

# OȚELURI PENTRU SCULE PENTRU LUCRU LA CALD

## Application Segments

Lucrări la cald

## Available Product Variants

Long Products\*

Plates

Open Die Forgings

\* Datele prezentate se referă exclusiv la produsele lungi. Vă rugăm să respectați explicațiile detaliate de la sfârșitul fișei tehnice (pdf).

## Product Description

BÖHLER W350 ISOBLOC is a material produced by the electroslag remelting process (ESR) which is particularly suitable for use in large casting and forging molds. Although the steel can be classified as a 5% chromium steel, the chemical composition has been chosen to provide the best possible through-hardening without any loss of toughness or resistance against heat-checkings. These properties make the steel the perfect choice to produce very large die casting molds, for example for mega- or giga-casting.

## Process Melting

Topit în aer + refulat

## Properties

- > Rezistență și ductilitate : very high
- > Rezistență la uzură : high
- > Machinability : very high
- > Duritate la cald (duritate roșie) : high
- > Poluabilitate : very high
- > Conductivitate termică : very high
- > Micro-curățenie : high

## Applications

- > Turnare sub presiune înaltă
- > Turnare prin injecție
- > Forjare progresivă (Hatebur)
- > Forjare (la cald / semi-cald)
- > Întărire prin presare / ștampilare la cald
- > Inginerie mecanică
- > Gravitate / presiune scăzută turnare sub presiune
- > Extrudare

## Technical data

Material designation		Standards	
BÖHLER patent	Market grade	#207	NADCA
E1850	NADCA		

Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V	N
0.38	0.20	0.55	5.00	1.80	0.55	def.

Material characteristics

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

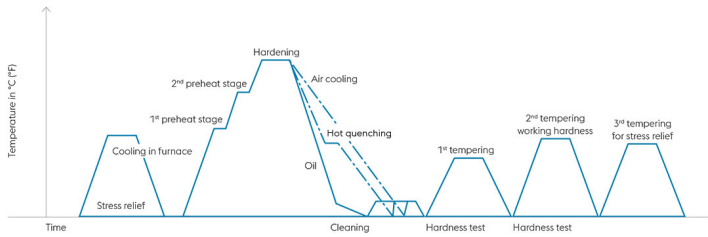
Delivery condition

Recoaptă	
Hardness (HB)	max. 205

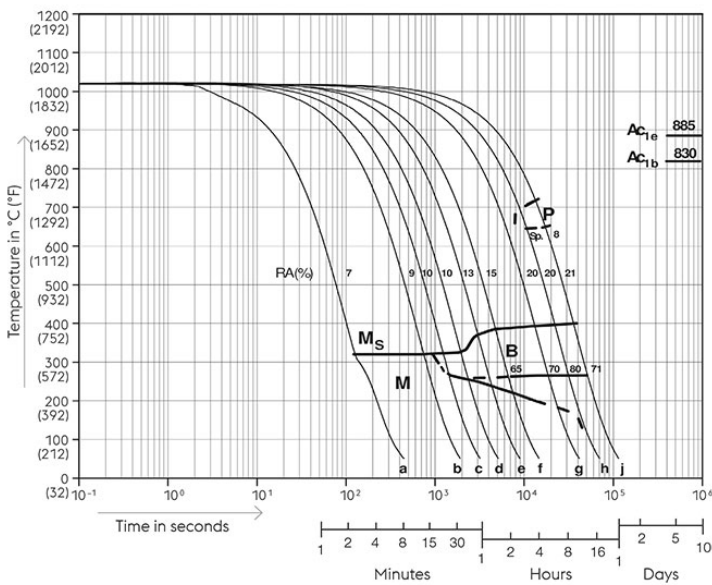
Heat treatment

Recoacere		
Temperature	750 to 800 °C	Slow controlled cooling in furnace at a rate of 10 to 20 °C/hr (50 to 68 °F/hr) down to approx. 600 °C (112 °F), further cooling in air.
Eliminarea stresului		
Temperature	600 to 670 °C	Slow cooling furnace. To relieve stresses caused by extensive machining, or for complex shapes. Soak for 1 -2 hours after temperature equalisation (in neutral atmosphere).
Călire și revenire		
Temperature	1,010 to 1,020 °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. For big dimensions it's recommended to reduce the temperature to 1010 °C (1850 °F); Quenching: oil, salt bath (500 - 550°C [932 - 1022 °F]), air, inert gas in vacuum; After hardening, required tempering treatment to achieve desired working hardness (see tempering chart).

