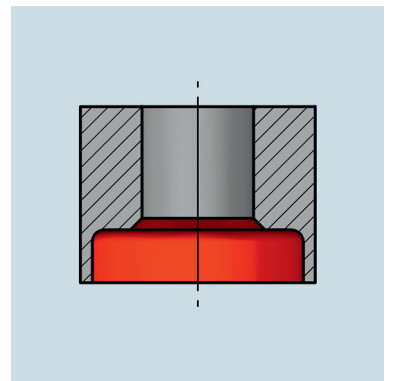
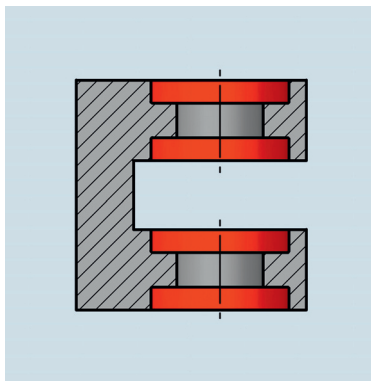


SOLO

单一工序内完成正反向镗孔加工



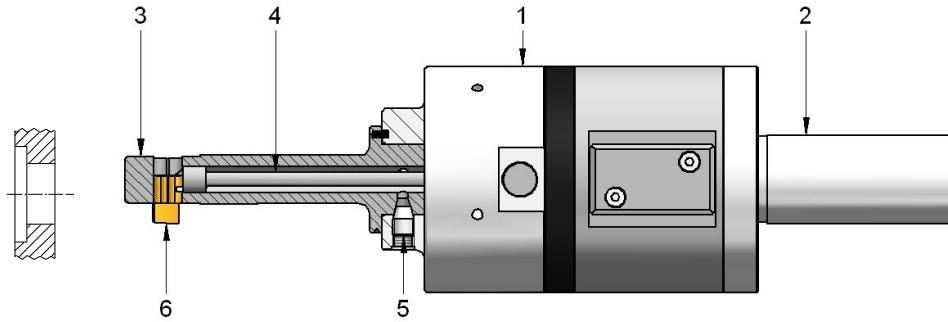
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1 刀具介绍 / Tool description



Pos.	说明	Description
1	刀具控制单元	Tool head
2	刀柄	Shank
3	刀片壳	Blade housing
4	刀片驱动杆	Blade control
5	紧固螺钉	Clamping screw
6	刀片或者可换刀片式刀架结构	Blade or cartridge with indexable inserts

作为世界刀具行业的先锋，瑞士好优利刀具公司开发一种操作简便的，能铰正反向台阶孔和成型孔的刀具。SOLO系列刀具在无定位装置配合，无需改变主轴转向，无冷却液压力要求，无机械接触装置的情况下具有良好的加工稳定性。

SOLO系列刀具适合在各种机器上使用（数控机床，流水线，多轴或常规机床）。

由于隔绝灰尘和切屑所产生的影响，加工系统具有很高的稳定性。其中一个因素就是切削刀片以径向方式打开和收回，从而避免了切屑干扰刀片的移动。另一方面，完全密封型的刀具设计（控制单元）能够有效的防止冷却液进入内部。

应用范围：

最小基孔直径： ~ 6毫米
 最大铰孔直径： ~ 49毫米
 最大单边切屑（铰孔宽度）： ~ 13毫米
 最大基孔/铰孔比： ~ 1:1.96

SOLO刀具全新的设计理念提供了简单友好的操作方式。极高的性价比配合最低的维护需求使得瑞士好优利SOLO系列刀具在大批量生产中获得最广泛的应用。

As a world-wide leader in tool development, **HEULE WERKZEUG AG** introduces an easy-to-use front and back spotfacing and formsinking tool. The SOLO tool functions **reliably** without anti-rotation device, change of spindle rotation, coolant pressure or contact mechanism.

The SOLO tool is immediately ready for operation on any machine (CNC, transfer, multispindle or conventional machine).

The inability of dirt and chips to penetrate the system guarantees a high process reliability. One reason for this is the cutting blade which moves in and out radially, preventing chips from jamming the system. In addition, the completely closed tool design (control unit) prevents any coolant contamination.

