BÖHLER

M310

KUNSTSTOFFFORMENSTAHL
PLASTIC MOULD STEEL

BÖHLER M310
ISOPLAST®

塑料模具钢

PLASTIC MOULD STEEL

钢材主要性能对照表

Qualitative comparison of the major steel properties

钢种 / Grade BÖHLER	耐磨性 Wear resistance	韧性 Toughness	抛光性 Polishability	供货硬度下的加工性能 Machinability in the as-supplied condition	供货硬度 Supplied condition
表面硬化态 / Case hardening steels*					
M100	+ +	+ +	+ +	+ + +	W / max. 205 HB
M130	+ +	+ +	+ +	+ +	W / max. 250 HB

钢种 / Grade BÖHLER	耐磨性 Wear resistance	韧性 Toughness	抛光性 Polishability	供货硬度下的加工性能 Machinability in the as-supplied condition	淬透性 Trough-hardenable	磨削性 Grainability	供货硬度 Supplied condition
调质态及沉淀硬化钢 / Hardened and tempered and precipitation hardened steels*							
M200	+ +	+	+	+ + +	+	+	V / 290 - 330HB
M201	+ +	+ +	+ +	+	+	+ + +	V / 290 - 330HB
M238	+ +	+ +	+ +	+	+ + +	+ + +	V / 290 - 330HB
M261 EXTRA	+ +	+	+	+ +	+ +	+	LA / ca./appr. 40 HRC
M461 EXTRA	+ +	+ + +	+ + +	+	+ +	+ + +	LA / ca./appr. 40 HRC

钢种 / Grade BÖHLER	耐腐蚀性 Corrosion resistance	耐磨性 Wear resistance	韧性 Toughness	抛光性 Polishability	供货硬度下的加工性能 Machinability in the as-supplied condition	供货硬度 Supplied condition
可热处理，耐腐蚀钢 / Hardenable, corrosion-resistant steels*						
M310 ISOPLAST	+ +	+ +	+	+ +	+ + +	最高至 225 HB
M330 VMR	+ +	+ +	+ +	+ +	+ + +	最高至 220 HB
M333 ISOPLAST	+ +	+ +	+ + +	+ + +	+ + +	最高至 220 HB
M340 ISOPLAST	+ + +	+ + +	+	+	+ +	最高至 260 HB
M390 MICROCLEAN	+ + +	+ + +	+ +	+ + +	+	最高至 280 HB
调质态耐腐蚀钢 / Heat treated, corrosion-resistant steels*						
M300 ISOPLAST	+ + +	+ +	+ +	+ + +	+	V / 900 - 1120 N/mm²
M314 EXTRA	+ +	+	+	+	+ +	V / ca./appr.1000 N/mm²
M315 EXTRA	+ +	+	+	+	+ + +	V / ca./appr.1000 N/mm²

*对每一组类型的钢材进行性能的描述 / The profiles given are characteristic of each group of steels

W = 软性退火态
V = 调质态，具有良好的机械性能
LA = 固溶退火及沉淀析出硬化态

W = soft annealed
V = hardened and tempered to obtain good mechanical properties
LA = solution annealed and precipitation hardened

性能

适用于塑料模具应用的高级马氏体不锈钢。

因为采用了电渣重熔的冶炼工艺，和严格控制的热加工和热处理过程，以及最优化的化学成分， BÖHLER M310 ISOPLAST 有以下优点：

- 高抛光性
- 高耐腐蚀性
- 良好的蚀刻性能
- 良好的加工性能
- 高耐磨性
- 优秀的气淬性能（100mm以内）

Properties

Advanced martensitic stainless chromium steel for plastic moulds.
Thanks to electroslag remelting, special measures in hot forming and heat treatment and optimization of chemical composition the
BÖHLER grade M310 ISOPLAST offers numerous advantages:

- Capability of taking a high polish
- Good corrosion resistance
- Good photoetching properties
- Good machinibilty
- High wear resistance
- Air hardenability up to 100 mm

