

PLASTIC
MOULD STEEL

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BÖHLER M340
ISOPLAST®

EXACTLY TO YOUR LIKING



An increase in productivity in high-tech mould-making can only be achieved by using mould steels with materials properties trimmed specifically towards the intended use. Due to the increased share of **glass-fiber reinforced** plastics, **BÖHLER M340 ISOPLAST** is also increasingly suitable for this kind of processing. In addition, this grade also provides **good food resistance**. Approvals for the food industry are available from voestalpine BÖHLER Edelstahl.

The following properties are decisive: **Wear resistance, corrosion resistance, toughness, etchability and polishability**. An optimum combination of properties appropriate to the intended use is made possible by specifically tailoring the heat treatment.

BÖHLER M340 ISOPLAST PROVIDES YOU WITH THESE ADVANTAGES.



A STEEL FOR EXTREMELY HIGH REQUIREMENTS

BÖHLER M340 ISOPLAST is a high performance plastic mould steel with a hardness of max. 56 HRC:

- » Excellent corrosion resistance properties
- » Suitable for heat treatment in vacuum furnaces
- » Fine carbide structure
- » Good dimensional stability with appropriate heat treatment
- » Excellent high wear resistance / edge-holdingability
- » Good machinability
- » Good polishability

Chemical composition (average %)

C	Si	Mn	Cr	Mo	V	+N
0.54	0.45	0.40	17.30	1.10	0.10	

UNIVERSAL & TOP PERFORMING



Advantages which highlight the cost saving potential of BÖHLER M340 ISOPLAST:

Well balanced material properties for an efficient tool manufacturing process:

- » Good machinability
- » Consistently high quality
- » Good polishability
- » Dimensional stability
- » Technical assistance and advice in tool manufacture and use

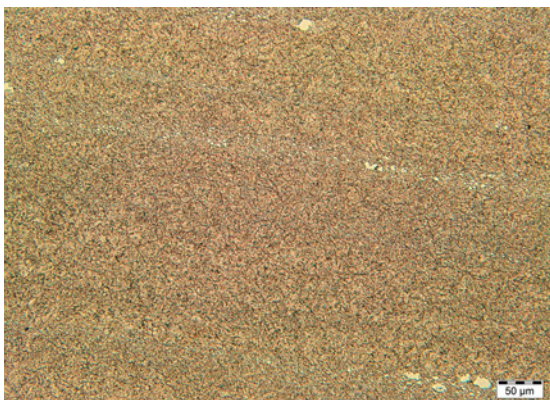
The usage of BÖHLER M340 ISOPLAST demonstrates its steadiness in several requirements:

- » Highest precision parts
- » Processability of plastics containing abrasive (GF, CF, ...) and corrosive fillers
- » Elevated processing temperatures
- » Higher tool economy
- » Applications for food processing
- » Instruments and knives typical for cutting applications

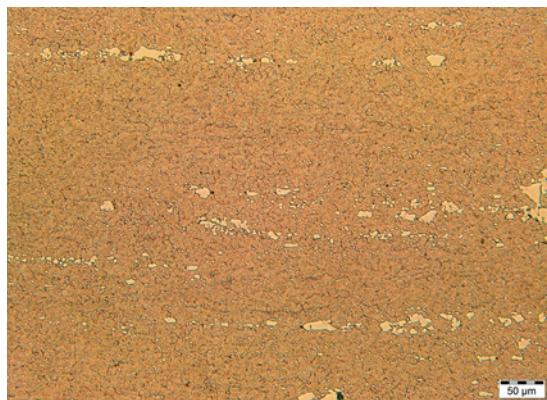


MICROSTRUCTURE

Comparison BÖHLER M340 ISOPLAST with WNr. 1.4112 – ESR. The fine, homogeneous microstructure results in good machinability and properties in service.



