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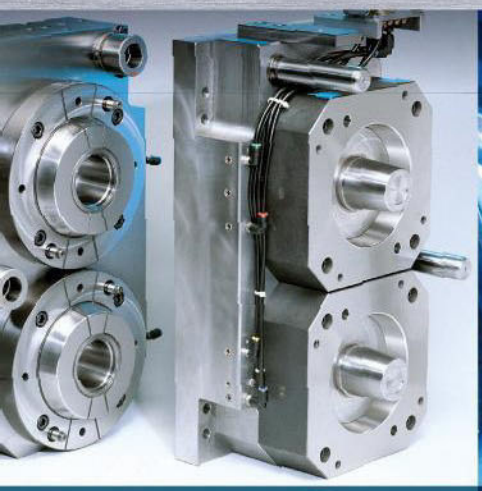
服务无止境 德松模具钢



热作模具钢

HOT WORK TOOL STEEL

BÖHLER W360

ISOBLOC®

德松模具钢
DESON STEEL

热作模具钢 / HOT WORK TOOL STEEL

高硬度热作模具钢
HOT WORK TOOL STEEL WITH HIGH HARDNESS

BÖHLER W360 ISOBLOC 是一种特别研发的锻造模具钢。这种钢材可用于对硬度和韧性均有较高要求的多种应用领域。

BÖHLER W360 ISOBLOC *was developed as a tool steel for dies and punches in warm and hot forging. The steel can be used for a variety of applications where hardness and toughness are required.*

性能特点

- 高硬度（硬度推荐范围：52 – 57 HRc）
- 优异的韧性
- 优秀的抗回火软化性能
- 优良的热传导性
- 可水冷
- 均匀的微观组织

Properties

- *High hardness (recommended in use: 52 – 57 HRc)*
- *Exceptional toughness*
- *High temper resistance*
- *Good thermal conductivity*
- *Can be cooled with water*
- *Homogeneous microstructure*

应用和用途

- 温、热锻模具及冲头
- 高速压力加工
- 高韧性要求的冷作模具
- 挤出工具（例如：挤出模）
- 压铸模具的型芯和镶件
- 塑料加工业中的特定应用

Applications and uses

- *Dies and punches in warm and hot forging*
- *Tooling for high speed presses*
- *Toughness-critical cold work applications*
- *Extrusion tooling, e.g. dies*
- *Core pins and inserts in die-casting dies*
- *Specific applications in the plastic processing sector*

BÖHLER W360 ISOBLOC 应市场的需求研制和生产，兼具高速钢的高硬度和热作模具钢的极佳韧性。这些特性可显著提高模具的使用寿命。

BÖHLER W360 ISOBLOC *has been developed to meet the requirements of the market and has the combined advantages of the high hardness of a high speed steel with the very good toughness of a hot work tool steel. These are characteristics which can significantly increase the life-time of your tool.*

电渣重熔工艺保证了钢材的高纯净度，从而获得了最佳的材料性能。

Electroslag remelting ensures a high metallurgical cleanliness and therefore best material properties

德松模具钢
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用事实说话
THE COMPARISON SPEAKS FOR ITSELF

BÖHLER W360 ISOBLOC的卓越性能得益于其获得专利的合金成分和电渣重熔工艺。

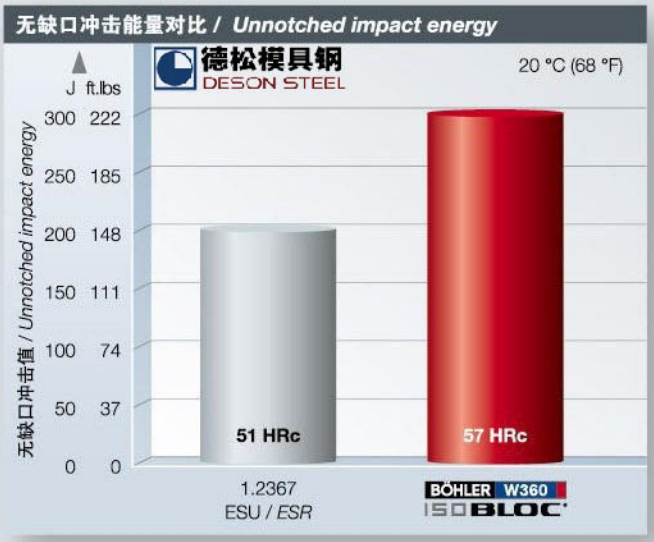
BÖHLER W360 ISOBLOC owes its excellent properties to a patented alloying concept and the electroslag remelting process.

