BÖHLER

EDRO

PLASTIC
MOULD STEEL

PLASTIC MOLD STEEL

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 EXTREMLY 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

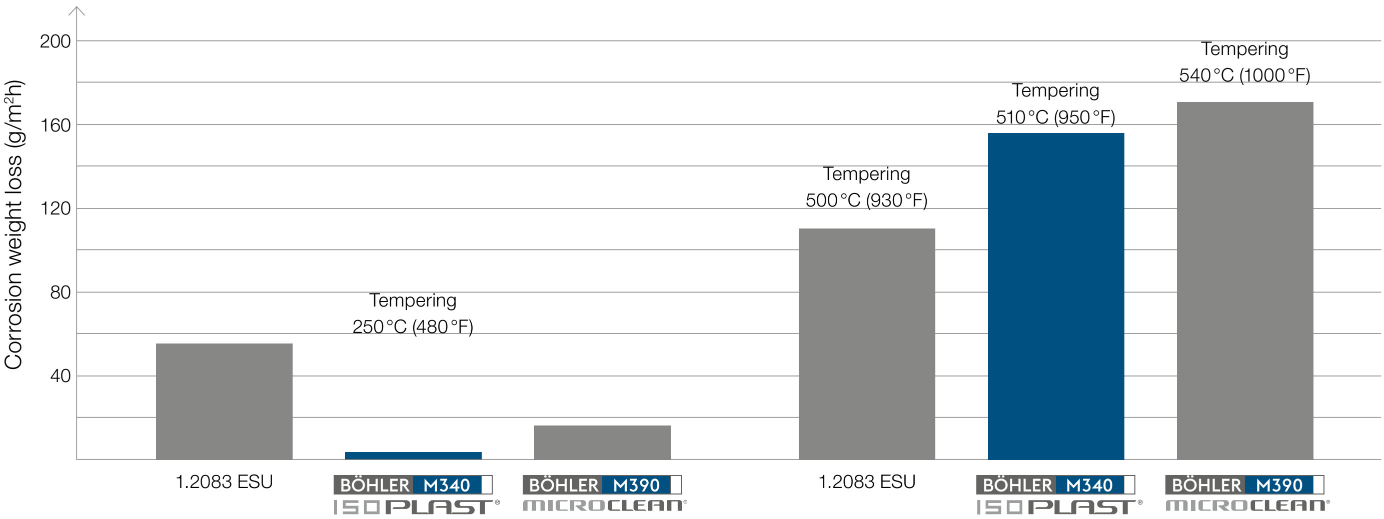
Comparison **BÖHLER M340 ISOPLAST** with WNr. 1.4112 – ESR. The fine, homogeneous microstructure results in good machinability and properties in service.

BÖHLER M340 ISOPLAST, 200X

WNR. 1.4112 – ESR, 200X

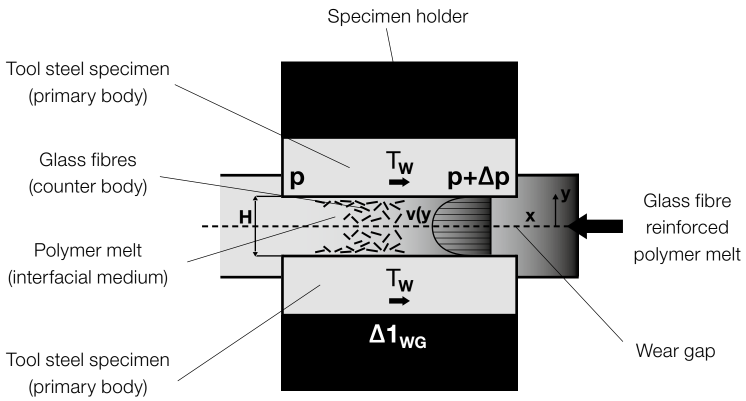
MATERIAL PROPERTIES

Corrosion resistance

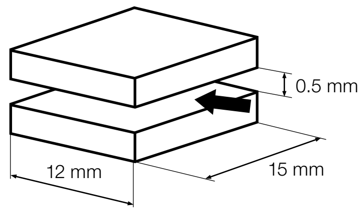


Heat treatment: without subzero treatment
Hardening temperature: 1.2083 at 1020 °C (1870 °F); M340 ISOPLAST at 1000 °C (1830 °F); M390 MICROCLEAN at 1150 °C (2100 °F)
Weight loss test: measured after 24h in 20% boiling acidic acid