BÖHLER M340 ISOPLAST, 200x

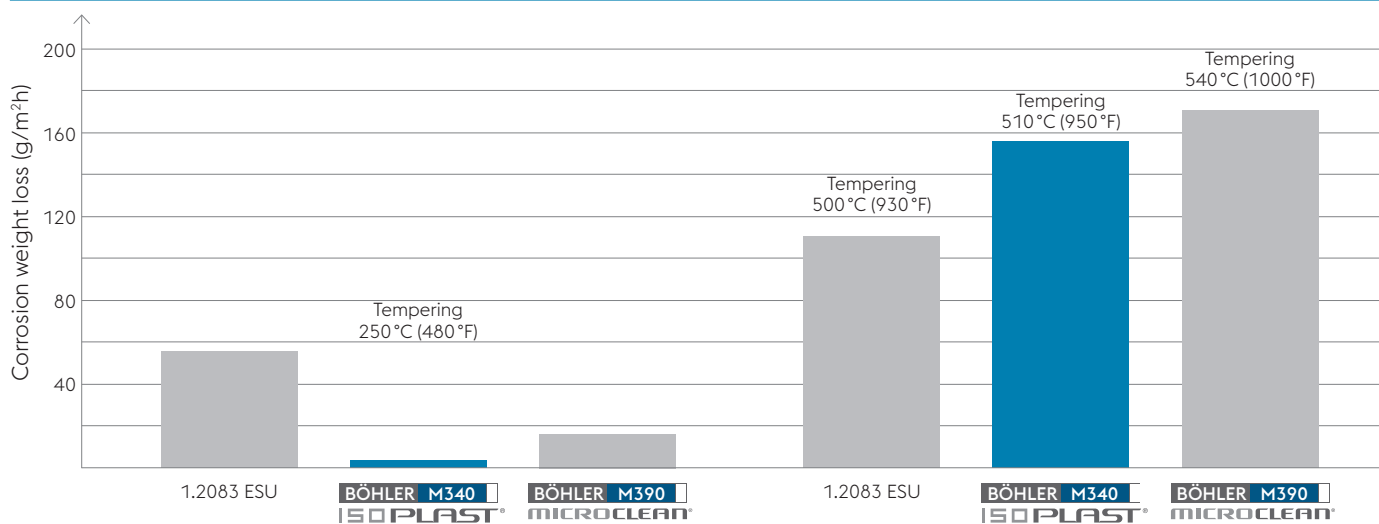


WNr. 1.4112 – ESR, 200x



MATERIAL PROPERTIES

Corrosion resistance

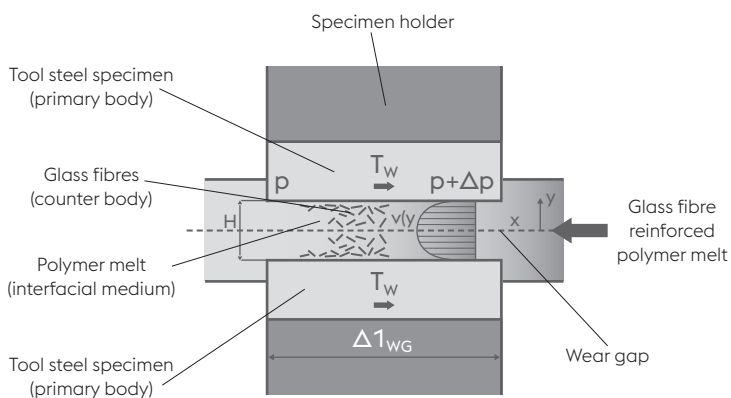


Heat treatment: without subzero treatment

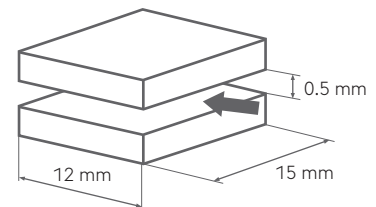
Hardening temperature: 1.2083 at 1020 °C (1870 °F); M340 ISOPLAST at 1000 °C (1830 °F); M390 MICROCLEAN at 1150 °C (2100 °F)