应用

适用于化学侵蚀严重（如PVC）或耐磨性要求较高的模具。
由于具有非常优异的抛光性能，此种钢材特别适用于镜片模具和其他光学产品的生产，例如照相机和眼镜上的部件。

BÖHLER M310 ISOPLAST 与模架不锈钢BÖHLER M315 EXTRA 共同提供了完美的不锈模具方案。

Application

Moulds for chemically aggresive plastics (e.g. PVC) and plastics containing abrasive fillers.
Owing to its excellent polishability this grade is particularly suited for moulds of lenses and other kinds of optical products, such as spectacles, camera parts.
BÖHLER M310 ISOPLAST provides together with the stainless mould frame steel
BÖHLER M315 EXTRA the PERFECT STAINLESS PLASTIC MOULD.

化学成分（平均值%） / Chemical composition (average %)				
C	Si	Mn	Cr	V
0,38	0,70	0,45	14,25	0,20

标准 / Standards

DIN	EN	AISI	UNS
~ 1.2083 ~ X42Cr13	X40Cr14	~ 420	~ S42000

UNE	JIS	UNI	AFNOR
~ F5263 ~ X40Cr13	~ SUS 420J2	~ X41Cr13KU	~ Z40C14

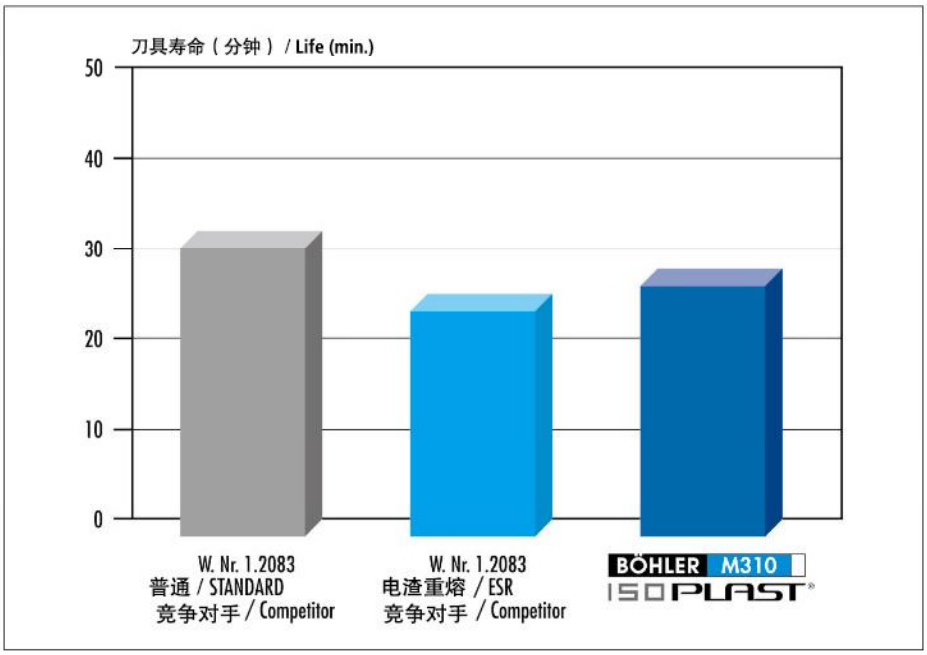
GOST
~ 40Ch13

机加工–车削

状态：退火
切削速度：180m/min