韧性

韧性是热作模具钢最重要的性能之一，用以避免模具开裂并且提高抗热龟裂和热冲击的性能。高硬度通常意味着低韧性，但这种情况在W360 ISOBLOC中却不存在。

Toughness

The toughness of hot work tool steels is one of the most important properties for safety against fracture and increased resistance to heat-checking and thermal shock. High hardness is usually associated with low toughness. This is not the case for W360 ISOBLOC.



在高硬度情况下，BÖHLER W360 ISOBLOC的韧性明显比1.2367 ESR高出很多。

BÖHLER W360 ISOBLOC has a significantly higher toughness than 1.2367 ESR – at a higher hardness.

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钢材主要性能比较
COMPARISON OF THE MAJOR STEEL PROPERTIES

热硬度

除了出色的韧性，W360 ISOBLOC还具有卓越的热稳定性。这反映在材料热负荷下高的热硬度和稳定性。这些特性可确保W360 ISOBLOC优异的抗热疲劳性能，并可避免模具灾难性失效的发生。

Hot hardness

Alongside the outstanding toughness, W360 ISOBLOC is distinguished by its high thermal stability. This is reflected in the high hot hardness and the stability of the material under thermal loading. These properties, combined in W360 ISOBLOC, ensure a high resistance to thermal fatigue and catastrophic failure.

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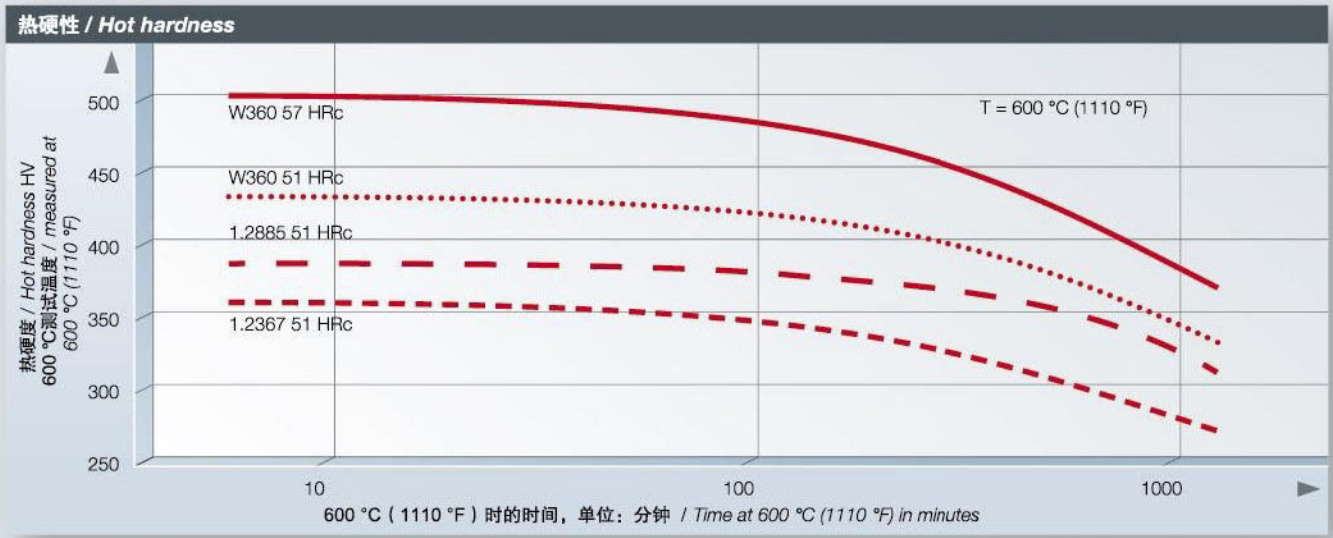
热硬性 / *Hot hardness*



51 HRc时，BÖHLER W360 ISOBLOC的热硬度高于1.2885和1.2367。如果BÖHLER W360 ISOBLOC的硬度增加到57 HRc，则热硬度进一步提高。

At 51 HRC, BÖHLER W360 ISOBLOC has a higher hot hardness than 1.2885 and 1.2367. If the hardness of BÖHLER W360 ISOBLOC is increased to 57 HRc, then the result is a further increase in the hot hardness.