Weight loss test: measured after 24h in 20% boiling acidic acid

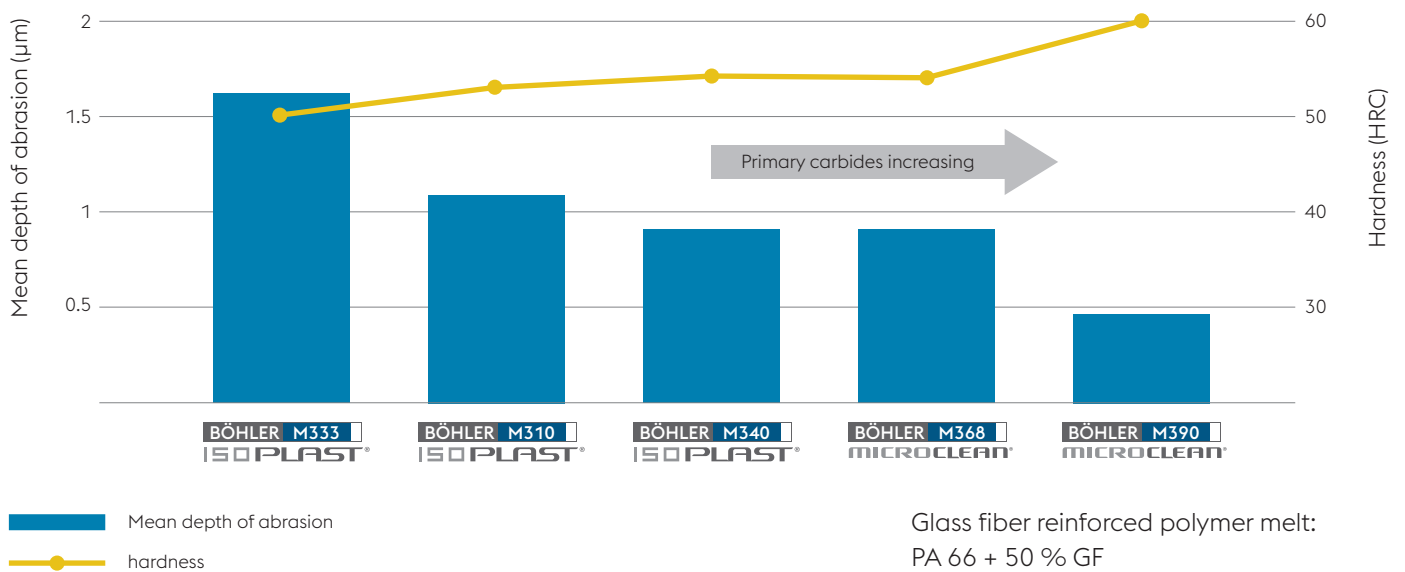
Small Plates Wear Tests



Mean depth of abrasion or weight loss of the testing plates indicates the wear resistance.



Wear resistance with plate-wear test





HEAT TREATMENT

Supplied condition

- » Soft annealed with max. 260 HB

Stress relieving

- » approx. 650 °C (1200 °F)
- » After temperature equalization, soak for 1 to 2 hours in neutral atmosphere. Slow cooling in furnace.

Hardening

- » 980 to 1000 °C (1800 – 1830 °F) / N₂
- » Holding time after temperature equalization: 15 to 30 minutes

Achievable hardness

- » max. 56 HRC

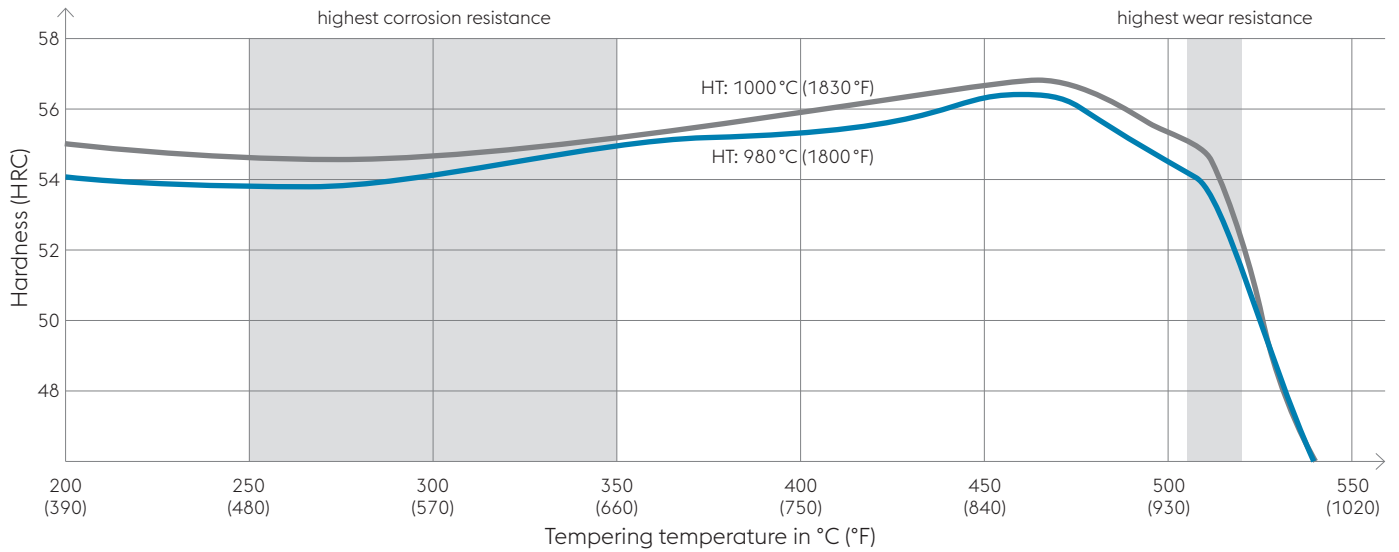
Tempering for highest corrosion resistance

