

HOT WORK TOOL STEELS

Available Product Shapes

Long Products	Open Die Forgings	Plates
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Product Description

A balanced alloy composition ensuring high toughness even in large tools and an improved thermal stability opts for an optimal hardness/strength-toughness/ductility ratio (elongation after fracture and percentage reduction of area after fracture) tailor-fit to every application.

Properties

- Very high toughness & ductility
- High wear resistance
- Very good machinability
- High hot hardness
- Very good polishability
- Very high thermal conductivity
- High micro-cleanliness
- High resistance to fire cracking
- Excellent homogeneity and isotropy
- Coatable
- Lowest levels of unwanted trace elements
- Can be nitrated
- Very high thermal stability

Applications

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

Material designation	
E1850	NADCA

Standards	
	Patent
#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	Machinability
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	max. 205 HB

Heat treatment

Annealing		
Temperature (°C °F)	800 1472 to 850 1562	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 (°C °F)	600 1112 to 650 1202	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 (°C °F)	1010 1850 to 1020 1868	Oil, hot quenching (500 - 550 °C [932 - 1022 °F]), air or vacuum with gas quenching. 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). After hardening, tempering to the desired working hardness, see tempering chart.

Physical Properties

Temperature (°C °F)	20 68
Density (kg/dm ³ lb/in ³)	7.8 0.28
Thermal conductivity (W/(m.K) BTU (IT) ft/hr/ft ² /F)	28.8 16.64
Specific heat (J/(kg.K) BTU (IT) lb/F)	460 109.87
Spec. electrical resistance (Ohm.mm ² /m 10 ⁻⁴ Ohm.inch ² /ft)	-
Modulus of elasticity (10 ³ N/mm ² 10 ³ ksi)	22 3.12

Thermal Expansions

Temperature (°C °F)	100 212	200 392	300 572	400 752	500 932	600 1112	700 1292
Thermal expansion (10 ⁻⁶ m/(m.K) 10 ⁻⁶ inch/(inch.F))	11.14 6.189	11.94 6.633	12.42 6.9	12.85 7.139	13.21 7.339	13.51 7.506	13.58 7.544

For more information see www.voestalpine.com/boehler-edelstahl

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ONE STEP AHEAD.