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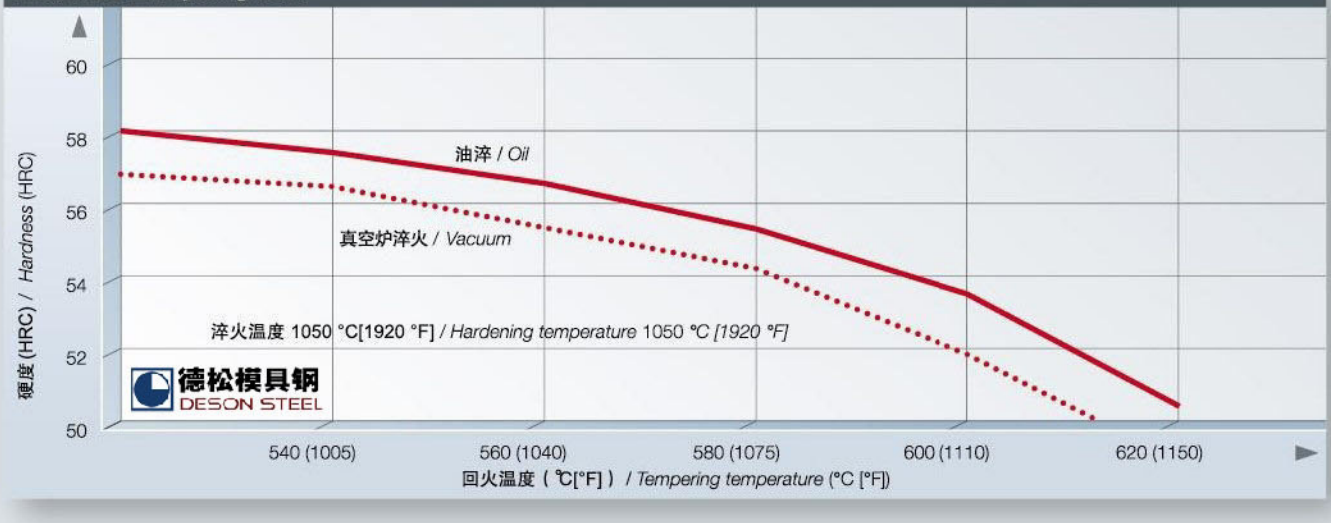
获取最佳性能的热处理工艺流程
BEST PROPERTIES

热处理流程图 / *Heat treatment sequence*

回火曲线图 / *Tempering chart*



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化学成份与物理性能
NUMBERS, DATA, FACTS