磨损量：0.2mm

Machining - Turning

Condition: annealed
Cutting speed: 180 m/min
Wear: 0,2 mm

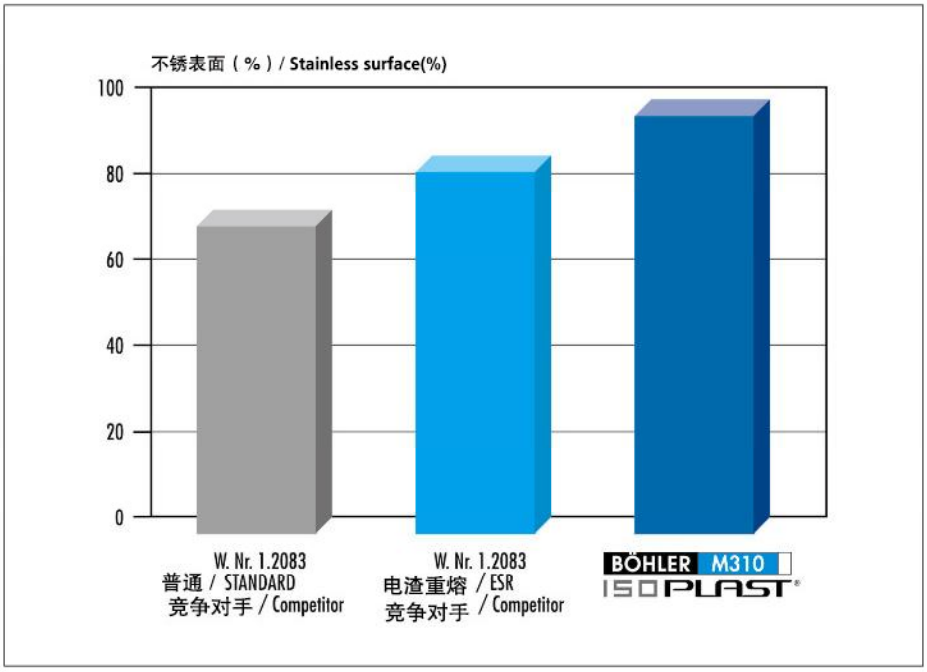


耐蚀性

盐雾测试（德国工业标准50021）
状态：淬火回火态

Corrosion resistance

Salt spray test (DIN 50021)
Condition: hardened and tempered

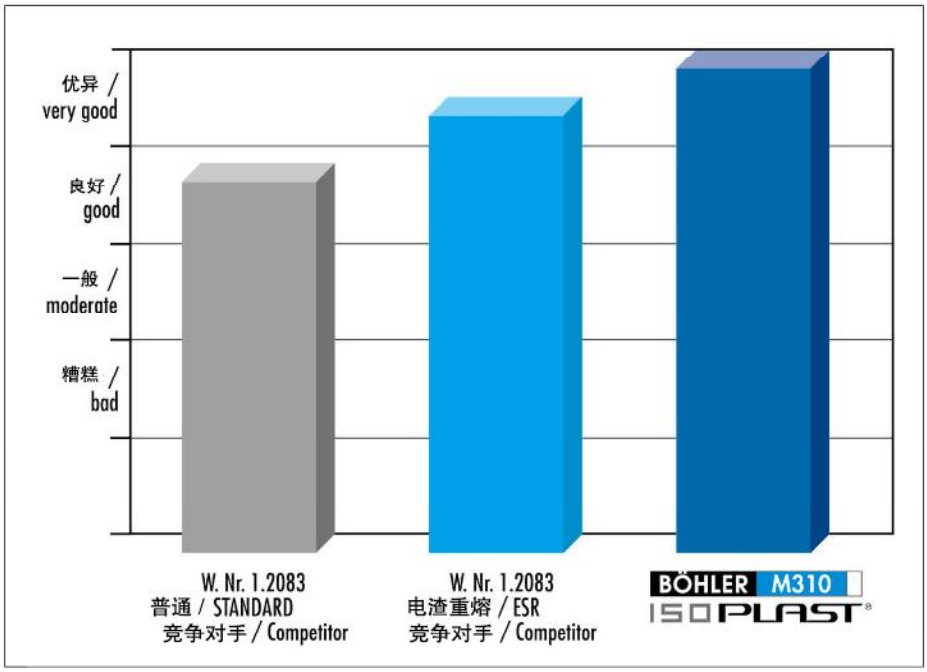


抛光性

状态：淬火回火态

Polishability

Condition: hardened and tempered



优异：
无宏观和微观缺陷

very good:
absence of macroscopic and micrscopic defects

良好：
无宏观缺陷
但有可见微观缺陷

good:
free from macroscopic defects,
however microscopic defects are visible

一般：
可见宏观缺陷

moderate:
macroscopic defects are visible

糟糕：
严重的表面侵蚀，可见
明显宏观缺陷

bad:
heavily impaired surface finish, macroscopic defects
may be detected even with unpractised eyes

热成形

锻造

1050 到 850℃（1922 到 1562°F）
炉中或保温材料中缓冷。

Hot forming

Forging:

1050 to 850°C (1922 to 1562°F)
Slow cooling in furnace or thermoinsulating material.