- » Deep freezing for transformation of retained austenite
- » Slow heating to tempering temperature
- » Time in furnace 1 hour for each 20 mm (0.79 inch) of workpiece thickness, but at least 2 hours
- » For information on the achievable hardness after tempering please refer to the tempering chart.
- » Tempering: 250 to 350 °C (480 – 660 °F)

Tempering for highest wear resistance

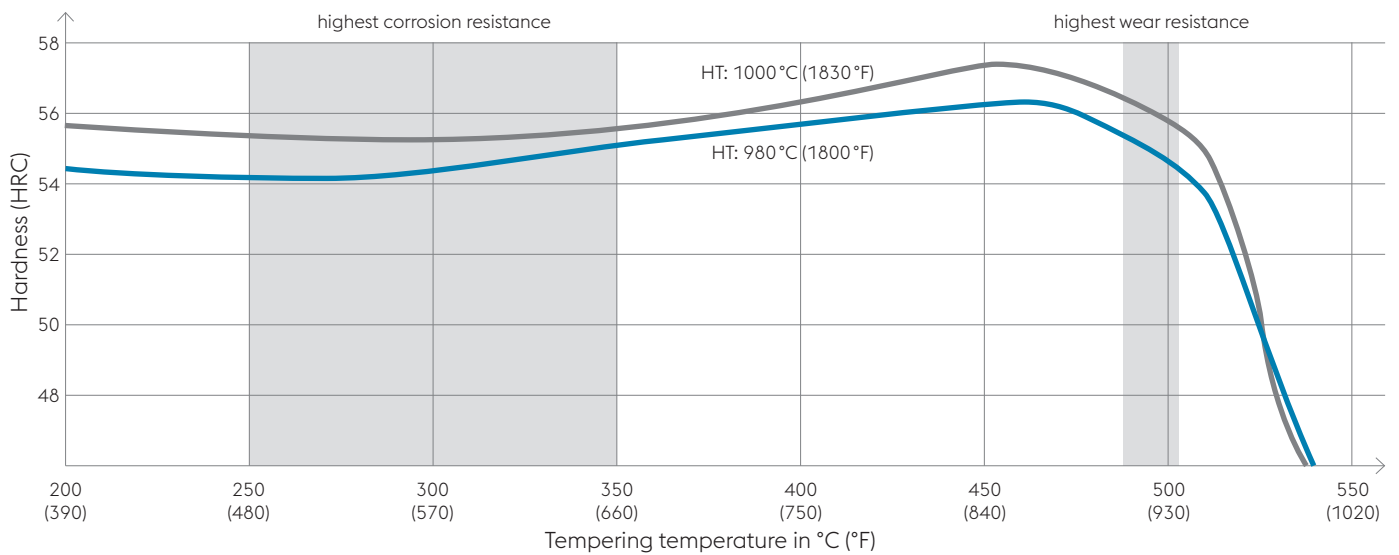
- » Deep freezing recommended
- » A deep freezing treatment immediately following hardening leads to increased tempering hardness values [Risk of stress cracking]
- » Slow heating to tempering temperature
- » Time in furnace 1 hour for each 20 mm (0.79 inch) of workpiece thickness, but at least 2 hours
- » For information on the achievable hardness after tempering please refer to the tempering chart.