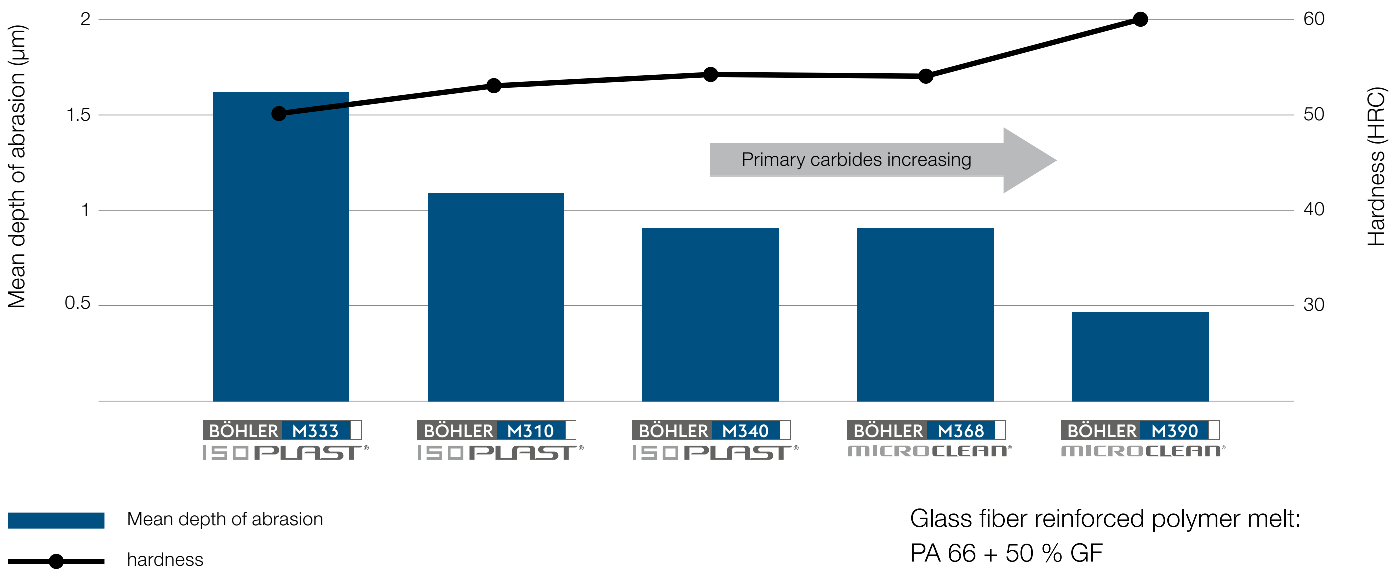
Small Plates Wear Tests



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



Wear resistance with plate-wear test



Glass fiber reinforced polymer melt:
PA 66 + 50 % GF

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 furnance.

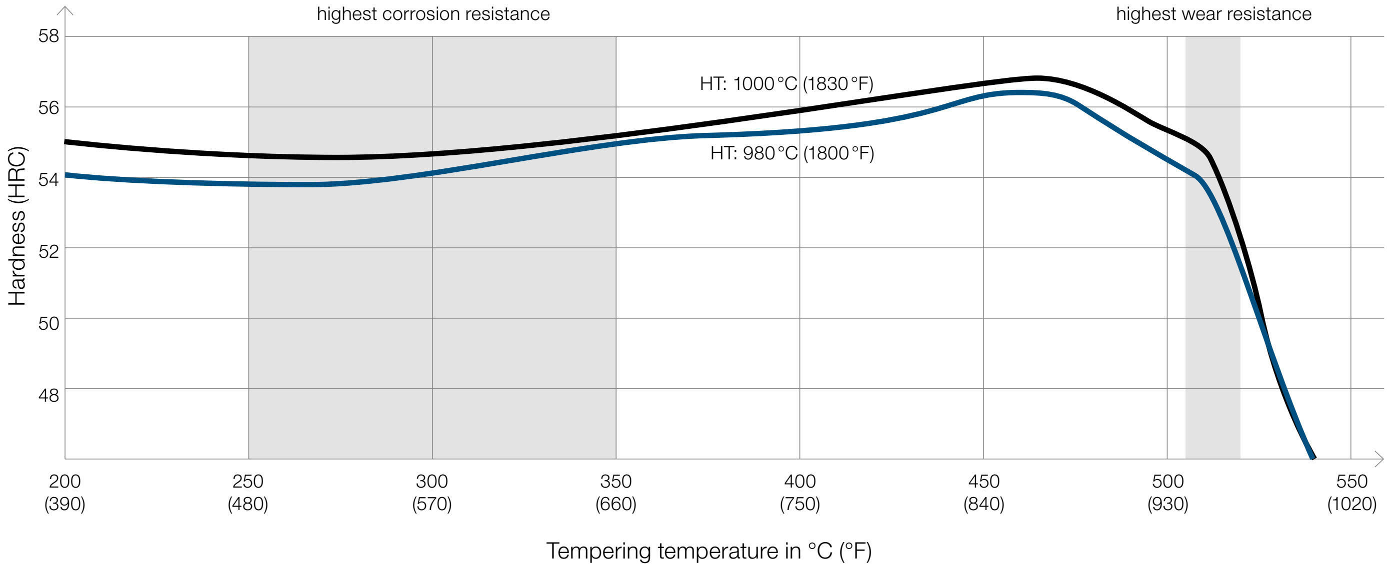
Hardening
- 980 to 1000 °C (1800 – 1830 °F) / N_2
- Holding time after temperature equalization: 15 to 30 minutes

