

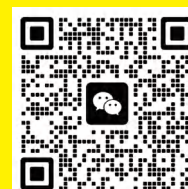


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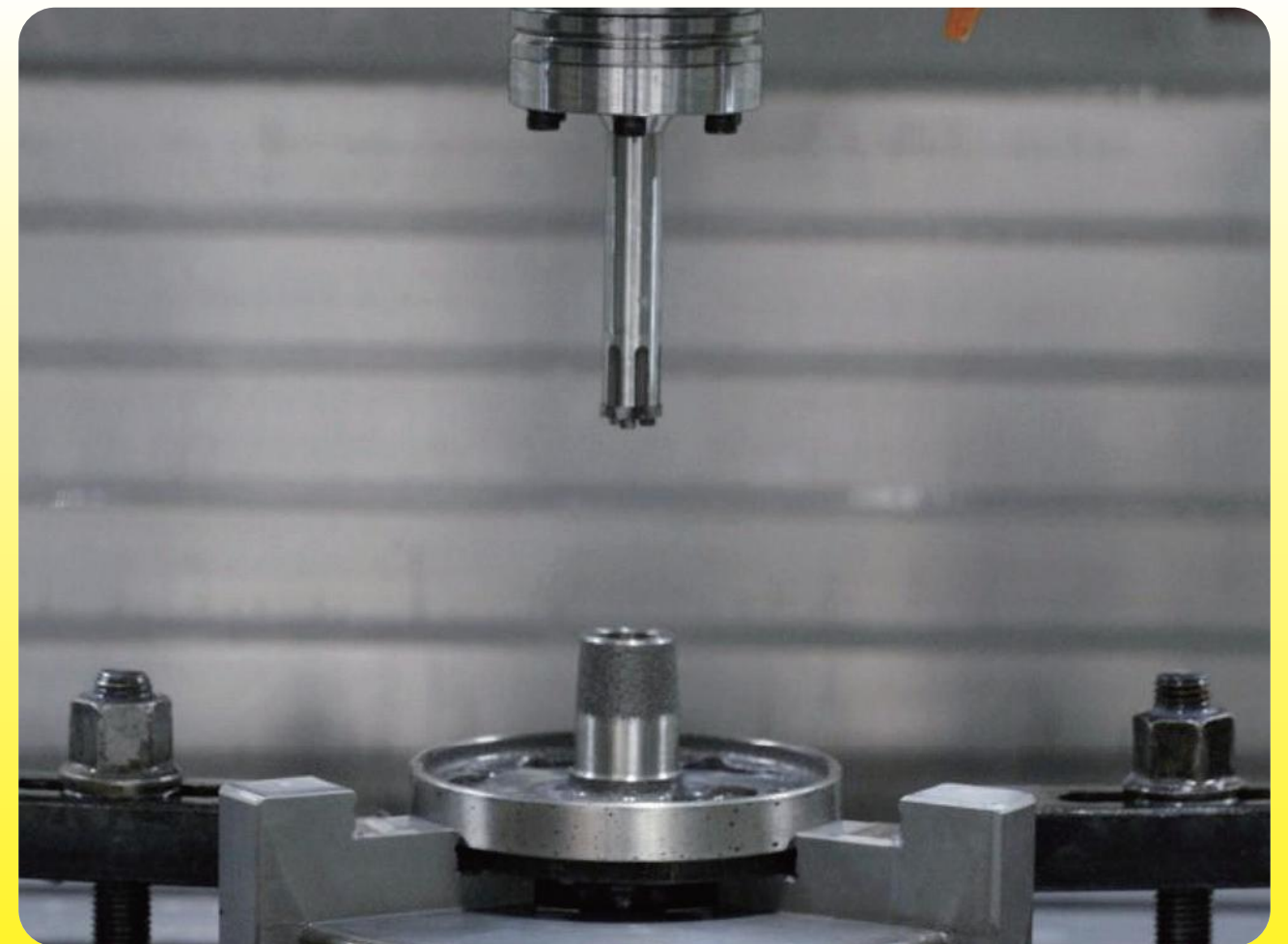


2024-2025样本



方瀚工具源头生产厂家

模块化铰削系统 Modular Reaming system



上海方瀚精密工具有限公司

Shanghai Fonhae Precision Tools Co., Ltd.

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可换头铰刀

Reamer With Removable Insert

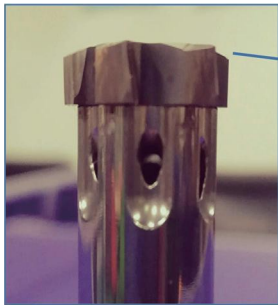
基础结构 Basic structure:

刀杆 , 刀头 Holder, Insert

连接结构 Connection structure:

高精度重复定位机构 High precision repeatable positioning mechanism

- ◎高精度简单重复定位机构，操作简单、更换方便、保证刀具更换精度一致性
High precision simple repeated positioning mechanism, simple operation, easy replacement, to ensure the consistency of tool replacement accuracy
- ◎替代传统整体结构铰刀，降低成本
Replace the traditional integral structure reamer, reduce the cost
- ◎替代传统焊接式铰刀涂层难题、提高刀具寿命、降低成本
Replace the traditional welding reamer coating problem, improve tool life, reduce costs
- ◎跳动不可调节，刀具精度由机床、现有工具系统保证
The runout is not adjustable, and the tool accuracy is guaranteed by the machine tool and the existing tool system

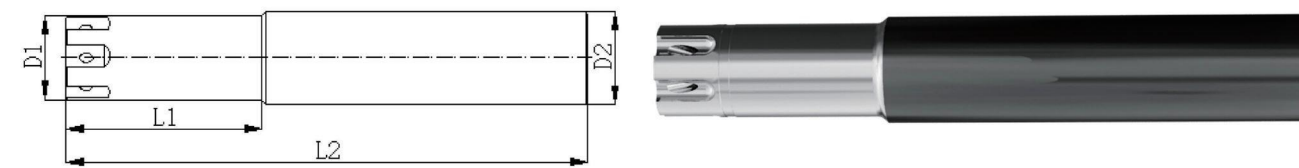


国家发明专利
National invention patent
高精度可重复定位机构
High precision repeatable positioning mechanism



应用范围 Application:

- 替代传统整体硬质合金、焊接铰刀，提高换刀精度、降低成本、提高刀具寿命。
Replace the traditional solid carbide, welding reamer, improve tool change accuracy, reduce cost, improve tool life
- 替代镗刀工艺，提高效率、适应工业化规模生产。
Replace boring tool process, improve efficiency, adapt to industrial scale production



