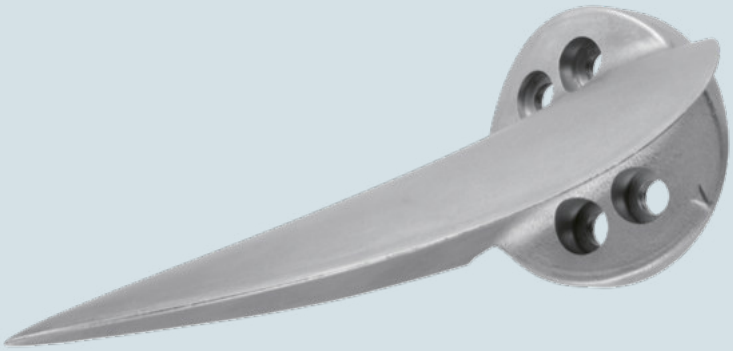
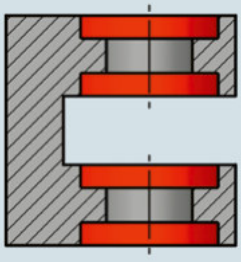
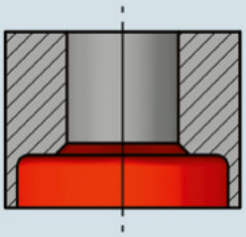
HEULE
PRECISION TOOLS

SOLO

Independent spotfacing and counterboring
front and back in one operation.







Online Information

www.heule.com/en/counterboring-tool/solo

SOLO

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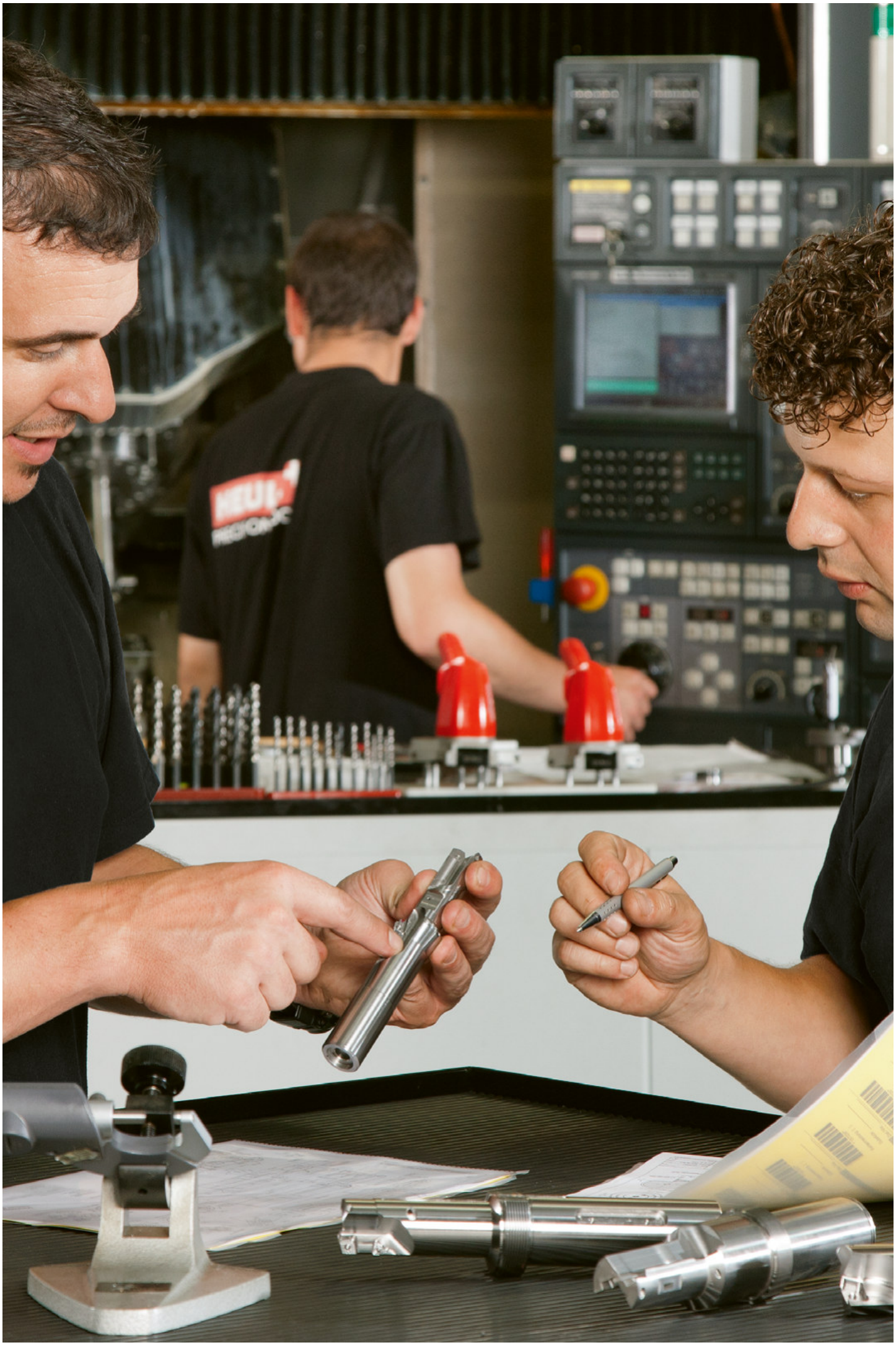