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)

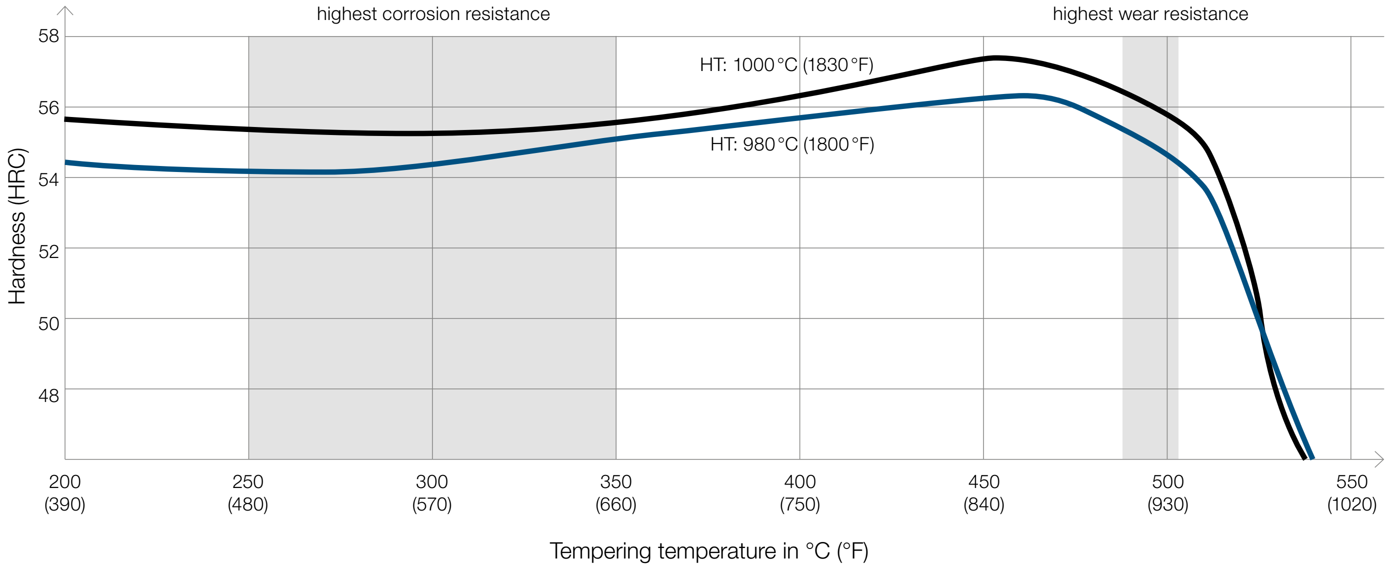
Tempering for highest wear resistance
- Deep freezing recommended
- A deep freezing treatment immediately following hardening leads to increased tempering hardness values [Risk of stress cracking]
- Slow heating to tempering temperature
- Time in furnace 1 hour for each 20 mm (0.79 inch) of workpiece 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 2 h

Tempering chart (with subzero treatment)