刀头范围 Insert range/mm	L1	L2	D1	D2	订货号Order number	库存stock	
φ15≤φ≤φ16	40	100	14	16	QPBD9.0-16-L40-L100	现货 In stock	
	70	120	14	16	QPBD9.0-16-L70-L120		
	100	150	14	16	QPBD9.0-16-L100-L150		
φ16<φ≤φ19	54	100	15	20	QPBD10.4（5）-20-L54-L100		
	80	130	15	20	QPBD10.4（5）-20-L80-L130		
	120	170	15	20	QPBD10.4（5）-20-L120-L170		
φ19<φ≤φ23	54	120	18	20	QPBD12-20-L54-L120		
	95	150	18	20	QPBD12-20-L95-L150		
	150	200	18	20	QPBD12-20-L150-L200		
φ23<φ≤φ28	30	120	22	20	QPBD15-20-L120		
	30	150	22	20	QPBD15-20-L150		
	30	200	22	20	QPBD15-20-L200		
φ28<φ≤φ33	30	120	27	25	QPBD17-25-L120		
	30	150	27	25	QPBD17-25-L150		
	30	200	27	25	QPBD17-25-L200		
φ33<φ≤φ38.5	根据方案定制 Customized upon request.						
φ38.5<φ≤φ44.5							
φ44.5<φ≤φ51							

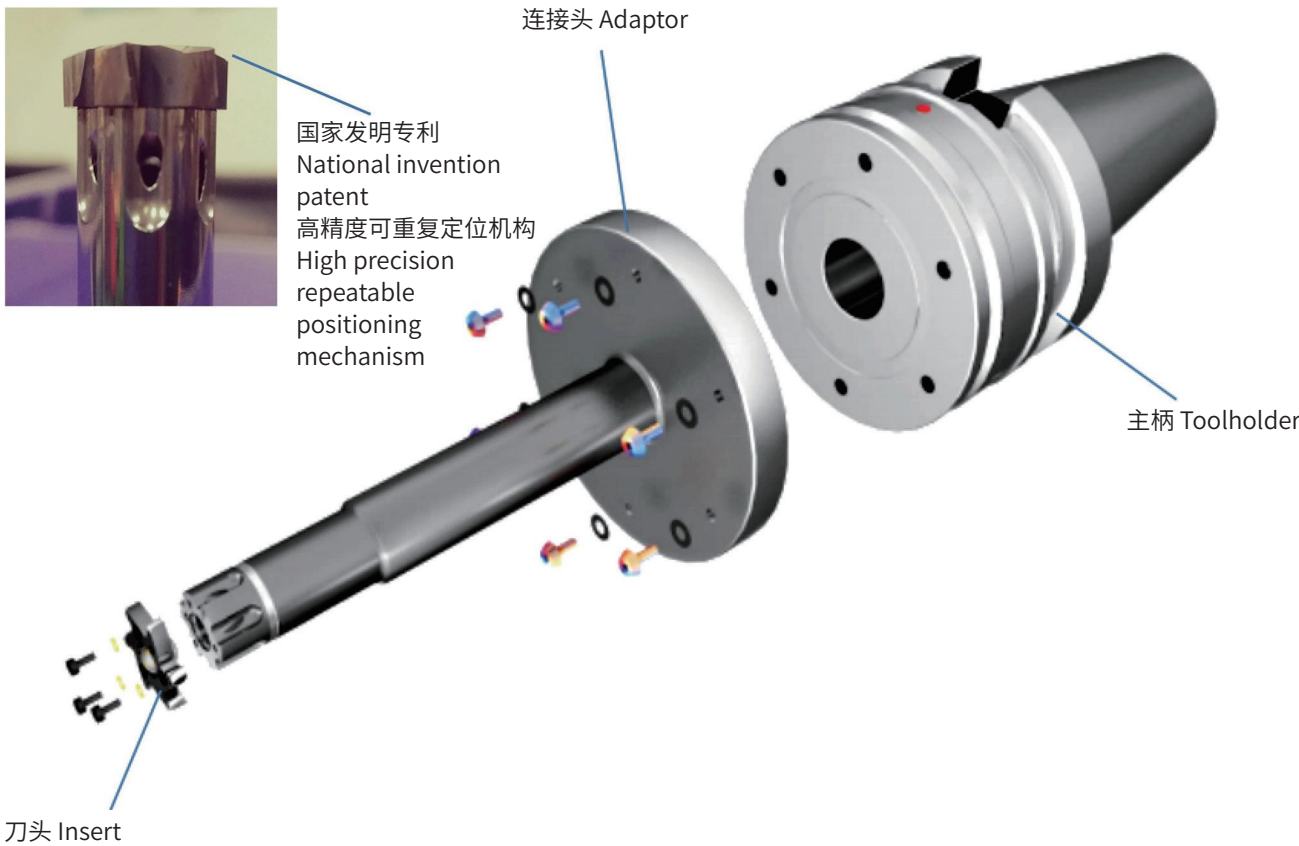
三大基础结构 Three basic structures:

手柄、连接头、刀头 Holder、Adaptor、Insert

两大连接结构 Two connected structures::

可调式刚性连接机构、高精度重复定位机构
Adjustable rigid connection mechanism, high precision repeated positioning mechanism

- ◎高精度简单重复定位机构为智能制造、专业制造提供基础
High-precision simple repetitive positioning mechanism provides the basis for intelligent manufacturing and professional manufacturing
- ◎操作简单、对客户要“0”基础要求，5分钟即可掌握调节、更换等使用
Simple operation, 0 basic requirements for customers, 5 minutes to master adjustment, replacement and so on



应用范围 Application:

适用直径、圆度、圆柱特殊要求孔类精加工。
Suitable for hole finishing with special requirements of diameter, roundness and cylinder
系统可调节、精度高、稳定、调节简单，适应大规模、流水线、智能化生产。
The system is adjustable, high precision, stable and simple to adjust. Adapt to large-scale, assembly line, intelligent production

1. 简单 Easy

调节简单，轻松实现系统误差 0.002mm 以内，简单培训即可
首次调节后，正常使用，无需再进行调节
高精度重复定位 0.003mm, 掌握简单
对客户无多余配套要求（无需对刀仪）
Simple adjustment, easy to achieve system error within 0.002mm, simple training can be
First adjustment, normal use, no need to adjust again
High precision repeated positioning 0.003mm, easy to master
No redundant requirements for customers（No need tool presetter）