热处理

退火：

840 到 870℃（1544 到 1598°F）
10–20℃/hr (50–68°F/hr) 的冷速缓冷至大约600℃后，继续空冷。
退火态硬度：**大约225HB**

Heat treatment

Annealing:

840 to 870°C (1544 to 1598°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 (approx. 1112°F), further cooling in air.
Hardness after annealing: **approx. 225 HB.**

应力消除：

大约650℃（1202°F）
热透后，在中性气氛中保温1–2小时或在炉中缓冷。

Stress relieving:

approx. 650 °C (1202°F)
After through heating, soak for 1 to 2 hours in neutral atmosphere/slow cooling in furnace.

淬火：

1000 至 1050℃（1832 到 1922°F）
油淬、空淬、气淬
温度平衡后，保温:15–30分钟

Hardening:

1000 to 1050°C (1832 to 1922°F) / Oil, air, gas
Holding time after temperature equalization: 15 to 30 minutes.

回火：

100 到 250℃（212 到 482°F）
淬火后，立即缓慢加热至回火温度（每20mm保温1小时，至少2小时）/ 空冷。

回火后的平均硬度值，请参考回火曲线图。

Tempering:

100 to 250°C (212 to 482°F)
Slow heating to tempering temperature immediately after hardening / time in furnace 1 hour for each 20 mm of workpiece thickness but at least 2 hours / cooling in air.
For average hardness figures to be obtained please refer to the tempering chart.

补焊：

不建议补焊。
如果焊接无法避免，请咨询我们的焊接工程师或卡芬贝格工厂的焊接技术部门。

Repair welding

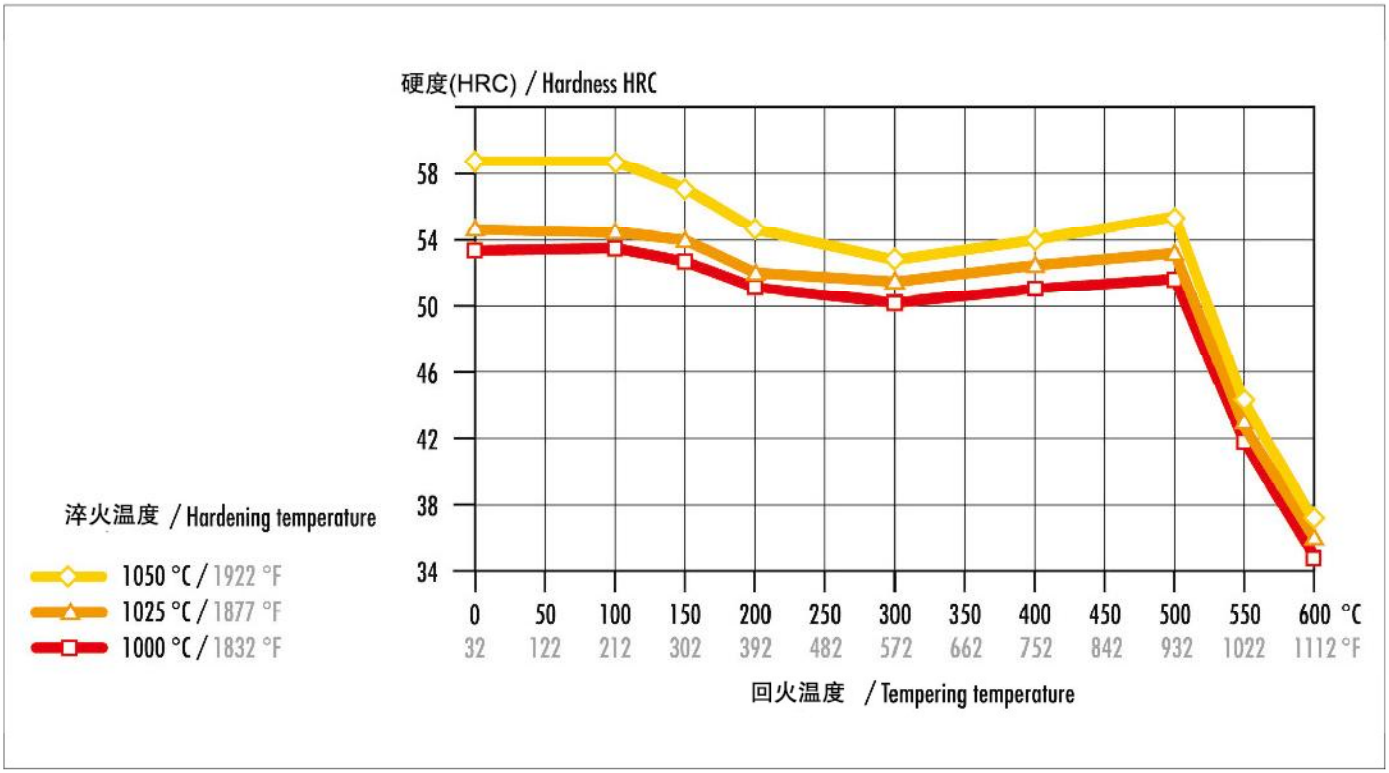
Welding is not to be recommended.
If it cannot be avoided, please consult our welding engineers or our Welding Technologie Department at Kapfenberg works.