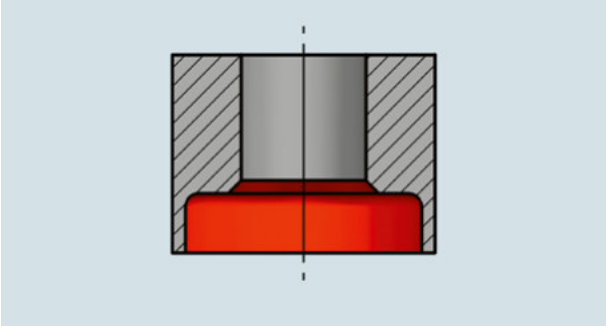
SOLO – The Automatic Front and Back Counterboring Tool

Machine automated counterboring and form-sinking, front and back, in one single pass.

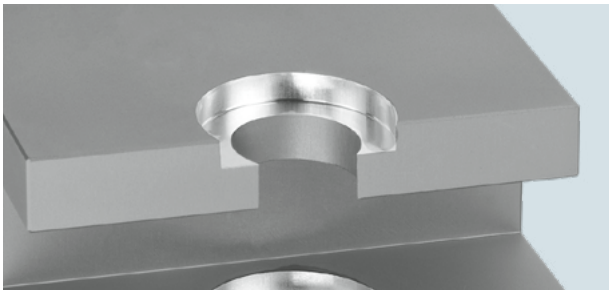
With consistent simplicity and process capability, the SOLO tool sells itself. Its successful operation in the aircraft industry for many years confirms its reliability and a superior product off the machine with maximum efficiency is guaranteed.

Blade housing, blade control and blade are designed individually to the customer-specific requirements. Your project, your specifications: because no application is the same.

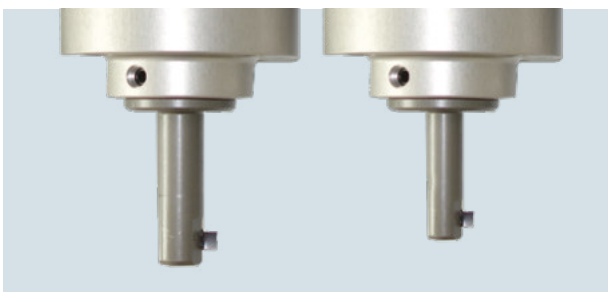
Characteristics and Advantages



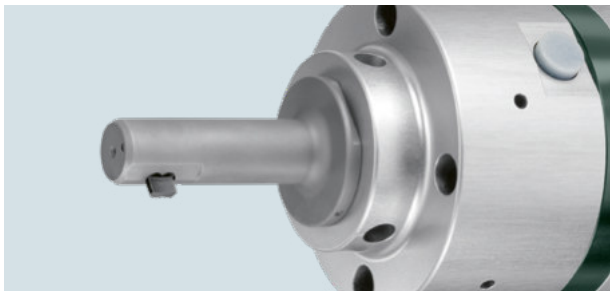
- SOLO allows for automatic front and back counterboring without requiring the workpiece to be turned.
- The access to the rear bore edge is gained through the bore itself.
- The SOLO system can be used for bore diameters starting from Ø6.0 mm. Counterbore diameters of up to Ø49.0 mm are achievable.