Application range:

Minimal bore Ø: ~ 6 mm
 Maximal countersink Ø: ~ 49mm
 Max. chip section (counterbore width) ~ 13mm
 Max. ratio bore-counterbore: ~ 1:1,96

The new tool design of the SOLO evokes simplicity and user-friendliness. The ratio of price/performance and the minimum required maintenance predestine **HEULE's SOLO** for successful application in large volume production.

1.1 SOLO与SOLO2的区别 / Differentiation SOLO/SOLO2

两种刀具的对比:

SOLO:

应用于较高的机加转速，高于1900转/分钟的情况

SOLO2:

应用于较低的机加转速，最高不超过1500转/分钟。刀片缩进时的转速为1900转/分钟

两种刀具在外观上没有什么区别，但是内部的机械结构是不一样的。

SOLO

-最低速率：1000转/分钟

↳ 黑色环控制单元

刀片在静止的时候收回。在达到最低速率时，刀片打开至工作位置。如果要收回刀片，主轴必须要停转。

SOLO2

SOLO2的激活速度大概在1900转/分钟，其控制单元通过一个绿色环来标记。

SOLO2的刀片在静止的情况下保持打开状态（主轴停转）。该刀具能够在小于1500转/分钟的范围内工作。刀片收回的速度大概在1900转/分钟。一旦超过这个速度，刀片就会被安全的收回到刀片壳内。

We differ between two types of SOLO tools:

SOLO:

For high machining speed rate higher 1900 rev/min

SOLO2:

For lower machining speed rate up to 1500 rev/min. Retract speed rate: 1900 rev/min.

The two tools do not differ in appearance. But the mechanical construction is different.

SOLO

- Minimum speed rate: 1000 rev/min

↳ Control unit with black ring

The blade is retracted at standstill. After exceeding the minimum speed rate, the blade extend to work position. To retract the blade the spindle must be stopped

SOLO2

The activation speed rate for SOLO2 is 1900 rev/min. The control unit is identified by a green ring.

The SOLO2 blade is extended at standstill (spindle stop). The tool can be used by a machining speed rate of 1500 rev/min. The retract speed rate of the blade is 1900 rev/min. After exceeding this speed rate, the blade retract safe into the blade housing.

区别SOLO:SOLO2 / Difference SOLO:SOLO2

	SOLO / 1900	SOLO2
主轴停转时刀片的位置 Position of blade spindle stop	收回 Retracted	打开 Extended
色环 Color ring	黑色 Black	绿色 Green
收回速度 Retract speed rate	-	1900转/分钟 1900 rev/Min
打开速度 Extend speed rate	1900转/分钟 1900 rev/min	-
加工切削速度 Machining speed rate	> 1900转/分钟 > 1900 U/min	0 - 1500转/分钟 0 - 1500 U/min

1.2 功能 / Function

SOLO

主轴静止: 刀片缩回

Spindle stop: Blade retracted

SOLO2

主轴静止: 刀片伸出

Spindle stop: Blade extended

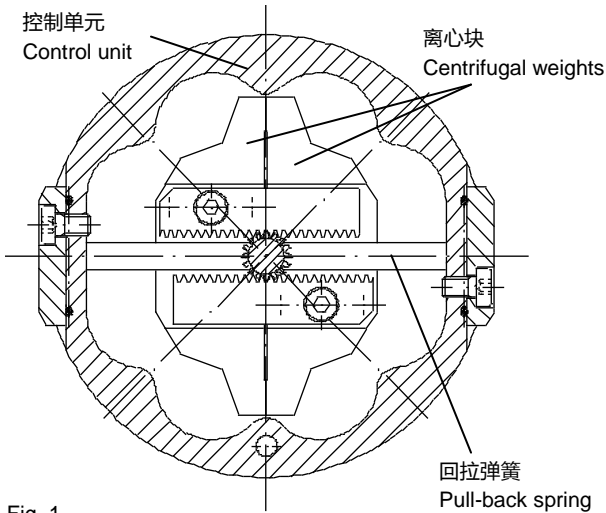


Fig. 1

两个离心块被安装在密封的控制单元内以防止灰尘的进入。当转速达到激活速度时，两个离心块开始朝外侧移动（图2）。

当离心块向外侧移动时，借助于两根条状齿轮带动中间的中心齿轮。中心齿轮通过刀片驱动杆带动刀片的打开和收回。

一旦主轴停止转动，复位弹簧又会将离心块拉回中间的位置（图1）。

特别注意：

- 请特别注意最小速率及激活速率!!!
(请查阅SOLO/SOLO2相关编程信息)

