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具有先进技术的钻石及CBN砂轮

Thanks for selecting YUBAO, the diamond and CBN Wheels, manufactured under advance technology.



深圳市玉寶鑽石工具有限公司
SHENZHEN YUBAO DIAMOND TOOLS CO., LTD.

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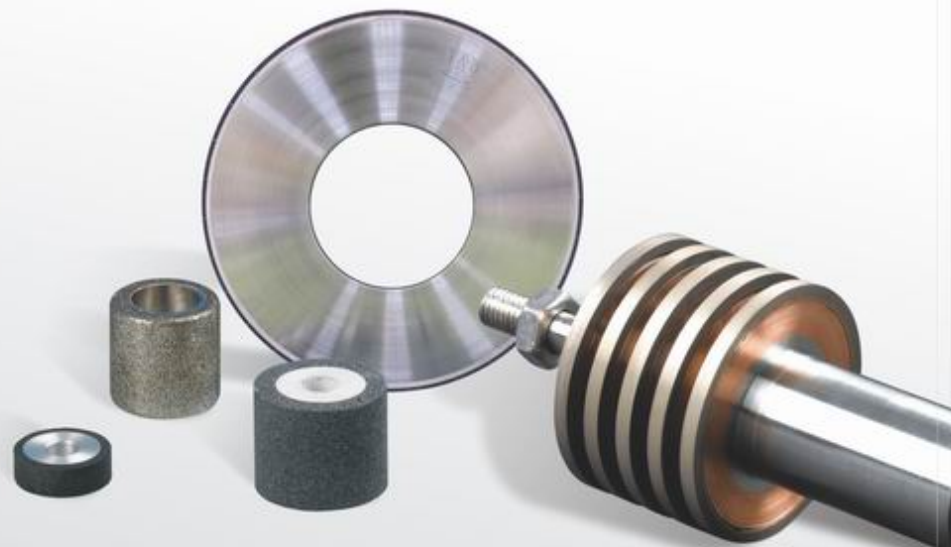
厂址: 中国·深圳·宝安·沙井·大王山富美达工业区
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专业钻石及CBN砂轮制造商
Professional manufacturer of diamond and CBN wheels



深圳市玉寶鑽石工具有限公司
SHENZHEN YUBAO DIAMOND TOOLS CO., LTD.

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好事不再难磨!™ Grinding to perfection-Difficult task made easy!

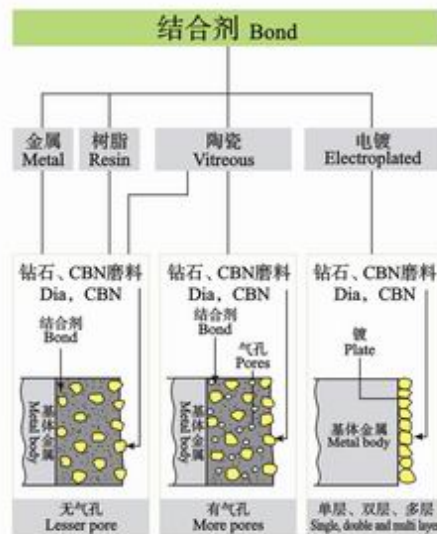
- ◆ 1996年10月得到台湾专家的指导, 开始针对珠宝厂家生产出第一片电镀钻石砂轮。
October, 1996 - With the guidance of experts from Taiwan, Yu Bao start to manufacture the electroplated diamond wheels provide to jewelry manufacturing industry.
- ◆ 1997年7月2号个体工商户执照申请注册成立——玉宝金刚石工具加工场。
2nd July, 1997 - Business license for Yu Bao Diamond Tools Processing successfully apply by Yu Bao.
- ◆ 1999年7月注册——玉宝金刚石工具厂。
July, 1999 - Register as Yu Bao Diamond Tools.
- ◆ 1999年8月投资福建古田玉宝金刚石刀具厂, 专业做切割石材类的锯片。
August, 1999 - Invest in a diamond tools factory named Fulian GuTian Yu Bao Diamond Tools. This factory specialized in manufacturers of stone cutting saw.
- ◆ 2004年4月引进进口设备, 投产金属结合法砂轮和树脂结合法砂轮。
April, 2004 - Import new processing equipment to produce the Metal Bond Wheel and Resin Bond Wheel.
- ◆ 2005年11月引进进口设备, 投产陶瓷结合法砂轮。
November, 2005 - Import new processing equipment to produce the Vitrified Bond Wheel.
- ◆ 2005年聘请台湾技术专家做厂长。
2005 - Hire Taiwanese technical expert as the factory director.
- ◆ 2006年深圳市玉宝钻石工具有限公司注册成立。
2006 - Register as Shen Zhen Yu Bao Diamond Tools Co. Ltd.
- ◆ 2009年营业部迁往至东莞。
2009-sales department moved to Dongguan.
- ◆ 2010年在江西购地设厂。
2010-buy a land to set up factory in Jiangxi.

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结合剂的种类 Bond	研磨特性 Feature
电镀法 Electroplated	高磨料率, 研磨效率佳, 但加工面粗。任何复杂形状或极小砂轮均可制造。 High efficiency, Good grinding performance, Rough finishing surface. Ease manufacturing of difficult and minimum type wheel.
树脂结合法 Resin	良好耐热性, 耐磨性、富弹性、加工面佳、不易产生碎屑。 Excellent heat-resistance, Good grinding performance, Elasticity, good finishing surface, Good wear-resistance, Not easy produce chips.
陶瓷结合法 Vitreous	砂轮有气孔, 散热性佳, 加工精度高, 容易修整, 适用范围广。 Having pores, Excellent heat-resistance, High efficiency, Easy dressing, Application to many fields.
金属结合法 Metal	砂轮形状保持力佳, 抗磨耗性大, 但研磨效率较差。 Good shape maintenance Good wear-resistance, Poor grinding efficiency, Long tool life.

结合剂种类及特征 Type and feature of bond



各种结合剂的物理特性 The physical properties of different bond



结合剂 Bond	符号 Symbol	磨削能力 Grinding performance	寿命 Lifespan
电镀 Electroplated	P	强 Strong	短 Short
树脂结合剂 Resin	B	中 Medium	中 Medium
陶瓷结合剂 Vitreous	V	弱 Weak	长 Long
金属结合剂 Metal	M	强 Strong	长 Long



钻石及CBN磨料适用加工材质 Application of diamond & CBN

■ 钻石有很强的硬度，非常适宜加工以下材质
Diamond has highest hardness, so it's suitable to process material as follows:

■ 立方氮化硼是由硼、氮两元素合成，很适合加工钢铁系列制品
CBN is made of B and N, So it's suitable to process steel product.

钻石 Diamond		立方氮化硼 CBN
锗 Ge	硅 silicon	高速工具钢 SKH
玻璃 glass	碳 carbon	工具钢 SK
铸铁 cast iron	塑料 plastics	合金工具钢 SKS
石英 quartz	橡胶 rubber	轴承钢 SUJ
水晶 crystal	石墨 graphite	不锈钢 SUS
宝石 stone	滑石 speckstone	铬钢 Cr
沥青 pitch	花岗石 granite	模具钢 die steel
石棉 asbestos	大理石 marble	铝镍钴磁合金 Alnico magnetic alloy
砷化镓 GaAs	混凝土 concrete	坡莫合金 permalloy
超硬合金 carbide	聚晶材料 polycrystalline material	铁硅铝磁合金 iron silicon aluminum alloy
铁氧磁体 ferrite	铁碳化钛 iron titanium material	耐热钢 SUH
金属陶瓷 cermet	铁钛合金 iron alloy	混合合金钢 SCM, SNCM, SCr
丙烯酸树脂 Acrylic	稀土类磁石 rare earth magnet	耐热合金 heart-resistance alloy
强化玻纤 glass fibre	喷射合金 jet alloy	镍铬铁合金 Nichrome
耐火材料 refractory	传统普通砂轮 traditional common wheel	钛合金 Titanium
喷射涂层 spray coating	加强塑料 FRP	特殊铸铁 special cast iron
碳化物工具 carbide tools		镍基合金 Nickel alloy
聚晶立方氮化硼 PCBN		钨铬钴合金 stellite
聚晶金刚石 PCD		金属涂层 metal coating
陶瓷(氧化物和非氧化物) ceramics		英高镍 Inconel

● 由于工业钻石是由碳组成，所以它的制品不适宜用于研磨钢材。研磨产生的高温使钢材中的碳和钻石反应，钻石颗粒会碳化。
Industrial diamond was made of carbon, so its product not suitable to grind steel. The high temperature produced by grinding will make diamond grain carbonization.

● 立方氮化硼对磨削硬度45HRC以上钢铁类的产品很有效果
CBN has excellent effect on steel products whose hardness are higher than 45HRC



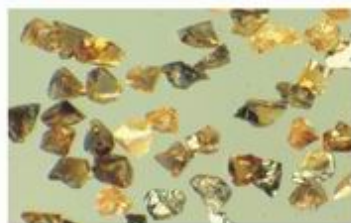
深圳市玉宝钻石工具有限公司砂轮技术及使用调查表 Questionnaire of SHENZHEN YUBAO DIAMOND TOOLS Co.,Ltd

客户名称: Customer name		联系人(Attn):	出货日期: Delivery date	使用人(User):
目前使用的钻石及CBN砂轮规格、尺寸: Description of your current wheel size				
电铸P法 <input type="checkbox"/> Electroplated wheels	型迹 Types	规格 Specifications	粒度 Grit Size	单价 Unit Price
树脂B法 <input type="checkbox"/> Resin bond wheels			月用量 Monthly Usage	厂牌 Brand
金属M法 <input type="checkbox"/> Metal bond wheels				
陶瓷V法 <input type="checkbox"/> Vitrified bond wheels				
现有砂轮加工状态及改善意见: Processing status and improving opinion		简图: Wheel sketch		
磨床名称(Machine brand)		机床型号(Machine model)		
工件名称 Work name				
材质名称 Material				
工件特殊处理 Treatment				
工件材质硬度 Workpiece hardness	HP			
研磨方式及马力 Grinding method and horse power				
研磨部位及尺寸 Grinding parts and dimension	每次进刀量 Depth of cut		粗磨(Coarse grinding)	次mm
			中磨(Medium grinding)	次mm
			细磨(Smooth grinding)	次mm
要求面粗度 (工件表面光洁度) Surface roughness	Ra	Rz	Ramx	砂轮线速度 Wheel speed
总研削量(余量) Stock grinding	mm	研磨液种类 Coolant		M/min
要求真圆度 Roundness	mm	粗研磨(Raw grinding)		m/min
要求平行度 Depth parallelism	mm	细研磨(Smooth grinding)		m/min
工件R角要求 Workpiece Angle R	mm	修整砂轮 Dressing wheel	<input type="checkbox"/> 水性的 water <input type="checkbox"/> 油性的 oil <input type="checkbox"/> 干磨Dry grinding <input type="checkbox"/> 合成油 Synthetic oil <input type="checkbox"/> 太古油 Pacific oil	
修整进刀量 Dressing feed	次		mm	
注意事项: Remarks				

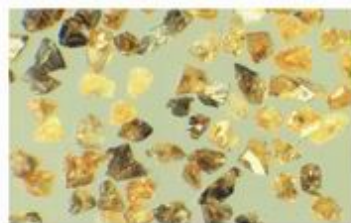


集中度的认识 Concentration

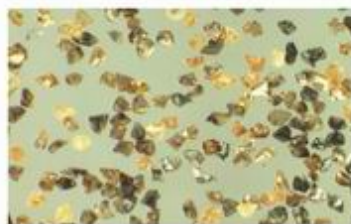
磨料集中度对比图 Concentration comparison chart



50集中度: 12.5v%
50concentration: 12.5V%



100集中度: 25v%
100concentration: 25V%



150集中度: 37.5v%
150concentration: 37.5V%



200集中度: 50v%
200concentration: 50V%

集中度的选择 Selection of concentration:

钻石和CBN精密研磨工具的性能很大程度上取决于集中度，即磨料与结合剂的体积比。
The grinding performance of diamond and CBN tools largely depends on concentration, namely the proportion of diamond or CBN in the unit volume

高集中度(125%-200%) High concentration (125%-200%)

成型研磨及形状稳定
Form grinding and stable shape

粗颗粒磨料(80#, 100#以下的粗磨料)
Coarse grain (under 80#, 100#)

磨料层宽度低于5mm
Rim width under 5mm

深切缓进研磨、如CNC多轴研磨设备
Creep feed grinding such as CNC multi-axis

超低集中度(25%-50%) Extra low concentration (25%-50%)

抛光研磨
Finishing grinding

特细颗粒(微粉磨料)800#以上的细磨料
Extra fine grain (above 800#)

磨料层特宽(如磨盘)
Extra wide rim width (such as grinding table)

一般集中度(50%-100%) Average concentration (50%-100%)

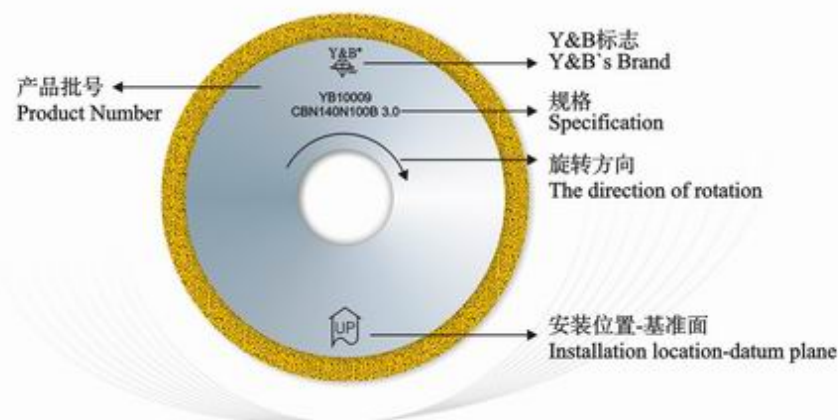
平面磨削、外圆研磨、工具和刀具研磨的干湿磨
Surface grinding, cylindrical grinding, wet and dry grinding of tools and cutting tools.