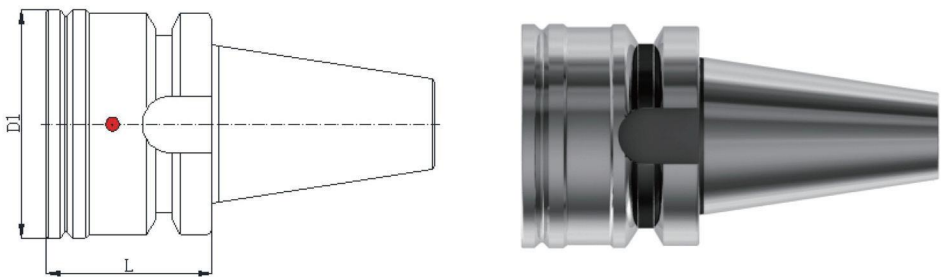
2. 稳定 Stable

对机床的径向误差有一定的修正能力
系统误差 0.002mm 以内，系统稳定，更换刀头使用扭力扳手，避免人为影响
刀头精度 0.003mm, 刀头直径一致性 0.002mm
整个系统连接稳定，刚性好，被加工零件各种形位公差稳定
寿命稳定
It has the ability to correct the radial error of the machine tool
The system error is less than 0.002mm, the system is stable, and the torque wrench is used to replace the insert to avoid human influence
Insert accuracy 0.003mm, tool head diameter consistency 0.002mm
The entire system is characterized by stable connections and high rigidity, ensuring that the geometric tolerance of the machined parts remain stable.
Life stability

3. 高效 Efficient

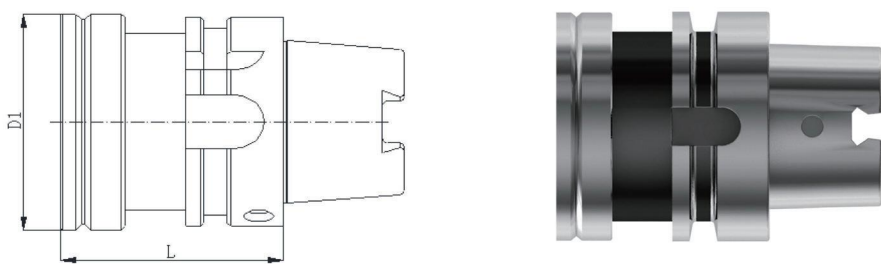
V=50~150m/minfz=0.07~0.3mm
实现高转速，高进给的高效加工
To achieve high speed, high feed efficient processing

BT 系列
BT Series



尺寸size	D1	L	订货编号Order number	库存stock
BT30	50	52	QPA50-BT30	现货In stock
BT40	65	57	QPA65-BT40	
BT50	65	60	QPA65-BT50	
BT50	80	60	QPA80-BT50	

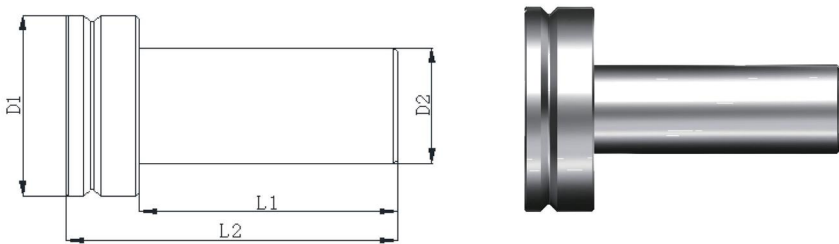
HSK 系列
HSK Series



尺寸size	D1	L	订货编号Order number	库存stock
HSK40A	50	52	QPA50-HSK40A	定制Customized
HSK50A	50	59	QPA50-HSK50A	
HSK63A	65	59	QPA65-HSK63A	现货In stock
HSK80A	65	59	QPA65-HSK80A	定制Customized
HSK100A	80	62	QPA80-HSK100A	现货In stock

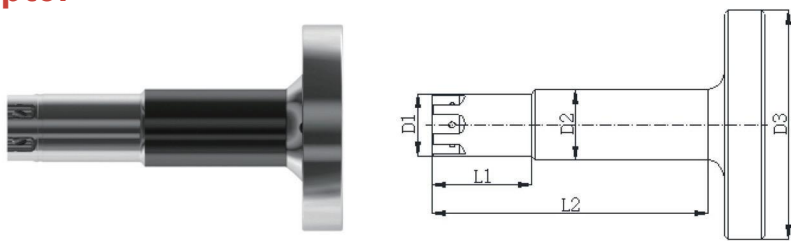
直柄系列

Straight Shank Series



D1	D2	L1	L2	订货编号Order number	库存stock
50	20	60	77	QPA50-20	定制Customized
50	25	60	77	QPA50-25	
50	32	60	77	QPA50-32	

一体式连接头
One-Piece Adaptor



刀头范围 Insert range/mm	D1	D2	D3	L1	L2	订货号Order number	库存stock
φ15≤φ≤φ16	14	20	65	40	82	QPB9.0-65-L40-L100-15	现货In stock
φ16<φ≤φ19	15	20	65	48	82	QPB10.4-65-L48-L100-15	
φ19<φ≤φ23	18	25	65	54	82	QPB12-65-L54-L100-18	
φ23<φ≤φ28	22	22	65	-	82	QPB15-65-L82-L100-22	
φ28<φ≤φ33	27	27	65	-	92	QPB17-65-L92-L110-27	预定 Pre-ordered
φ33<φ≤φ38.5	32	32	65	-	95	QPB22-65-L95-L110-32	
φ38.5<φ≤φ44.5	37	37	65	-	115	QPB24-65-L115-L130-37	
φ44.5<φ≤φ51	43	40	65	30	115	QPB27-65-L115-L130-43	
φ51<φ≤φ58	48	55	80	30	115	QPB34-80-L115-L130-48	
φ58<φ≤φ68	55	55	80	30	115	QPB42-80-L115-L130-55	
φ68<φ≤φ78	65	55	80	30	115	QPB52-80-L115-L130-65	
φ78<φ≤φ89	76	55	80	30	115	QPB62-80-L115-L130-75	
上述其余规格尺寸根据方案定制 The rest of the above sizes are customized upon request							
φ89<φ≤φ100	根据方案定制Customized upon request						
φ100<φ≤φ140	根据方案定制Customized upon request						

