★★★★★
	★★★	★★★★★	★★★
	★★★★★	★★★★★	★★★★★
	★★	★★★★★	★★
	★★★★★	★★★★★	★★★★★

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 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.
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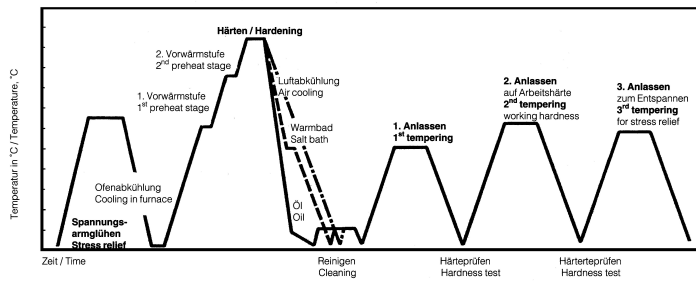
Stress relieving

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.
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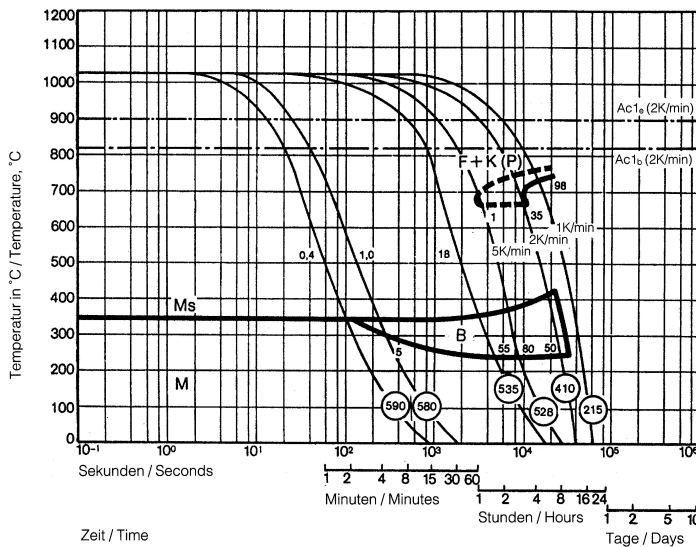
Hardening and Tempering

Temperature	1,020 to 1,080 °C 1,868 to 1,976 °F	(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).
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Heat treatment sequence



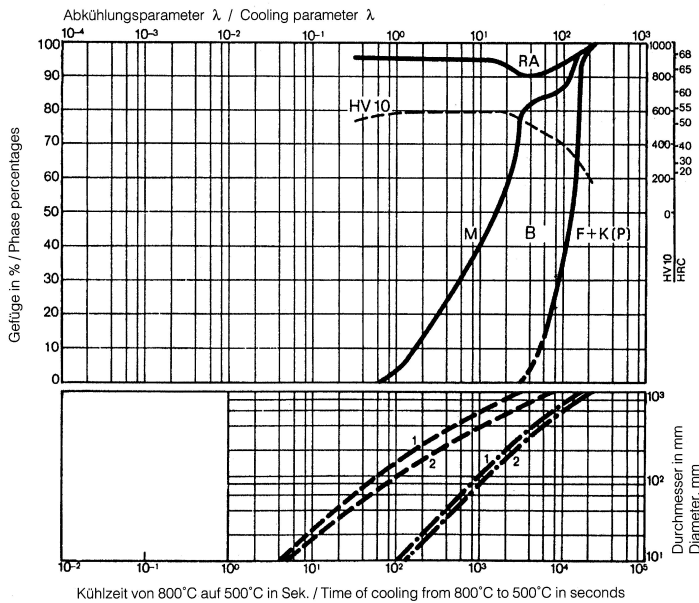
Continuous cooling CCT curves



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

O Vickers hardness
1...35 phase percentages
0.4...18 cooling parameter, i.e. duration of cooling from 800 - 500°C (1472-932°F) in $s \times 10^{-2}$
5...1 K/min cooling rate in K/min in the 800 - 500°C (1472-932°F) range