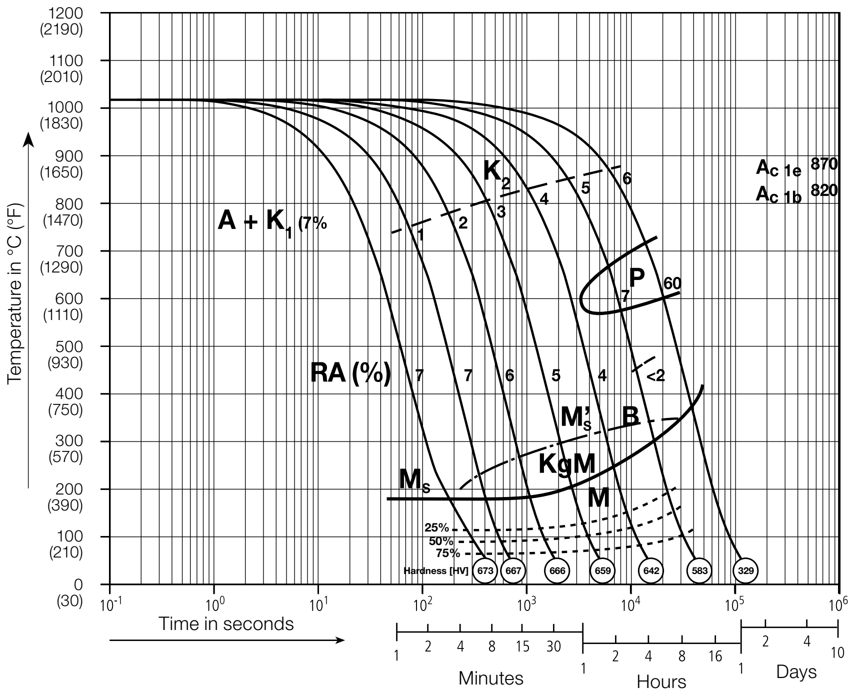


Heat treatment: Hardening in vacuum furnace; Tempering 3 x 2 h

Continuous cooling CCT curves

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

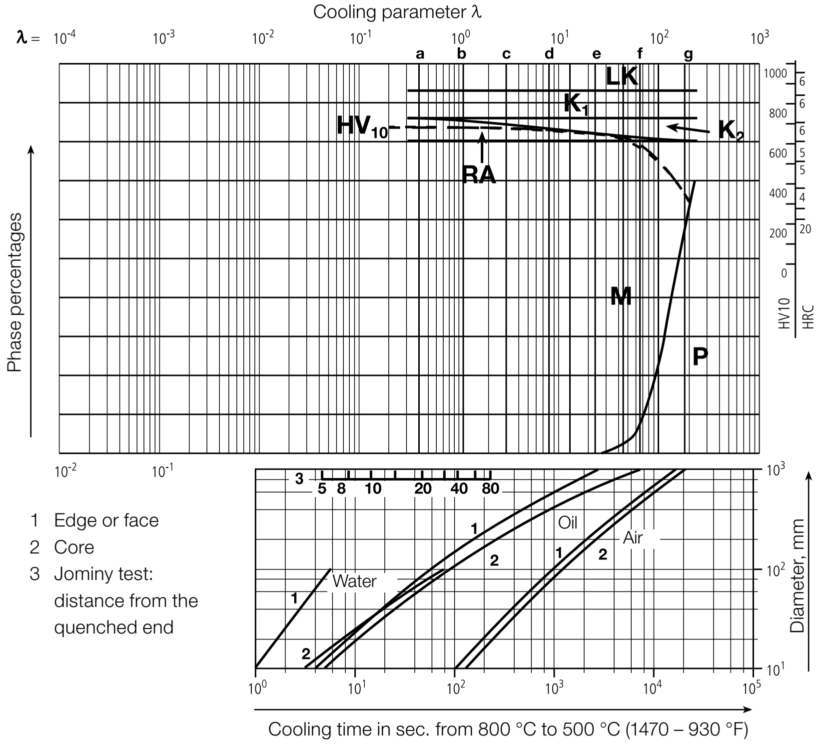
7…60	Phase percentages in %
0.4…180	Cooling parameter, i.e. duration of cooling from 800 – 500 °C (1470 – 930 °F) in s x 10^{-2}



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 68 °F	7.70 kg/dm³ 0.278 lbs/in³
Specific heat capacity at	20 °C 68 °F	460 J/(kg.K) 0.110 Btu/lb°F
Thermal conductivity at	20 °C 68 °F	18.2 W/(m.K) 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