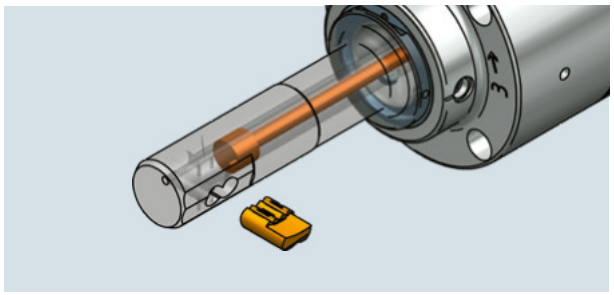
- The maximal bore-counterbore-ratio is 2xbore-Ød - 1.0 mm in normal cases including material with high strength properties such as titanium or Inconel.
- SOLO handles workpieces with interrupted bore edges without any difficulties, even in materials with very high tensile strength.



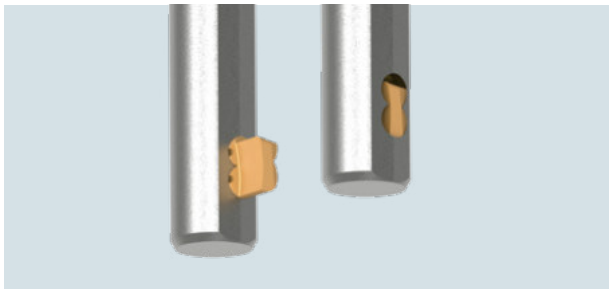
- Excellent process reliability and performance due to optimal specification to suit your particular applications.
- Modular setup: The tool head and the shank are standard. The blade housing, the blade control and the blade are adapted to your application.



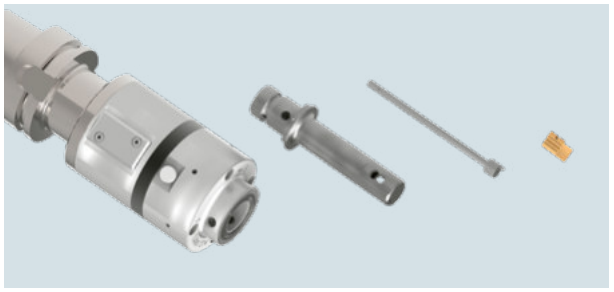
- The tool is immediately ready for operation on any machine (CNC, Transfer, Multi spindle, conventional machine) without any pre-settings.
- The SOLO tool functions reliably without anti-rotation device, change of spindle rotation, coolant pressure or contact mechanism.



- Easy to operate: The blade or the support of the inserts will be extended reliably by the centrifugal force generated by the activation speed in SOLO. Alternatively, SOLO2 retracts the blade through centrifugal force.
- Made with material-dependent cutting geometries and coatings, the carbide blades are easily changed by hand in the machine.



- The reliable blade system and housing is resistant to dirt and chips. The radially extending and retracting blade is guided by the blade housing and is responsible for safe and reliable operation. It prevents the chips from jamming.
- Simple construction together and fully mechanical operation in a closed system guarantee reliable functioning.