Quantitative phase diagram

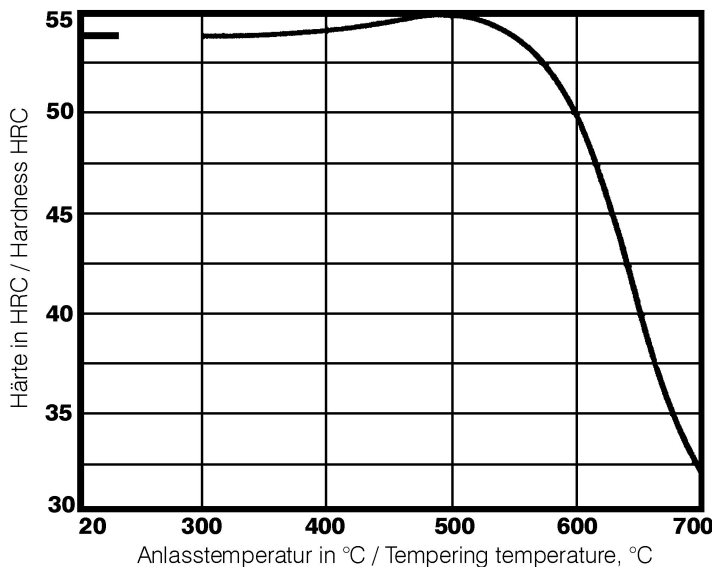


B... Bainite
F... Ferrite
K... Carbide
M... Martensite
P... Perlite
RA... Retained austenite

----- 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.

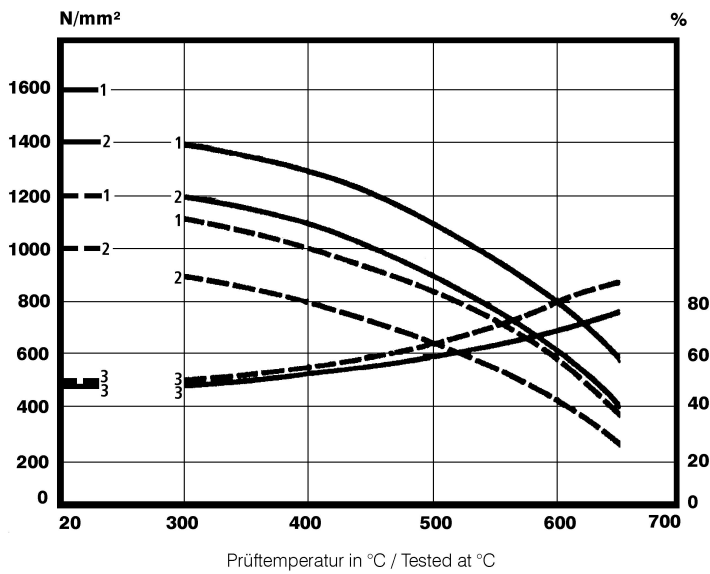
1st tempering approx. 86°F (30°C) above maximum secondary hardness.

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.

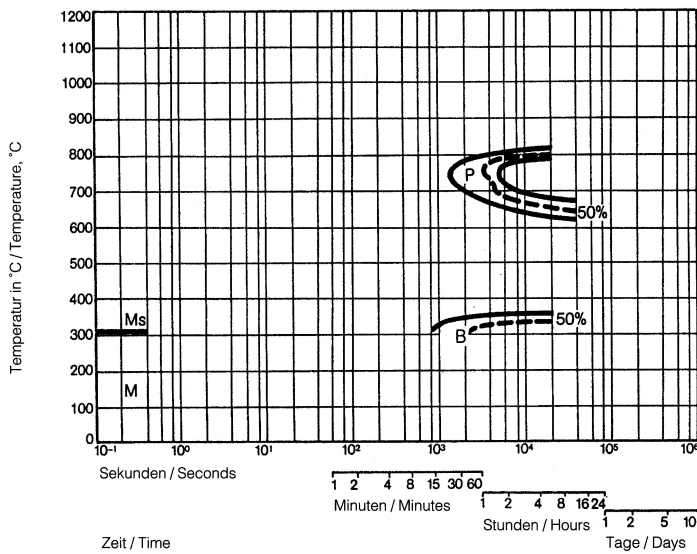
Hardening temperature: 1050°C (1922°F)
Specimen size: square 50 mm

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 °F)	20 68
Density (kg/dm ³ lb/in ³)	7.8 0.28
Thermal conductivity (W/(m.K) BTU/ft h °F)	22.8 13.17
Specific heat (kJ/kg K BTU/lb °F)	0.47 0.1123
Spec. electrical resistance (Ohm.mm ² /m 10 ⁻⁴ Ohm.inch ² /ft)	0.52 2.46
Modulus of elasticity (10 ³ N/mm ² 10 ³ ksi)	213 30.86

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

Temperature (°C °F)	100 212	200 392	300 572	400 752	500 932	600 1,112
Thermal expansion (10 ⁻⁶ m/(m.K) 10 ⁻⁶ inch/inch. °F)	10.75 6	11 6.1	12.11 6.7	12.68 7	14.17 7.9	14.34 8

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