模块化柔性连接系统

Modular Flexible Connection System



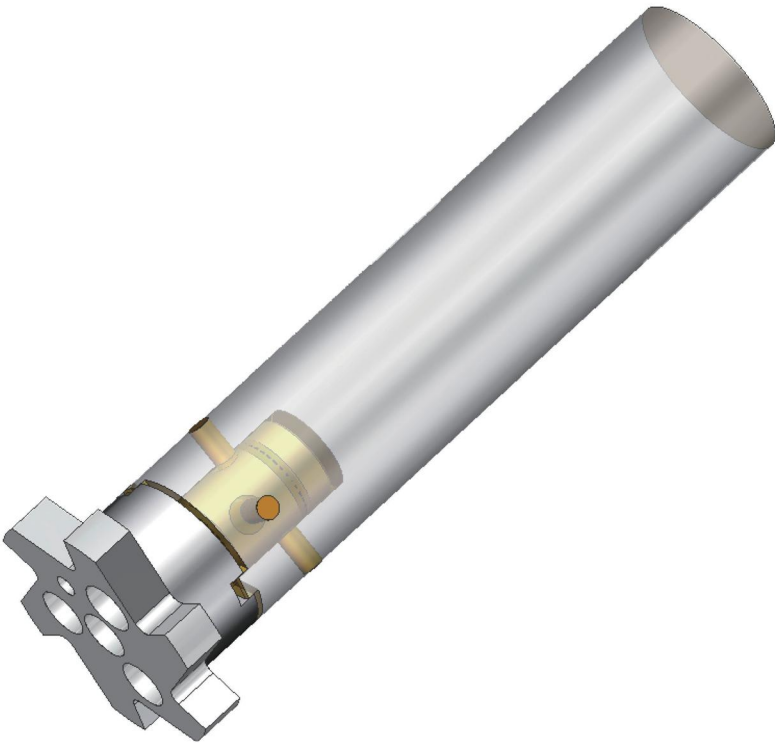
基础结构 Basic structure:

刀杆，柔性连接结构，刀头 Holder, Flexible adaptor, Insert

连接结构 Connection structure:

柔性连接结构 Flexible connection structure

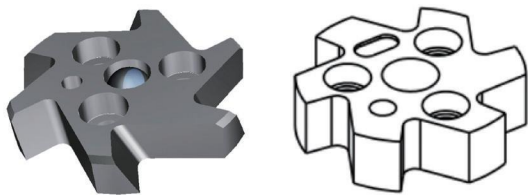
- ◎柔性连接解决机床跳动大、调节难度大、进刀精度无法保证工况难题
- The flexible connection solves the problem that the machine tool has large runout, difficult adjustment, and the feed accuracy cannot guarantee the working condition
- ◎根据方案定制
- Customized upon request



应用范围 Application:

适用 10 倍、20 倍甚至 50 倍、深孔铰削加工；
采用浮动结构，对底孔无修正功能；
特别适合车床调节跳动难度大，进刀过程中刀具精度无法保证孔类铰削加工。
Suitable for 10 times, 20 times or even 50 times, deep hole reamer processing
Adopt floating structure, no correction function to the bottom hole
Especially suitable for lathe adjustment runout difficult In the process of feeding, the tool accuracy cannot guarantee the hole reaming

刀头
Insert

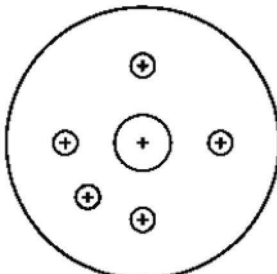
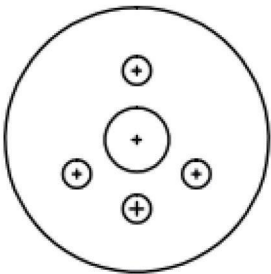


项 名	刀头直径 Insert diameter/mm	厚度 TH/mm	刃数Number of blades	起订量/片 MOQ	订货号 Order number	库存 stock	材质 material
常规系列 Conventional series	$\phi 12 \leq \phi \leq \phi 15$	6.5	6	10	15T1- ϕ	待定 pending	金属 陶瓷 cermet
	$\phi 15 < \phi \leq \phi 16$	6.6	6	10	16T1- ϕ	半成品 semi- finished products	
	$\phi 16 < \phi \leq \phi 19$	6.78	6	10	19T1- ϕ		
	$\phi 19 < \phi \leq \phi 23$	8.33	6	10	23T1- ϕ		
	$\phi 23 < \phi \leq \phi 28$		6	10	28T1- ϕ		
	$\phi 28 < \phi \leq \phi 33$		8	5	33T1- ϕ		
	$\phi 33 < \phi \leq \phi 38.5$	10	8	5	38.5T1- ϕ		
	$\phi 38.5 < \phi \leq \phi 44.5$		8	2	44.5T1- ϕ		
	$\phi 44.5 < \phi \leq \phi 51$	10.3	8	2	51T1- ϕ		
定制系列 Custom series	$\phi 51 < \phi \leq \phi 58$	11.3	8	2	58T1- ϕ	定制 Customized	
	$\phi 58 < \phi \leq \phi 68$	13.0	8	2	68T1- ϕ		
	$\phi 68 < \phi \leq \phi 78$		8	2	78T1- ϕ		
	$\phi 78 < \phi \leq \phi 89$	15.5	8	2	89T1- ϕ		
	$\phi 89 < \phi \leq \phi 100$		10	2	100T1- ϕ		
	$\phi 100 < \phi \leq \phi 140$	根据方案定制Customized upon request					
定制系列 Custom series	$\phi 12 \leq \phi \leq \phi 15$	6.5	6	10	15T1- ϕ	半成品 semi- finished products	硬质 合金 Solid carbide
	$\phi 15 < \phi \leq \phi 16$	6.6	6	10	16T1- ϕ		
	$\phi 16 < \phi \leq \phi 19$	6.78	6	10	19T1- ϕ		
	$\phi 19 < \phi \leq \phi 23$	8.33	6	10	23T1- ϕ		
	$\phi 23 < \phi \leq \phi 28$		6	10	28T1- ϕ		
	$\phi 28 < \phi \leq \phi 33$	10	8	5	33T1- ϕ		
	$\phi 33 < \phi \leq \phi 38.5$		8	5	38.5T1- ϕ		
	$\phi 38.5 < \phi \leq \phi 44.5$		8	2	44.5T1- ϕ		
	$\phi 44.5 < \phi \leq \phi 51$	10.3	8	2	51T1- ϕ		
定制系列 Custom series	$\phi 51 < \phi \leq \phi 58$	11.3	8	2	58T1- ϕ	定制 Customized	
	$\phi 58 < \phi \leq \phi 68$	13.0	8	2	68T1- ϕ		
	$\phi 68 < \phi \leq \phi 78$		8	2	78T1- ϕ		
	$\phi 78 < \phi \leq \phi 89$	15.5	8	2	89T1- ϕ		
	$\phi 89 < \phi \leq \phi 100$		10	2	100T1- ϕ		
	$\phi 100 < \phi \leq \phi 140$	根据方案定制Customized upon request					