从实验室到客户

BÖHLER把工具的成本效益视为模具钢开发过程中的一大核心加以考虑。

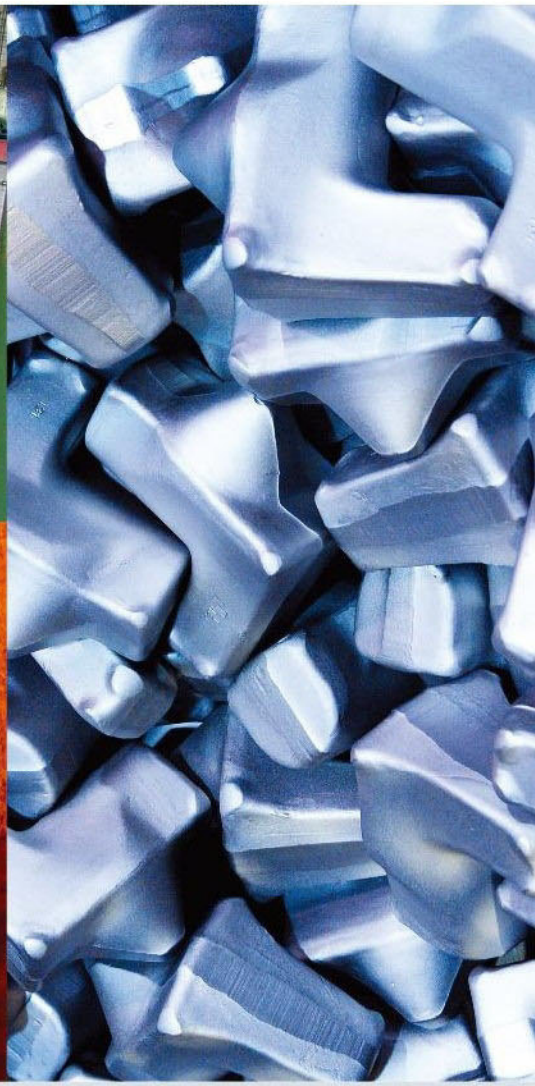
BÖHLER W360 ISOBLOC之数据和图表一览。

From laboratory to customer

BÖHLER recognises cost effectiveness of tooling as a central concern during the development process.

The facts and figures of BÖHLER W360 ISOBLOC at a glance.

化学成分（平均值%） / *Chemical composition (average %)*					
C	Si	Mn	Cr	Mo	V
0,50	0,20	0,25	4,50	3,00	0,55



物理性能 / *Physical properties*	
状态：淬火+回火 / *Condition: hardened and tempered*	
密度 (20 °C) / *Density at 20 °C* *Density at 68 °F*	7,6 kg/dm^3 0.274 lbs/in^3
电阻率 (20 °C) / *Electrical resistivity at 20 °C* *Electrical resistivity at 68 °F*	0,59 Ohm.mm^2/m 0.98 x 10^{-3} Ohm circular-mil per ft

20 °C（68 °F）到 ... °C（°F）时的热膨胀系数 / *Thermal expansion between 20 °C (68 °F) and ... °C (°F)*							
100 °C	200 °C	300 °C	400 °C	500 °C	600 °C	700 °C	
11,1	11,5	11,9	12,3	12,8	13,2	13,6	10^{-6} m/(m.K)
210 °F	390 °F	570 °F	750 °F	930 °F	1110 °F	1290 °F	
6.2	6.4	6.6	6.8	7.1	7.3	7.6	10^{-6} in/in °F

热传导系数 Btu/ft h°F / *Thermal conductivity Btu/ft h°F*						
	100 °C	200 °C	300 °C	400 °C	500 °C	德松模具钢 DESON STEEL
	31,5	32,3	32,6	32,5	31,9	in W/(m.K)
	210 °F	390 °F	570 °F	750 °F	930 °F	
	18.2	18.7	18.8	18.8	18.4	Btu/ in/ft^2 h°F

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热处理
NUMBERS, DATA, FACTS

供货状态
• 退火态，硬度最高205 HB

热处理

退火
• 750 - 800 °C（1380 to 1470 °F），保温时间：6–8小时
• 以10-20 °C/ h（50-68 °F/ h）随炉慢冷到600 °C（1110°F）左右，然后空冷。

应力消除
• 650-700 °C（1200-1290°F）
• 热透后，中性气氛中保温1-2小时。
• 炉内缓慢冷却。

淬火
• 1050℃（1920°F）/油冷，盐浴（500-550℃（930-1020°F）），空冷，真空炉气体淬火
• 热透后，保温15–30分钟

回火（参照回火曲线图）
淬火后立刻缓慢加热至回火温度。炉内保温时间以工件厚度计算，每20mm保温1小时，但最少2小时。空冷。建议回火至少三次。

Supplied condition
• *Annealed, 205 HB max.*

Heat treatment

Annealing
• *750 bis 800 °C (1380 to 1470 °F), Holding time 6 to 8 hours*
• *Slow, controlled cooling in furnace at a rate of 10 to 20 °C/h (50 to 68 °F/h) down to approx. 600 °C (1110 °F), further cooling in air.*

Stress relieving
• *650 bis 700 °C (1200 to 1290 °F)*
• *After through-heating, soak for 1 to 2 hours in a neutral atmosphere.*
• *Cool slowly in furnace.*

Hardening
• *1050 °C (1920 °F)/oil, salt bath 500 bis 550 °C (930 to 1020 °F), air, vacuum furnace with gas quenching*
• *Holding time after through-heating: 15 to 30 minutes*

Tempering (according to tempering chart)
Slowly heat to tempering temperature immediately after hardening. Time in furnace: 1 hour for every 20 mm of workpiece thickness but at least 2 hours. Cool in air. We recommend that the steel be tempered at least 3 times.