细颗粒磨料(230#, 270#以上的细磨料)
Fine grain (above 230#, 270#)

磨料层比较宽的
Wide rim width



钻石及CBN砂轮标示说明 Diamond and CBN wheels designation

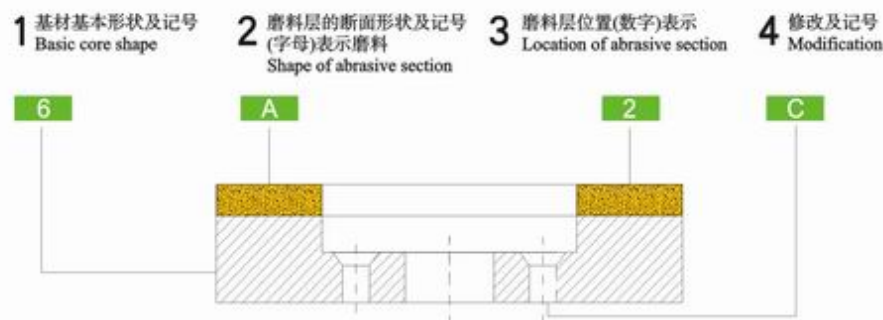


CBN	140	N	100	B	14A1	3.0
磨料 Abrasive	粒度 Grit size	硬度 Hardness grade	集中度 Concentration	结合法 Bond	形状 Shape	磨料层厚度 Thickness
D-天然钻石 D-nature diamond	16 200	J软 soft	25低low	(M)金属法 Metal	参 看 标 准 形 状 Please see the standard shape	1.5
SD-合成钻石 SD-synthetic diamond	20 230 30 270 40 325	L	50 75	(B)树脂法 Resin		2
SDC-金属被覆钻石 SDC-coating diamond	50 400 60 600 80 800	N	100 125	(P)电镀法 Electroplated		3 5
CB-立方氮化硼 CB-cubic boron nitride	100 1000 120 1500	R	150 175	(V)陶瓷法 Vitrified		8
CBN-金属被覆氮化硼 CBN-coating CBN	140 2000 170 3000	T硬 hard	200高high	(HB)硬焊法 Weld		10



玉宝砂轮形状的表达方法 Designation example of YUBAO wheels

■ 标示范例: 6A2C
Example: 6A2C



■ 基材基本形状及记号
Basic core shape and symbol

记号 Symbol	形状 Shape
1	
2	
3	
4	
6	
9	
11	
12	
14	
15	

■ 磨料层的断面形状及记号
Abrasive section shape and code

记号 Symbol	断面形状 Shape	记号 Symbol	断面形状 Shape	记号 Symbol	断面形状 Shape
[A]		[EE]		[LL]	
[AH]		[ET]		[M]	
[B]		[F]		[P]	
[BT]		[FF]		[Q]	
[C]		[G]		[QQ]	
[CH]		[GN]		[R]	
[D]		[H]		[S]	
[DD]		[J]		[U]	
[E]		[K]		[V]	
[ER]		[L]		[Y]	



磨料层位置及记号 Location and symbol of abrasive section

■ 磨料层位置(数字)表示 Location of abrasive section

记号 Symbol	位置 Location	形状 Shape	定义 Description
1	外周 Periphery		磨料层位于基材的周边, 并延伸至整个砂轮厚度(轴向), 其厚度可大于、等于或小于磨料层的宽度(径向), 基材的一个或多个外凸台不计放砂轮厚度(对此定义而言) The abrasive layer is along the outer edge of base material of the wheel (axial direction) throughout its thickness. Its thickness can be larger or smaller than or equal to the width of abrasive layer (radial direction). The thickness of the wheel does not include one or more protrusion of base material (in so far as it concerns this definition)
2	侧面 One side		磨料层位于基材的端面, 其宽度从周边伸向中心。它可覆盖或不覆盖整个端面, 磨料层的宽度大于其厚度。 The abrasive layer is on the surface of the base material and extends from the side to the side to the center. It may or may not cover the entire surface. The abrasive layer's width is greater than its thickness.
3	两侧面 Both side		磨料层位于基材的两端面, 并从周边伸向中心。它可覆盖或不覆盖整个端面, 磨料层的宽度应大于其厚度。 The abrasive layer is on both surface of the base material, and extends from the side to the side to the center. It may or may not cover the entire surface. The abrasive layer's width is greater than its thickness.
4	向内侧面 倾斜或带有弧形 Concave or arc		此代号应用于2、6、11、12和15型的砂轮基材, 磨料层位于端面上, 此壁以一个角度或弧度从周边较高点向中心较低点延伸。 This code applies to grinding wheel base material of model NO.2、6、11、12 and 15, with the abrasive layer on the surface of a wall. The latter extend from a higher point on the side to the lower point in the center with an angle or arc.
5	向外侧面 倾斜或带有弧形 Convex or arc		此代号应用于2、6、11、12和15型的砂轮基材, 磨料层位于端面上, 此壁以一个角度或弧度从周边较低点向中心较高点延伸。 This code applies to grinding wheel base material of model NO.2、6、11、12 and 15, with the abrasive layer on the surface of a wall. The latter extend from a lower point on the side to the higher point in the center with an angle or arc.
6	外周的一部份 Part of periphery		磨料层位于基材周边, 但不占有基材整个厚度, 也不覆盖任一端面。 The abrasive layer is on the edge of base material, but does not cover the latter's thickness or any of its surface.
7	侧面的一部份 Part of side		磨料层位于基材的一个端面上, 而不延伸到基材的周边, 但它可延伸或不延伸至中心。 The abrasive layer is on the surface of base material, but not cover the latter's edge. It may or may not extend to the center.
8	整体 Throughout		砂轮全部由磨料和结合剂组成, 无基材。 The grinding wheel is composed entirely of abrasive material and bond. There are no core.
9	边角落 Corner		磨料层只占基材周边上的一个角, 而不延伸到另一角。 The abrasive layer is only at the corner of the base material's out edge, without extending to any other corner.
10	内侧 Annular		磨料层位于基材的整个内孔。 The abrasive layer fills the internal hole of the core.



磨料层位置及记号

Location and symbol of abrasive section

■ 变形补充部分表示 Supplemental information on odd shape

- 1、如果不存在修改，可以省略该表示
1、 Any illustration which is not revised may be omitted
- 2、如果存在两个以上位置的修改，使用字母组合进行表示。
2、 Where there are revision to two or more positions, the same shall indicated by the way of combination of alphabets.

记号 Symbol	位置 Location	形状 Shape	定义 Description
B	段差孔 Segment gap hole		基材内钻有埋头孔 Holes drilled and counter-bored in core
C	埋锥孔 Conical countersunk hole		基材内钻有锥形埋头孔 Holes drilled and counter-bored sunk in core
H	直孔 Through hole		基材内钻有直孔 Straight holes drilled in core
M	直孔及螺纹孔 (混合孔) Mixed hole		基材内钻有混合孔(既有直孔又有螺纹孔) Mixed holes, some plain, some threaded in the core
P	单侧面间隙 One-sided gap		砂轮基材的一端面减薄，其厚度小于砂轮的厚度 Relief on one side of the wheel, thickness of core less than wheel thickness.
O	直凹形磨料层 Sunken abrasive layer		砂轮磨料嵌入基材的凹面 The abrasive layer is embedded in the sunken side of the core.
Q	磨料层嵌入型 Embedded abrasive layer		磨料层三个面部分或整个地嵌入基材 Three surfaces of abrasive section partially or wholly enclosed by the core.
R	两侧间隙 Double-sided gap		砂轮基材减薄，其厚度小于砂轮磨料层的厚度 Relief on both sides of the wheel, the thickness of the core less than wheel thickness.
S	扇形层锯齿形状 (磨料层分段带槽) Sector layer sawtooth (abrasive layer segmentation groove)		金刚石锯齿装于整体的基材上(锯齿间隙与定义无关) The cutting off wheel (saw) has a section which is interrupted by grooves and applied to a core with solid rim (clearance between segments has no bearing on definition).
Ss	磨料层锯齿形状 及基材带有沟槽 Sector layer saw tooth and substrate with grooves		金刚石锯齿装于带槽的基材上 The cutting-off wheel (saw), with segments mounted on solid and slotted core rim.
T	螺纹孔 Thread hole		基材带螺纹孔 Threaded holes in core.
V	磨料层倒锥式 Concave abrasive layer		镶在基材上磨料层的内角或弧的凹面朝外。 例外：磨料层形状AH镶在其凹面朝外的基材上 The abrasive section is considered inverted if mounted on the core so that the interior point of any angle or the concave side of any arc is exposed.
W	带柄 Mounted		在基材周边有磨料层的带柄磨头 Abrasive section core and mounting shaft cannot be dismounted.
Y	磨料层逆向插入层 Reversed embedded abrasive layer		见Q和V定义 See description for Q and V.



标准形状之记号

Basic shapes and sizes

Y&B 1A1 D×T×H	Y&B 1EE1 D×T×H×V×X	Y&B 1LL6Y D×T×H×V×U1×U2×X
Y&B 1A8 D×T×H	Y&B 1E6Q D×T×H×V×U×X	Y&B 1Q1 D×T×H×X×R
Y&B 1A1R D×T×H×X	Y&B 1EE6Y D×T×H×V×U1×U2×X×R	Y&B 1V1 D×T×H×V×X
Y&B 1A6Q D×T×H×V×U×X	Y&B 1E9 D×T×H×V×J×X	Y&B 2A2 D×T×H×W×X
Y&B 1B1 D×T×H×V×X	Y&B 1F1 D×T×H×X×R	Y&B 3A1 D×T×H×J×U×X
Y&B 1B5 D×T×H×W×V×X	Y&B 1FF1 D×T×H×X×R	Y&B 3F2 Diamond Curve Generator Wheels D×X×M/C
IDD6Y D×D1×D2×T×H×S0×20×V1×V2×U×X	Y&B 1FF6Y D×T×H×U1×U2×X×R	Y&B 3V2T D×L(20)×45°×W×X
Y&B 1E1 D×T×H×V×X	Y&B 1L1 D×T×H×X×R	Y&B 4A2 D×T×H×J×S×W×X

<p>Y&B 4B2</p> <p>$D \times T \times H \times J \times V \times W \times X$</p>	<p>Y&B 6FF6Y</p> <p>$D \times T \times H \times E \times K \times U \times X$</p>	<p>Y&B 11EE9</p> <p>$D \times T \times H \times E \times J \times K \times S \times U \times W \times X$</p>
<p>Y&B 4BT9</p> <p>$D \times T \times H \times J \times K \times W \times X \times V^{\circ} (5^{\circ})$</p>	<p>Y&B 6P4</p> <p>$D \times T \times H \times X \times R$</p>	<p>Y&B 6P5</p> <p>$D \times T \times H \times X \times R$</p>
<p>Y&B 4M1</p> <p>$D \times T \times H \times E \times J \times K \times S \times W \times U$</p>	<p>Y&B 9A1</p> <p>$D \times T \times H \times P \times X$</p>	<p>Y&B 11V2</p> <p>$D \times T \times H \times E \times J \times K \times U \times X$</p>
<p>Y&B 4T1</p> <p>$D \times T \times H \times J \times W \times X \times V^{\circ} (10^{\circ})$</p>	<p>Y&B 9A3</p> <p>$D \times T \times H \times E \times W \times X$</p>	<p>Y&B 11V5</p> <p>$D \times T \times H \times E \times J \times K \times S \times V \times W \times X$</p>
<p>Y&B 6A2</p> <p>$D \times T \times H \times E \times W \times X$</p>	<p>Y&B 9U1</p> <p>$D \times T \times H \times E \times J \times W \times X$</p>	<p>Y&B 11V9</p> <p>$D \times T \times H \times E \times J \times K \times S \times U \times X$</p>
<p>Y&B 6A2S</p> <p>$D \times T \times H \times E \times K \times W \times X$</p>	<p>Y&B 11A2</p> <p>$D \times T \times H \times E \times J \times K \times S \times W \times X$</p>	<p>Y&B 12A2(20°)</p> <p>$D \times T \times H \times E \times J \times K \times S \times W \times X$</p>
<p>Y&B 6A9</p> <p>$D \times T \times H \times E \times K \times U \times X$</p>	<p>Y&B 11B2</p> <p>$D \times T \times H \times E \times J \times K \times S \times W \times X$</p>	<p>Y&B 12A2(45°)</p> <p>$D \times T \times H \times E \times J \times K \times S \times W \times X$</p>
<p>Y&B 6F2</p> <p>$D \times L \times Y \times S \times X$</p>	<p>Y&B 11C9</p> <p>$D \times T \times H \times E \times J \times K \times S \times U \times W \times X$</p>	<p>Y&B 12C9(20°)</p> <p>$D \times T \times H \times E \times J \times K \times S \times U \times W \times X$</p>

<p>Y&B 12C9(45°)</p> <p>$D \times T \times H \times E \times J \times K \times S \times U \times W \times X$</p>	<p>Y&B 14E9Q</p> <p>$D \times T \times H \times T_2 \times J \times V \times U \times X$</p>	<p>Y&B HH1 Hand Lapper</p> <p>$L \times E \times L_1 \times W \times X$</p>
<p>Y&B 12V2</p> <p>$D \times T \times H \times E \times J \times K \times S \times X \times U$</p>	<p>Y&B 14F1</p> <p>$D \times T \times H \times J \times U \times R \times X$</p>	<p>Y&B P Diamond Pellet</p> <p>A TYPE (Flat) B TYPE (Concave) C TYPE (Convex)</p>
<p>Y&B 12V4</p> <p>$D \times T \times H \times E \times K \times S \times V \times W \times X$</p>	<p>Y&B 3F1</p> <p>$D \times T \times H \times J \times U \times R \times X$</p>	<p>Y&B Diamond Hand Files (Iron Working Use)</p> <p>N TYPE (Previous use) $L \times T \times P$ F TYPE $L \times T \times P$</p>
<p>Y&B 12V5</p> <p>$D \times T \times H \times E \times J \times K \times S \times V \times W \times X$</p>	<p>Y&B HMF Honing Stones</p> <p>$L \times T \times W \times R \times X$</p>	<p>Y&B Handy Machine Files</p> <p>D TYPE $L \times T \times Y \times L_1$ M TYPE $L \times L_1$</p>
<p>Y&B 12V9</p> <p>$D \times T \times H \times E \times J \times K \times S \times U \times X$</p>	<p>Y&B 15A2</p> <p>$D \times T \times H \times E \times J \times K \times U \times W \times X$</p>	<p>Y&B DW Mounted Wheels</p> <p>DW $D \times Y \times L \times T \times X$ DWJ-1 $D \times T \times Y \times L_1$ DWJ-2 $D \times T \times Y \times L_1$ For JIG Grinding DW-TA $D \times T \times Y \times L \times T_1 \times V \times U$ DW-T $D \times T \times L \times V$ DW-T (Electro-Plated Wheel) $D \times T \times Y \times L \times V$</p>
<p>Y&B 14A1</p> <p>$D \times T \times H \times J \times U \times X$</p>	<p>Y&B 15V4</p> <p>$D \times T \times H \times E \times J \times K \times V \times U \times W \times X$</p>	
<p>Y&B 14E1</p> <p>$D \times T \times H \times J \times V \times U \times X$</p>	<p>Y&B 15V5</p> <p>$D \times T \times H \times E \times J \times K \times V \times W \times X$</p>	
<p>Y&B 14EE1</p> <p>$D \times T \times H \times J \times V \times U \times X$</p>	<p>Y&B 15V9</p> <p>$D \times T \times H \times E \times J \times K \times S \times V \times U \times X$</p>	

■ 1 平形系列砂轮 Straight grinding wheel

1.1 平形砂轮—1A1型形状、尺寸见图1、表1

Straight grinding wheel-1A1、Sketch shown in Fig.1, specification shown in Table1

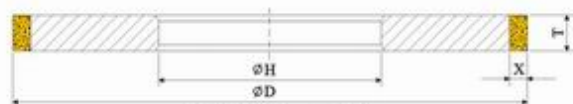


图1 平形砂轮—1A1型
Fig1. Straight grinding wheel-1A1



表1 平形砂轮—1A1型尺寸
Table 1 Specification of Straight grinding wheel-1A1

D	T	H	X	
12	8~12	6	2, 3	
14	8~14			
15	8~14			
16	8~16	10	2, 3	
18				
20				
23	12~20	5, 6, 8, 10, 12	2, 2.5, 3, 4	
25	2~20			5, 6, 8, 10, 12, 13
30				10, 12, 12.7, 16
35	0.2~20	8, 10, 12, 12.7, 16	2, 2.5, 3, 4, 5	
40				
45				
50	0.4~30	8, 10, 12, 12.7, 16	3, 4, 5	
60				
75				
80	10, 16, 19.05, 20, 22.23, 25.4	20, 22.23, 25.4, 31.75, 32	3, 4, 5, 6	
100				
115				
125	2~20	20, 22.23, 25.4, 31.75, 32	3, 4, 5, 6	
150	0.8~35	25.4, 31.75, 32, 40	4, 5, 6, 8, 10	
175	1~35	31.75, 32, 40	5, 6, 8, 10, 16	
180	3~35	31.75, 32, 40	5, 6, 8, 10, 16	
200	10~40	31.75, 32, 40, 50.8, 75, 76.2	5, 6, 8, 10, 16, 20	
250	1~40	50.8, 75, 76.2, 101.6, 127	5, 6, 8, 10, 16, 20	
300	10~60	75, 76.2, 101.6, 127, 203	5, 6, 8, 10, 16, 20, 25	
350	3~60	127, 203	5, 6, 8, 10, 16, 20, 25	
400	12~50	203, 304.8, 305	5, 6, 8, 10, 12, 15	
450				
500				
600	3.5~50	132, 304.8, 305	5, 6, 8, 10, 12, 15	
700				
750				
800	12~60	203, 304.8, 305	5, 6, 8, 10, 12, 15	
850				
900				
850	18~50	132, 304.8, 305	5, 6, 8, 10, 12, 15	
900				

■ 1 平形系列砂轮 Straight grinding wheel

1.2 平形砂轮—9A1型形状、尺寸见图2、表2 (用于无心磨削)

Straight grinding wheel-9A1、Sketch shown in Fig.2, specification shown in Table 2-for centreless grinding

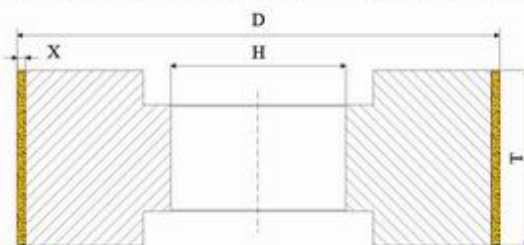
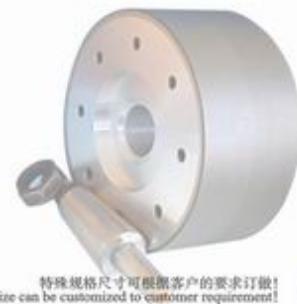