SOLO

主轴转动: 刀片伸出

Spindle in rotation: Blade extended

SOLO2

主轴转动: 刀片缩回

Spindle in rotation: Blade retracted

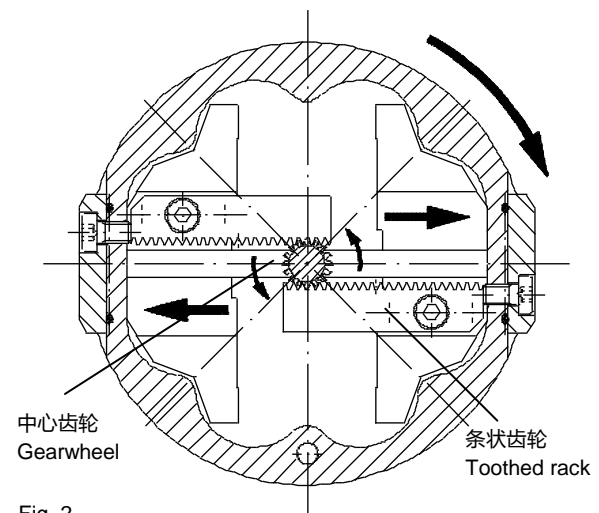


Fig. 2

Two centrifugal weights are installed in a control unit closed against dirt. With the activation speed rate the centrifugal weights start moving outwards. (Fig. 2).

The weights moving outwards are turning a gearwheel via two toothed racks. This gearwheel drives the blade out or in by means of a blade control.

Pull-back springs push the centrifugal weights back to the centre when the spindle stops (Fig. 1).

Attention:

- Please pay attention to minimum speed rate / activation speed rate!!!
(See programming information SOLO / SOLO2)

SOLO

刀片收回

Blade retracted

主轴静止

Spindle stopp

SOLO2

刀片收回

Blade retracted

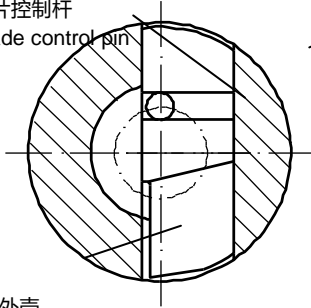
主轴转动

Spindle in rotation

切面 A-A / Section A-A

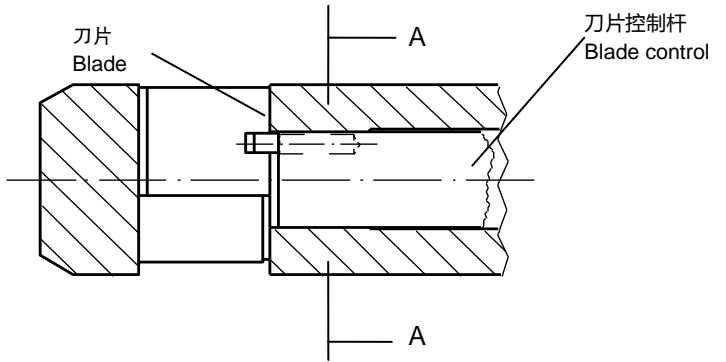
刀片控制杆
Blade control pin

刀片
Blade



刀片外壳
Blade housing

Fig. 3



SOLO

刀片打开

Blade extended

主轴转动

Spindle in rotation

SOLO2

刀片打开

Blade extended

主轴静止

Spindle stopp

剖面 B-B / Section B-B

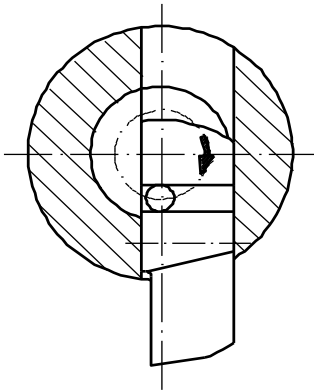
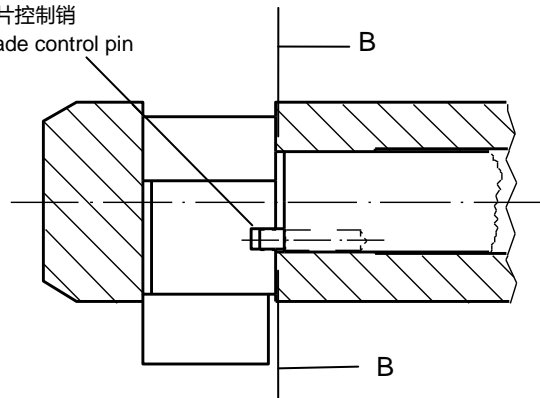