CCT曲线图 / *Continuous cooling CCT curves*

奥氏体化温度：1050 °C（1920°F）
保温时间：30分钟

5 ··· 100　相含量百分比%

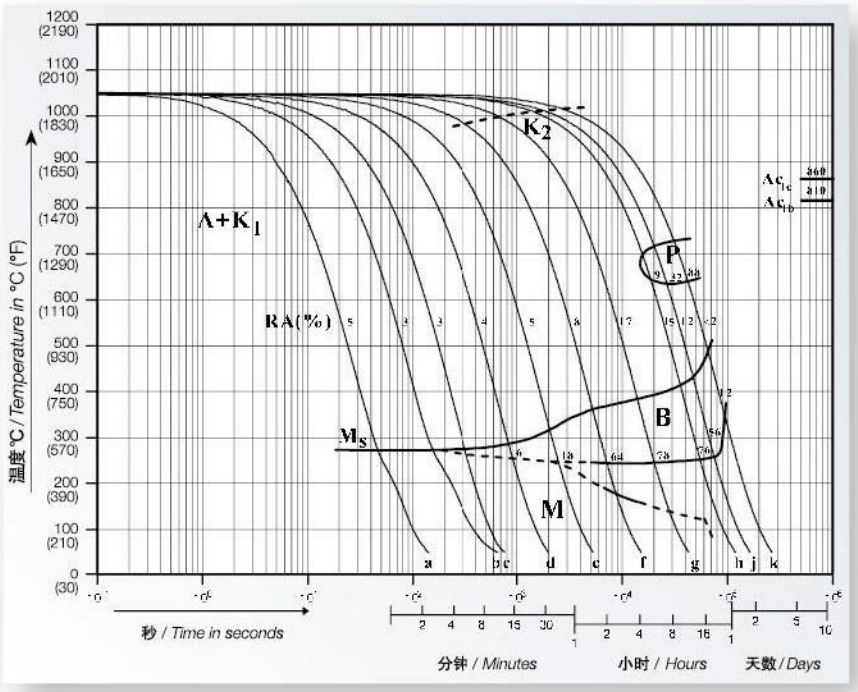
0,15 ... 400 冷却参数（λ），即从800℃（1470°F）到500℃（930°F）的冷却时间，单位：秒 x 10^{-2}

Austenitizing temperature: 1050 °C (1920 °F)
Holding time: 30 minutes

5 ... 100 phase percentages

0.15 ... 400 cooling parameter (λ), i.e. duration of cooling from 800 – 500° C (1470 – 930 °F) in s x 10^{-2}

试样 / *Sample*	λ	HV_{10}
a	0,15	785
b	0,50	760
c	1,10	762
d	3,00	754
e	8,00	724
f	23,00	582
g	65,00	498
h	180,00	453
j	250,00	415
k	400,00	294



定量相图 / *Quantitative phase diagram*

$K_{1,2}$	碳化物 / *Carbide*
RA	残余奥氏体 / *Retained austenite*
A	奥氏体 / *Austenite*
M	马氏体 / *Martensite*
P	珠光体 / *Perlite*
B	贝氏体 / *Bainite*

