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 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
- English (United Kingdom) : 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.

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	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.

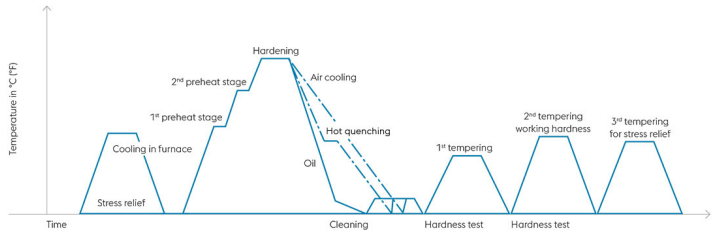
Stress relieving

Temperature	600 to 670 °C	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).

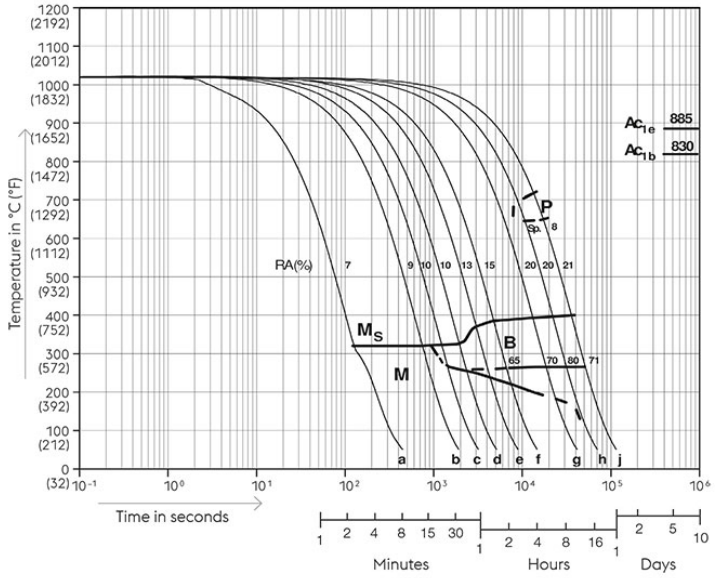
Hardening and Tempering

Temperature	1,010 to 1,020 °C	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

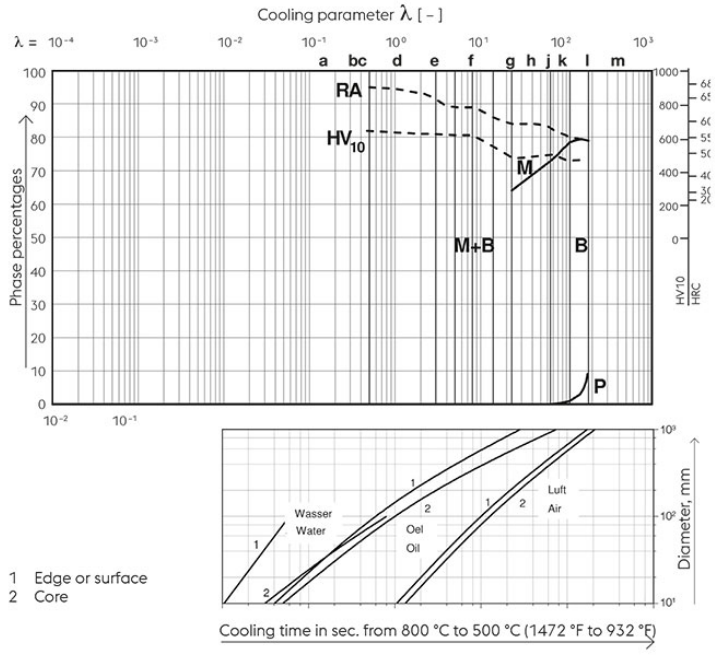


Austenitising temperature: 1020°C (1868°F)
Holding time: 15 minutes
5...100 phase percentages
0.5...180 cooling parameter, i.e. duration of cooling from 800 - 500°C (1472-932°F) in s x 10^{-2}

Table:

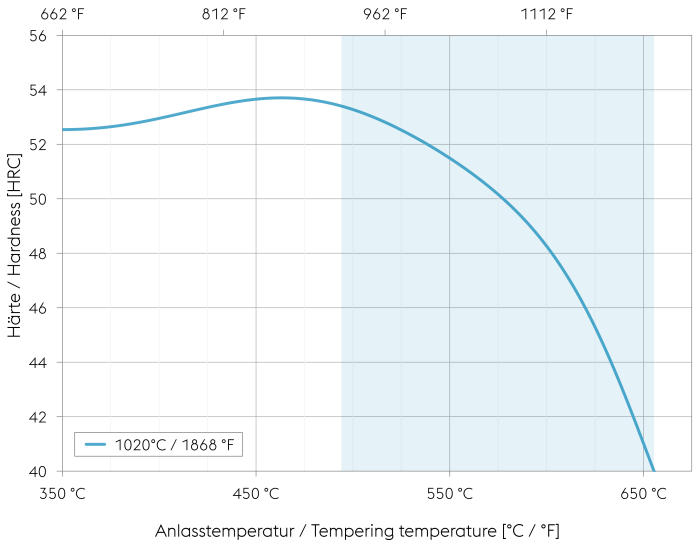
Sample	λ	HV10	Sample	λ	HV10
a	0,5	630	f	23	478
b	3	616	g	65	497
c	5	606	h	110	454
d	8	606	j	180	459
e	14	517			

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)	20
Density (kg/dm³)	7.8
Thermal conductivity (W/(m.K))	28.8
Specific heat (kJ/kg K)	0.46
Spec. electrical resistance (Ohm.mm²/m)	-
Modulus of elasticity (10³N/mm²)	214

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

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

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/

voestalpine
ONE STEP AHEAD.