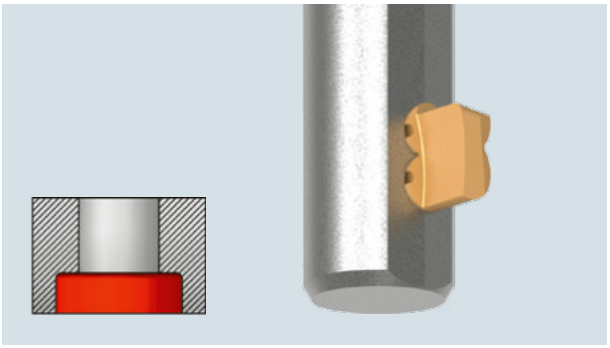


- Simple, easy-to-maintain tool design.
- Superior price/performance-ratio, excellent process capability with minimum maintenance make SOLO first choice when it comes to efficient high-volume production.

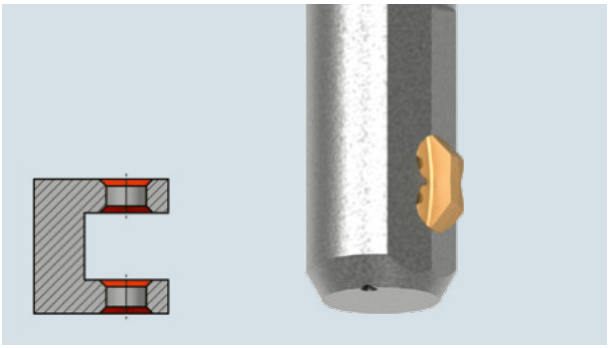
This tool system is simple and easy-to-use. The high process capability and efficient operation give SOLO the competitive edge for successful use in high-volume production.

SOLO's application range:

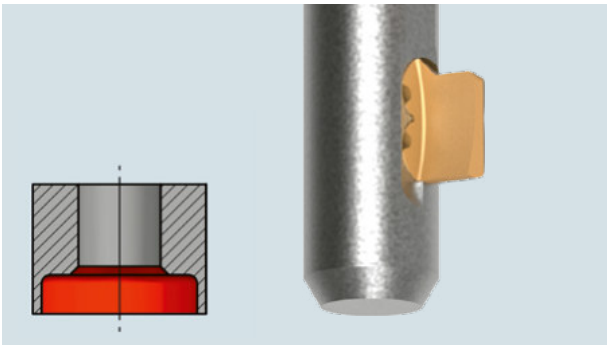
Minimal bore-Ø	6.0 mm
Maximal sinking-Ø	49.0 mm
Maximal chip section (Counterbore width)	13.0 mm



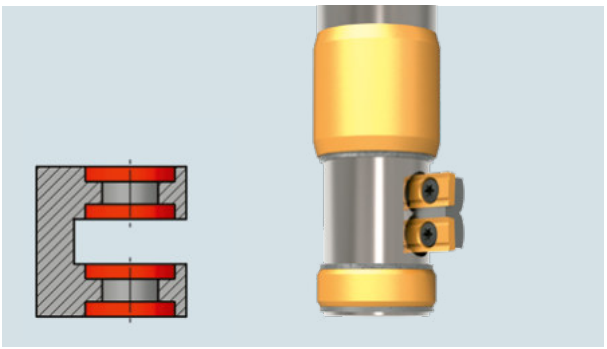
Back Spotfacing



Chamfering front and back

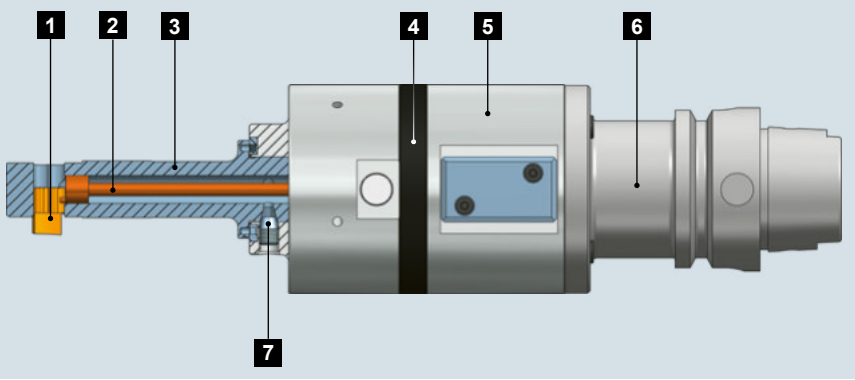


Formsinking backward



Couterboring forward and backward by insert holder with inserts

NOTE
Customer-specific solutions are process capable and designed to meet the requirements of the application in all aspects. Efficiency is the main focus of the SOLO tool concept. Please contact us and show us your application – we will design the right tool for you.