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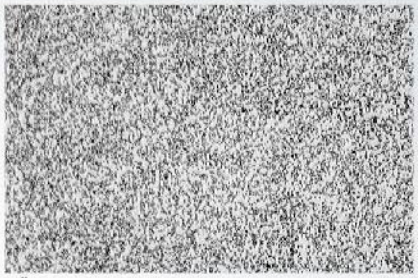
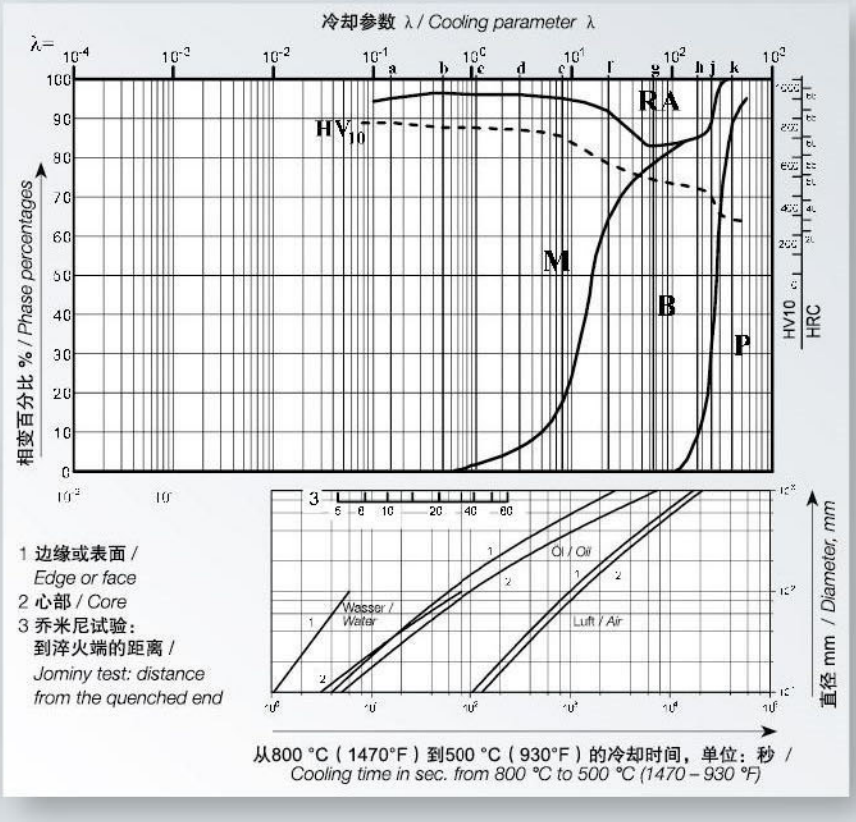
退火态显微组织 / *Annealed microstructure*





机加工建议
MACHINING RECOMMENDATIONS

德松模具钢 DESON STEEL

状态：退火态，表中数据仅供参考

硬质合金刀具车削				
车削深度 mm	0,5 – 1	1 – 4	4 – 8	≥ 8
进给量 mm/U	0,1 – 0,3	0,2 – 0,4	0,3 – 0,6	0,5 – 1,5
BOEHLERIT–牌号	SB10, SB20	SB10, SB20, SB30	SB30, EB20	SB30, SB40
ISO–牌号	P10, P20	P10, P20, P30	P30, M20	P30, P40
	切削速度 v_c（m/min）（f.p.m）			
可转位硬质合金刀具 刃口寿命：15 min	310 – 200	220 – 130	180 – 100	120 – 50
钎焊硬质合金刀具 刃口寿命：30 min	260 – 150	210 – 100	130 – 85	90 – 50
涂覆硬质合金可转位刀具 刃口寿命：15 min				
BOEHLERIT ROYAL 121	– 300	– 270	– 195	– 125
BOEHLERIT ROYAL 131	– 240	– 175	– 135	– 70
钎焊硬质合金的切削角度				
后角	6° – 8°	6° – 8°	6° – 8°	6° – 8°
前角	12°	12°	12°	12°
倾角	0°	-4°	-4°	-4°

高速钢刀具车削					
车削深度 mm	0,5	3	6	10	≥10
进给量 mm/U	0,1	0,5	1,0	1,5	≥1,5
BOEHLERIT/DIN–牌号	S700/DIN S10-4-3-10				
	切削速度 v_c（m/min）（f.p.m）				
寿命：60 min	45 – 30	30 – 22	22 – 18	18 – 12	16 – 8
前角	14°	14°	14°	14°	14°
后角	8°	8°	8°	8°	8°
倾角	0°	0°	-4°	-4°	-4°

硬质合金刀片铣削				
进给量 mm / tooth（inch / tooth）	– 0,2	0,2 – 0,4		
	切削速度 v_c（m/min）（f.p.m）			
BOEHLERIT SBF / ISO P25	150 – 100	110 – 60		
BOEHLERIT SB40 / ISO P40	100 – 60	70 – 40		
BOEHLERIT ROYAL 131 / ISO P35	130 – 85			