Fig. 4

刀片控制销
Blade control pin



一个小的刀片驱动销以偏心方式嵌入在刀片驱动杆前端的凹槽内（图3）。随着刀片驱动杆的转动，刀片驱动销驱动刀片的打开与收回（图4）。

正常情况下，切削过程中产生的反作用力直接到达刀片壳，而非刀片驱动销。

A small blade control pin fixed eccentrically on the front side of the blade control engages into a small groove at the blade (Fig. 3). By turning the blade control, the blade is driven outwards or inwards by means of the blade control pin (Fig. 4).

The cutting forces are taken by the blade housing; not by the blade control pin.

2 刀具选型 / Tool selection

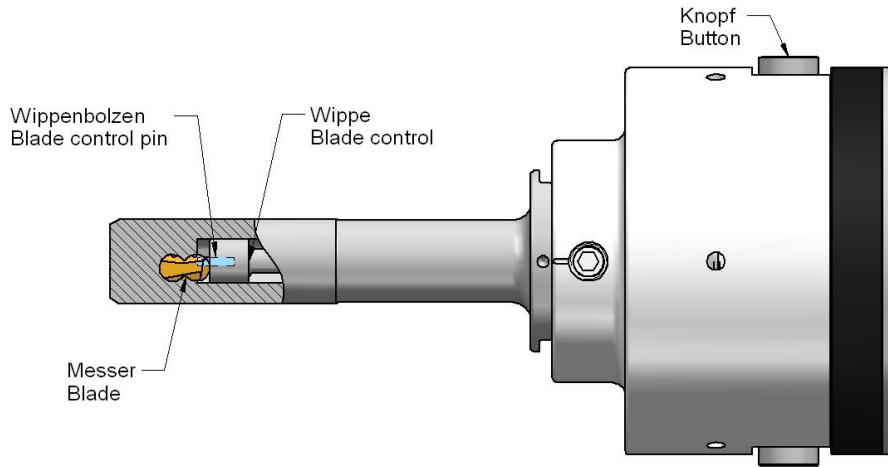
SOLO系列刀具选型需要提供下列应用参数：

- 总孔直径（带公差）
- 镗孔直径（带公差）
- 加工长度 / 钻孔深度
- 刀具配合 / 刀杆
- 加工材质 / 加工环境
- 冷却方式

The following application data is required for the selection of a SOLO tool:

- Countersink diameter (with tolerance)
- Bore diameter (with tolerance)
- Working length / Bore depth
- Tool adaption / Shank
- Material / environment
- Collant

3 刀片更换 / Change the blade

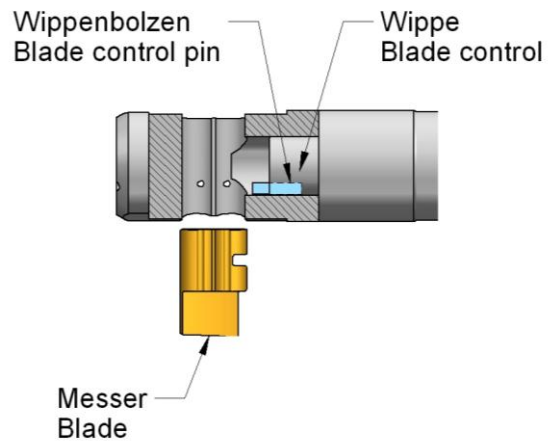
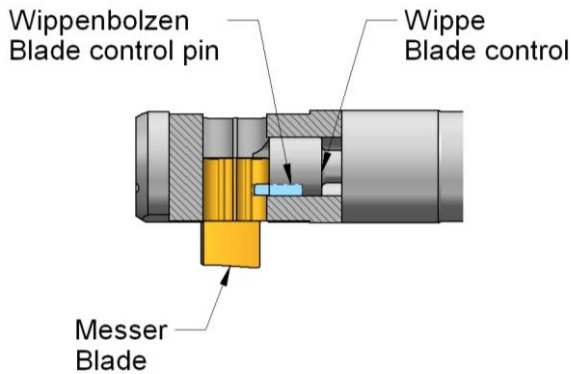


拆除刀片:

通过按压刀具控制单元两侧的按钮，可以使刀片驱动杆和刀片驱动销往回收起。这样，刀片会被松开并且可以推出。当刀片被完全推出后，才能松开按钮。

Dismantling of blade:

By simultaneous pressing on the side buttons at the tool head the blade control and the blade control pin are pulled back. Thus, the blade is released and can be pushed out. Keep the buttons pressed until the blade is completely removed.



