BÖHLER

BÖHLER W350
ISOBLOC®

HOT WORK TOOL STEELS

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 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-hardenability 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

Airmelted + Remelted

Properties

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

Applications

- High Pressure Die-Casting
- General Components for Mechanical Engineering
- Extrusion
- Forging (Hot / Semi-hot)
- Injection Molding
- Progressive Forging (Hatebur)
- Gravity / Low Pressure Die-Casting
- Press Hardening / Hot Stamping
- Mechanical Engineering

Technical data

Material designation	
BÖHLER patent	Market grade
E1850	NADCA

Standards	
#207	NADCA

Chemical composition (wt. %)

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

voestalpine BÖHLER Edelstahl GmbH & Co KG
https://www.voestalpine.com/bohler-edelstahl/de/

voestalpine
ONE STEP AHEAD.

Material characteristics

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

Delivery condition

Annealed

Hardness (HB)	max. 205

Heat treatment

Annealing

Temperature	750 to 800 °C | 1,382 to 1,472 °F	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.

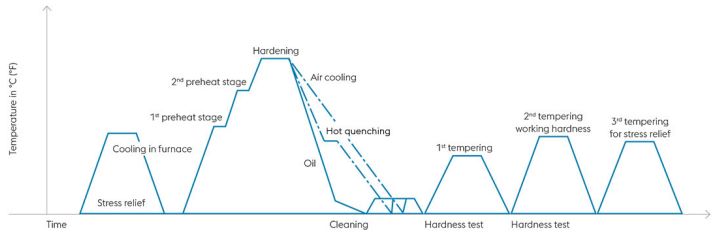
Stress relieving

Temperature	600 to 670 °C | 1,112 to 1,238 °F	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).

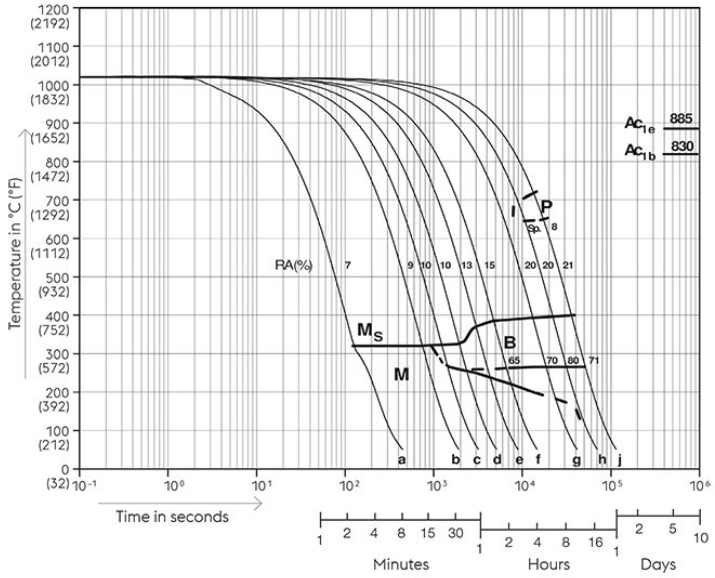
Hardening and Tempering

Temperature	1,010 to 1,020 °C | 1,850 to 1,868 °F	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