镶嵌硬质合金刀具钻孔				
钻头直径 mm	3 – 8	8 – 20	20 – 40	
进给量 mm / rev.（inch/rev.）	0,02 – 0,05	0,05 – 0,12	0,12 – 0,18	
BOEHLERIT / ISO-Hartmetallsorte	HB10/K10	HB10/K10	HB10/K10	
	切削速度 v_c（m/min）（f.p.m）			
	50 – 35	50 – 35	50 – 35	
顶角	115 – 120°	115 – 120°	115 – 120°	
后角	5°	5°	5°	

Condition: annealed, figures given are guidelines only

Turning with sintered carbide				
Depth of cut mm (inches)	0.5 – 1 (.02 – .04)	1 – 4 (.04 – .16)	4 – 8 (.16 – .31)	over 8 (over .31)
Feed mm / rev. (inches/rev.)	0.1 – 0.3 (.004 – .012)	0.2 – 0.4 (.008 – .016)	0.3 – 0.6 (.012 – .024)	0.5 – 1.5 (.020 – .060)
BOEHLERIT grade	SB10, SB20	SB10, SB20, EB10	SB30, EB20	SB30, SB40
ISO grade	P10, P20	P10, P20, M10	P30, M20	P30, P40
	Cutting speed v_c m/min (f.p.m)			
Indexable inserts Tool life: 15 min.	310 – 200 (1015 – 655)	220 – 130 (720 – 425)	180 – 100 (590 – 330)	120 – 50 (395 – 165)
Brazed carbide tools Tool life: 30 min.	260 – 150 (850 – 490)	210 – 100 (690 – 330)	130 – 85 (425 – 280)	90 – 50 (295 – 165)
Coated indexable inserts Tool life: 15 min.				
BOEHLERIT ROYAL 121	up to 300 (980)	up to 270 (885)	up to 195 (640)	up to 125 (410)
BOEHLERIT ROYAL 131	up to 240 (790)	up to 175 (575)	up to 135 (445)	up to 70 (230)
Tool angles for brazed carbide tools				
Clearance angle	6° – 8°	6° – 8°	6° – 8°	6° – 8°
Rake angle	12°	12°	12°	12°
Inclination angle	0°	-4°	-4°	-4°

Turning with high speed steel					
Depth of cut mm (inches)	0.5 (.02)	3 (.12)	6 (.24)	10 (.40)	over 10 (.40)
Feed mm / rev. (inches/rev.)	0.1 (.004)	0.5 (.020)	1.0 (.040)	1.5 (.060)	over 1.5 (.060)
HSS-grade BÖHLER/DIN	S700 / DIN S10-4-3-10				
	Cutting speed v_c m/min (f.p.m)				
Tool life: 60 min.	45 – 30 (150 – 100)	30 – 22 (100 – 70)	22 – 18 (70 – 60)	18 – 12 (60 – 40)	16 – 8 (50 – 25)
Rake angle	14°	14°	14°	14°	14°
Clearance angle	8°	8°	8°	8°	8°
Inclination angle	0°	0°	-4°	-4°	-4°

Milling with inserted tooth cutter				
Feed mm/tooth (inches/tooth)	up to 0.2 (.008)	0.2 – 0.4 (.008 – .016)		
	Cutting speed v_c m/min (f.p.m)			
BOEHLERIT SBF / ISO P25	150 – 100 (490 – 330)	110 – 60 (360 – 195)		
BOEHLERIT SB40 / ISO P40	100 – 60 (330 – 195)	70 – 40 (230 – 130)		
BOEHLERIT ROYAL 131 / ISO P35	130 – 85 (425 – 280)			

Drilling with inserted carbide				
Drill diameter mm (inches)	3 – 8 (.12 – .31)	8 – 20 (.31 – .80)	20 – 40 (.80 – 1.6)	
Feed mm / rev. (inches/rev.)	0.02 – 0.05 (.001 – .002)	0.05 – 0.12 (.002 – .005)	0.12 – 0.18 (.005 – .007)	
BOEHLERIT/ISO grade	HB10 / K10	HB10 / K10	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°	

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官网：www.diesteelchina.com

销售：sales@diesteelchina.com

投诉：admin@diesteelchina.com

东莞：东莞市长安镇沙头靖海永福科技园

深圳：深圳市宝安区沙井新二村新二大道