辅件
Accessories

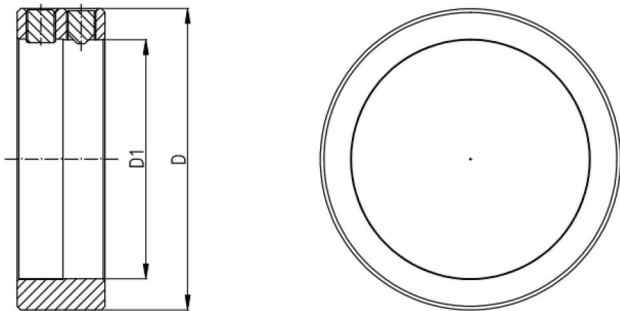


校验头
Correcting Unit



配合刀头直径 Match the insert diameter/mm	订货号Order number	库存stock
$\phi 15 \leq \phi \leq \phi 16$	QPDB16	现货In stock
$\phi 16 < \phi \leq \phi 19$	QPDB19	
$\phi 19 < \phi \leq \phi 23$	QPDB23	
$\phi 23 < \phi \leq \phi 28$	QPDB28	
$\phi 28 < \phi \leq \phi 33$	QPDB33	
$\phi 33 < \phi \leq \phi 38.5$	QPDB38.5	
$\phi 38.5 < \phi \leq \phi 44.5$	QPDB44.5	定制Customized
$\phi 44.5 < \phi \leq \phi 51$	QPDB51	
$\phi 51 < \phi \leq \phi 58$	QPDB58	
$\phi 58 < \phi \leq \phi 68$	QPDB68	
$\phi 68 < \phi \leq \phi 78$	QPDB78	
$\phi 78 < \phi \leq \phi 89$	QPDB89	
$\phi 89 < \phi \leq \phi 100$	QPDB100	

调节环
Adjustable Ring



调节环 Adjustable ring	D	D1	匹配主柄编码 Matches the toolholder code	配套扳手 Matching wrench	库存stock
QPE50	65	50	QPA50-20 QPA50-25 QPA50-32 QPA50-BT30 QPA50-HSK40 QPA50-HSK50	L 型 4×140	现货 In stock
QPE65	82	65	QPA65-BT40 QPA65-BT50 QPA65-HSK63 QPA65-HSK80		
QPE80	100	80	QPA80-BT50 QPA80-HSK100		

刀头扳手
Insert Wrench



扳手型号 Wrench type	批头型号 Batch head type	对应的螺丝 Corresponding screw	对应扭力值 Corresponds to the torque value	库存stock
1/4 0.4-2.6N.m	T6	M2.0×8	0.65-0.7N.m	现货In stock
	T8	M2.5×8	1.25-1.3N.m	
	T10	M3.0×10	2.1-2.2N.m	

刀头螺丝
Insert Screw



刀头直径 Insert diameter/mm	订货号 Order number	订货号 Order number	库存stock
φ15<φ ≤φ16	M2.5×8	T8	现货In stock
φ16<φ ≤φ19	M2.0×8	T6	
φ19<φ ≤φ23	M2.5×8	T8	
φ23<φ ≤φ28			
φ28<φ ≤φ33			
φ33<φ ≤φ38.5	M3.0×10	T10	
φ38.5<φ ≤φ44.5			
φ44.5<φ ≤φ51			
φ51<φ ≤φ58	M4×10	4×70	
φ58<φ ≤φ68			
φ68<φ ≤φ78			
φ78<φ ≤φ89			
φ89<φ ≤φ100			



刀头直径 Insert diameter/mm	拆卸棒规格 Remove rod specification	底座规格 Base specification	库存stock
φ15<φ ≤φ16	φ4×4 φ30×95	φ50×15×φ9.5	现货In stock
φ16<φ ≤φ19			
φ19<φ ≤φ23			
φ23<φ ≤φ28			
φ28<φ ≤φ33			
φ33<φ ≤φ38.5			
φ38.5<φ ≤φ44.5			
φ44.5<φ ≤φ51	φ5×4 φ30×95		
φ51<φ ≤φ58			
φ58<φ ≤φ68			
φ68<φ ≤φ78			
φ78<φ ≤φ89			
φ89<φ ≤φ100			

【1】清洁机床主轴锥孔后，如图用千分表打主轴内锥孔跳动，若内锥孔跳动 $\leq 0.02\text{mm}$ ，则此系统方可弥补机床误差。
After cleaning the spindle cone hole of the machine tool, use the dial gauge to beat the inner cone hole of the spindle as shown in the figure. If the inner cone hole pulsation is less than 0.02mm , the system can make up for the machine tool error

【2】清洁主柄上端面及锥面后，将主柄安装在机床主轴上。
After cleaning the toolholder, install the it on the machine tool spindle.

【3】如图所示将千分表打在主柄光面上，主柄取下旋转 180° 再安装主轴上，选择跳动最小的方向重新安装主柄。
As shown in the figure, put the dial gauge on the smooth surface of the toolholder, remove the toolholder, rotate 180° and install it on the spindle, select the direction with the least runout to reinstall the toolholder

【4】安装调节环，调整限位螺丝使旋转调节环相对顺畅即可。
Install the adjusting ring and adjust the limit screw so that the rotating adjusting ring is relatively smooth

【5】清洁接头法兰面，如图安装六颗弹簧垫圈（凸面向上）和接头压紧螺丝，弹簧垫圈微量变形为宜。
Clean the flange surface of the connector and install six spring washers (convex face up) and the adaptor pressing screw as shown in the figure. The spring washers should be slightly deformed



- 【6】清洁校验头端面及钢珠、锥孔，（清理完使用气枪吹一下效果更好）并将钢珠用手压入校验头没有标刻面，使用压紧螺丝将校验头固定在连接头上渐进锁紧刀头螺丝。
Clean the section of the correcting unit, steel ball, cone hole, (after cleaning, use an air gun to blow the effect is better) , press the steel ball into the check head without marking surface, and use the pressing screw to fix the check head to the adaptor and gradually lock the insert screw
- 【7】如图所示将千分表针头对准校验头中间位置，表针与校验头水平放置。
Align the dial needle with the middle position of the correcting unit as shown in the figure, and place the dial needle horizontally with the correcting unit
- 【8】旋转主轴找到最高点，并将调节环的调节螺丝旋转到最高点同方向点，使用内六角扳手进行调节，调节量为最大跳动的一半，重复此步骤，直至跳动 <0.002mm。
Rotate the spindle to find the highest point, and rotate the adjusting screw of the adjusting ring to the highest point in the same direction, adjust with the hex wrench, adjust the amount to half the maximum runout, repeat this step until the runout < 0.002mm
- 【9】交叉紧固 6 个连接头压紧螺丝；再次确认系统跳动≤ 0.002mm。
Cross-tighten 6 adaptor pressing screws;Check that the system runout ≤ 0.002mm
- 【10】拆卸校验头并安装刀头，渐进锁紧压紧螺丝，再次确认系统跳动≤ 0.003mm。
Remove the correcting unit and install the insert. Gradually lock the pressing screws and confirm that the system runout is less than 0.003mm