### Heat treatment sequence



### Continuous cooling CCT curves

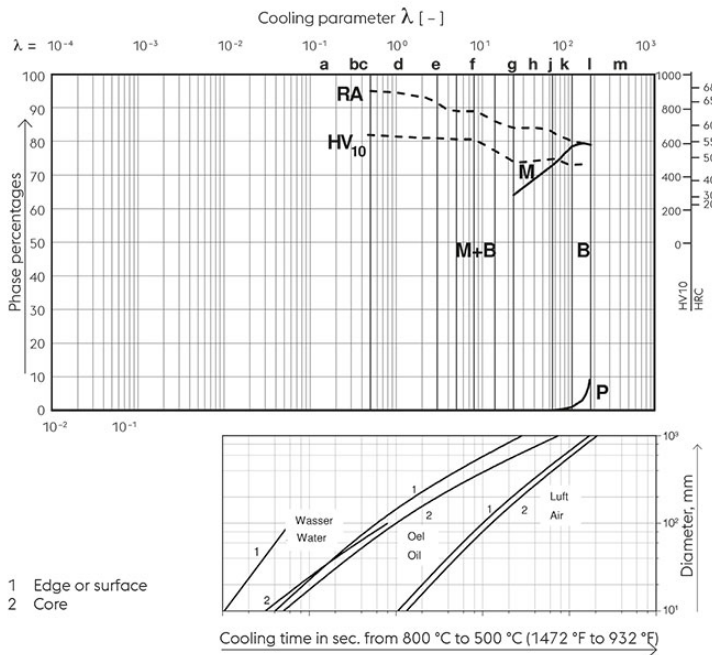


Austenitising temperature: 1020°C (1868°F)  
Holding time: 15 minutes  
5...100 phase percentages  
0.5...180 cooling parameter, i.e. duration of cooling from 800 - 500°C (1472-932°F) in s x 10<sup>-2</sup>

Table:

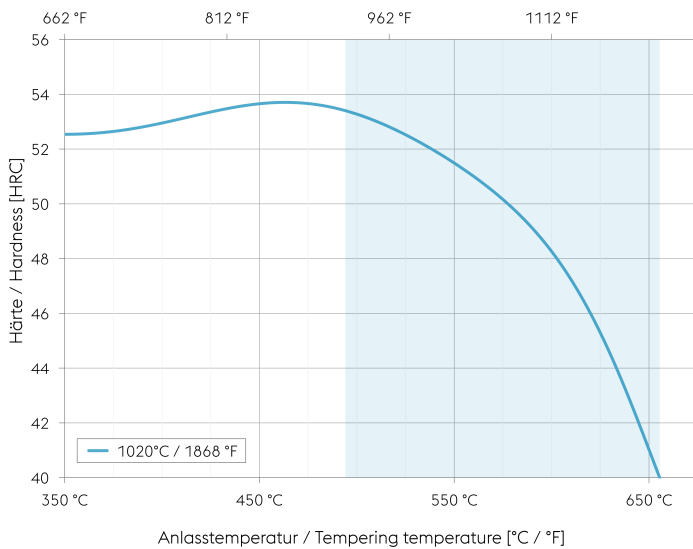
Sample	λ	HV10	Sample	λ	HV10
a	0,5	630	f	23	478
b	3	616	g	65	497
c	5	606	h	110	454
d	8	606	j	180	459
e	14	517			

Quantitative phase diagram



A... Austenite  
B... Bainite  
K... Carbide  
M... Martensite  
P... Pearlite  
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: 1020°C (1868°F)  
Specimen size: square 20 mm

### Physical Properties

<b>Temperature (°C)</b>	<b>20</b>
Density (kg/dm <sup>3</sup> )	7.8
Thermal conductivity (W/(m.K))	28.8
Specific heat (kJ/kg K)	0.46
Spec. electrical resistance (Ohm.mm <sup>2</sup> /m)	-
Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup> )	214

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

<b>Temperature (°C)</b>	<b>100</b>	<b>200</b>	<b>300</b>	<b>400</b>	<b>500</b>	<b>600</b>	<b>700</b>
Thermal expansion (10 <sup>-6</sup> m/(m.K))	11.1	11.9	12.4	12.9	13.2	13.5	13.6

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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