1 Solid carbide blade or Blade holder with inserts
2 Blade control
3 Blade housing
4 Center ring
5 Tool head
6 Shank direct adaption
7 Clamping screw

SOLO fulfills the requirements of diverse materials and applications. To do this, two systems with different machining parameters have been developed: SOLO and SOLO2. Although their appearance is almost identical, their mechanical setup is completely different.

SOLO:
For high machining speeds, exceeding 1900 rev./min.

SOLO2:
For low machining speeds up to 1400 rev./min., Retracting speed 1900 rev./min.

SOLO

SOLO operates with a minimum speed of 1900 rev./min. When standing still, the blade is in retracted position. It is only by exceeding the minimum speed that the blade is being extended into working position. Stopping the spindle moves the blade back into the blade housing. The distinguishing feature of SOLO is the black center ring.

SOLO2

The blade of the SOLO2 tool is extended whenever the spindle is stopped. The tool is meant for use up to a maximal machining speed of 1500 rev./min. The speed needed for retracting the blade is 1900 rev./min. It is only by exceeding this speed that the blade retracts safely into the blade housing. The distinguishing feature of SOLO2 is the green center ring.

Overview of distinguishing features	SOLO	SOLO2
Blade position at standstill (spindle stopped)	retracted	extended
Color center ring	black	green
Required speed for extending blade	1900 rev./min.	0 = standstill
Required speed for retracting blade	0 = standstill	1900 rev./min.
Machining speed	> 1900 rev./min.	0 – 1500 rev./min.

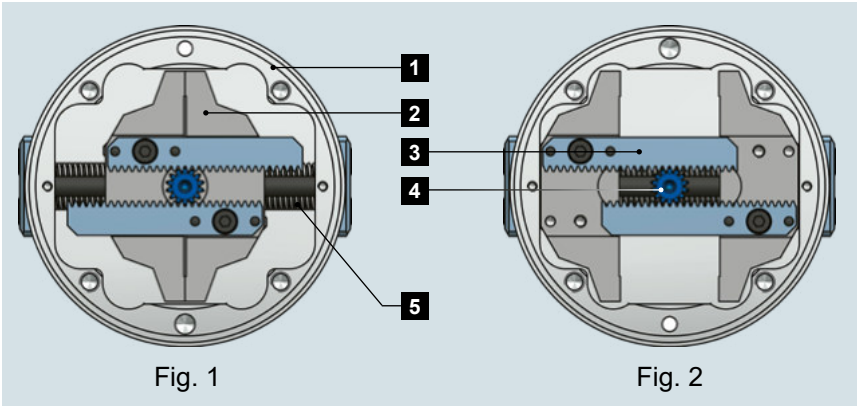
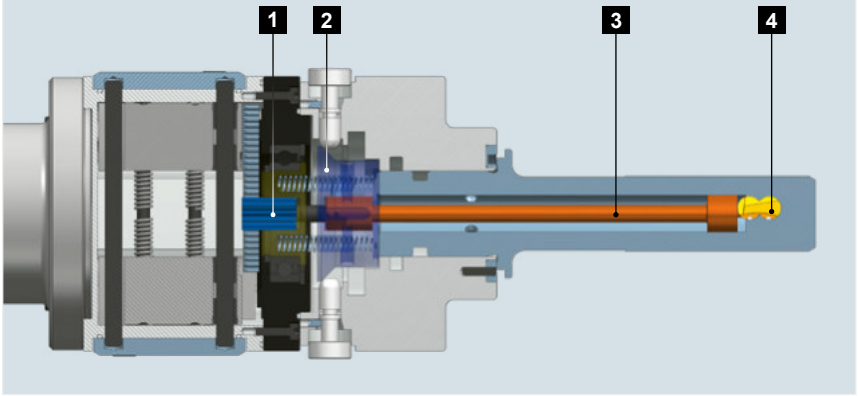