Tempering chart (without subzero treatment)



Heat treatment: Hardening in vacuum furnace; Tempering 3 x 2h

Tempering chart (with subzero treatment)



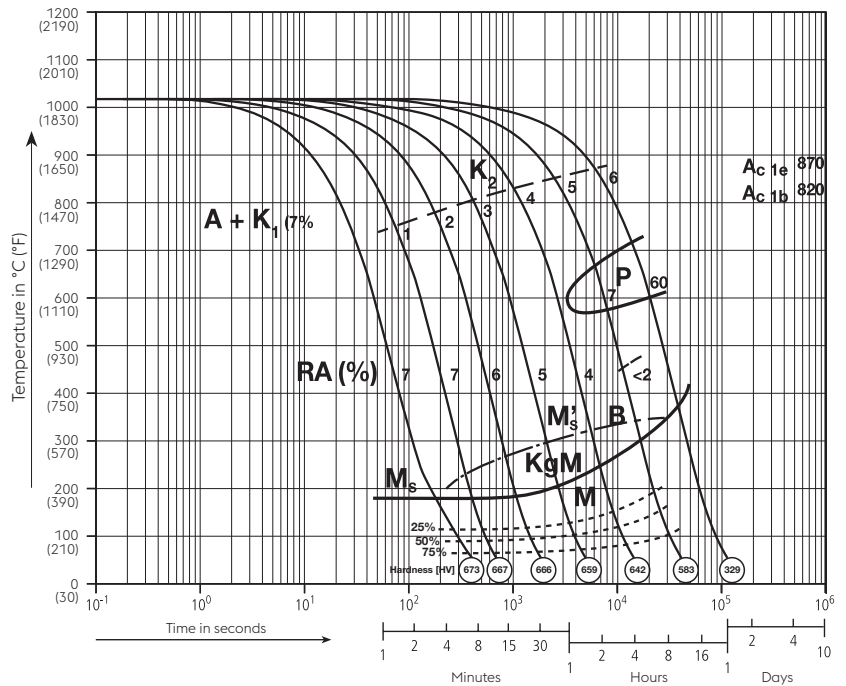
Heat treatment: Hardening in vacuum furnace; Tempering 3 x 2h



Continuous cooling CCT curves

Austenitizing temperature: 1000 °C (1830 °F)
 Holding time: 30 minutes

- 7...60 Phase percentages in %
- 0.4...180 Cooling parameter, i.e. duration of cooling from 800 - 500 °C (1470 - 930 °F) in $s \times 10^{-2}$