图2 平形砂轮—9A1型
Fig2. Straight grinding wheel-9A1



表2 平形砂轮-9A1型 (用于无心磨削) 尺寸
Table1. Straight grinding wheel for centreless grinding

D	T	H	X
100	50, 60, 100	31.75, 32, 35, 50	3, 5
125	50, 60, 100, 120		
150		31.75, 32, 35, 50, 70	
160	50, 60, 100, 125	31.75, 32, 35, 50	3, 5, 6
175	50, 60, 100, 120, 125	31.75, 32, 35, 50, 75	
200	50, 60, 100, 120, 125	50, 75, 80	3, 5, 6
250	50, 100, 125		
300	80, 100, 125, 150, 200	120, 127	5, 6, 10
350	60, 120, 125, 150, 200	120, 127, 203	
400	60, 120, 150, 200	127, 203, 228.6	
450	60, 150, 200, 250, 300	203, 228.6, 250, 305	5, 6, 10, 15
500	60,120,150,200,225,300,400,600	203, 254, 304.8, 305	
600	60, 100, 150, 200, 250, 300, 400	304.8, 305	
700			



1.3 平形砂轮—1A8型形状、尺寸见图3、表3。

1.3 Straight grinding wheel-1A8、Sketch shown in Fig.3, specification shown in Table 3.

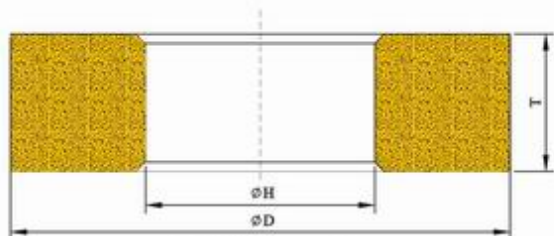


图3 平形砂轮—1A8型
Fig.3 Straight grinding wheel-1A8

表3 平形砂轮—1A8型尺寸
Table 3 Specification of Straight grinding wheel-1A8

D	T	H
2.5		1
3	4	1, 1.5
4	4, 6	
5	4, 6, 8	1, 2
6		2
7	6	3
8	6, 8, 10	
10	6, 8, 10, 12	
12	8, 10, 12	3, 6
14	8, 10, 12, 14	6
15		
16	8, 10, 12, 14, 16	10
18		
20		
23	12, 14, 16, 18, 20	



1.4 平形砂轮—1A1R型形状、尺寸见图4、表4。

1.4 Straight grinding wheel-1A1R、Sketch shown in Fig.4, specification shown in Table 4.

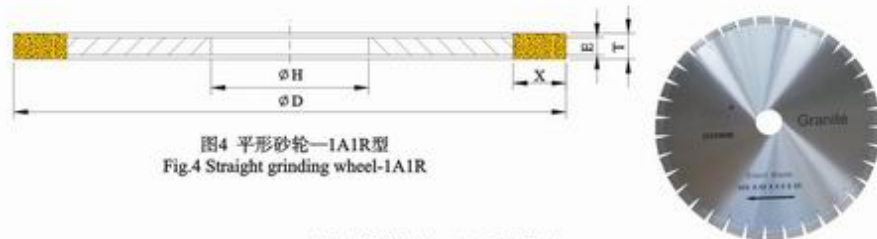


图4 平形砂轮—1A1R型
Fig.4 Straight grinding wheel-1A1R

表4 平形砂轮—1A1R型尺寸
Table 4 Specification of Straight grinding wheel-1A1R

D	T/E	H	X
60	0.8/0.5	10	5, 7, 8
80		20	
100	0.7/0.5, 1.0/0.8, 0.8/0.6	20, 31.75, 32	
150		31.75, 32, 75	
200	1/0.5, 1.2/0.8, 1.4/1	31.75, 32, 75	
250		31.75, 32, 75	
300	1.4/1	31.75, 32, 75	

1.5 平形砂轮—1V9型形状、尺寸见图5、表5。

1.5 Straight grinding wheel-1V9、Sketch shown in Fig.5, specification shown in Table 5.

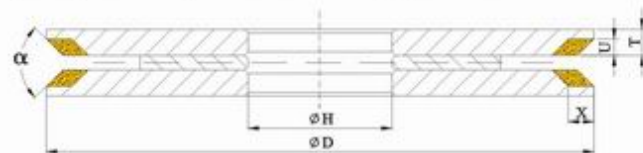


图5 平形砂轮—1V9型
Fig.5 Straight grinding wheel-1V9

表5 平形砂轮—1V9型尺寸
Table 5 Specification of Straight grinding wheel-1V9

D	T	H	U	X	α
150	10	32	2, 3	1.5, 3, 6	90°, 120°
175					90°
200					
250		75			

1.6 平形砂轮—1DD1型形状、尺寸见图6、表6。

1.6 Straight grinding wheel-1DD1, Sketch shown in Fig.5, specification shown in Table 6.

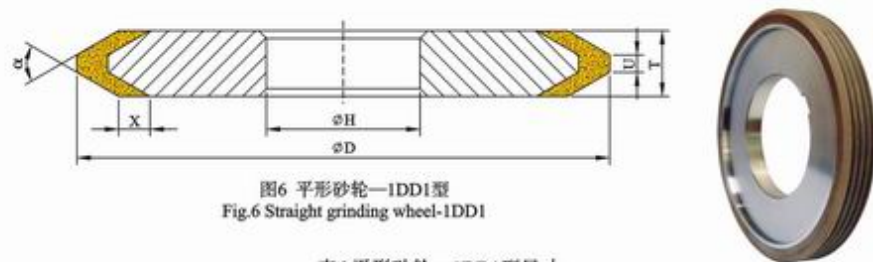


图6 平形砂轮—1DD1型
Fig.6 Straight grinding wheel-1DD1

表6 平形砂轮—1DD1型尺寸
Table 6 Specification of Straight grinding wheel-1DD1 mm

α	30°	35°	40°	45°	60°	90°
X	3.5	3	3	2.5	2	1.5
	7	6	6	5	4	3

D	T	H	U
75	6, 8	19.05, 20, 32	1~2
90		20, 31.75, 32	
100	8, 10, 12, 14, 16, 18	31.75, 32	1.5~3
125	12, 14, 16, 18		2~3
150	16, 18, 20		3~4

1.7 平形砂轮—1EE1V型形状、尺寸见图7、表7。

1.7 Straight grinding wheel-1EE1V, Sketch shown in Fig.7, specification shown in Table 7.

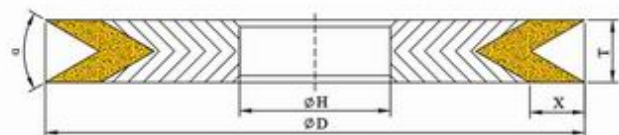


图7 平形砂轮—1EE1V型
Fig.7 Straight grinding wheel-1EE1V

表7 平形砂轮—1EE1V型尺寸
Table 7 Specification of Straight grinding wheel-1EE1V mm

D	T	H	α	X
100	7	20	120°	1.5, 3
110				
125				
150	10, 12	31.75, 32	125°, 135°	
175	15		135°	

1.8 平形砂轮—1F1型形状、尺寸见图8、表8。

1.8 Straight grinding wheel-1F1, Sketch shown in Fig.8, specification shown in Table 8.

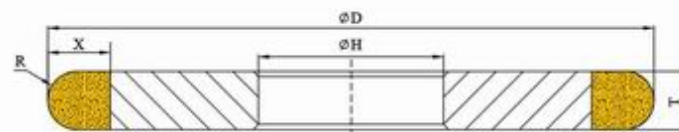


图8 平形砂轮—1F1型
Fig.8 Straight grinding wheel-1F1

表8 平形砂轮—1F1型尺寸
Table 8 Specification of Straight grinding wheel-1F1 mm

D	T	H	X
12	1~4	3	3, 4, 5, 6
15		5	
35		5, 10	
50	1~5	10	
60		10, 20	
75	2~6	19.05, 20	4, 5, 6, 7
80		19.05, 20, 31.75, 32	
100		3~12	31.75, 32
125	31.75, 32, 75		
150	3~16	75, 127	5, 6, 7, 8, 10, 15
175		127, 203	
200	4~20		
250			
300	6~25		
350			
400	8~30		
R=T/2			



- 1.9 平形砂轮—1FF1型形状、尺寸见图9、表9。
1.9 Straight grinding wheel-1FF1、Sketch shown in Fig.9, specification shown in Table 9.

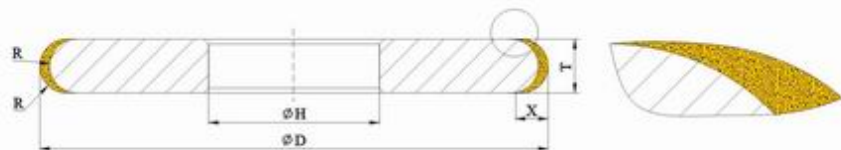


图9 平形砂轮—1FF1型
Fig.9 Straight grinding wheel-1FF1

表9 平形砂轮—1FF1型尺寸
Table 9 Specification of Straight grinding wheel-1FF1 mm

D	T	H
50	4, 5, 6, 8, 10	10
75		19.05, 20
100	4, 5, 6, 8, 10, 12, 15	19.05, 20, 31.75, 32
125		
150	8, 10, 12, 15, 20	31.75, 32
200		31.75, 32, 75
R=T/2, X≤R.		

- 1.10 平形砂轮—1FF1V型形状、尺寸见图10、表10。
1.10 Straight grinding wheel-1FF1V、Sketch shown in Fig.10, specification shown in Table 10.

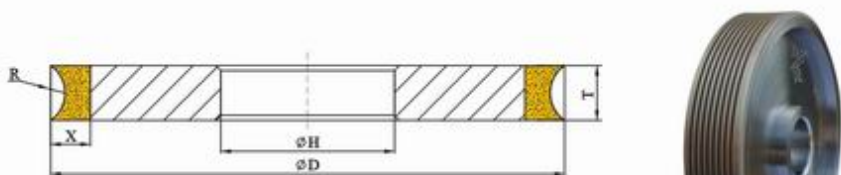


图10 平形砂轮—1FF1V型
Fig.10 Straight grinding wheel-1FF1V

表10 平形砂轮—1FF1V型尺寸
Table 10 Specification of Straight grinding wheel-1FF1V mm

D	T	H	X	R
125	13	20	10	10
150	18	32	15	12

- 1.11 平形砂轮—1V1型形状、尺寸见图11、表11。
1.11 Straight grinding wheel-1V1、Sketch shown in Fig.11, specification shown in Table 11.

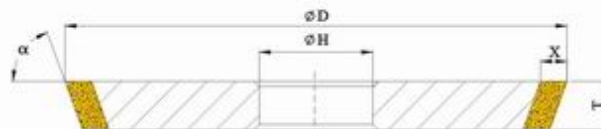


图11 平形砂轮—1V1型
Fig.11. Straight grinding wheel-1V1

表11 平形砂轮—1V1型尺寸
Table 11 Specification of Straight grinding wheel-1V1 mm

D	T	H	α	X
45	2~15	10, 12, 12.7, 16	20°, 25° 30°, 45°, 60°	2, 3, 4, 5
50				
60		12, 12.7, 16, 19.05, 20		
75		16, 19.05, 20, 25.4		
80	3~20	20, 25.4, 31.75, 32		
100		25.4, 31.75, 32, 40		
125		31.75, 32, 40		
150	8~25	31.75, 32, 40, 50.8, 75		
175		50.8, 75, 101.6, 127		
200	10~30	75, 101.6, 127, 203	3, 4, 5, 6, 8	
250		127, 203		
300				
350				
400	10~35			



1.12 平形砂轮—1L1型形状、尺寸见图12、表12。

1.11 Straight grinding wheel-1L1, Sketch shown in figure 12, specification shown in Table 12.

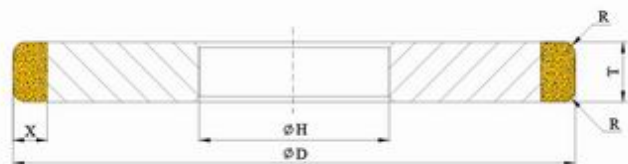


图12 平形砂轮—1L1型
Fig.12 Straight grinding wheel-1L1

表12 平形砂轮—1L1型尺寸
Table 12 Specification of Straight grinding wheel-1L1 mm

D	T	H	R	X
50	2, 3, 4, 5, 6, 8	10, 12, 12.7, 16	0.5, 1, 2, 3	2, 3, 4, 5
60				
75	3, 4, 5, 6, 8, 10	16, 19.05, 20	0.5, 1, 2, 3, 4	2, 3, 4, 5
100				
125	3, 4, 5, 6, 8, 12	31.75, 32	0.5, 1, 2, 3, 4, 5	3, 4, 5, 6, 8
150				
175	5, 6, 8, 12	31.75, 32, 75	0.5, 1, 2, 3, 4, 5, 6	4, 5, 6, 8, 10
200				
250	8, 12, 15	75, 127	0.5, 1, 2, 3, 4, 5, 6	5, 6, 8, 10, 12, 15
300				
350	12, 15, 20, 25, 30	127, 203	0.5, 1, 2, 3, 4, 5, 6	5, 6, 8, 10, 12, 15
400				



1.13 单面凸砂轮—3A1型形状、尺寸见图13、表13。

1.13 Hubbed wheel-3A1, Sketch shown in Fig.13, specification shown in Table 13.

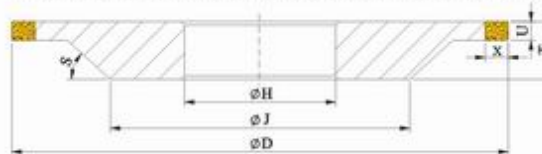


图13 单面凸砂轮—3A1型
Fig.13. Hubbed wheel-3A1

表13 单面凸砂轮—3A1型尺寸
Table 13 Specification of Hubbed wheel-3A1 mm

D	T	H	J	U	X	S
75	5~10	19.05, 20	40~50	0.8~5	2, 3, 4, 5	30°, 45°
100	5~15	19.05, 20, 31.75, 32	50~80	1~8	3, 4, 5, 6	
125			90~110			
150	10~15	31.75, 32	100~130	1~10	3, 4, 5, 6	
175	12~20		120~140			
200	12~30	31.75, 32, 75	130~160	2~10	4, 5, 6, 8, 10	
250			150~200	5~10		
300	15~40	127, 203	200~250	6~15	4, 5, 6, 8, 10	
350			250~300	6~20		
400	20~50	203, 305	300~350	10~30	5, 6, 8, 10, 12, 15	
500			350~400			
600	20~60	305	400~500	10~30	5, 6, 8, 10, 12, 15	
700			450~600			

1.14 斜边砂轮—4B2型形状、尺寸见图14、表14。

1.14 Tapered wheel-4B2, Sketch shown in Fig.14, specification shown in Table 14.

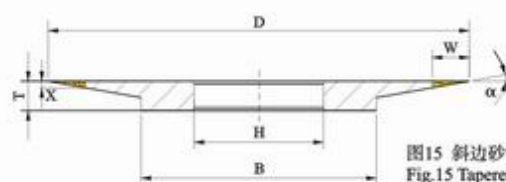


图15 斜边砂轮—4B2型
Fig.15 Tapered wheel-4B2

表14 斜边砂轮—4B2型尺寸
Table 14 Specification of Tapered wheel-4B2 mm

D	W	T	B	X	α	H
65	10	6	40	1	7°	22
75		6	50	1		22.225 (7/8")
80		6	50	1	10°	24
100		6	50	1		25
125		6	50	1	15°	31.75 (1 1/4")
150		8	120	1		32
180		8	120	1		



- 1.15 双面凹砂轮—9A3型形状、尺寸见图15、表15。
1.15 Wheel recessed two sides-9A3, sketch shown in Fig.15, specification shown in Table 15

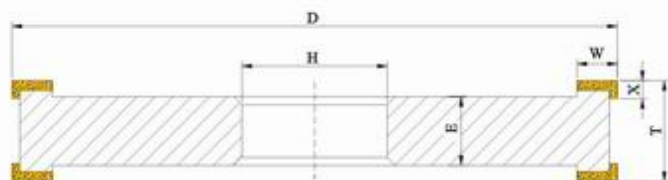


图15 双面凹砂轮—9A3型
Fig 15. Wheel, recessed two sides-9A3

表15 双面凹砂轮—9A3型尺寸
Table 15 Specification of wheel, recessed two sides-9A3 mm

D	T	H	W	X
75	15~20	16, 19.05, 20, 22	4, 5, 6	2, 3, 4, 5
100	20~25	19.05, 20, 22, 31.75, 32	4, 5, 6, 8, 10	
125				
150	20~30	31.75, 32	4, 5, 6, 8, 10, 12, 15	
175				
200	20~40	31.75, 32, 75	8, 10, 12, 15	
230		31.75, 32, 75, 127		
250		75, 127		
300	25~50	127	8, 10, 12, 15	
350				

$E \leq T/2$



- 1.16 双面凸砂轮—14A1型形状、尺寸见图16、表16。
1.16 Duplex hubbed wheel-14A1, Sketch shown in Fig.16, Specification shown in Table 16.