回火曲线图

样品尺寸：20*20mm²

Tempering chart

Spezimen size: square 20 mm

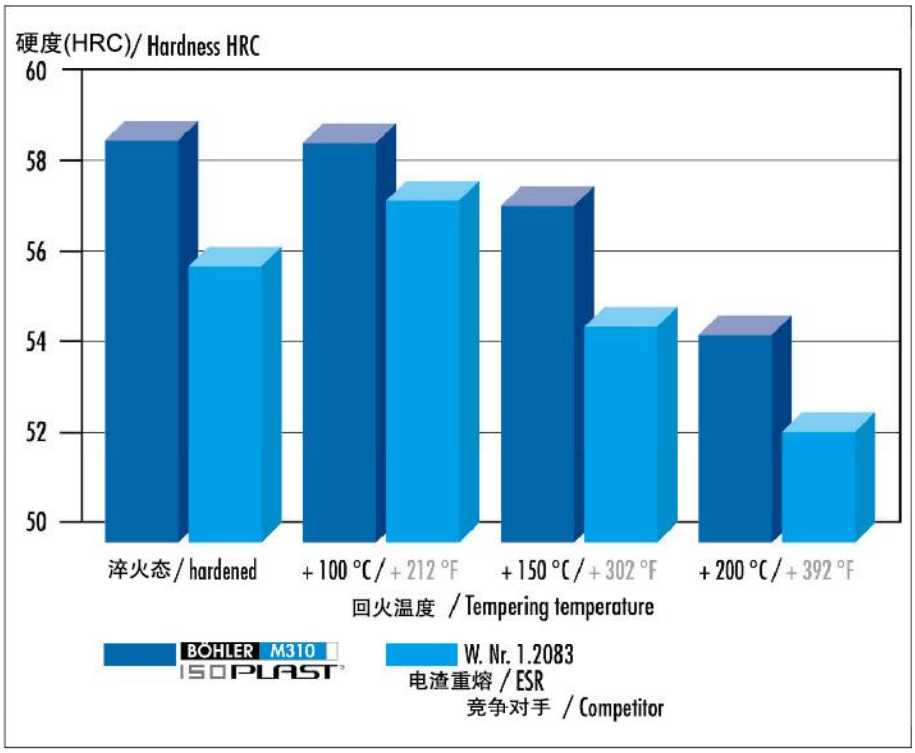


回火后的硬度 – 与竞争对手产品对比

淬火温度：1050℃

Hardness after tempering - Comparison with competitor

Hardness temperature: 1050°C (1922°F)