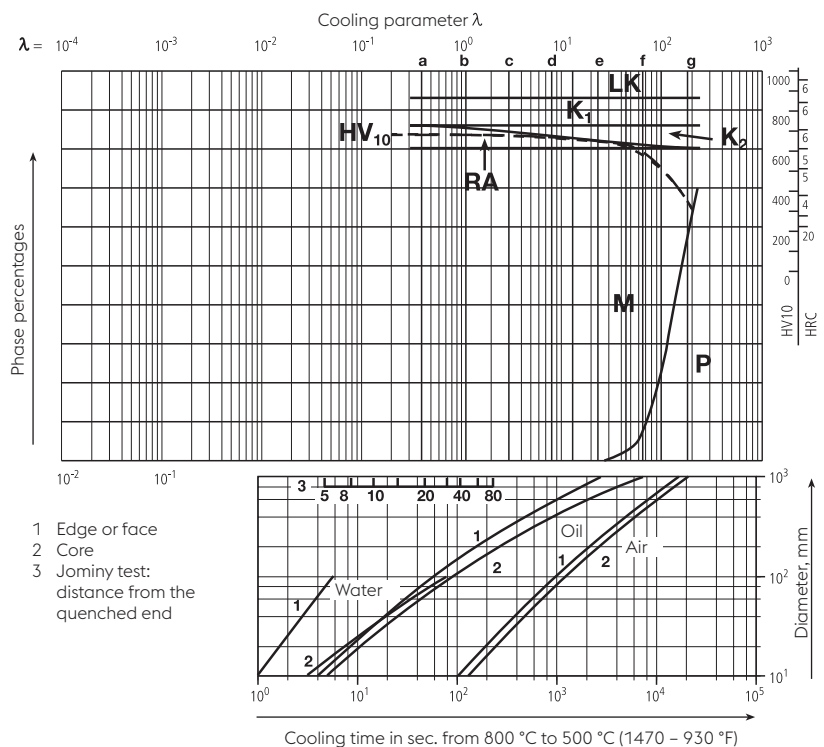


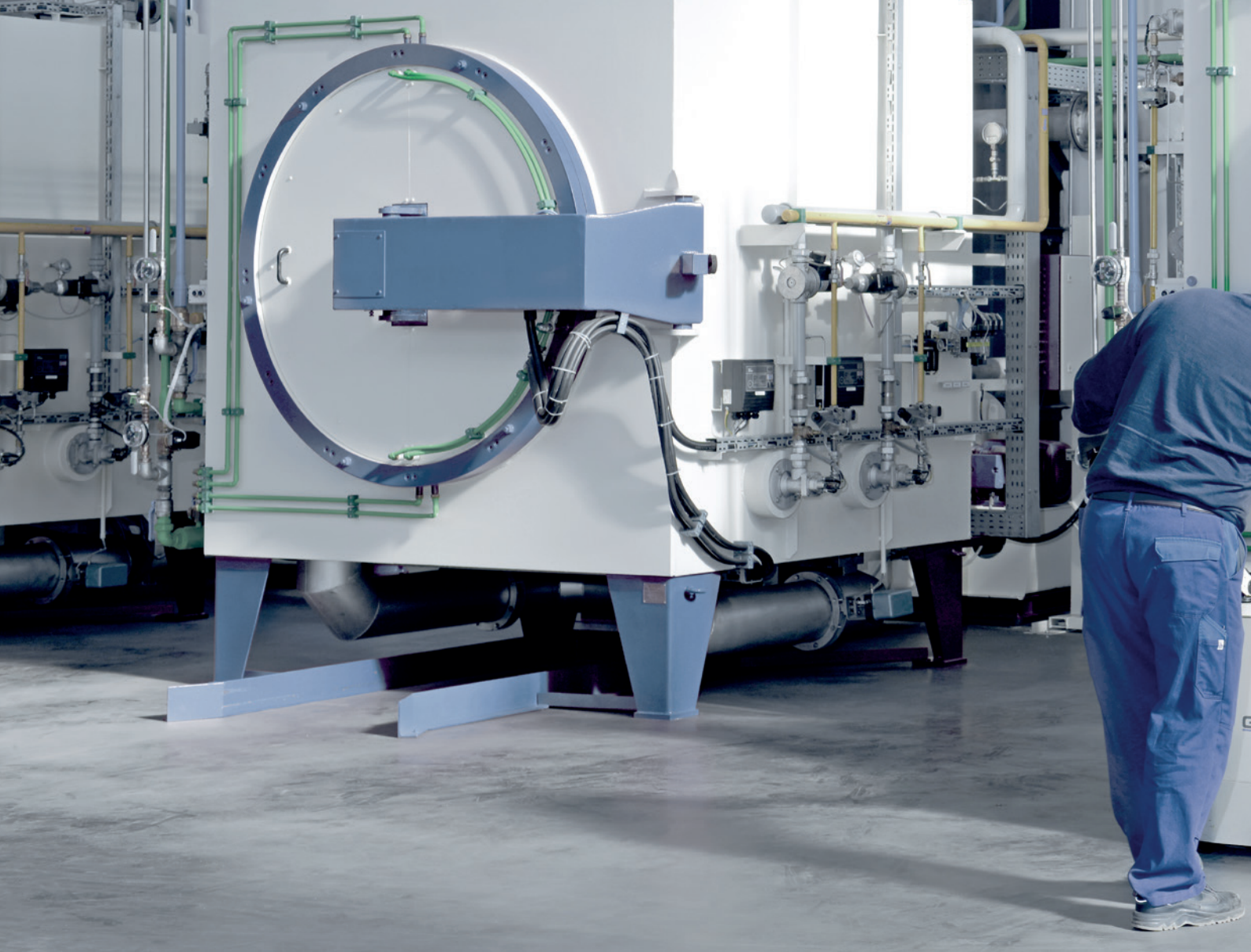


TOP PERFORMANCE THANKS TO PROPER TREATMENT

Quantitative phase diagram

- K1 Carbides which are not dissolved during austenitization (7%)
- K2 Start of carbide precipitation during quenching from austenitizing temperature
- Ms-Ms' Range of grain boundary martensite
- LK Ledeburitic carbides
- RA Retained austenite
- A Austenite
- M Martensite
- P Perlite
- B Bainite