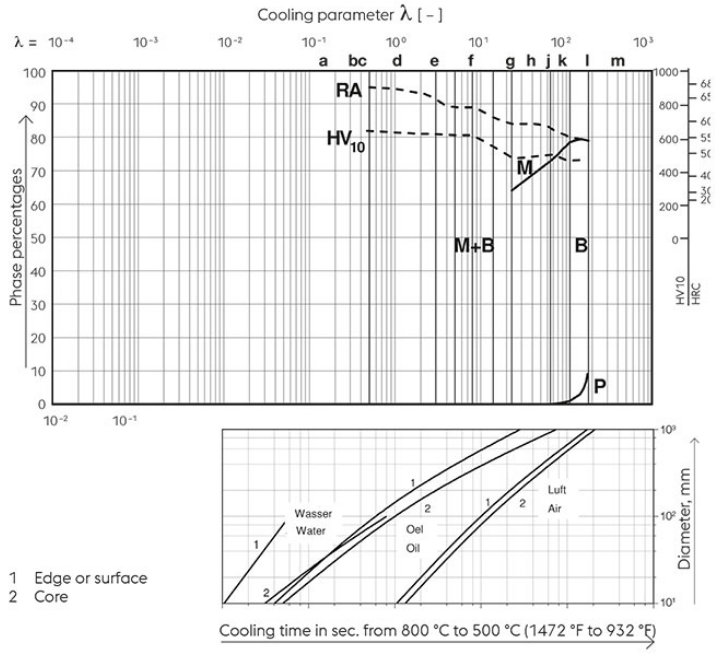


Austenitising temperature: 1020°C (1868°F)
Holding time: 15 minutes
5...100 phase percentages
0.5...180 cooling parameter, i.e. duration of cooling from 800 - 500°C (1472-932°F) in s x 10^{-2}

Table:

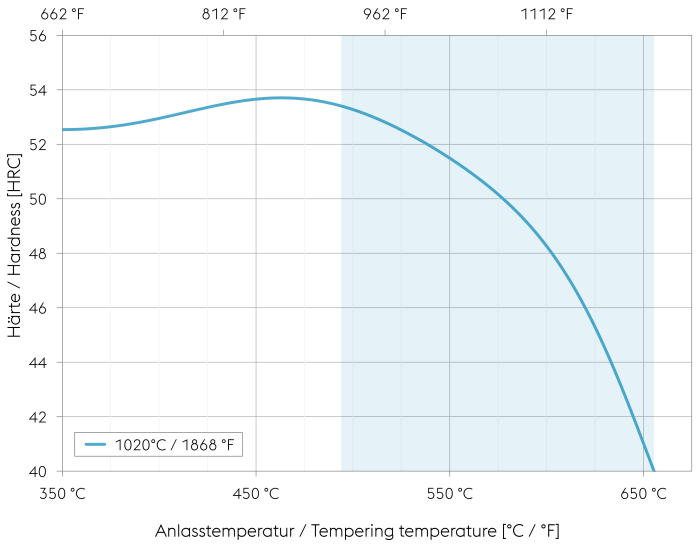
Sample	λ	HV10	Sample	λ	HV10
a	0,5	630	f	23	478
b	3	616	g	65	497
c	5	606	h	110	454
d	8	606	j	180	459
e	14	517			

Quantitative phase diagram



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

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)	28.8 | 16.64
Specific heat (kJ/kg K | BTU/lb °F)	0.46 | 0.1099
Spec. electrical resistance (Ohm.mm^2/m | 10^{-4} Ohm.inch^2/ft)	-
Modulus of elasticity (10^{3}N/mm^2 | 10^{3}ksi)	214 | 31.04

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

Temperature (°C | °F)	100 | 212	200 | 392	300 | 572	400 | 752	500 | 932	600 | 1,112	700 | 1,292
Thermal expansion (10^{-6} m/(m.K) | 10^{-6} inch/inch.°F)	11.1 | 6.2	11.9 | 6.6	12.4 | 6.9	12.9 | 7.2	13.2 | 7.3	13.5 | 7.5	13.6 | 7.6

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.

Sheet & Plates: Product Variant may differ in terms of melting process, technical data, delivery, and surface condition as well as available product dimensions. Please contact voestalpine BÖHLER Bleche GmbH & Co KG.

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.

voestalpine BÖHLER Edelstahl GmbH & Co KG
Mariazeller Straße 25
8605 Kapfenberg, AT
T. +43/50304/20-0
E. info@bohler-edelstahl.at
https://www.voestalpine.com/bohler-edelstahl/de/