装载刀片:

通过按压刀具控制单元两侧的按钮使刀片驱动杆和刀片驱动销往回拉起。保持按压状态直至刀片被完全插入刀片壳的窗口内。

1. 刀片被插入刀片窗口后再松开按钮。
2. 将刀片慢慢推入刀片窗口内，直至刀片驱动销再次与刀片完全咬合（能够清楚地听到“咔嚓”的声音）。

注意事项:

换刀片按钮必须始终保持弹起的状态（在不需要压入的时候）。

Insertion of blade:

By simultaneous pressing on the side buttons at the tool head the blade control with blade control pin is pulled back. Keep the buttons pressed until the blade is inserted in the blade window of the blade housing.

1. Insert blade in blade window. Side buttons can be released.
2. Shift blade into the blade window so that the blade control pin engages into the blade again - a distinct **click** can be heard.

Attention:

The buttons always has to be moved out (it mustn't be pressed in anymore).

4 刀片控制杆及刀片外壳的更换

Change of blade control and blade housing

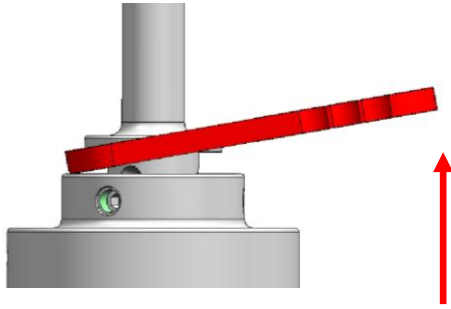


Fig. 5

分解:

1. 松开控制单元部位的三个紧固螺钉 (Pos.5), 松开部分即可, 无需将其扭下。
2. 将刀片壳向前拉动, 与控制单元分离开。如果是较小尺寸的刀片壳, 可以使用SOLO扳手来分离 (图5)。
3. 然后同样将刀片驱动杆向前用力拉动, 但不要松动其他部件。如果是较小尺寸的刀片驱动杆, 同样可以使用SOLO扳手来分离 (图6)。

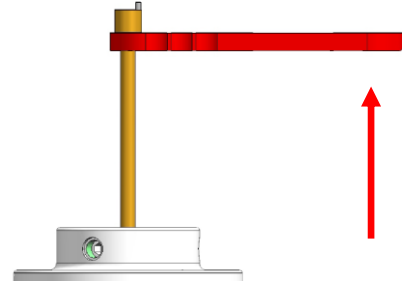
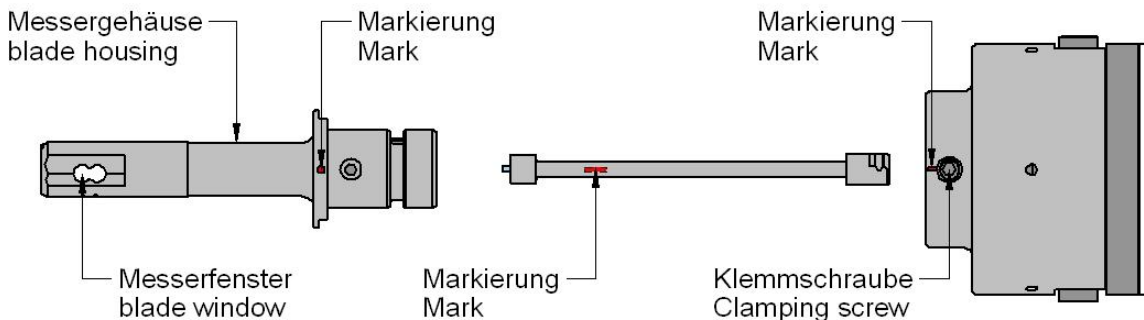


Fig. 6

Dismantling:

1. Release the 3 clamping screws at the tool head, i.e. unscrew them a little.
2. Pull the blade housing forward, away from the tool head. By small diameters and/or short length, use the SOLO key for disassembly (Fig. 5).
3. Then pull blade control also forwards away with some force, but without releasing anything. By small diameters and/or short length, use the SOLO key for disassembly (Fig. 6).