NUMBERS, FACTS AND DATA

Physical properties

Density at	20 °C	7.70 kg/dm ³
	68 °F	0.278 lbs/in ³
Specific heat capacity at	20 °C	460 J/(kg.K)
	68 °F	0.110 Btu/lb°F
Thermal conductivity at	20 °C	18.2 W/(m.K)
	68 °F	10.52 Btu/ft h°F

Magnetizability existing



Thermal conductivity

100 °C	200 °C	300 °C	400 °C	500 °C	
19.2	21.0	22.0	22.7	23.6	W/(m.K)
210 °F	390 °F	570 °F	750 °F	930 °F	
11.10	12.13	12.71	13.12	13.64	Btu/ft h°F

Thermal expansion between 20 °C (68 °F) and ... °C (°F)

100 °C	200 °C	300 °C	400 °C	500 °C	
10.88	10.78	11.21	11.61	11.90	10 ⁻⁶ m/(m.K)
210 °F	390 °F	570 °F	750 °F	930 °F	
6.04	5.99	6.23	6.45	6.61	10 ⁻⁶ in/in°F

Modulus of elasticity

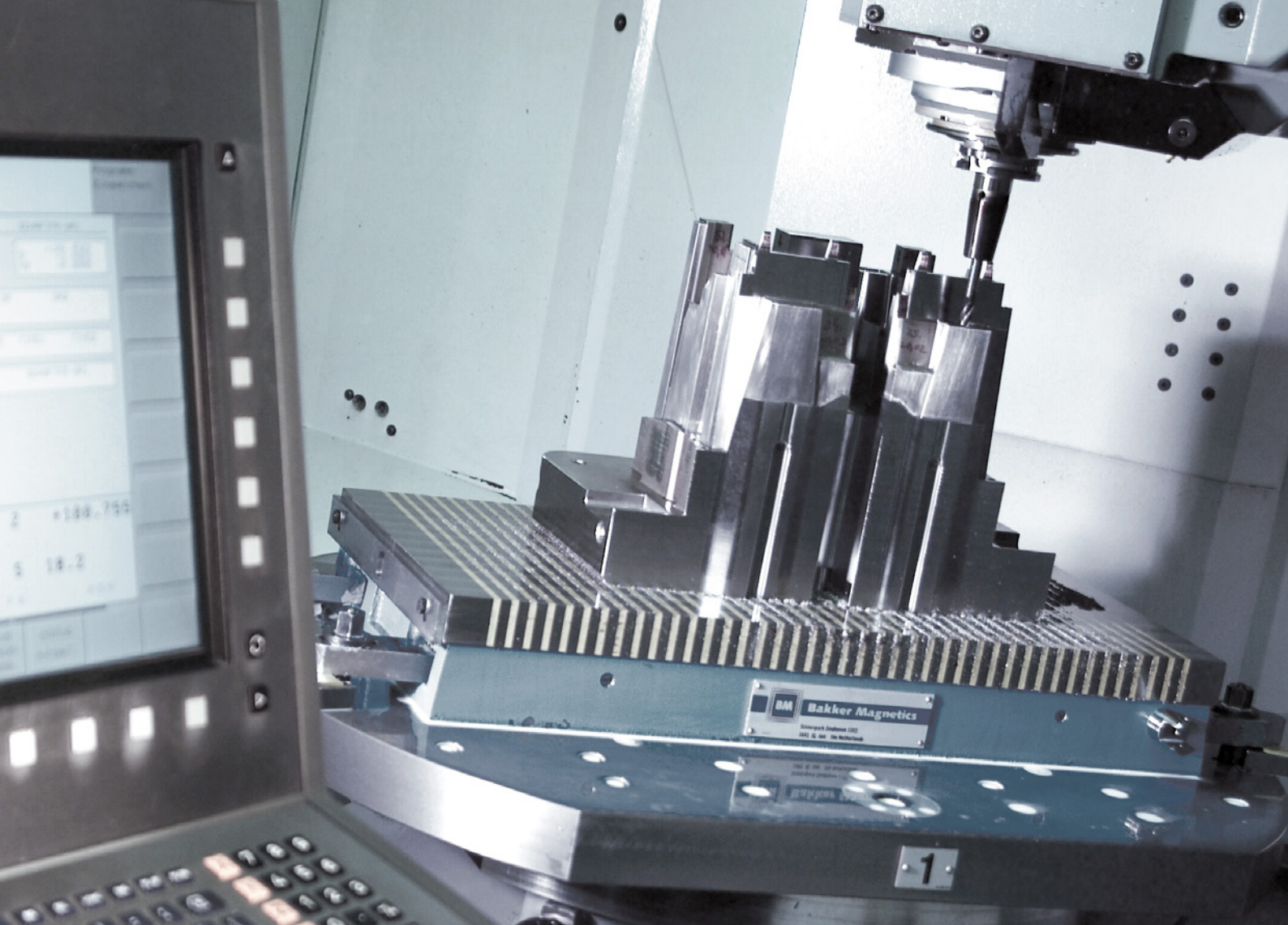
20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	
219	215	209	201	193	183	10 ³ N/mm ²
68 °F	210 °F	390 °F	570 °F	750 °F	930 °F	
31.8	31.2	30.3	29.1	28.0	26.5	10 ³ KSI