1. 请严格按照以上操作步骤调节系统，若有未尽详细之处，务必遵守现场操作培训进行操作。

2. 此系统所有配件皆经过特殊加工处理，切勿使用其它产品代替任一配件。

3. 系统调节完毕后，取下调节环，确保所有螺丝处于上紧状态，方可进行加工。

4. 当系统长期未使用时，所有的螺丝需重新拧紧，并检查系统跳动。

5. 注意温差变化，导致系统热胀冷缩影响加工精度。
- 1、Strictly follow the preceding steps to adjust the system. If the details are not specified, follow the on-site operation training

2、All parts of this system are specially processed, do not use other products to replace any part

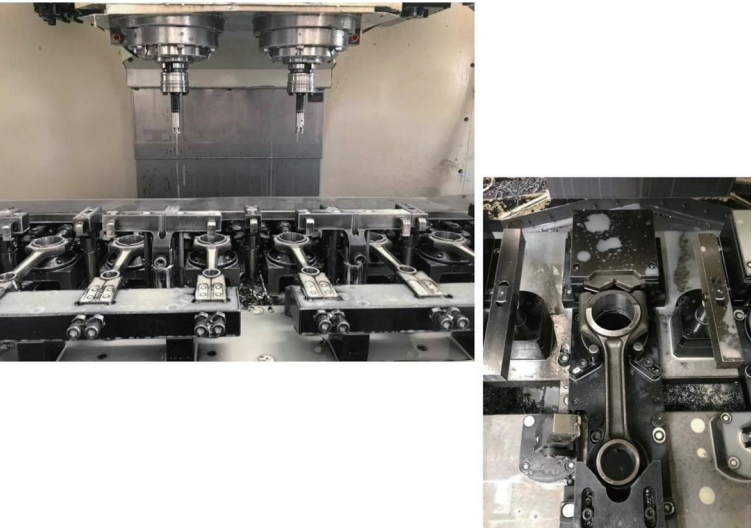
3、After the adjustment of the system is completed, remove the adjustable ring and ensure that all screws are in the tightening state before processing

4、When the system is not used for a long time, all screws need to be tightened again, and check the system runout

5、Pay attention to the change of temperature, resulting in thermal expansion and cold contraction of the system affecting the machining accuracy

被加工材料 Processed material	C70S6
使用系统型号 System model	QPB12-65-L82
铰刀 Reamer	23T1-22
V (m/min)	124
N (r/min)	1800
fz (mm)	0.15
F (mm/min)	1600
ap (mm)	0.2
Ra (um)	0.2-0.4
圆柱度 cylindricity (mm)	0.005
寿命 life (m)	100

φ22 (+0.021/0) ×20mm
使用机床 Use a machine tool: BT40
中心内冷 Central internal cooling



加工实例 汽车转向器

Processing Example Automobile Steering Gear

被加工材料 Processed material	C70S6
使用系统型号 System model	QPB9-65-L82
铰刀 Reamer	19T1-15.03
V (m/min)	72
N (r/min)	1500
fz (mm)	0.09
F (mm/min)	800
Ra (um)	0.4-0.8
圆柱度 cylindricity (mm)	0.005
垂直度 perpendicularity (mm)	0.05
寿命 (件) life (pieces)	2500 件pcs

φ15.03 (+0.01/-0.01) ×48
使用机床 Use a machine tool: BT40
内冷 internal-cooling



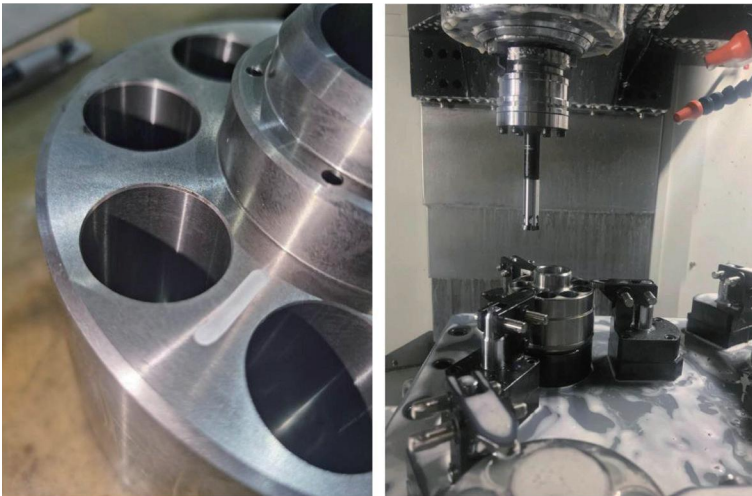
加工实例 油泵

Processing Example Oil Pump



被加工材料 Processed material	QT550-7
使用系统型号 System model	QPB15-65-L110-24
铰刀 Reamer	28C0-27.94
V (m/min)	175
N (r/min)	2000
fz (mm)	0.08
F (mm/min)	1000
ap (mm)	0.22
Ra (um)	0.4
寿命 life (m)	63

φ27.94 (+0.021/0) ×70mm
使用机床 Use a machine tool: BT40
中心内冷 Central internal cooling

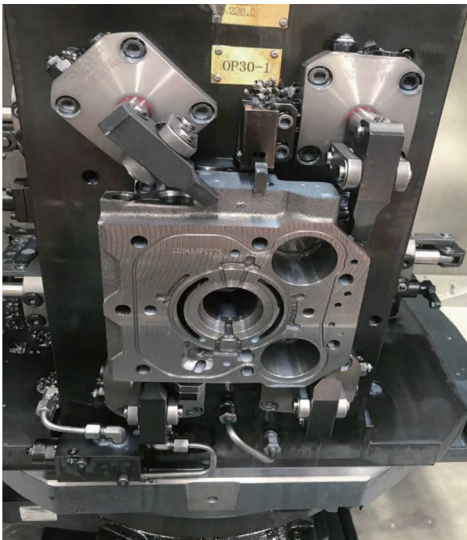


加工实例 液压件

Processing Examples Of Hydraulic Parts

被加工材料 Processed material	QT400
使用系统型号 System model	QPB27-65-L91-L110
使用刀片 Insert	51C0-45
V (m/min)	120
N (r/min)	850
fz (mm)	0.15
F (mm/min)	1020
Rz (um)	10
圆柱度 cylindricity (mm)	0.01
垂直度 perpendicularity (mm)	0.05
寿命 life (m)	100