组装:

1. 轻微用力将刀片驱动杆压入控制单元直至两者完全相互咬合。

注意:

组合过程中需要将刀片驱动杆, 刀片壳以及控制单元上的“|”标记位置相互对齐。

2. 将刀片壳套上并推入控制单元内, 锁紧两个紧固螺钉 (Pos.5)。

注意:

组合过程中需要将刀片驱动杆, 刀片壳以及控制单元上的“|”标记位置相互对齐。

3. 锁紧三个紧固螺钉 (Pos.5)。

Assembly:

1. Press blade control with slight force into the tool head (catch) until the blade control engages.

Attention:

Line up the blade control, the blade housing and the tool head with the corresponding mark.

2. Mount blade housing on the tool head.

Attention:

To assemble the blade housing correct, the blade housing with the position pin has to be rotated approximately 10° into the clearance of the position pin (Fig. 7). Afterwards both markings (notches) have to be aligned to each other.

3. Tighten the 3 clamping screws firmly.

5 性能检测 / Function control

SOLO



在主轴静止的情况下，可以使用以下方式来检测刀具的性能是否完好（刀具的打开动作和收回动作）。

插入SOLO扳手并且顺时针方向旋转（SOLO2为逆时针方向），如果是SOLO，刀片将会打开，如果是SOLO2，刀片将会收回。

在完成性能检测后，SOLO扳手必须回到相反的位置直至位置键到达控制单元凹槽的末端。刀片壳必须和控制单元上的凹点对齐。

注意：

涉及SOLO扳手的所有操作必须手工完成，并且注意来自刀片的干扰。

该检测操作建议在刀具一段时间未被使用的情况下进行；同样，在更换了刀片，刀片壳以及刀片驱动杆后，也可以进行检测操作；或者在有必要检测的情况下。

注意：

在使用刀具前，SOLO扳手必须从刀具上取下，否则会产生危险

紧固螺丝必须被锁紧

在确认以上情况下刀具才可以被使用

The possibility is given to check the function of the tool (extension and retraction of blade) when the spindle is stopped.

Insert the SOLO key and turn clockwise (SOLO2 counter clockwise). By the SOLO the blade moves out and by the SOLO2 the blade moves in.

After the function test of the blade, the SOLO key has to be backed off in opposite direction until the position pin hits the end stop by the notch of the control unit. The blade housing must be aligned with the notch by the control unit.

Attention:

All turns with the SOLO key must be done smoothly by hand, to detect any interference with the blade.

This operational check is advisable if the tool hasn't been used for a certain time, after change of blade, blade housing, blade control as well, or if the tool function needs to be checked.

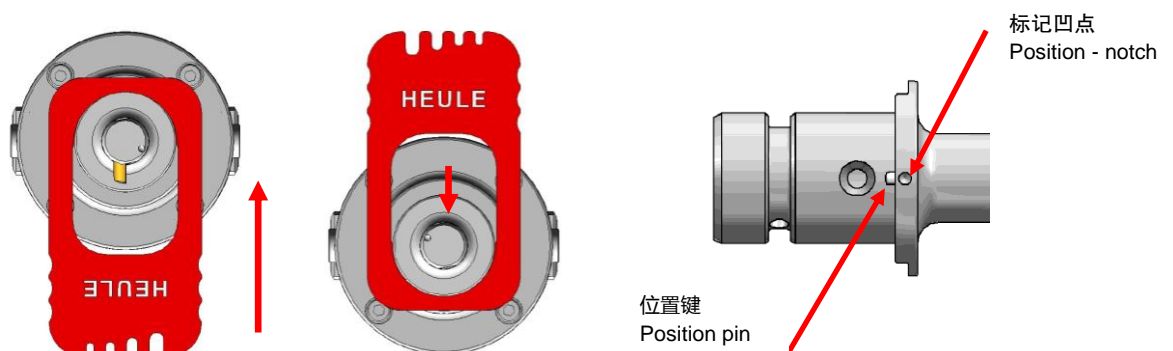
Attention:

It is important that the SOLO key is removed before put back in operation => Danger of injuring oneself

The clamping screws have to be tightened.

The tool is now ready to use.

