

HOT WORK TOOL STEELS

Application Segments

Hot Work

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 W360 ISOBLOC is a material produced by the electroslag remelting process (ESR), which has been specially adapted for use at high tool hardnesses in the range of 51-57 HRC. Although the steel can be classified as a 5% chromium steel, the increased carbon and molybdenum content coupled with state-of-the-art manufacturing technology ensures that BÖHLER W360 ISOBLOC still shows a very good toughness and an exceptionally good thermal resistance, even at high hardness levels. These properties make the steel the perfect choice for smaller components in the die casting sector (e.g., mold inserts, cores, core pins, ejector pins, etc.). The material also is frequently the preferred choice for closed-die and open-die forging tools due to its high wear resistance. Because of this excellent wear resistance and the high toughness, BÖHLER W360 ISOBLOC is also frequently used for cold work applications and as a molding material for plastic injection molds. The Steel also is available as powder material for metal-3D-printing under the brand name BÖHLER W360 AMPO.

Process Melting

Airmelted + Remelted

Properties

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

Applications

- | | | |
|---|--------------------------------------|---------------------------------|
| > High Pressure Die-Casting | > Forging (Hot / Semi-hot) | > Progressive Forging (Hatebur) |
| > Extrusion | > Fine Blanking, Stamping, Blanking | > Coining |
| > General Components for Mechanical Engineering | > Gravity / Low Pressure Die-Casting | > Injection Molding |
| > Press Hardening / Hot Stamping | > Rolling | > Shearing / Machine Knives |
| > Mechanical Engineering | > Motorsport industry | > Cold Forming |
| > Fasteners, Bolts, Nuts | > Forging Applications | > Machine knife (for producers) |
| > Powder Pressing | > Rolls | > Screws and Barrels |
| > Standard Parts (Molds, Plates, Pins, Punches) | > Pill punching dies | > Glasfibre reinforced plastics |

Technical data

Material designation	
BÖHLER patent	Market grade

Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V
0.50	0.20	0.25	4.50	3.00	0.60

Material characteristics

	High temperature strength	High temperature toughness	High temperature wear resistance
BÖHLER W360 ISOBLOC	★★★★★	★★★★★	★★★★★
BÖHLER W300 ISOBLOC	★★	★★★★★	★★
BÖHLER W300 ISODISC	★★	★★★	★★
BÖHLER W302 ISOBLOC	★★★	★★★★★	★★★
BÖHLER W302 ISODISC	★★★	★★★	★★★
BÖHLER W303 ISODISC	★★★★★	★★★	★★★★★
BÖHLER W320 ISODISC	★★★	★★	★★★
BÖHLER W350 ISOBLOC	★★★	★★★★★	★★★
BÖHLER W400 VMR	★★	★★★★★	★★
BÖHLER W403 VMR	★★★★★	★★★★★	★★★★★

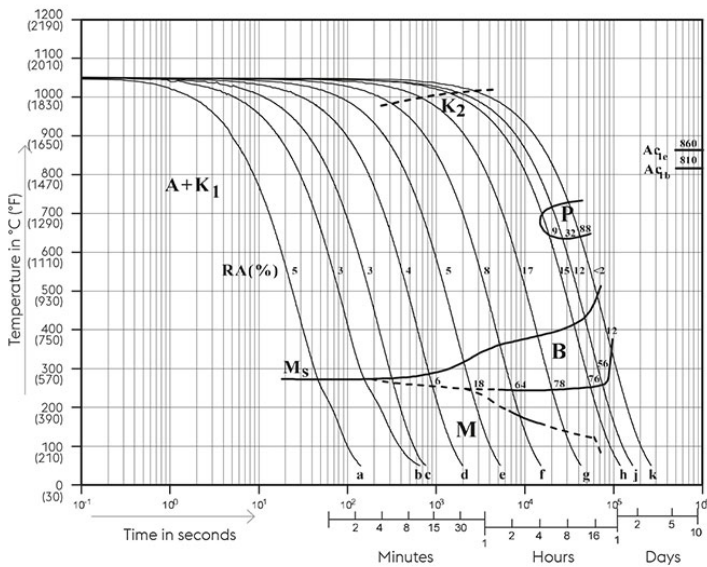
Delivery condition

Annealed	
Hardness (HB)	max. 205

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	650 to 700 °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	1,050 °C	Holding time after temperature equalization: 15 to 30 minutes; In order to prevent coarsening of the grain, hardening must be carried out at the recommended temperature; Quenching: oil, salt bath (500 - 550°C [930 to 1020 °F]), air, inert gas in vacuum; After hardening, required tempering treatment to achieve desired working hardness (see tempering chart).