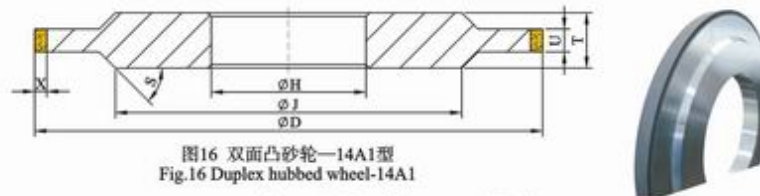


图16 双面凸砂轮—14A1型
Fig.16 Duplex hubbed wheel-14A1

表16 双面凸砂轮—14A1型尺寸
Table 16 Specification of duplex hubbed wheel-14A1 mm

D	T	H	J	U	X	S
75	5~10	19.05, 20	40~50	0.8~5	2, 3, 4, 5	30°, 45°
100	5~15	19.05, 20, 31.75, 32	50~80	1~8	3, 4, 5, 6	
125			90~110			
150	10~15	31.75, 32	100~130	1~10	4, 5, 6, 8, 10	
175	12~20		120~140			
200	12~30	31.75, 32, 75	130~160	2~10	4, 5, 6, 8, 10	
250			150~200	5~10		
300	15~40	127, 203	200~250	6~15	4, 5, 6, 8, 10	
350			250~300	6~20		
400	20~50	203, 305	300~350	10~30	5, 6, 8, 10, 12, 15	
500			350~400			
600	20~60	305	400~500	10~30	5, 6, 8, 10, 12, 15	
700			450~600			

- 1.17 双面凸砂轮—14E1型形状、尺寸见图17、表17。
1.17 Duplex hubbed wheel-14E1, Sketch shown in Fig.17, Specification shown in Table 17

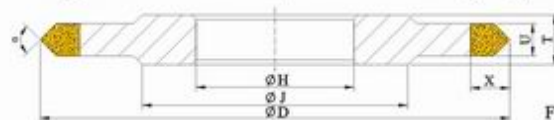


图17 双面凸砂轮—14E1型
Fig.17 Duplex hubbed wheel-14E1

表17 双面凸砂轮—14E1型尺寸
Table 17 Specification of duplex hubbed wheel-14E1 mm

D	J	T	H	U	X	α
50	24	4~6	10	1~5	6, 8	35°, 45°, 40°, 60°, 90°
60	28	5~8	10, 20			
70	35					
100	50					
125	66	6~10	31.75, 32	3~10	6, 8	35°, 45°, 40°, 60°, 90°
150	85					
200	120	8~12	75, 127	5~16	6, 8	35°, 45°, 40°, 60°, 90°
300	250	12~20				
400	350					

Y&B® 玉宝钻石砂轮形状和尺寸分类图
Sketch and the size of wheels from YUBAO

■ 1.18 双面凸砂轮—14EE1型形状、尺寸见图18、表18。

1.18 Duplex hubbed wheel-14EE1, Sketch shown in Fig.18, Specification shown in Table 18.

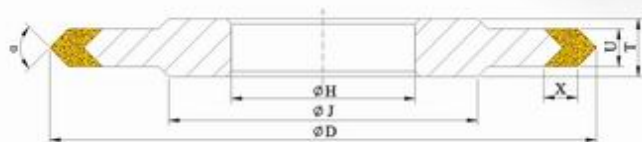


图18 双面凸砂轮—14EE1型
Fig.18 Duplex hubbed wheel-14EE1

表18 双面凸砂轮—14EE1型尺寸
Table 18 Specification of duplex hubbed wheel-14EE1 mm

α	30°	35°	40°	45°	60°	90°
X	3.5	3	3	2.5	2	1.5
	7	6	6	5	4	3

D	T	J	H	U
75	6, 8, 10	50	19.05, 20	3, 4, 6, 8
100		70		
125		100		
150	6	120	31.75, 32	3, 4
175	8	140	32, 75	4, 5
200	10	160		
250	15	200		
400	10	230	32, 75, 203	6, 8



Y&B® 玉宝钻石砂轮形状和尺寸分类图
Sketch and the size of wheels from YUBAO

■ 1.19 双面凸砂轮—14F1型形状、尺寸见图19、表19。

1.19 Duplex hubbed wheel-14F1, Sketch shown in Fig.19, Specification shown in Table 19.



图19 双面凸砂轮—14F1型
Fig.19 Duplex hubbed wheel-14F1

表19 双面凸砂轮—14F1型尺寸
Table 19 Specification of duplex hubbed wheel-14F1 mm

D	T	H	J	U	X	S
75	5~10	19.05, 20	40~50	1~5	3, 4, 5	30°, 45°
100	5~15	19.05, 20, 31.75, 32	50~80	1~8	3, 4, 5, 6	
125			90~110			
150	10~15	31.75, 32	100~130	2~10	4, 5, 6, 7, 8	
175	12~20		120~140			
200	12~30	31.75, 32, 75	130~160			
250			150~200	5~10		
300	15~40	127, 203	200~250	6~15	5, 6, 7, 8, 10	
350			250~300			
400	20~50		300~350	6~20		

R=U/2.

■ 1.20 双面凸砂轮—14E6Q型形状、尺寸见图20、表20。

1.20 Duplex hubbed wheel-14E6Q, Sketch shown in Fig.20, Specification shown in Table 20.



图20 双面凸砂轮—14E6Q型
Fig.20 Duplex hubbed wheel-14E6Q

表20 双面凸砂轮—14E6Q型尺寸
Table 20 Specification of duplex hubbed wheel-14E6Q mm

D	T	T1	H	U	X	J	α
40	6	4	10	1~2	6	22	35°, 45° 60°, 90°
50			10, 19.05, 20, 22.23			32	
75						50	
100	5	5	31.75, 32			70	
125			100				
150	12		76.2, 75	120			
220				180			

1.21 磨量规砂轮—14A3型、尺寸分别见图21、表21。

1.21 Wheels, grinding gauge-14A3, Sketch shown in Fig.21, Specification shown in Table 21

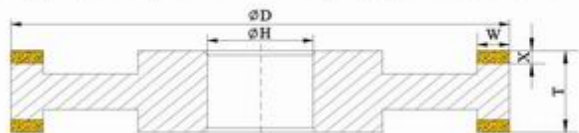


图21 磨量规砂轮—14A3型
Fig.21 Wheels, grinding gauge-14A3

表21 磨量规砂轮—14A3型尺寸

Table 21 specification of Wheels, grinding gauge-14A3

D	T	H	X	W
125	12	31.75, 32	2	4, 5
150	12, 16			
175				
230	12, 16, 20	75	2, 3	8, 10

J, E由供需双方商定。J, E are specified.

2 杯碗碟形系列砂轮 Straight cup, taper cup and dish wheels

2.1 杯形砂轮—6A9型形状、尺寸见图22、表22。

2.1 Straight cup wheels-6A9, Sketch shown in Fig.22, specification shown in Table 22.

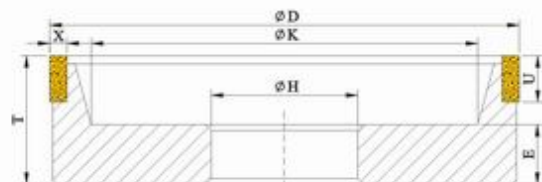


图22 杯形砂轮—6A9型
Fig.22 Straight cup wheel-6A9

表22 杯形砂轮—6A9型尺寸

Table 22 Specification of Straight cup wheel-6A9

D	T	H	X	U
75	25	19.05, 20		
100	25, 30			
125				
150	30, 35	31.75, 32	1.5, 3	6, 10
175				
200	35, 40, 50	31.75, 32, 75		
250				

E, K由供需双方商定。E, K are specified.

2.2 杯形砂轮—6A2型形状、尺寸见图23、表23。

2.2 Straight cup wheels-6A2, Sketch shown in Fig.23, specification shown in Table 23.

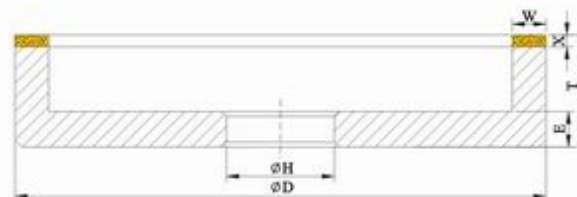


图23 杯形砂轮—6A2型
Fig.23 Straight cup wheel-6A2

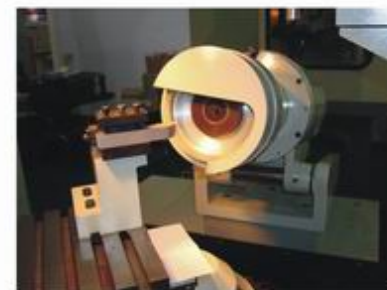


表23 杯形砂轮—6A2型尺寸

Table 23 Specification of Straight cup wheel-6A2

D	T	H	W	X
40	10~20	10	3, 5	2, 3, 4
50			3, 5, 6, 8	2, 3, 4, 5
75	10~25	10, 19.05, 20	3, 5, 6, 8, 10	
100	15~30	19.05, 20	3, 5, 6, 8, 10, 12, 15, 20	3, 4, 5, 6
125	15~35	25.4, 31.75, 32	3, 5, 6, 8, 10, 12, 15, 20, 25, 30	
150			5, 6, 8, 10, 12, 15, 20, 25	
175	15~40		6, 8, 10, 12, 15, 20, 25	3, 4, 5, 6, 8
200	20~55		6, 8, 10, 12, 15, 20, 25, 30	
250		32, 75	10, 12, 15, 20, 25, 30	4, 5, 6, 8, 10
300	25~60	75, 127	15, 20, 25, 30, 35, 40	
350	30~60		20, 25, 30, 35, 40, 50	
400		127, 203		
450	30~80			

E由供需双方商定。E is specified.



2.3 碗形砂轮—11A2型形状、尺寸见图24、表24。

2.3 Taper cup wheels-11A2, Sketch shown in Fig.24, specification shown in Table 24.

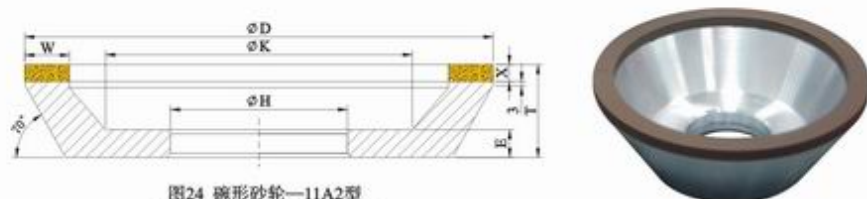


图24 碗形砂轮—11A2型
Fig.24 Taper cup wheel-11A2

表24 碗形砂轮—11A2型尺寸
Table 24 Specification of Taper cup wheel-11A2

D	T	H	E	W	X
75	25	19.05, 20	10	3, 5, 6, 8, 10	2, 3, 4, 5, 6
100	25~40	19.05, 20, 31.75, 32		6, 8, 10, 12	
125		31.75, 32, 40		8, 10, 12, 15	
150	30~50	31.75, 32, 40	12, 15	8, 10, 12, 15, 20, 25	3, 4, 5, 6, 8
200					

K由供需双方商定。E is specified.

2.4 碗形砂轮—11A9型形状、尺寸见图25、表25。

2.4 Taper cup wheels-11A9, Sketch shown in Fig.25, specification shown in Table 25.



图25 碗形砂轮—11A9型
Fig.25 Taper cup wheel-11A9

表25 碗形砂轮—11A9型尺寸
Table 25 Specification of Taper cup wheel-11A9

D	D1	T	H	X	U
90	75	25	19.05, 20, 35	3	4
100	80~85	25~40	19.05, 20, 31.75, 32	3, 4, 5	4~8
125	105~110				
150	130~135		31.75, 32, 40		

E、K由供需双方商定。E、K are specified.

2.5 碗形砂轮—11V2型和11V9型形状、尺寸分别见图26、图27、表26。

2.5 Taper cup wheels-11V2, Sketch shown in Fig.26、Fig.27, specification shown in Table 26.



图26 碗形砂轮—11V2型
Fig.26 Taper cup wheel-11V2

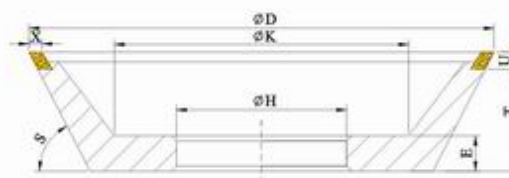


图27 碗形砂轮—11V9型
Fig.27 Taper cup wheel-11V9

表26 碗形砂轮—11V2型和11V9型尺寸
Table 26 Specification of Taper cup wheel-11V2 and 11V9

D	T	H	S
30	15	8, 10	60°
50	25	10, 19.05, 20	
75	25, 30, 32	19.05, 20	
90	35, 40	19.05, 20, 31.75, 32	70°
100			
125	35, 40, 45, 50	19.05, 20, 31.75, 32	
150		31.75, 32	

X	U	H
X	11V9	1.5, 2, 3, 4, 5, 10
	11V2	3, 4, 5, 10
U	11V9	5, 6, 7, 8, 10
	11V2	2, 3, 4

K、E由供需双方商定。K、E are specified.

- 2.6 碟形砂轮—12A2/20° 型形状、尺寸见图28、表27。
2.6 Dish wheel-12A2/20°, Sketch shown in Fig.28, specification shown in Table 27.

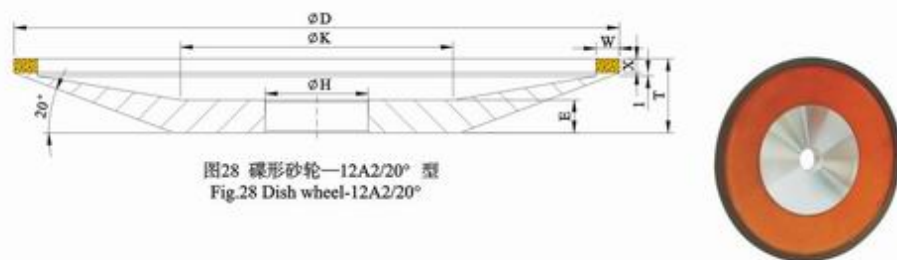


图28 碟形砂轮—12A2/20° 型
Fig.28 Dish wheel-12A2/20°

表27 碟形砂轮—12A2/20° 型尺寸
Table 27 Specification of Dish wheel-12A2/20° mm

D	T	H	E	W	X
75	12	10, 19.05, 20	5	3, 5, 6, 10	2, 3, 4, 6
100	15	19.05, 20	6		
125	18	31.75, 32	8	5, 6, 10	
150	20		9	5, 6, 10, 15	
175	22	10	6, 10, 15		
200	24	31.75, 32, 40, 75	11	6, 10, 15, 20	
250	26		12		

K由供需双方商定。K is specified.

- 2.7 碟形砂轮—4BT9型形状、尺寸见图29、表28。
2.7 Dish wheel-4BT9, Sketch shown in Fig.29, specification shown in Table 28.

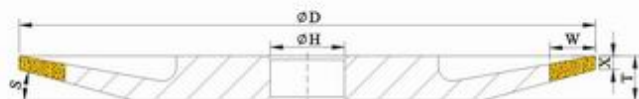


图29 碟形砂轮—4BT9型
Fig.29 Dish wheel-4BT9

表28 碟形砂轮—4BT9型尺寸
Table 28 Specification of Dish wheel-4BT9 mm

D	T	H	W	X	S
50	6	10	6, 7, 8, 10	1	20°, 25°
75	8, 10	10, 19.05, 20	6, 8, 8.5, 10		
100	8, 10, 12	19.05, 20	6, 8, 10, 12, 14.5	1~1.5	20°
125	15	31.75, 32	8, 10, 12, 14.5, 15	1.5~3	

- 2.8 碟形砂轮—12V2型形状、尺寸见图30、表29。
2.8 Dish wheel-12V2, Sketch shown in Fig.30, specification shown in Table 29.