CCT曲线图

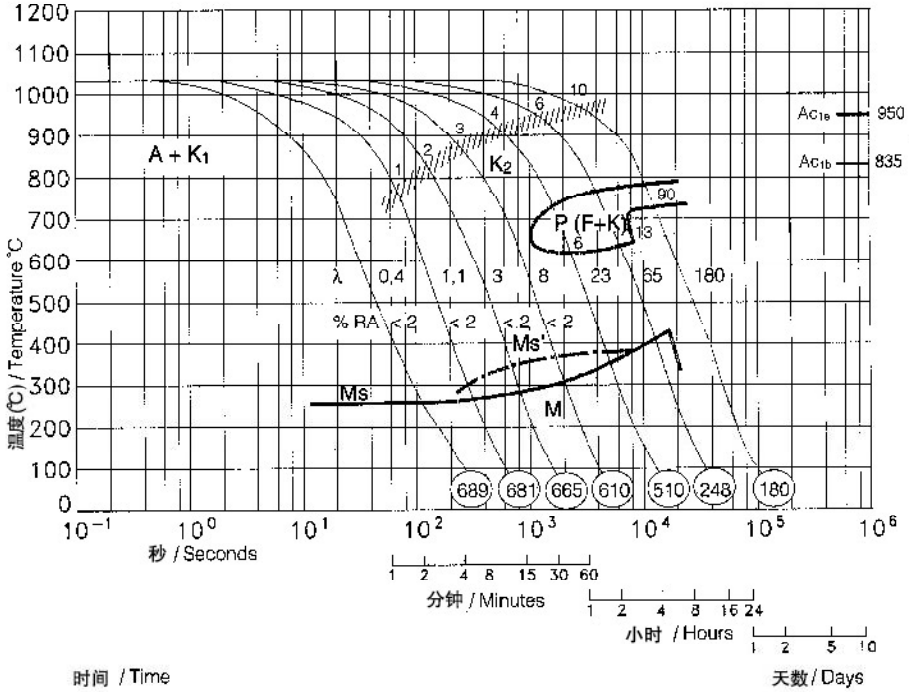
Continuous cooling CCT curves

奥氏体化温度：1025℃
保温时间：30分钟

维氏硬度
1 ... 90 相百分比
0,4 ··· 180 冷却参数，即由800℃冷却到500℃所需时间，单位：秒 x 10^{-2}
K_1... 奥氏体化过程中未溶碳化物含量(8%)
K_2... 冷却过程中形成的新碳化物含量
Ms-Ms':马氏体形成温度范围

Austenitising temperature: 1025°C (1877°F)
Holding time: 30 minutes

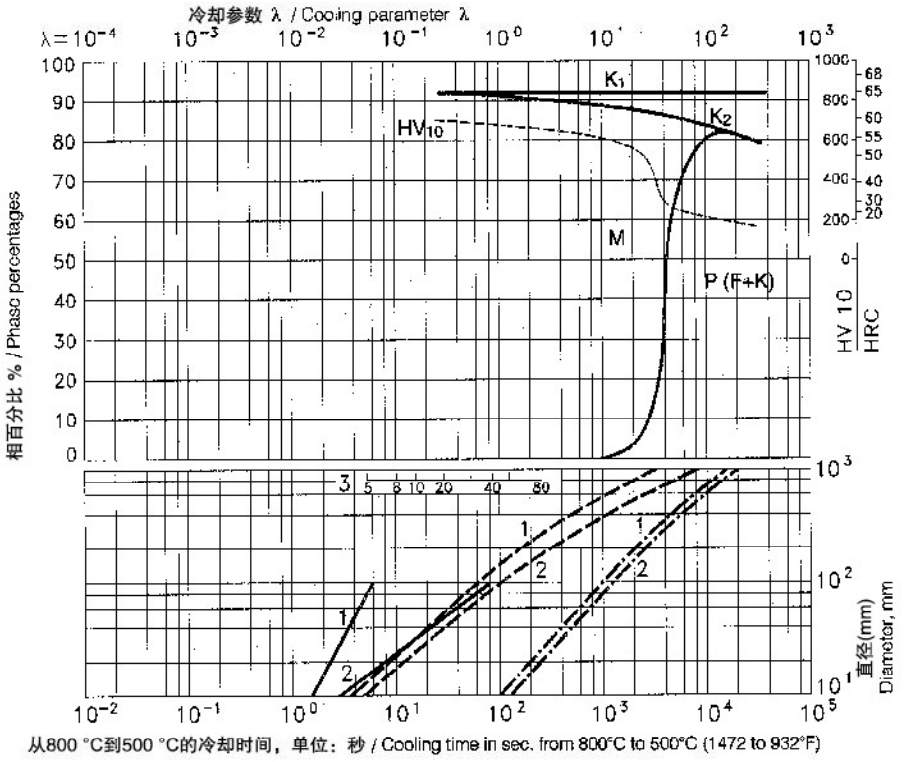
◯ Vickers hardness
1 . . . 90 phase percentages
0.4 . . . 180 cooling parameter, i.e. duration of cooling from 800-500°C (1472-932°F)in s x 10^{-2}
K_1.... carbides not dissolved during austenitization (8%)
K_2.... carbides newly formed during cooling
Ms-Ms'...range of grain boundary martensite formation