φ45 (+0.021/0) ×65mm
使用机床 Use a machine tool: HSK100A
内冷 internal-cooling



加工实例 空调压缩机

Processing Exampleair Conditioning Compressor



被加工材料 Processed material	HT250
使用系统型号 System model	QPB9.0-65-L70-L88
使用刀片 Insert	16T1-16
V (m/min)	100
N (r/min)	2000
fz (mm)	0.08
F (mm/min)	1000
Rz (um)	0.4-0.8
圆柱度 cylindricity (mm)	0.003

φ16 (+0.012/+0.003) ×58mm
使用机床 Use a machine tool:
专机 Specialized machine

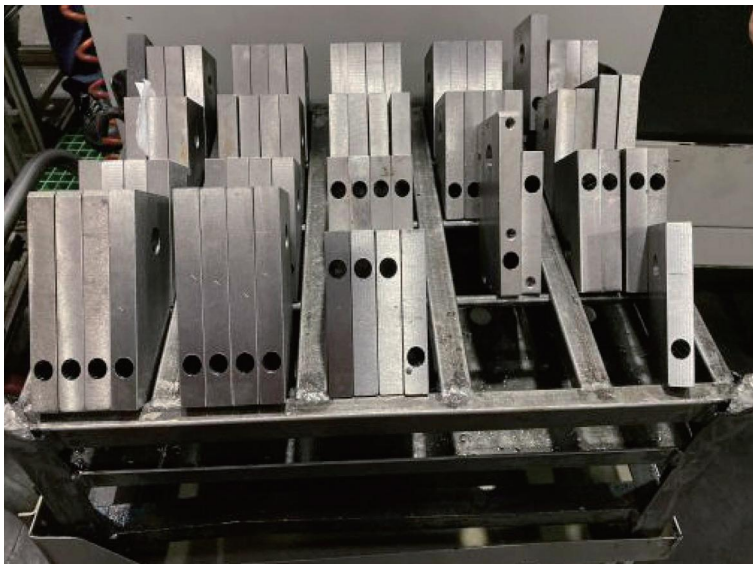


加工案例 液压缸体

Processing Case Hydraulic Cylinder

被加工材料 Processed material	45# 钢
使用系统型号 System model	QPB9.0-65-L120-150
使用刀片 Insert	16T1-16
V (m/min)	90
N (r/min)	1800
fz (mm)	0.075
F (mm/min)	800
Ra (um)	0.4
圆柱度 cylindricity (mm)	0.005
寿命 life (m)	60

φ16 (±0.01) ×115mm
使用机床 Use a machine tool: BT40



加工案例 摇臂

Processing Example Oil Pump



被加工材料 Processed material	QT500-7
使用系统型号 System model	QPB10.4-65-L82-L100
使用刀片 Insert	18H0-18.503
V (m/min)	17.5
N (r/min)	300
fz (mm)	0.167
F (mm/min)	300
Ra (um)	0.8
圆柱度 cylindricity (mm)	0.003
寿命 life (m)	100

φ18.5 (+0.009/-0.003) ×14mm
使用机床 Use a machine tool: BT40

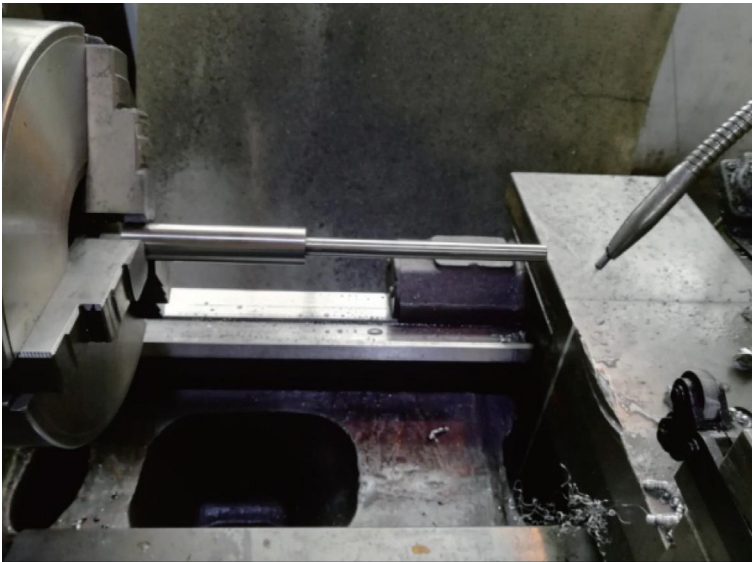


加工实例 喷油嘴

Processing Instance Nozzle

被加工材料 Processed material	17-4 不锈钢 17-4 Stainless steel
使用系统型号 System model	柔性连接系统 Flexible connection system
使用刀片 Insert	QPDYX8-6.82
V (m/min)	4.3
N (r/min)	200
fz (mm)	0.01
F (mm/min)	10
Ra (um)	0.6-0.8
寿命 life (m)	20

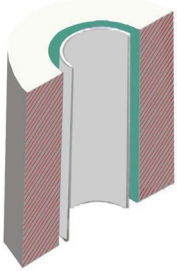
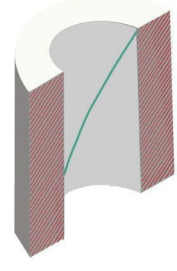
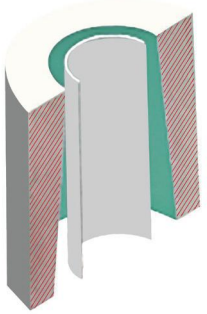
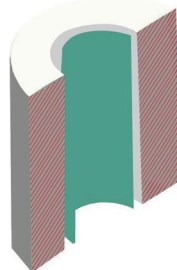
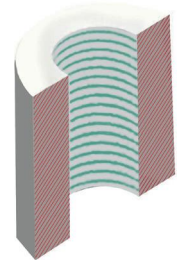
φ6.82 (+0.05/0) ×180mm
使用机床 Use a machine tool:
普通车床 center lathe