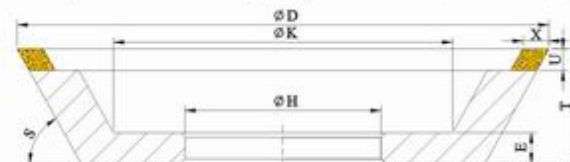


图30 碟形砂轮—12V2型
Fig.30 Dish wheel-12V2

表29 碟形砂轮—12V2型尺寸
Table 29 Specification of Dish wheel-12V2 mm

D	T	H	U	X	S
50	10, 12	10	2, 3	2, 3	40°
75	10, 12, 15	10, 19.05, 20			3
90			19.05, 20, 31.75, 32	3, 4	
100	12, 15	3, 4, 5			5, 8, 10
125			15, 16, 18	31.75, 32	
150	16, 18	75, 127	3, 4, 5		
175	18, 20			5, 6, 8	
200	20, 25				
250	20, 25, 30				

K, E由供需双方商定。K, E are specified.

- 2.9 碟形砂轮—12V9型形状、尺寸见图31、表30。
2.9 Dish wheel-12V9, Sketch shown in Fig.31, specification shown in Table 30.



图31 碟形砂轮—12V9型
Fig.31 Dish wheel-12V9

表30 碟形砂轮—12V9型尺寸
Table 30 Specification of Dish wheel-12V9 mm

D	T	H	E	U	X
75	20	19.05, 20	10	6	1.5, 3
100				6, 10	
125	19.05, 20, 31.75, 32				
150					

K由供需双方商定。K is specified.



YUBAO 珠宝钻石砂轮形状和尺寸分类图

Sketch and the size of wheels from YUBAO

3 筒形系列砂轮 Cylinder wheel

3.1 筒形砂轮2号—2F2/2型形状、尺寸见图32、表31。

3.1 Cylinder wheel NO.2-2F2/2, Sketch shown in Fig.32 ,specification shown in Table 31.

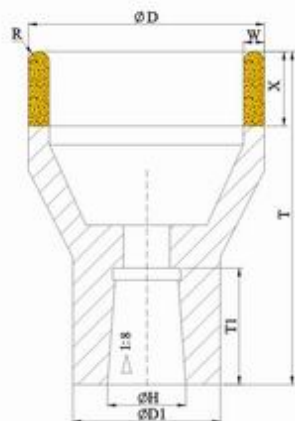


图32 筒形砂轮2号—2F2/2型
Fig.32 Cylinder wheel NO.2-2F2/2



表31 筒形砂轮2号—2F2/2型尺寸
Table 31 Cylinder wheel NO.2-2F2/2

D	D1	T	H	W	X	R	T1
28, 33, 38, 43, 53, 63	28	55	18	3	7	1.5	22

mm

4 专用系列砂轮 Specialized series wheels

4.1 磨边砂轮—2D9型形状、尺寸见图33、表32。

4.1 Edge grinding wheels-2D9, Sketch shown in Fig.33, specification shown in Table 32.

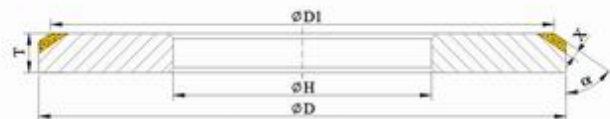


图33 磨边砂轮—2D9型
Fig.33 Edge grinding wheel-2D9

表32 磨边砂轮—2D9型尺寸
Table 32 Edge grinding wheel-2D9

D	D1	H	X	α
101~106	100	65	2	30°, 45°, 60°
161~168	160	105		

T=6 ($\alpha \geq 45^\circ$), T=8 ($\alpha < 45^\circ$)



YUBAO 珠宝钻石砂轮形状和尺寸分类图

Sketch and the size of wheels from YUBAO

4.2 磨边砂轮—16A1型形状、尺寸见图34、表33。

4.2 Edge grinding wheels-16A1, Sketch shown in Fig.34, specification shown in Table 33.

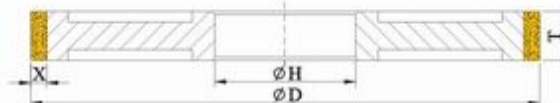


图34 磨边砂轮—16A1型
Fig.34 Edge grinding wheel-16A1

表33 磨边砂轮—16A1型尺寸
Table 33 Specification of Edge grinding wheel-16A1

D	T	H	X
160, 170, 180, 190	25	16, 25.4	2.5, 3, 5

mm

5 磨盘 Grinding board

5.1 磨盘—1A2T型形状、尺寸见图35、表34。

5.1 Grinding board-1A2T, Sketch shown in Fig.35, specification shown in Table 34.



图35 磨盘—1A2T型
Fig.35 Grinding board-1A2T



表34 磨盘—1A2T型尺寸
Table 34 Specification of Grinding board-1A2T

D	D1	T	H	W	W1	X	d	α	安装孔
200	199	25, 28	140	30	8	3, 5	170	2° 30'	4-M12
250	249	25, 28	180	35	8	3, 5	220	2° 30'	4-M12
250	249	25, 28	150	50	10	3, 5	200	3°	4-M12
300	299	28	220	40	10	3, 5	250	2° 30'	6-M12
350	349	28	270	40	10	3, 5	300	2° 30'	6-M12
350	349	28	230	60	10	3, 5	300	3°	6-M12

mm

5.2 磨盘—7×1A2T型形状、尺寸见图36、表35。

5.2 Grinding board-7*1A2T, Sketch shown in Fig.36, specification shown in Table 35.

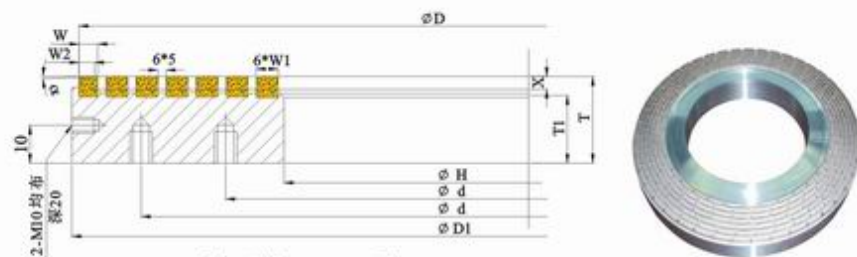


图36 磨盘—7×1A2T型
Fig.36 Grinding board-7*1A2T

表35 磨盘—7×1A2T型尺寸
Table 35 Specification of Grinding board-7*1A2T mm

D	D1	T	T1	H	W	W1	W2	X	α	d	安装孔
600	610	28	24	240	25	20	10	3, 5	3°	300 500	6-M10 12-M10

5.3 磨盘—12A2T型形状、尺寸见图37、表36。

5.3 Grinding board-12A2T, Sketch shown in Fig.37, specification shown in Table 36.

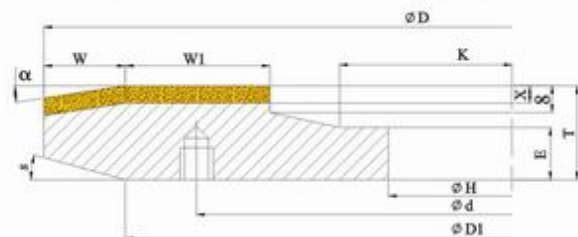


图37 磨盘—12A2T型
Fig.37 Grinding board-12A2T

表36 磨盘—12A2T型尺寸
Table 36 Specification of Grinding board-12A2T mm

D	D1	T	H	E	K	W	W1	X	α	S	d	安装孔
180	140	37	50.8	16	88	15	25	5	1° 30'	45°		6-M8
300	210	50	100	20	170	18	22	6	2°	34°		6-M8
320	220	50	32	20	170	22	28	6	2°	32°		6-M8
			100									
400	280	45	25	20	220	35	35	6	3°	23°		6-M12
			100									
450	290	45	100	20	220	30	2×20	6	3°	18°		6-M12
			200									

6 磨石 stone

6.1 带柄圆弧/三角磨石—HH/HEE型形状、尺寸见图38、表37。

6.1 Mounted stone HH/HEE, Sketch shown in Fig.38, specification shown in Table37.

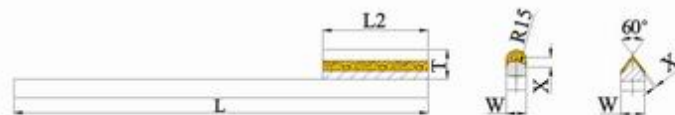


图38 带柄圆弧/三角磨石—HH/HEE型
Fig.38 Mounted stone, roll shaped-HH/Tapered mounted stone-HA

表37 带柄圆弧磨石—HH/HEE型尺寸
Table 37 Specification of Mounted stone, roll shaped-HH/HEE mm

L	L2	T	W	X
150	40	5/12	10	2

6.2 带柄长方磨石—HA型形状、尺寸见图39、表38。

6.2 Mounted stone-HA, Sketch shown in Fig.39, specification shown in Table 38.



图39 带柄长方磨石—HA型
Fig.39 Mounted stone-HA

表38 带柄长方磨石—HA型尺寸
Table 38 Specification of Mounted stone-HA mm

L	L2	T	W	X
150	40	5	10	2



Y&B 玉宝钻石砂轮形状和尺寸分类图
Sketch and the size of wheels from YUBAO

6.3 圆头珩磨石—HMA/1型形状、尺寸见图40、表39。

6.3 Honing stone, roll shaped-HMA/1, Sketch shown in Fig.40, Specification shown in Table 39.



图40 圆头珩磨石—HMA/1型
Fig.40 Honing stone, rolled shape-HMA/1

表39 带圆头珩磨石—HMA/1型尺寸
Table 39 Specification of honing stone, rolled shape-HMA/1

L	W	T	X
16	2.5, 5	3, 5	1, 2
20	5, 6		
25			
26	10	10	

6.4 长方珩磨石—HMA/2型、弧面珩磨石—HMH/1型、弧面斜头珩磨石—HMH/2型,形状、尺寸分别见图41~43、表40。
6.4 Rectangle honing stone-HMA/2, Honing stone, roll shaped-HMH/1, Tapered honing stone-HMH/2, sketch shown in Fig.41~43, Specification shown in Table 40.



图41 长方珩磨石—HMA/2型
Fig.41 Rectangle honing stone-HMA/2

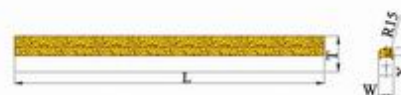


图42 弧面珩磨石—HMH/1型
Fig.42 Honing stone, roll shaped-HMH/1



图43 弧面斜头珩磨石—HMH/2型
Fig.43 Tapered honing stone, rolled shaped-HMH/2

表40 长方珩磨石—HMA/2型、弧面珩磨石—HMH/1型、弧面斜头珩磨石—HMH/2型
Table 40 Rectangle honing stone-HMA/2, honing stone, rolled shaped-HMH/1, Tapered honing stone-HMH/2

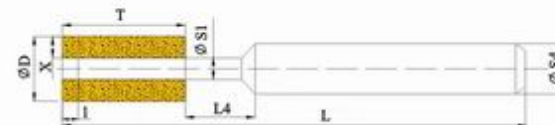
L	W	T	X
16	3, 5	3.5	1, 2, 3
22			
26		5	
30			
40			
50	6, 8	6, 8	
63		8	
72	8	8, 10	
80		10	
100	10, 12	10, 13, 14	
125			
150	12, 13		
160		16	
200	12, 13, 16		



Y&B 玉宝钻石砂轮形状和尺寸分类图
Sketch and the size of wheels from YUBAO

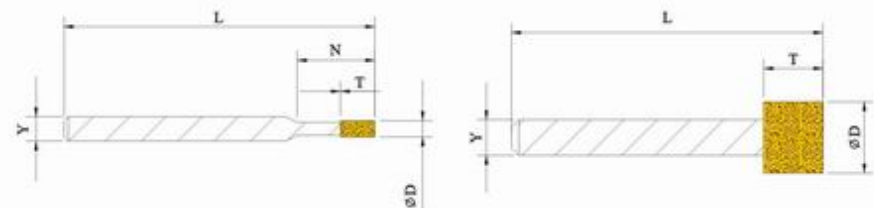
7 磨头 Mounted points

7.1 平形磨头
Straight points



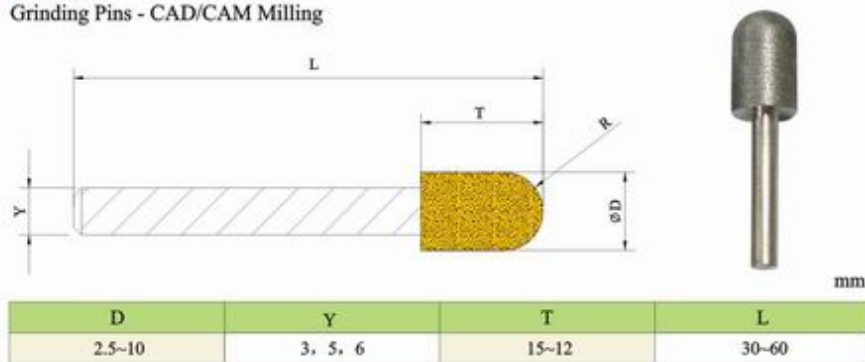
D	T	Sd	X	L	S1	L4
3	4, 6	3	0.65	66	1.7	2~8
4	6		1.15			
5			1.65			
6	1.5					
8	6, 8, 10	6	2.0		3	
10	6	6, 8, 10	2.5	70	6	4~6
12						
14						
16						
20	12					

7.2 内孔研磨磨棒
Grinding Pins for internal grinding

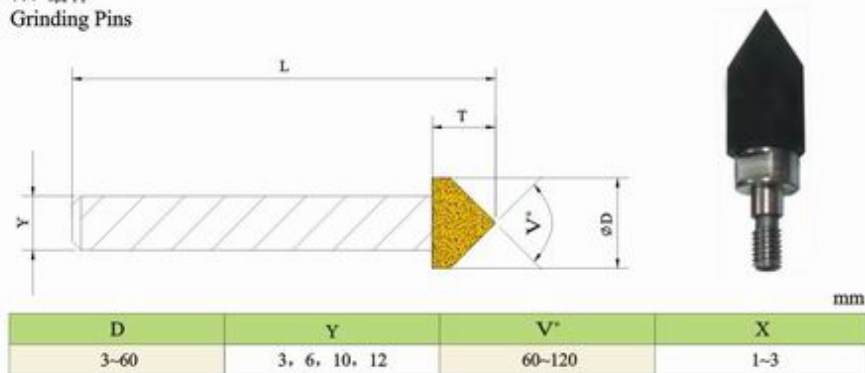


D	T	N	L	Y
0.4-20	2-10	5, 8, 12, 15, 22	45, 50, 80	3, 6

7.3 磨棒
Grinding Pins - CAD/CAM Milling



7.4 磨棒
Grinding Pins

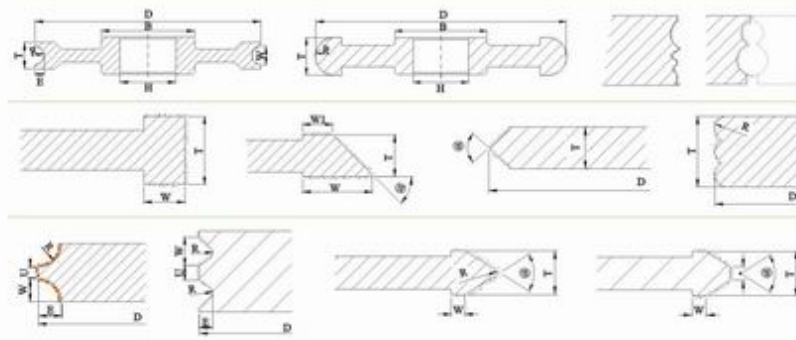


7.5 电铸钻石小钻头 Electroplated Diamond pins

用途：使用玉石、精密陶瓷的细小加工。
Usage: Diamond pins are suitable for internal grinding, such as jade and precision pottery.