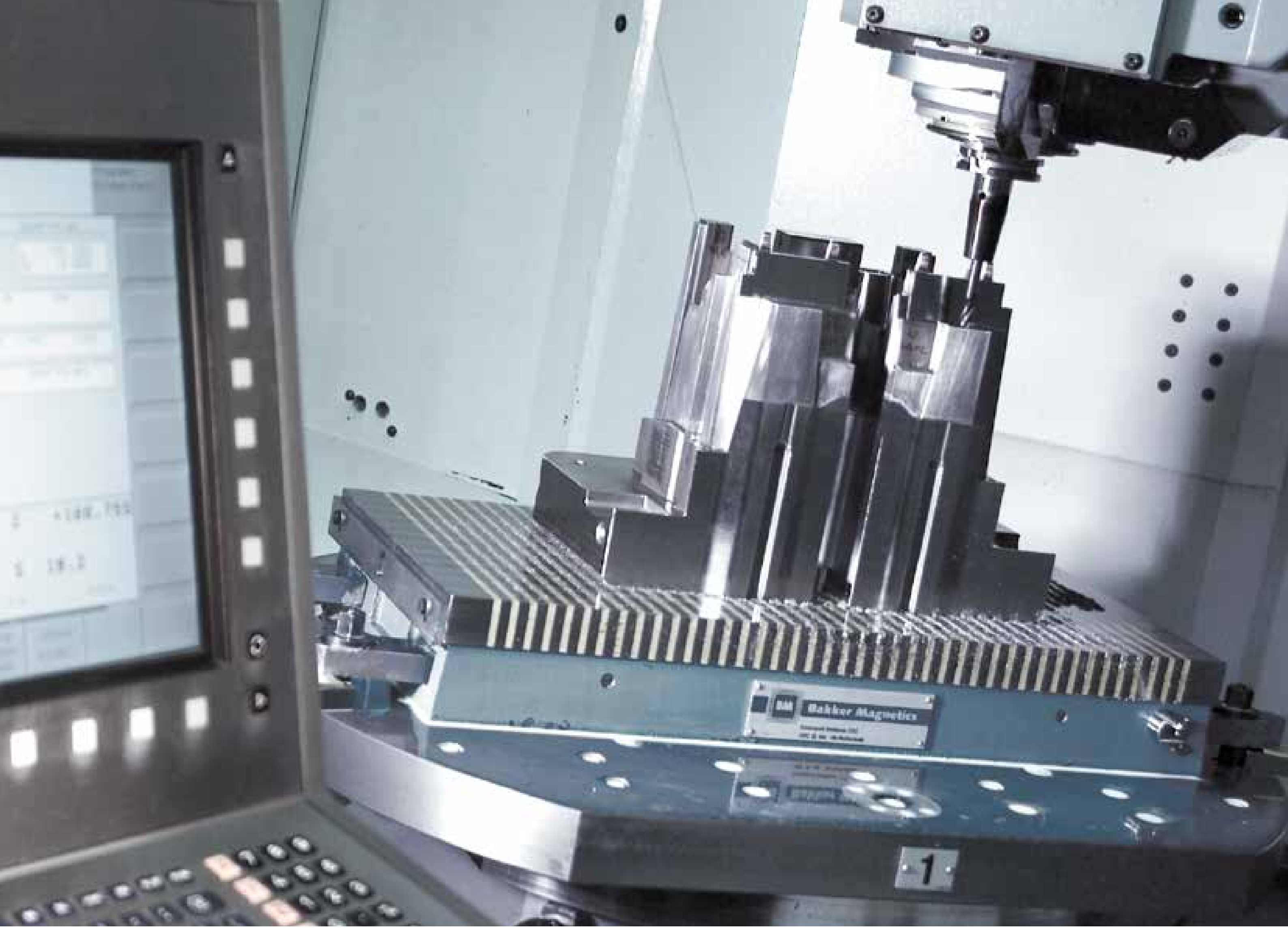
20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	
219	215	209	201	193	183	10^3 N/mm^2
68 °F	**210 °F**	**390 °F**	**570 °F**	**750 °F**	**930 °F**	
31.8	31.2	30.3	29.1	28.0	26.5	10^3 KSI

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** **BÖHLERIT LC 235 C**	 up to 260 (850) up to 230 (755)	 up to 220 (720) up to 180 (590)	 up to 150 (490) up to 130 (425)
Tool angles for brazed tools **Rake angle** **Clearance angle** **Inclination angle**	 12° – 15° 6° – 8° 0°	 12° – 15° 6° – 8° 0°	 12° – 15° 6° – 8° -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

MATERIALS | MOLD BASES | PVD COATINGS | ADDITIVE

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