SOLO2



6 SOLO系列硬质合金刀片切削参数

Cutting data for SOLO carbide blades

请注意最小速率

Pay attention to minimum speed rate

材质 Material	切削速度 v_c (m/min.) Cutting speed v_c (m/min.)	给进量 f (mm/U) Feed f (mm/rev.)
		根据基孔/铰孔比值 depending of ratio bore-counterbore
普通钢 < 700 N/mm ² unalloyed steel < 700 N/mm ²	50 - 100	0.03 - 0.1
普通钢 > 700 N/mm ² unalloyed steel > 700 N/mm ²	50 - 100	0.03 - 0.08
合金钢 < 800 N/mm ² alloyed steel < 800 N/mm ²	50 - 100	0.03 - 0.08
合金钢 > 800 N/mm ² alloyed steel > 800 N/mm ²	40 - 80	0.03 - 0.08
工具钢 > 1000 N/mm ² tool steel > 1000 N/mm ²	25 - 50	0.03 - 0.06
工具钢 < 1000 N/mm ² tool steel < 1000 N/mm ²	35 - 70	0.03 - 0.08
灰口铸铁 > 250 HB gray cast iron > 250 HB	40 - 80	0.04 - 0.1
灰口铸铁 > 350 HB gray cast iron > 350 HB	35 - 70	0.03 - 0.1
中度铸钢 cast steel middle skill	35 - 70	0.03 - 0.08
球墨铸铁 nodular cast iron	35 - 70	0.03 - 0.1
铝 aluminium	100 - 200	0.03 - 0.1
钛合金 titanium alloy	30 - 50	0.03 - 0.1

请注意表中的切削值仅仅是**参考值**，在使用过程中需要根据实际情况对该参数进行适当调整。

Please note that the cutting values are **standard values** only. They can be adjusted both upwards and downwards.

7 编程信息 / Programming information

7.1 SOLO

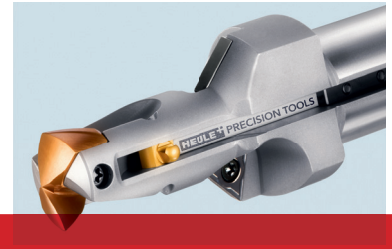
注意事项: 请注意最小速率。		Attention: Pay attention to minimum speed rate.
EV: 向前快进		EV: Rapid feed forwards
ER: 向后快退		ER: Rapid feed backwards
AR: 向后工退		AR: Working feed backwards
h: 工件厚度		h: Workpiece height
t: 沉孔深度		t: Countersink depth
G: 毛边高度		G: Burr height
S: 安全距离		S: Clearance distance

<p>1. 向前快进 主轴在静止 (转速为0) 的状态下以向前快进的方式通过工件被加工孔 (刀片收回状态)</p> <p>位置: $h + G + S$</p> <p>1. EV With stopped spindle (speed rate: 0) pass through the workpiece in EV (blade retracted)</p>		<p>4. 向前快进 以向前快进的方式离开被加工沉孔</p> <p>4.1 停止冷却</p> <p>位置: $h + G + S$</p> <p>4. EV Travel out of countersink in EV</p> <p>4.1. Coolant off</p>	
<p>2. 主轴旋转 顺时针方向加速主轴至激活速度 (刀片将打开) 注意: 至少需要1秒延时 / 注意不要低于最小速度</p> <p>2.1 打开冷却</p> <p>位置: $h + G + S$</p> <p>2. Spindle in rotation Activate spindle clockwise (blade extended) Raise up to working speed rate. Attention: dwell time at least 1 sec. / Pay attention to minimum speed rate.</p> <p>2.1 Coolant on</p>		<p>5. 主轴停转 主轴停转, 速度归零 (刀片将收回) 注意: 至少需要1秒延时</p> <p>位置: $h + G + S$</p> <p>5. Spindle stop Stop the spindle, speed rate: 0 (blade retracted) Attention: dwell time at least 1 sec.</p>	
<p>3. 向后工退 向后工退的方式对工件进行切削</p> <p>位置: $h - t$</p> <p>3. AR Machine workpiece backwards in AR</p>		<p>6. 向后快退 以向后快退的方式将已经停转主轴的刀具抽离工件 (刀片已缩回, 转速为0)</p> <p>6. ER With stopped spindle withdraw the tool from workpiece in ER (blade retracted; speed rate: 0)</p>	