定量相图

Quantitative phase diagram

A.... 奥氏体 / Austenite
F.... 铁素体 / Ferrite
K.... 碳化物 / Carbide
M.... 马氏体 / Martensite
P.... 珠光体 / Pearlite



— 水冷 / Water cooling
- - - 油冷 / Oil cooling
-•- 空冷 / Air cooling

1 .... 边缘或表面 / Edge or face
2 .... 心部 / Core
3 .... 乔米尼试验：到表面的距离 / Jominy test: distance from the face end

机加工建议

退货态，平均值

硬质合金刀具车削			
车削深度 mm	0,5 – 1	1 – 4	4 – 8
进给量 mm / rev	0,1 – 0,2	0,2 – 0,4	0,3 – 0,6
BÖHLER牌号	SB10,SB20, EB10	SB20, EB10, EB20	SB30, EB20, HB10
国际标准牌号	P10, P20, M10	P10, M10, M20	P30, M20, K10
		切削速度 vc m/min (f.p.m)	
镶嵌硬质合金刀片 刃口寿命: 15 min	260 – 200	200 – 150	150 – 110
钎焊硬质合金刀具 刃口寿命: 30 min	210 – 170	170 – 130	140 – 90
涂覆镶嵌硬质合金刀片 刃口寿命: 15 min BOEHLERIT ROYAL 121 BOEHLERIT ROYAL 131	 – 240 – 210	 – 210 – 160	 – 160 – 140
钎焊硬质合金刀具的切削角度 前角 后角 倾角	 12 – 15° 6 – 8 0°	 12 – 15° 6 – 8 0°	 12 – 15° 6 – 8 - 4°

高速钢刀具车削			
车削深度 mm	0,5	3	6
进给量 mm / rev	0,1	0,5	1,0
BÖHLER牌号高速钢刀具	S700 / DIN S10-4-3-10		
		切削速度 vc m/min (f.p.m)	
刃口寿命: 60 min	55 – 45	45 – 35	35 – 25
前角 后角 倾角	14 – 18° 8 – 10° 0°	14 – 18° 8 – 10° 0°	14 – 18° 8 – 10° 0°

硬质合金刀具铣削		
进给量 mm / tooth	– 0,2	0,2 – 0,3
	切削速度 vc m/min (f.p.m)	
BOEHLERIT SBF/ ISO P25	160 – 100	110 – 60
BOEHLERIT SB40/ ISO P40	100 – 60	70 – 40
BOEHLERIT ROYAL 131 / ISO P35	140 – 110	140 – 110

硬质合金刀具钻孔			
钻孔直径 mm	3 – 8	8 – 20	20 – 40
进给量 mm / rev	0,02 – 0,05	0,05 – 0,12	0,12 – 0,18
BÖHLER 牌号/国际标准牌号	HB10/K10	HB10/K10	HB10/K10
		切削速度 vc m/min (f.p.m)	
	50 – 35	50 – 35	50 – 35
顶角	115 – 120°	115 – 120°	115 – 120°
倾角	5°	5°	5°