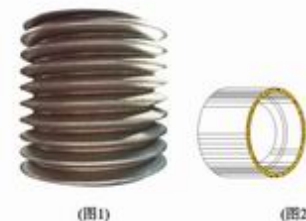


成型钻石砂轮 Diamond Formed Wheel

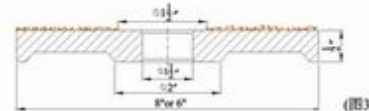


成型钻石砂轮可用于碳化钨钢刀、大理石、宝石、贝壳、石墨、珊瑚、人造宝石等工艺品的成型加工。
Diamond Formed Wheel can be used for form grinding, such as tungsten carbide inserts, marble, jewel, shell, graphite, coral and synthetic jewel.

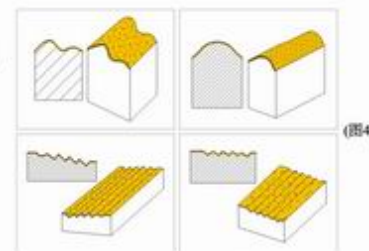
1. 长形多沟钻石砂轮 Long multi-grooves Formed Wheel (见图1)
此大型砂轮是配合专用机器从事宝石圆珠或长柱型而线条简单的饰品快速生产。
Long multi-grooves formed wheels are used with specialized machine for mass production of round ball and nbsprectangular prism trinket.



2. 钻石钻管 Diamond Welltube (见图2)
电铸钻管，适用于石墨，大理石，贝壳的钻孔。2" ~ 6" 的大口径特别适用于玻璃、纤维的钻切取材。粒度有#40/50, #50/60, #60/80, #80/100四种。
Diamond Welltube is used for drilling graphite, marble and shell. Large size such as 2" ~ 6" most suitable for glass and fiber drilling. There is four kinds of grit such as #40/50, #50/60, #60/80, #80/100.

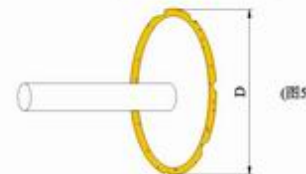


3. 钻石磨盘 Diamond Grinding Table (见图3)
玉宝制造的钻石磨盘可用于水钻及红宝石的多面体平面加工。
Diamond Grinding Table is used for processing surface of water drill and ruby.



4. 钻石成型修整块 Diamond Block (见图4)
钻石成型修整块用于树脂砂轮的整形和修锐作用。
Diamond Block is used for truing and dressing diamond wheel.

5. 带柄钻石锯片 Mounted Diamond Saw Blade (见图5)
适用于半宝石、FRP、铝、陶瓷、电木塑胶、石材等之切割，雕刻作业。
Mounted Diamond Saw Blade is used for cutting semi-precious stone, FRP, aluminum ceramic bakelite, rubber, stone.



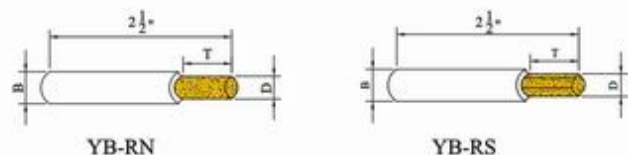


电铸钻石及CBN研磨工具

Electroplated diamond and CBN grinding wheels

1. 电铸法钻石刨刀 Electroplated plane cutter

用途: 可安装在手工工具上, 适用于铝、铜、FRP等铁金属、非金属之钻、切、铣、扩孔等工作。
Usage: Electroplated plane cutter can be used to hand tools, and it's suitable for Aluminum, Copper, FRP and nonmetal to drill and cut.



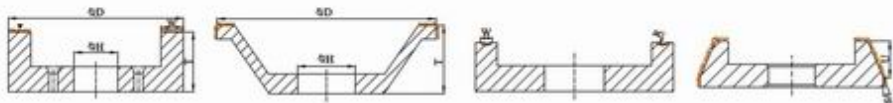
2. 钻石麻花钻头 Diamond Twist Drill

用途: 适用FRP、电木塑胶、石棉、铁弗龙等之钻孔加工。
Usage: Diamond twist drill are suitable for FRP, rubber, asbestos and teflon to drill.



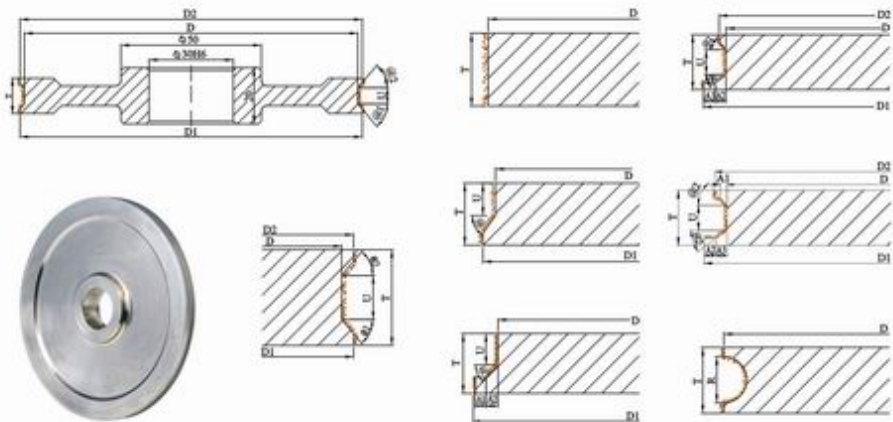
3. 碗型钻石砂轮 Electroplated Taper Cup Wheel

电铸的碗型钻石砂轮可用于陶瓷、玻璃、超硬合金或高速钢的研磨, 特别对于各型的车刀或雕刻刀、钻头的修锐之用。
Electroplated Taper Cup Wheel is used for grinding ceramic, glass, carbide and high speed steel, most suitable for reshaping of turning tools, drills and engraving tool.



4. 表镜片修边用钻石砂轮 Diamond Wheel for Lens Edge

玉宝制造的表镜片修边用钻石砂轮使用手表镜片的倒角修边。也可用于牙科口腔反射镜片及光学镜片的外缘成型。
Diamond Wheel for Lens Edge from YUBAO can be used for grinding watch glass edge and forming grinding of reflectoscope and optical glass.



钻石及CBN工具磨削方式

Grinding method

工具、刀具 Tools, cutting tools

工件 Workpiece	磨削方法 Grinding method	
	外圆磨 Cylindrical grinding	无心磨 Centreless grinding
超硬钨钢 (铣刀、钻头、铰刀、滚刀) Carbide (milling-cutter, drill, reamer, hob)		
金属陶瓷 (切削刀片) Cement (knives)	平面磨 Straight grinding	双端面磨 Surface grinding
陶瓷 (塞规、量块) Ceramic (feller gauge, thickness feeler)		
聚晶钻石 (PCD) 立方氮化硼 (PCBN) (切削刀片) (knives)	倒角磨 Chamfer grinding	开槽磨(深切缓进式) Slot grinding (creep)
	工具(修磨) Tools	
工具钢 (丝锥、拉刀、钻头、铣刀、滚齿刀) Steel (tap, broach, bit, milling, hob)		





钻石及CBN工具磨削方式 Grinding method

■ 模具Die-set

工件 Workpiece	磨削方法 Grinding method	
	外圆磨 Cylindrical grinding	内圆磨 Internal cylindrical grinding
超硬钨钢 (伸线模、冲头、 冲压模、冷压模) Carbide (wire drawing die, punch, stamping die, cold die)		
合金钢 (推杆、冲模导销) Alloy steel (putters, stamping die)	平面磨 Surface grinding	倒角磨 Chamfer grinding
工具钢 (模具) Tool steel (die-set)	切割 Cutting	仿磨 Copying grinding



钻石及CBN工具磨削方式 Grinding method

■ 玻璃、镜片研磨Glass and lens grinding

工件 Workpiece	磨削方法 Grinding method	
	外圆磨 Cylindrical grinding	横轴平面磨 Transverse grinding
玻璃 (汽车玻璃、装饰玻璃) Glass (Auto glass, ornamental glass)		
镜片 (棱镜) 光学玻璃 Lens (prism) optical glass	倒角磨边 Chamfer edging grinding	汽车玻璃倒角 Auto glass chamfer grinding
水晶 Crystal	钻孔 Drilling	切割 Cutting
石英 Quartz		
宝石 Precious stone		



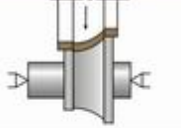

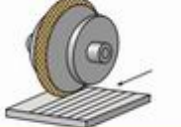
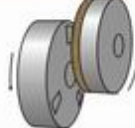


■ 机械零件、汽车部件 Mechanical parts, Auto parts

工件 Workpiece	磨削方法 Grinding method	
	外圆磨 Cylindrical grinding	内圆磨 Internal cylindrical grinding
超硬钨钢 (轧辊、导板) Carbide(roll, guida plate)		
铝合金 Aluminum alloy	无芯磨 Centreless grinding	平面磨 Surface grinding
塑胶、塑料 Rubber, Plastics		
铸铁 (凸轮轴、曲轴、机床导轨) Cast iron (camshaft crankshaft, machine rail)	横轴平面磨 Transverse grinding	双端面磨 Two surface grinding
		
烧结粉末合金 Sintered powder	切割 Cutting	珩磨 Honing grinding
		
陶瓷 Ceramics		

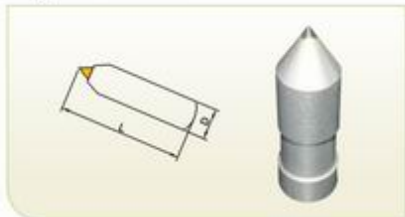


■ 电子零件材料 Electronic parts

工件 Workpiece	磨削方法 Grinding method	
	无芯磨 Centreless grinding	横轴平面磨 Transverse grinding
铁氧体(磁铁、磁头) Ferrite (magnet, headmagnet)		
Sm-Co	双端面磨 Two surface grinding	成型磨 Form grinding
		
Nd-Fe		
铁、硅、铝、磁合金 Fe, Si, Al	切割 Cutting	超薄切割 Extra thin cutting-off
		
电子零件、陶瓷 (光铁管件) Electronic part, Ceramic (Fibe tube)		镜面切削磨 Lens grinding
		
硅(单晶硅、多晶硅) Silicon (single-point silicon, poly point silicon)		



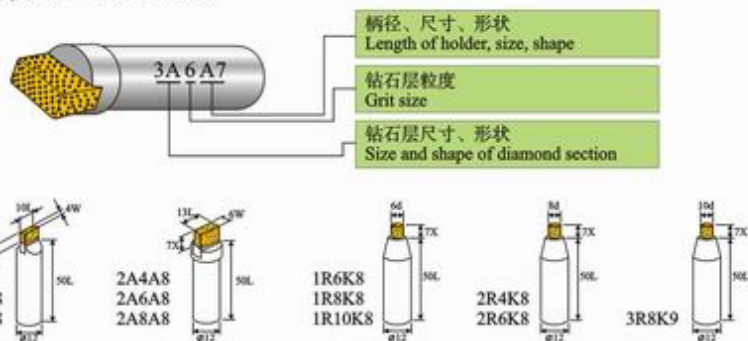
■ 单石修刀
Single Point Dresser



■ 钼棒及超级钻石
Molybdenum Rod and Super Diamond



■ 结合修刀 Combined dresser



柄径、尺寸、形状 Length of holder, size, shape					
钻石层粒度 Grit size					
钻石层尺寸、形状 Size and shape of diamond section					
1A4F8 1A6F8	2A4A8 2A6A8 2A8A8	1R6K8 1R8K8 1R10K8	2R4K8 2R6K8	3R8K9	
钻石修刀之粒度代号 Dresser grit size	4	6	8	10	12
被修整之砂轮粒度 Wheel grit size	#46	#54-#100	#120-#150	#180以细 more than #180	V法及CBN砂轮专用 For Vitrified and CBN wheels

● 手柄钻石油石
Mounted stone



● 抛光工具
Polishing tools



● 修锐工具
Dressing tools



■ 4.砂轮的修整及修锐 Truing and dressing

钻石和CBN砂轮的最佳性能只有偏心 and 几何形状误差最小时才能达到。玉宝生产的所有钻石或CBN砂轮，在出厂之前都已通过品管，确保砂轮在要求公差内，在一般情况下，可以直接使用，但在一些要求较严格的研磨作业上，安装后的修整是必要的。

The optimum performance of diamond and CBN wheel can be achieved only when out of center and geometry error are the smallest. All products from YUBAO have passed quality control before selling to ensure their tolerance. General, those wheels can be used directly, but it's necessary to truing after installing in some strict work.

● 修整(Truing)

将砂轮研磨面修平或整形成所需要形状，并使其与砂轮心轴同心作业。如图一，但此时砂轮表面相当之平滑，磨料颗粒突出表面不多。如以此情况下的砂轮来研磨，其磨削会将其工作物烧焦或产生打滑现象。

Work correcting run-out and shape when setting the wheel to the machine. Shown in figure 1, the wheel surface is rather smooth, only a little abrasive grite exposing from the surface. If grinding at such condition, the workpiece will be burnt and slide.

● 修锐(Dressing)

将砂轮平滑表面，包围在磨料附近的结合剂去除，使磨料锐角能适当地露出结合剂表面，以便产生磨削能力。如图二，当钻石及CBN砂轮经过适当修整后，约85%以上磨料将不断地产生新锐角以利研磨工作。相对地氧化铝砂轮则只有30%以下的磨料产生研磨作用，而其它磨料则在修锐中脱落掉了。

Work exposing the abrasive grit from the wheel surface after truing to improve grinding performance. Shown in figure 2. After dressing, more than 85 percent abrasive grite engaged in grinding. Relatively, only less than 30% abrasive grite in Al₂O₃ wheels engaged in grinding, other particle fallen off the surface.

■ 各种结合剂修整(修圆) Truing of different bonds

修整器种类 Truing unit	结合剂种类 Bonds			
	树脂B法	金属M法	陶瓷V法	电铸P法
多点含钻石 Poly point diamond	++	+	+	-
单点钻石 Single point diamond	+	-	+	-
动力旋转式钻石 Diamond rotary dresser	+++	+++	+++	-
刹车旋转式 Brake dresser	+++	+++	-	-
软钢和钢或钼钢块 Mild steel/molybdenum steel block	+	-	-	-
电铸或金属结合块 Electroplated Metal bond block	++	++	+	-
碳化硅砂轮 SiC wheels	++	++	-	-

削正完成 After truing



图一 Fig. 1

■ 各种结合剂修锐(目粒)种类方式 Dressing of different bonds

修整器种类 Truing unit	结合剂种类 Bonds			
	树脂B法	金属M法	陶瓷V法	电铸P法
氧化铝修锐棒 Al ₂ O ₃ stick	++	++	-	-
游离磨料 Isolated grain	++	-	-	-
软钢和钢或钼钢磨削 Mild steel/molybdenum steel block	++	-	-	-
单点钻石 Poly point diamond	+	-	+	-
动力旋转式或碳化硅砂轮 Rotary dresser or SiC wheel	+	+	-	-
旋转式钢刷 Rotating steel brush	+	-	-	-
动力旋转式钻石 Rotary diamond	+	+	++	-

削锐完成 After dressing



图二 Fig. 2

("+" 越多表示越好, "-" 表示不建议使用)
("++" means the more the better, "-" not advised to use)

■ 以下介绍6种修整砂轮的方法 Six ways of dressing wheel

● 电铸/金属结合剂金刚石状工具 Electroplated/Metal Bond Block

a 其削正方式是指将一平直的铁块铸上钻石磨料来削正平直形砂轮,如图1。或其铁块有成某一形状来将砂轮成型为所需的形状,如图2。
First we plate diamond on a straight iron then dress one straight wheel, take fig.1 as example. Or we dress one Form Wheel with a match iron block.

b 电铸整形块广泛的应用于树脂CBN砂轮,但也有少数用于陶瓷CBN砂轮,甚至亦用于金属结合剂CBN砂轮的整形工作。
Electroplated Block mainly used for resin bond wheel, some used for Vitrified CBN wheel, as well as Metal bond CBN wheel.

● 使用刹车式砂轮修整器(图4,图5) Brake Dresser

下面为修整砂轮装在刹车修整器上,并平行或偏斜 $30^{\circ} \sim 45^{\circ}$ 的固定在被修整砂轮之正下方,然后用手转动旋转把手,直到修整轮与被修整砂轮接触,而修整轮被带动旋转后,开始前后直到修整作业的完成。修整的进刀量为 $0.01 \sim 0.05\text{mm}/\text{回}$,并尽可能给予充分冷却。

First the wheel should be fixed under the Brake Dresser, parallel or off $30^{\circ} \sim 45^{\circ}$, Then rotate the brake dresser until the wheel which to be dressed contact with the dress wheel and finish dress. The dress infeed is $0.01-0.05\text{mm}$, and the wheel should be cool enough.