7.2 SOLO2

注意事项: 请注意最小刀片收回速率		Attention: to minimum retract speed rate.
EV: 向前快进		EV: Rapid feed forwards
ER: 向后快退		ER: Rapid feed backwards
AR: 向后工退		AR: Working feed backwards
h: 工件厚度		h: Workpiece height
t: 沉孔深度		t: Countersink depth
G: 毛边高度 S: 安全距离		G: Burr height S: Clearance distance

<p>1. 刀片收速度 顺时针方向加速主轴至收回速度，最低1900转/分，然后以向前快进的方式通过被加工孔（刀片已收回）</p> <p>位置: $h + G + S$</p> <p>1. Retract speed rate Active spindle clockwise, Retract speed rate: min. 1900 rev/min., pass through the workpiece in EV (blade retracted)</p>		<p>4. 向前快进 以向前快进的方式离开加工台阶 4.1 停止冷却</p> <p>位置: $h + G + S$</p> <p>4. EV Travel out of countersink in EV</p> <p>4.1. Coolant off</p>	
<p>2. 切削工件速度 如果切削速度高于200转/分钟，请将实际速度降至200转/分钟，或停转主轴。 注意：至少需要1秒延时</p> <p>2.1 进行冷却</p> <p>位置: $h + G + S$</p> <p>2. Machining speed rate If the working speed is higher than 200 rev/min. slow down the working speed below 200 rev/min. or work with spindle stop. Attention: dwell time at least 1 sec.</p> <p>2.1 Coolant on</p>		<p>5. 刀片收回速度 将主轴的转速加速到收回速度（最低1900转/分）（刀片将收回） 注意：至少需要1秒延时</p> <p>位置: $h + G + S$</p> <p>5. Retract speed rate Raise the spindle speed rate up to retract speed rate (min 1900 U/min) (blade retracted) Attention: dwell time at least 1 sec. until the blade retract</p>	
<p>3. 向后工退 恢复至需要的切削速度，然后以向后工退的方式对工件进行切削</p> <p>位置: $h - t$</p> <p>3. AR Machine workpiece backwards in AR and machining speed rate.</p>		<p>6. 向后快退 在保持收回速度的同时，以向后快退的方式将刀具抽离工件（刀片已收回）</p> <p>6. ER In retract speed rate withdraw the tool from workpiece in ER (blade retracted)</p>	

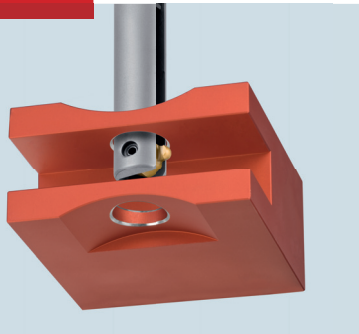


单次工序

好优利公司的刀具在单次的操作工序内，即可去除正反两面的毛刺

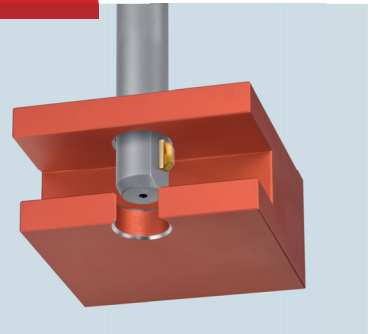
去毛刺

- COFA
- SNAP



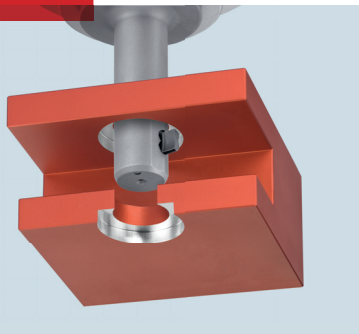
倒角

- SNAP
- GH-S
- DEFA



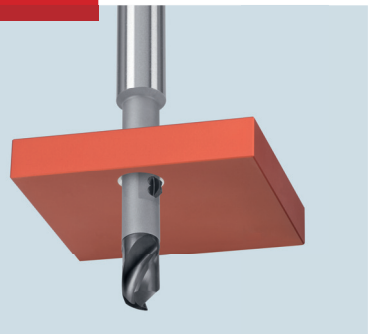
沉毛孔

- SOLO
- GH-Z/E
- GH-K



钻孔

- VEX-P
- VEX-S



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