BÖHLER M310 ISOPLAST®

Recommendation for machining

(Condition annealed, average values)

Turning with carbide tipped tools			
depth of cut mm	0,5 to 1	1 to 4	4 to 8
feed, mm/rev.	0,1 to 0,2	0,2 to 0,4	0,3 to 0,6
BOEHLERIT grade	SB10, SB20, EB10	SB20, EB10, EB20	SB30, EB20, HB10
ISO grade	P10, P20, M10	P10, M10, M20	P30, M20, K10
		cutting speed, m/min	
indexable carbide inserts edge life 15 min	260 to 200	200 to 150	150 to 110
brazed carbide tipped tools edge life 30 min	210 to 170	170 to 130	140 to 90
hardfaced indexable carbide inserts edge life 15 min BOEHLERIT ROYAL 121 BOEHLERIT ROYAL 131	 to 240 to 210	 to 210 to 160	 to 160 to 140
cutting angles for brazed carbide tipped tools rake angle clearance angle angle of inclination	 12 to 15° 6 to 8° 0°	 12 to 15° 6 to 8° 0°	 12 to 15° 6 to 8° - 4°

Turning with HSS tools			
depth of cut, mm	0,5	3	6
feed, mm/rev.	0,1	0,5	1,0
HSS-grade BÖHLER/DIN	S700 / DIN S10-4-3-10		
		cutting speed, m/min	
edge life 60 min	55 to 45	45 to 35	35 to 25
rake angle clearance angle angle of inclination	14 to 18° 8 to 10° 0°	14 to 18° 8 to 10° 0°	14 to 18° 8 to 10° 0°

Milling with carbide tipped cutters		
feed, mm/tooth	to 0,2	0,2 to 0,3
	cutting speed, m/min	
BOEHLERIT SBF/ ISO P25	160 to 100	110 to 60
BOEHLERIT SB40/ ISO P40	100 to 60	70 to 40
BOEHLERIT ROYAL 131 / ISO P35	140 to 110	140 to 110

Drilling with carbide tipped tools			
drill diameter, mm	3 to 8	8 to 20	20 to 40
feed, mm/rev.	0,02 to 0,05	0,05 to 0,12	0,12 to 0,18
BOEHLERIT / ISO-grade	HB10/K10	HB10/K10	HB10/K10
		cutting speed, m/min	
	50 to 35	50 to 35	50 to 35
top angle	115 to 120°	115 to 120°	115 to 120°
clearance angle	5°	5°	5°

物理性能 Physical properties

密度 /
Density at 20°C (68°F) ..... 7,68 .....kg/dm^3

热传导率 /
Thermal conductivity at 20°C (68°F) ..... 19,5 .....W/(m.K)

比热 /
Specific heat at 20°C (68°F) ..... 460 .....J/(kg.K)

电阻率 /
Electrical resistivity at 20°C (68°F)..... 0,65 .....Ohm.mm^2/m

弹性模量 /
Modulus of elasticity at 20°C (68°F) ..... 217 x 10^3 ...N/mm^2

带磁性能 / ..... **具有磁性**
Magnetic properties ..... magnetic

20℃–...℃范围内热膨胀系数（10^{-6} m/(m.k)）/ Thermal expansion between 20°C (68°F) and ...°C (°F), 10^{-6} m/(m.K) at				
100°C (212°F)	200°C (392°F)	300°C (572°F)	400°C (752°F)	500°C (932°F)
10,6	10,9	11,3	11,7	12,0

弹性模量，10^3 N/mm^2 Modulus of elasticity, 10^3 N/mm^2 at				
20°C (68°F)	100°C (212°F)	200°C (392°F)	300°C (572°F)	400°C (752°F)
217	213	206	198	190

如希望了解资料中未充分说明的应用和加工程序，请随时咨询。

As regards applications and processing steps that are not expressly mentioned in this product description/data sheet, the customer shall in each individual case be required to consult us.

采用无氯漂白纸张 无环境污染 / Printed on chlorine-free bleached paper having no polution effects

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