● 用游离的磨料来修整碗型砂轮(图6) Dress tapered wheel Dissociated Grain

碗型砂轮可以用游离的磨料来修整磨料层的平面度及修锐。将 $80\# \sim 140\#$ 之GC磨料散放于玻璃板或铸铁平板上,用手拿着砂轮以画8字的方式轻轻的修整平面度及修锐。

We can use dissociated grain to dress taper cup wheel. First we put some GC grain on a glass plate or a iron plate, then the wheel walk on the plate like "8".

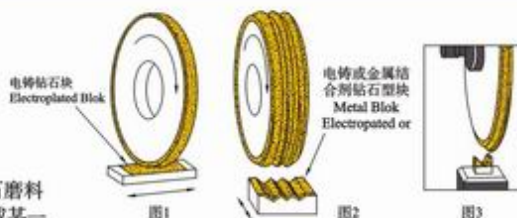


图1

图2

图3

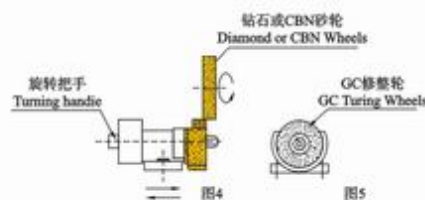


图4

图5

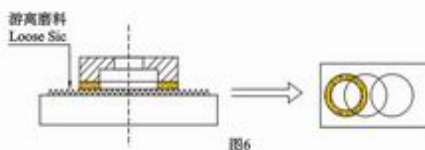


图6

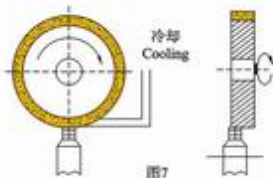
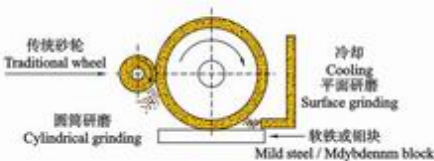


图7

传统砂轮
Traditional wheel圆筒研磨
Cylindrical grinding冷却
Cooling平面研磨
Surface grinding软铁或钼块
Mild steel / Molybdenum block

● 使用钻石结合修刀修整(图7) Dress with Combined Dresser

这个方法仅使用于CBN砂轮,不适用于钻石砂轮。钻石结合修刀的粒度为 $\#20 \sim \#100$ 之间,进给磨削量为 $0.01 \sim 0.02\text{mm}$,但最后一次进给磨削量只用 0.005mm 。修整时,充分冷却是必要的。(本公司可提供修整CBN砂轮的结合修刀,欢迎订购)。

Combined Dresser is only for CBN wheel, not suitable for diamond wheel. The grit size of combined dresser rang from $\#20$ to $\#100$, and infeed is $0.01 \sim 0.02\text{mm}$, but the last infeed is 0.005mm . Adequate cool is necessary when dressing. (Combined Dresser is available)

● 使用软铁/钼块来修整及修锐(树脂和金属结合法修正之用)

Using Mild Steel and Molybdenum Block to truing and dressing(for resin bond and metal bond wheel)

a 用软铁来修整钻石和CBN砂轮是个简易有效的方法。只要将未修整未修锐砂轮跟整形块对磨,直到砂轮形状达到正确为止,此一软铁块会使砂轮易于脱落其颗粒,因此修整的作业一开始就必须依照正常的研磨条件及充分的冷却,方可有效的修正及修锐钻石或CBN砂轮。其表面会产生粗糙铁屑而且有许多孔(这些孔是修正的磨料颗粒脱落结合剂而产生的)
Using mild steel and molybdenum block to dress wheels is an easy and effective method. Grinding the wheel with a block until the wheel shape is intended for, but the mild iron block make the grain easily fall off from the wheel, so in order to dress the wheel effectively, the wheel should be cooled enough at first. If dress to excess, there will be chips and pores on the surface of the wheel which caused by the grain fallen off.

b 刚开始时,其进刀量应该保持小量进刀,一般不超过 0.012mm 。然后慢慢的增加进刀量,一直到 0.025mm 为止或所需要的形状为止。继续此种状况,一直到砂轮表面能有最佳研磨效果为止。
At first, we should keep small infeed less than 0.012mm , then increase the infeed to 0.025mm or the shape intended for. Keep the action till the wheel surface gain the best grinding performance.

● 用GC油石条来修锐砂轮 Dressing wheel with GC Oil Stone

钻石或CBN砂轮,如采用(1)或(3)方式修整后,一定要用 $220\#$ 的GC油石条再做修锐处理,如此,砂轮方可有良好的研磨性能。此外,当钻石或CBN砂轮经研磨后,若发生塞目或感觉不锐利时,用GC油石条来清除塞目使新研磨刃重现,也是十分有效的方法。此方法可适用于平直型或碗型轮,其进刀量为 $0.6-1.5\text{mm}$ 。横向速度为 $1-3\text{m}/\text{min}$,如此反复修锐直至完成为止。有一点应注意的是砂轮转速应降低,若转速固定,则采取电源时开时关的方法,利用油石条之减速作用达到修锐目的。

After using method (1) or (3) to dress wheel, we should use $220\#$ GC oil stone to dress the wheel again, only so the wheel has good performance. Besides, if the wheel surface is clogged or not sharp we can use GC oil stone to remove chips and come into new grinding edge, this is an effective method which suitable for straight and taper cup wheels, the infeed is $0.6-1.5\text{mm}$, table speed is $1-3\text{m}/\text{min}$, dressing like this again and again till it's finished. But we should decrease the PRM, if the PRM is fixed, we can switch the power on and off every now and then, and decrease the oil stone speed in order to gain the performance.



砂轮的使用说明

Instruction of how to use grinding tools

1. 机械与砂轮 Machine and wheels

研磨时，砂轮与工件之间的任何异常震动都会影响研磨效果及加速砂轮之磨损。因此良好的机械条件和正确的选择砂轮是同等重要的。良好的机械条件如下：

When grinding, any abnormal vibrates will affect the performance and wear of the wheel, so choosing good condition is as important as choosing wheel. The good condition are as follows:

- 机械结构应该有足够的刚性，且最好基材固定，以免操作时结构之震动
The facility should be strong enough and stable so as to avoid vibrating when working.
- 主轴培林应保持良好状况及高负荷，以确保主轴能平顺运转
Make sure The spindle in good condition and high loading, so as to ensure the spindle runs very true.
- 各部的机械件与工作台面不可松动
All parts and grinding table should be stable
- 使用高精度法兰，并定期检查主轴，尤其当有异常作业情况发生时，请检测主轴是否有偏摆现象。有了良好的机械条件，再正确的安装砂轮，并用测微器检测砂轮的径向与轴向偏摆度是否在要求的公差内：平行砂轮在0.02以下 碗型砂轮在0.03以下
Using the high efficient flange and make a construction of spindle regular. Especially when machine work abnormally, please check the spindle deviance. Then assembling the wheel correctly and using the dial gauge to ensure the formal and axial run-out are within 0.02 (if the wheel is straight) or 0.03 (if the wheel is tapered).

2. 使用前注意事项 Remarks before using the wheel

- 使用湿磨加工时，请特别注意研磨液不能中断。
A steady coolant supply is important in wet grinding.
- 请勿做变更砂轮形状的增加后加工，若真的有必要，请先洽本公司。
Do not change the wheel shape, if it's necessary, please tell us..
- 凡是遇到砂轮的形状及尺寸与磨床指定尺寸（砂轮外径、厚度、孔径）有不相搭配的情况，请勿使用。
Do not use the wheel if the wheel shape and size not match the machine tool.
- 砂轮的基材若是铁制品，请勿将其表面的防锈剂擦除干净。
Don't Remove the rust preventer on the wheel surface if the wheel body is iron.
- 砂轮的基材是陶瓷制品，请于安装前，先以木追轻轻敲打砂轮侧面，并检查敲打的声音。
Carrying out a sound inspection before assembling the wheel if the wheel body is ceramics.
- 砂轮应是按设计好的使用方法，来做外径研磨或侧面研磨等，请与使用前，先确认是否符合其使用目的。
Do not grinding material that are not specifically intended for your wheels, since wheel is designed for special work.
- 使用砂轮时可能产生火花，因此不可在可能引火或爆炸环境中使用。
Do not use the wheel in a condition that may catch fire or explode since it can generate electrical sparkle.

3. 安装与校正的注意事项 Remarks when instrlling and checking wheel

- 要将砂轮安装到磨床上或者拆卸下来时，请务必将机床电源关掉。
Make sure the power source off before assembling or disassembling the wheel.
- 将砂轮装入法兰时，请勿用木锥敲击强行安装
When assembling the flange to the wheel, make sure do not force it in by a stick.



砂轮的使用说明

Instruction of how to use grinding tools

- 砂轮的基材若是陶瓷制品，请将玉宝商标的位置朝上，并使砂轮和轴心成垂直方位安装为妥
If the core is ceramic products, please keep the spindle and the wheel in perpendicular position
- 法兰安装时，螺丝请以对角线的顺序位置均等扭紧，确保锁紧，不得松动。
When assembling the flange, make sure the bolts are fastened and secured.

4. 冷却

对于钻石或CBN砂轮，可以依作业需要采用干式或湿式研磨。但一般而言，湿式研磨有较多好处：如延长砂轮使用寿命及研磨性能较佳等。所以除非作业条件受限，否则应尽可能采用湿式研磨作业。在湿式研磨作业上，正确的研磨液喷落点该是在研磨接触点上才是最有效的方法。而在深切研磨作业时，应有更大量的研磨液来作业。

Wet grinding and dry grinding is adapted when working with diamond and CBN wheels. But generally, wet grinding is preferred, for its long lifespan and optimum grinding performance etc. so only if the condition is restricted, wet griding is always adaped. Feeding of coolant at the contact area is significantly. But at creep grinding, we should prefer a large mount of coolant.

5. 研磨液的主要功能：The function of coolant.

- 能对砂轮及工件表面充分冷却，防止烧伤工件及砂轮
Can cool the surface of the grinding wheels and workpiece to avoid the workpiece and wheel be burnt.
- 清洗砂轮表面的杂屑
Can remove the chips on the wheel surface
- 提供润滑效果，降低砂轮的研磨抵抗，以提高表面精度及延长砂轮寿命
Can lubricate the wheel to prevent damage to the work piece, then improve accuracy and lifespan of the tool
- 研磨液分为非水溶性和水溶性两大类，非水溶性的研磨液润滑性较好，可用于提高研磨性能及研磨精度，防止研磨烧焦。例如，成型研磨，总形研磨，螺纹或齿轮研磨，搪磨，精密研磨，或一些大接触面积的研磨作业。而水溶性研磨液因湿润性较好，冷却效果较好，且作业环境较好，所以一般的研磨作业都采用水溶性研磨液。
There are two kinds of coolant, namely water solution and non-water solution, The use of non-water solutions coolant increase the removal rate, accuracy and to prevent damage to work. Such as Form grinding, Screw or Gear grinding, hone grinding, precision grinding or grinding work with large contact area. On the other hand, water solutions has a better cool performance, so wet grinding is preferred and generally recommended method to use.
- 研磨液的选择很重要，且如何维护和使用也很重要。例如，保持研磨液的干净，可以增加砂轮寿命及工件表面的精度，亦可增加研磨液的使用寿命。正确的喷落点可以有效的地冷却及洗净。此外，在树脂砂轮的使用上，若使用水溶性研磨液，会降低结合剂的硬度，所以尽可能保持研磨液的PH值在9以上，液温不要超过30℃。
Choosing a appropriate coolant is as important as using and maintaining coolant. For example: keep clean of the coolant, It can improve the wheel lifespan and the accuracy of the work piece, it can also prolong the lifespan of the coolant. Feeding of coolant at the contact area is significantly cool and wash up. Use of water solutions is not recommend during grinding with resin bonded wheels, due to the risk of reducing hardness, so the PH of the coolant should be above 9 and the temperature should be lower than 30° C.



砂轮的使用说明

Instruction for usage of grinding tools

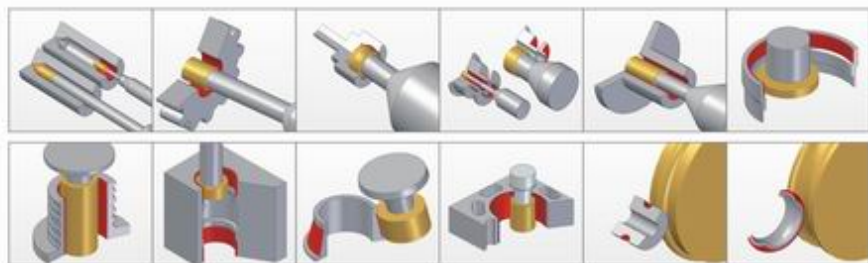
6. 研磨作业之相关注意事项 Remarks

- 千万别让手或身体任何部位触碰到正在旋转的砂轮。此外，在进行干式研磨后，由于砂轮会产生高温，请别让手或身体的任何部位触碰到砂轮。
Do not touch a wheel which are working or after dry grinding, since it can produce high tempture.
- 砂轮的检查票上有记载最高使用周速度及磨床心轴容许之回转速度，绝对不容许超越规定范围之使用。
Make sure the maximum speed indicated on the wheel is suitable for the machine on which it will be used. And do not exceed the maximum recommended speed for operating your wheel.
- 凡是遇到有异常噪音或异常震动发生时，请立即退刀，脱离加工件，并且停机。
Stop working and switch off the machine if there is abnormal noise and shake.
- 开始作业前，请先空机试运转1到3分钟，并且检查砂轮回转方向是否正常，且没有震动现象发生。
Before working, make sure the machine work without wheel for 1 or 3 minters, and inspect if the rotation of the wheel is right and no shake.
- 湿式研磨时，请确认研磨点上有充分的研磨液供应不断。
Make sure a steady coolant supply in the contact area when wet grinding.
- 当砂轮和工件接触时，请勿过度急躁进刀，且勿于超负荷的情况下连续使用。
Before the wheel contact workpiece, do not use instantly, and work continuously under high loading.
- 干式研磨时，请勿使砂轮发生烧焦现象。
Make sure the wheel will not be burnt when dry drinding.

7. 保管及操作之相关注意事项 About storage

- 使用之后，将砂轮拆卸下收藏的时候，请收藏干燥场所。
After using the wheel, please store it in a dry place.
- 砂轮的基材若是铁制品，请先涂抹防锈剂，然后妥善保管。
If the material of the wheel is steel, please apply oil before store.

■ 研磨例 Grinding Example



钻石及CBN砂轮磨削参数

Grinding parameter

- 所有的磨削加工的实现，砂轮都必须进行高速回转运动，砂轮的速度即磨削速度，通常按以下公式计算：

All works require the wheels rotating in a high speed. The wheel speed is namely grinding speed. According to the following formula

$$V_s = \frac{\pi d_s n_s}{60 \times 1000}$$

V_s = 砂轮圆周速度(m/s), d_s = 砂轮直径(mm), n_s = 砂轮转速(r/min = r.p.m), 普通磨削, V_s 一般为30-35m/s, 当 $V_s > 50m/s$ 时, 称为高速磨削。

V_s = Peripheral speed(m/s), d_s = Grinding wheel diameter(mm), n_s = Grinding wheel speed(r/min = r.p.m), Generally, V_s is 30-35m/s, when $V_s > 50m/s$, It's high speed grinding.

■ 表面粗度换算表 Mean surface roughness

Ra(μm)	0.02	0.03	0.05	0.07	0.09	0.10	0.12	0.14	0.15	0.17	0.20	0.24	0.27	0.31
Rz(μm)	0.1	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.8	0.9	1.1	1.3	1.4	1.6
Rmax(μm)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8
Ra(μm)	0.34	0.41	0.48	0.54	0.61	0.68	0.77	0.85	0.94	1.02	1.19	1.36	1.53	1.70
Rz(μm)	1.8	2.2	2.5	2.9	3.2	3.6	4.1	4.5	5.0	5.4	6.3	7.2	8.1	9.0
Rmax(μm)	2.0	2.4	2.8	3.2	3.6	4.0	4.5	5.0	5.5	6.0	7.0	8.0	9.0	10.0

■ 砂轮周速度推荐表 The recommend grinding rate.