MACHINING GUIDELINES

Turning with sintered carbide

Depth of cut mm (inch)	0.5 - 1 (.02 - .04)	1 - 4 (.04 - .16)	4 - 8 (.16 - .31)
Feed mm/rev. (inch/rev.)	0.1 - 0.2 (.004 - .008)	0.2 - 0.4 (.008 - .016)	0.3 - 0.6 (.012 - .024)
BÖHLERIT grade	SB10, SB20, EB10	SB20, EB10, EB20	SB30, EB20, HB10
ISO grade	P10, P20, M10	P20, M10, M20	P30, M20, K10
Cutting speed v_c (m/min) (f.p.m)			
Indexable inserts Tool life: 15 min.	260 - 200 (850 - 655)	200 - 150 (655 - 490)	150 - 110 (490 - 360)
Brazed tools Tool life: 30 min.	210 - 170 (690 - 560)	170 - 130 (560 - 425)	140 - 90 (460 - 295)
Coated indexable inserts			
BÖHLERIT LC 225 C	up to 260 (850)	up to 220 (720)	up to 150 (490)
BÖHLERIT LC 235 C	up to 230 (755)	up to 180 (590)	up to 130 (425)
Tool angles for brazed tools			
Rake angle	12° - 15°	12° - 15°	12° - 15°
Clearance angle	6° - 8°	6° - 8°	6° - 8°
Inclination angle	0°	0°	-4°

Condition is soft annealed, guidelines



Milling with inserted tooth cutter

Feed mm/tooth (inch/tooth)	up to 0.2 (.008)	0.2 – 0.3 (.008 – .012)
Cutting speed v_c (m/min) (f.p.m)		
BÖHLERIT LW 225	220 – 200 (720 – 655)	140 – 60 (460 – 195)
BÖHLERIT SB40 / ISO P40	100 – 60 (330 – 195)	70 – 40 (230 – 130)
BÖHLERIT LC 444 W	140 – 110 (460 – 360)	–

Drilling with sintered carbide

Drill diameter mm (inch)	3 – 8 (.12 – .31)	8 – 20 (.31 – .80)	20 – 40 (.80 – 1.6)
Feed mm/rev. (inch/rev.)	0.02 – 0.05 (.001 – .002)	0.05 – 0.12 (.002 – .005)	0.12 – 0.18 (.005 – .007)
BÖHLERIT/ISO grade	HB10/K10		
Cutting speed v_c (m/min) (f.p.m)	50 – 35 (165 – 115)	50 – 35 (165 – 115)	50 – 35 (165 – 115)
Point angle	115° – 120°	115° – 120°	115° – 120°
Clearance angle	5°	5°	5°

Condition is soft annealed, guidelines

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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ONE STEP AHEAD.