Continuous cooling CCT curves

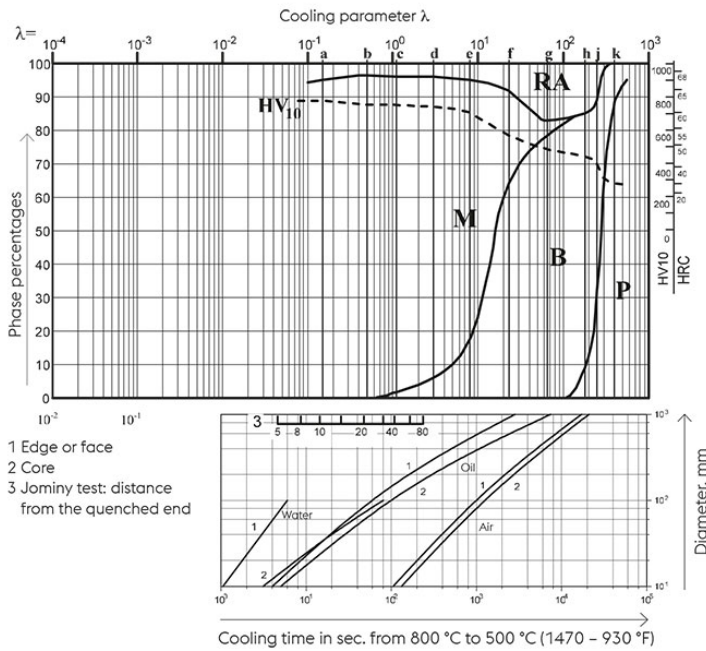


Austenitising temperature: 1050°C (1922°F)
 Holding time: 30 minutes
 5...100 phase percentages
 0.5...400 cooling parameter, i.e. duration of cooling from 800 - 500°C (1472-932°F) in $s \times 10^{-2}$

Table:

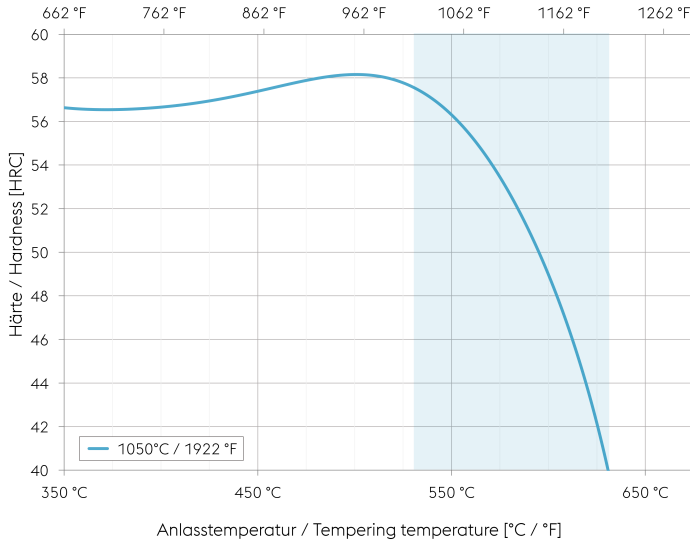
Sample	λ	HV10	Sample	λ	HV10
a	0,15	785	f	23	582
b	0,50	760	g	65	498
c	1,10	762	h	180	453
d	3	754	j	250	415
e	8	724	k	400	294

Quantitative phase diagram



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

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

Physical Properties

Temperature (°C)	20
Density (kg/dm ³)	7.8
Thermal conductivity (W/(m.K))	30.8
Specific heat (kJ/kg K)	0.43
Spec. electrical resistance (Ohm.mm ² /m)	-
Modulus of elasticity (10 ³ N/mm ²)	212

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	11.6	12.1	12.5	12.8	13.3

Long Products: For additional specifications and technical requirements, please contact our regional voestalpine BÖHLER sales companies.

Open Die Forgings: Product Variant may differ in terms of melting process, technical data, delivery, and surface condition as well as available product dimensions. Please contact the business unit Open Die Forgings of voestalpine BÖHLER Edelstahl GmbH & Co KG.

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