	钻石砂轮Diamond wheel		氮化硼砂轮CBN wheel	
	干磨Dry(M/min)	湿磨Wet(M/min)	干磨Dry(M/min)	湿磨Wet(M/min)
电铸砂轮 Electroplated	600-1200	1000-1800	600-1200	1000-1800
树脂砂轮 Resin Bonded	700-1300	1300-1800	800-1400	1400-2000
金属砂轮 Metal Bonded	500-1000	1400-1800	500-1200	1500-2100
陶瓷砂轮 Vitrified Bonded	1000-1800	1200-3600	1600-2000	1600-4800



钻石及CBN砂轮磨削参数 Grinding parameter

平面研磨/surface grinding:

进刀量/infeed:

#80-#120 0.01-0.04mm

#140-#200 0.01-0.02mm

#230-#325 0.005-0.01mm

横向进给速度/table speed:10-25m/min.

纵向进给速度/cross speed:

for diamond:1/5-1/3 of rim width.

钻石砂轮:砂轮磨料层幅宽的1/5-1/3。

For CBN:1/4-3/4 of rim width.

CBN砂轮:砂轮磨料层幅宽的1/4-3/4。

内孔研磨/Internal grinding:

进刀量/infeed:

#80-#120 0.005-0.02mm

#120-#200 0.002-0.01mm

#230-#325 0.001-0.007mm

横向进给速度/table speed:0.5-2m/min.

工作周速度/peripheral speed of workpiece:20-40/min

工具研磨/Tool grinding:

进刀量/infeed:

#80-#120 0.02-0.05mm

#120-#200 0.01-0.03mm

#230-#325 0.005-0.01mm

横向进给速度/table speed:0.5-4m/min.

外径研磨/External cylindrical grinding:

进刀量/infeed:

#80-#120 0.01-0.03mm

#140-#200 0.01-0.02mm

#230-#325 0.005-0.01mm

横向进给速度/table speed:0.5-2m/min.

工作周速度/peripheral speed of workpiece:20-40/min

以上提供的加工参数,可视为一种参考数据,在实际的运用中,仍可根据机械的刚性,工件的特性及尺寸,砂轮外径,砂轮磨料层宽度等条件加以修正。但有一个基本的原则是可以遵循的:

若用高进给速度,则宜采取小进刀量

若用低进给速度,则可采取大进刀量

The parameter can be view as a reference, we can adjust the grinding parameter in practical work according work piece, wheel diameter and abrasive width. There is a rule we can follow:

If the infeed speed is fast, the depth of cut should be shallow.

If the infeed speed is small, the depth of cut should be deep.

深进刀研磨 Deep Depth of Cut

由于深进刀研磨较一般的研磨有经济优势,所有越来越受到重视,基本上,这种研磨均采用湿式研磨,且均采用高进刀量及低横向进刀速度。

Because deep depth of cut grinding has economy advantage compared with the general grinding, so more and more attention are paid to it. Basically, we often adopt wet grinding, high depth of cut and low table speed.

采用深进刀量研磨,机械的要求就要特别严格,例如高强度的机械刚性及缓慢的横向驱动装置。这种研磨技术,由于广泛的运用条件,实在很难提供一个正确的加工参数,在此,我们仅提供一个一般性的技术参数范围仅供参考:

进刀量:1.0-3.5mm/次

横向进刀速度:30-300mm/min

If we adopt high depth of cut, strong machine and slow stable speed device are needed. Because this way is abundant adopted, it's difficult for us to provide a parameter, so we just give a general parameter range as reference.

Infeed: 1.0-3.5 once

Stable speed: 30-300mm/min



钻石和CBN砂轮磨削参数 Grinding Parameter

砂轮的周速度

周速度对于砂轮的研磨性能,砂轮寿命及工件的加工表面粗度有很大的影响,因此,我们郑重的建议您:一定要依据机械的主轴转速,选择适当的砂轮外径,以便能够达到合适的砂轮周速度

The peripheral speed has a great effect on the performance and lifespan of the wheel as well as the workpiece surface roughness, so we recommend you choose appropriate diameter according to the wheel speed so as to attain an optimum peripheral speed.

不同砂轮直径和圆周速度下的砂轮转速(化为整数)

The grinding wheel speed of different diameter and peripheral speed (r/min)

转速表 RPM (每分钟转速, r/min)

砂轮直径 (mm)	圆周速度 (m/s)								
	14	16	18	20	22	24	26	28	30
5									
10	26.750	30.950							
15	17.810	20.390	22.900	25.500	28.000	30.550			
20	13.810	15.280	17.200	19.100	21.000	22.900	24.830	26.800	28.600
25	10.700	12.210	13.750	15.300	16.800	18.340	19.890	21.400	22.900
30	8.910	10.190	11.460	12.740	14.000	15.280	16.550	17.850	19.100
40	6.690	7.640	8.600	9.530	10.500	11.460	12.420	13.390	14.300
50	5.350	6.100	6.870	7.650	8.400	9.150	9.950	10.700	11.470
75	3.550	4.080	4.580	5.100	5.600	6.110	6.630	7.140	7.630
100	2.660	3.060	3.440	3.825	4.200	4.590	4.960	5.350	5.730
125	2.130	2.440	2.750	3.050	3.355	3.670	3.990	4.280	4.580
150	1.770	2.030	2.290	2.550	2.800	3.060	3.310	3.570	3.820
175	1.530	1.750	1.970	2.200	2.410	2.620	2.840	3.060	3.270
200	1.330	1.530	1.720	1.910	2.100	2.290	2.480	2.680	2.860
250	1.070	1.220	1.370	1.530	1.680	1.830	1.990	2.140	2.290
300	980	1.020	1.150	1.270	1.400	1.530	1.650	1.780	1.910
350	760	870	980	1.010	1.200	1.310	1.420	1.530	1.640
400	670	760	860	950	1.050	1.150	1.240	1.340	1.430
500	530	610	690	760	840	910	990	1.070	1.150
600	450	510	570	640	700	760	830	890	950



国内外工业钻石粒度尺寸对照表

Industrial diamond grit size comparison chart

中国(CHINA) GB2086-1979	中国(CHINA) GB6986-86	美国(U.S.A) G.E.Co	美国(U.S.A) NSB174-20-81	西欧(欧洲) (West Europe) FEPA	英国(BRITAIN) DE BEERS Co	英国(BRITAIN) B.S.1987	西德 (West Europe) DIN848-65	前苏联 (RUSSIA) ГОСТ19206-80	日本(JAPAN) JIS6002-63	相近项目 Similar outline
W05	<0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-0.5	0-1	1500
W1	<1	0.5-1	0.5-1	0.5-1	0.5-1	0.5-1	0.5-1	0.5-1	0-1	1500#
W1.5	0.5-1.5	0.5-1.5	0.5-1.5	0.5-1.5	0.5-1.5	0.5-1.5	0.5-1.5	0.5-1.5	0-1	800
W2	1-2.5	1.5-3	1.5-3	1.5-3	1.5-3	1.5-3	1.5-3	1.5-3	0-1	800#
W2.5	2.5-5	2.5-5	2.5-5	2.5-5	2.5-5	2.5-5	2.5-5	2.5-5	0-1	2000
W3	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	0-1	1500
W3.5	3.5-7	4-8	4-8	4-8	4-8	4-8	4-8	4-8	0-1	1500#
W4	4-8	4-8	4-8	4-8	4-8	4-8	4-8	4-8	0-1	1500#
W4.5	4.5-9	5-10	5-10	5-10	5-10	5-10	5-10	5-10	0-1	1500#
W5	5-10	5-10	5-10	5-10	5-10	5-10	5-10	5-10	0-1	1500#
W5.5	5.5-11	6-12	6-12	6-12	6-12	6-12	6-12	6-12	0-1	1500#
W6	6-12	6-12	6-12	6-12	6-12	6-12	6-12	6-12	0-1	1500#
W6.5	6.5-13	7-14	7-14	7-14	7-14	7-14	7-14	7-14	0-1	1500#
W7	7-14	7-14	7-14	7-14	7-14	7-14	7-14	7-14	0-1	1500#
W7.5	7.5-15	8-12	8-12	8-12	8-12	8-12	8-12	8-12	0-1	1500#
W8	8-12	8-12	8-12	8-12	8-12	8-12	8-12	8-12	0-1	1500#
W8.5	8.5-16	9-12	9-12	9-12	9-12	9-12	9-12	9-12	0-1	1500#
W9	9-12	9-12	9-12	9-12	9-12	9-12	9-12	9-12	0-1	1500#
W9.5	9.5-18	10-20	10-20	10-20	10-20	10-20	10-20	10-20	0-1	1500#
W10	10-20	10-20	10-20	10-20	10-20	10-20	10-20	10-20	0-1	1500#
W10.5	10.5-20	11-15	11-15	11-15	11-15	11-15	11-15	11-15	0-1	1500#
W11	11-15	11-15	11-15	11-15	11-15	11-15	11-15	11-15	0-1	1500#
W11.5	11.5-20	12-22	12-22	12-22	12-22	12-22	12-22	12-22	0-1	1500#
W12	12-22	12-22	12-22	12-22	12-22	12-22	12-22	12-22	0-1	1500#
W12.5	12.5-25	13-18	13-18	13-18	13-18	13-18	13-18	13-18	0-1	1500#
W13	13-18	13-18	13-18	13-18	13-18	13-18	13-18	13-18	0-1	1500#
W13.5	13.5-25	14-20	14-20	14-20	14-20	14-20	14-20	14-20	0-1	1500#
W14	14-20	14-20	14-20	14-20	14-20	14-20	14-20	14-20	0-1	1500#
W14.5	14.5-25	15-25	15-25	15-25	15-25	15-25	15-25	15-25	0-1	1500#
W15	15-25	15-25	15-25	15-25	15-25	15-25	15-25	15-25	0-1	1500#
W15.5	15.5-30	16-24	16-24	16-24	16-24	16-24	16-24	16-24	0-1	1500#
W16	16-24	16-24	16-24	16-24	16-24	16-24	16-24	16-24	0-1	1500#
W16.5	16.5-30	17-28	17-28	17-28	17-28	17-28	17-28	17-28	0-1	1500#
W17	17-28	17-28	17-28	17-28	17-28	17-28	17-28	17-28	0-1	1500#
W17.5	17.5-35	18-30	18-30	18-30	18-30	18-30	18-30	18-30	0-1	1500#
W18	18-30	18-30	18-30	18-30	18-30	18-30	18-30	18-30	0-1	1500#
W18.5	18.5-40	19-40	19-40	19-40	19-40	19-40	19-40	19-40	0-1	1500#
W19	19-40	19-40	19-40	19-40	19-40	19-40	19-40	19-40	0-1	1500#
W19.5	19.5-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50	0-1	1500#
W20	20-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50	0-1	1500#
W20.5	20.5-60	21-60	21-60	21-60	21-60	21-60	21-60	21-60	0-1	1500#
W21	21-60	21-60	21-60	21-60	21-60	21-60	21-60	21-60	0-1	1500#
W21.5	21.5-70	22-70	22-70	22-70	22-70	22-70	22-70	22-70	0-1	1500#
W22	22-70	22-70	22-70	22-70	22-70	22-70	22-70	22-70	0-1	1500#
W22.5	22.5-80	23-80	23-80	23-80	23-80	23-80	23-80	23-80	0-1	1500#
W23	23-80	23-80	23-80	23-80	23-80	23-80	23-80	23-80	0-1	1500#
W23.5	23.5-90	24-90	24-90	24-90	24-90	24-90	24-90	24-90	0-1	1500#
W24	24-90	24-90	24-90	24-90	24-90	24-90	24-90	24-90	0-1	1500#
W24.5	24.5-100	25-100	25-100	25-100	25-100	25-100	25-100	25-100	0-1	1500#
W25	25-100	25-100	25-100	25-100	25-100	25-100	25-100	25-100	0-1	1500#
W25.5	25.5-110	26-110	26-110	26-110	26-110	26-110	26-110	26-110	0-1	1500#
W26	26-110	26-110	26-110	26-110	26-110	26-110	26-110	26-110	0-1	1500#
W26.5	26.5-120	27-120	27-120	27-120	27-120	27-120	27-120	27-120	0-1	1500#
W27	27-120	27-120	27-120	27-120	27-120	27-120	27-120	27-120	0-1	1500#
W27.5	27.5-130	28-130	28-130	28-130	28-130	28-130	28-130	28-130	0-1	1500#
W28	28-130	28-130	28-130	28-130	28-130	28-130	28-130	28-130	0-1	1500#
W28.5	28.5-140	29-140	29-140	29-140	29-140	29-140	29-140	29-140	0-1	1500#
W29	29-140	29-140	29-140	29-140	29-140	29-140	29-140	29-140	0-1	1500#
W29.5	29.5-150	30-150	30-150	30-150	30-150	30-150	30-150	30-150	0-1	1500#
W30	30-150	30-150	30-150	30-150	30-150	30-150	30-150	30-150	0-1	1500#
W30.5	30.5-160	31-160	31-160	31-160	31-160	31-160	31-160	31-160	0-1	1500#
W31	31-160	31-160	31-160	31-160	31-160	31-160	31-160	31-160	0-1	1500#
W31.5	31.5-170	32-170	32-170	32-170	32-170	32-170	32-170	32-170	0-1	1500#
W32	32-170	32-170	32-170	32-170	32-170	32-170	32-170	32-170	0-1	1500#
W32.5	32.5-180	33-180	33-180	33-180	33-180	33-180	33-180	33-180	0-1	1500#
W33	33-180	33-180	33-180	33-180	33-180	33-180	33-180	33-180	0-1	1500#
W33.5	33.5-190	34-190	34-190	34-190	34-190	34-190	34-190	34-190	0-1	1500#
W34	34-190	34-190	34-190	34-190	34-190	34-190	34-190	34-190	0-1	1500#
W34.5	34.5-200	35-200	35-200	35-200	35-200	35-200	35-200	35-200	0-1	1500#
W35	35-200	35-200	35-200	35-200	35-200	35-200	35-200	35-200	0-1	1500#
W35.5	35.5-210	36-210	36-210	36-210	36-210	36-210	36-210	36-210	0-1	1500#
W36	36-210	36-210	36-210	36-210	36-210	36-210	36-210	36-210	0-1	1500#
W36.5	36.5-220	37-220	37-220	37-220	37-220	37-220	37-220	37-220	0-1	1500#
W37	37-220	37-220	37-220	37-220	37-220	37-220	37-220	37-220	0-1	1500#
W37.5	37.5-230	38-230	38-230	38-230	38-230	38-230	38-230	38-230	0-1	1500#
W38	38-230	38-230	38-230	38-230	38-230	38-230	38-230	38-230	0-1	1500#
W38.5	38.5-240	39-240	39-240	39-240	39-240	39-240	39-240	39-240	0-1	1500#
W39	39-240	39-240	39-240	39-240	39-240	39-240	39-240	39-240	0-1	1500#
W39.5	39.5-250	40-250	40-250	40-250	40-250	40-250	40-250	40-250	0-1	1500#
W40	40-250	40-250	40-250	40-250	40-250	40-250	40-250	40-250	0-1	1500#
W40.5	40.5-260	41-260	41-260	41-260	41-260	41-260	41-260	41-260	0-1	1500#
W41	41-260	41-260	41-260	41-260	41-260	41-260	41-260	41-260	0-1	1500#
W41.5	41.5-270	42-270	42-270	42-270	42-270	42-270	42-270	42-270	0-1	1500#
W42	42-270	42-270	42-270	42-270	42-270	42-270	42-270	42-270	0-1	1500#
W42.5	42.5-280	43-280	43-280	43-280	43-280	43-280	43-280	43-280	0-1	1500#
W43	43-280	43-280	43-280	43-280	43-280	43-280	43-280	43-280	0-1	1500#
W43.5	43.5-290	44-290	44-290	44-290	44-290	44-290	44-290	44-290	0-1	1500#
W44	44-290	44-290	44-290	44-290	44-290	44-290	44-290	44-290	0-1	1500#
W44.5	44.5-300	45-300	45-300	45-300	45-300	45-300	45-300	45-300	0-1	1500#
W45	45-300	45-300	45-300	45-300	45-300	45-300	45-300	45-300	0-1	1500#
W45.5	45.5-310	46-310	46-310	46-310	46-310	46-310	46-310	46-310	0-1	1500#
W46	46-310	46-310	46-310	46-310	46-310	46-310	46-310	46-310	0-1	1500#
W46.5	46.5-320	47-320	47-320	47-320	47-320	47-320	47-320	47-320	0-1	1500#
W47	47-320	47-320	47-320							