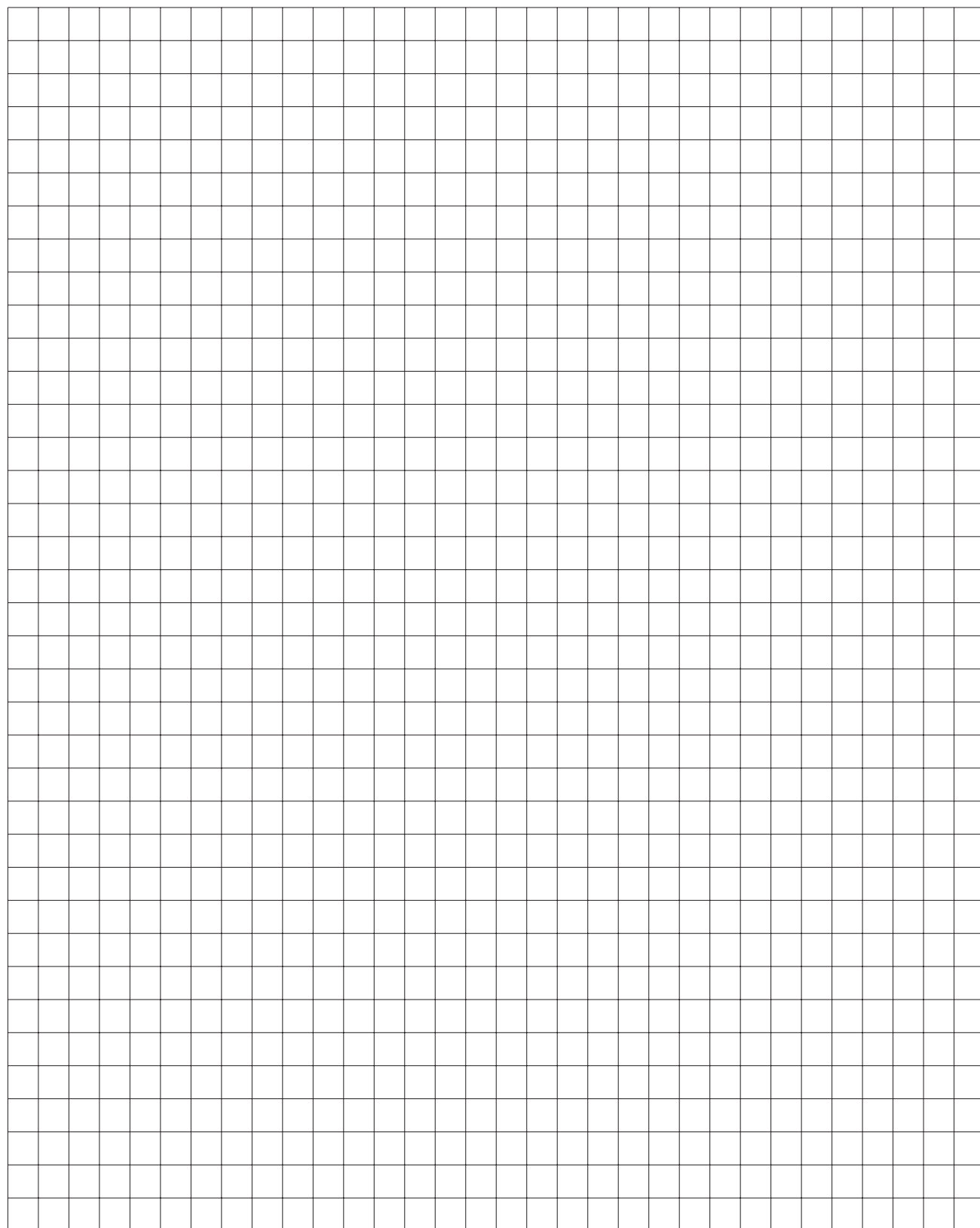


解决方案

Solution



问题 question	解决方案 solution	问题 question	解决方案 solution
孔偏大 Hole too large 	1. 降低系统误差 2. 降低线速度 3. 增加进给 4. 缩短系统伸进量 5. 增加冷却液浓度 6. 检查刀头磨损 7. 调整刀头尺寸 1.Reduce error 2.Reduce cutting speed 3.Increase feed 4.Reduce depth of cut 5.Increase coolant mix 6.Check insert wear 7.Adjust insert size	孔壁有刀痕 Retention marks in hole 	1.降低系统误差 2.检查刀头磨损 3.缩短系统伸进量 4.使用倒角更大的刀头 5.降低退刀速度 1.Reduce error 2.Check insert wear 3.Reduce depth of cut 4.Use a larger chamfer insert 5.Reduce pull back speed
锥孔 Taper hole 	1. 降低系统误差 2. 降低线速度 3. 降低进给量 4. 减小加工余量 5. 增加工件夹紧刚性 6. 比较夹紧与非夹紧时的孔径变化 7. 检查铁屑流动方向 1.Reduce error 2.Reduce cutting speed 3.Reduce feed 4.Reduce machining allowance 5.Improve workpiece clamping 6.Compare bore in clamped and unclamped condition 7.Check chip flow	排屑困难 Chip removal difficulty 	1.降低冷却液浓度 2.增加系统伸进量 3.检查刀头磨损 4.改变刀头倒角角度 1.Reduce coolant mix 2.Increase depth of cut 3.Check insert wear 4.Change chamfer angle
孔偏小 Hole too small 			1.更换刀头 2.降低冷却液浓度 3.增加系统伸进量 4.提高线速度 5.降低进给量 1.Change insert 2.Reduce coolant mix 3.Increase depth of cut 4.Increase cutting speed 5.Reduce feed rate
孔内有振纹 Hole shows chatter marks 	1. 降低系统误差 2. 改变刀头倒角角度 3. 增加工件夹紧刚性 4. 降低线速度 5. 增加进给 1.Reduce error 2.Change chamfer angle 3.Improve workpiece clamping 4.Reduce cutting speed 5.Increase feed rate	表面质量不理想 Surface quality unsatisfactory 	1.检查刀头磨损 2.降低系统误差 3.使用内冷机床 4.增加冷却液浓度 1.Check insert wear 2.Reduce error 3.Use coolant machine 4.Increase coolant mix



应用技术是检验刀具性能的关键一步，设计制造的刀具是否可以满足客户要求，是否可以提升客户的加工效率，降低成本，都需要应用技术的支持。同样一把刀具，不同的加工参数和策略，结果可能会差异巨大。

如有任何需要请联系我们，期待与您合作！

Application technology is a key step to test tool performance. Whether the tool designed and manufactured can meet customer requirements, whether it can improve customer processing efficiency and reduce costs, all need the support of application technology. The same tool, different processing parameters and strategies, the results may be very different.

If you have any needs, please contact us and look forward to cooperating with you.