Fig. 1 Fig. 2

1 Control unit
2 Centrifugal elements
3 Toothed rack
4 Pinion
5 Return spring

Fig. 1: Spindle stopped: Blade extended
Fig. 2: Activation speed: Blade retracted

Forced by the rotation of the tool at the indicated activation speed, two centrifugal weights start moving outwards up to the stop. The weights moving outwards are turning a pinion via two toothed racks. This pinion drives the blade **out** or **in** by means of the blade control. The end of the blade control is a bolt that rests in the blade groove. The distance traveled by the centrifugal weights causes a turn of the blade control by 180° which moves the blade out into working position.



1 Gear wheel
2 Blade control support
3 Blade control
4 Blade

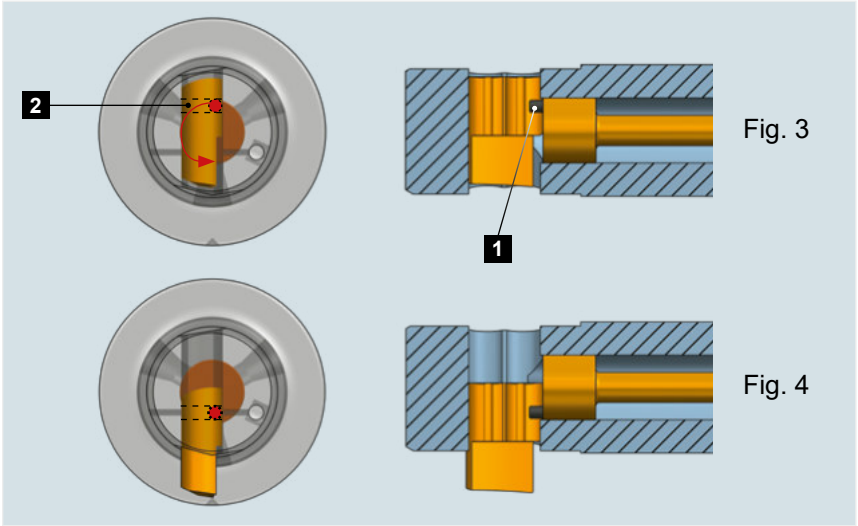


Fig. 3

Fig. 4

1 Blade control bolt
2 Blade groove

Fig. 3: Blade retracted
Fig. 4: Blade extended

SOLO Range Summary

The product range consists of the two different tool heads that distinguish SOLO from SOLO2. Since each tool is tailor-cut to the customer-specific application, there is no standardized range. HEULE defines the tool according to the application data listed in this chapter.

Image 1: On the left SOLO, on the right SOLO2. Both featuring direct adaption shanks (standard).

	SOLO	SOLO2
Complete system	GH-B-O-0084	GH-B-O-0085
Center ring	black	green
Blade position at standstill	retracted	extended
Activation speed	1900 rev./min.	Spindle stop
Retracting speed	Spindle stop	1900 rev./min.
Machining speed	1900 - 3000 rev./min.	0 - 1500 rev./min.

The special version SOLO2S (S=Strong) features a reinforced blade housing and a reinforced support of the blade housing. The use of this version has is mandatory in application cases where the bore diameter is larger than 30 mm.

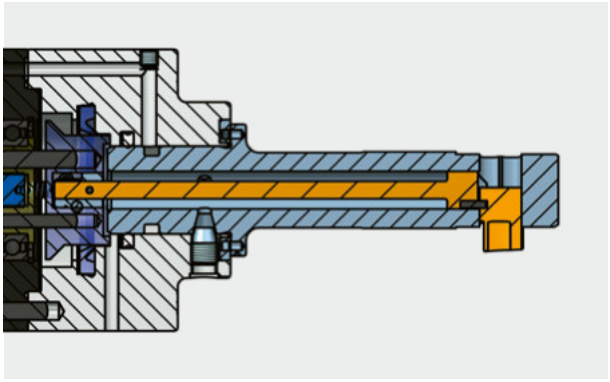


Image 1: SOLO2 Standard version

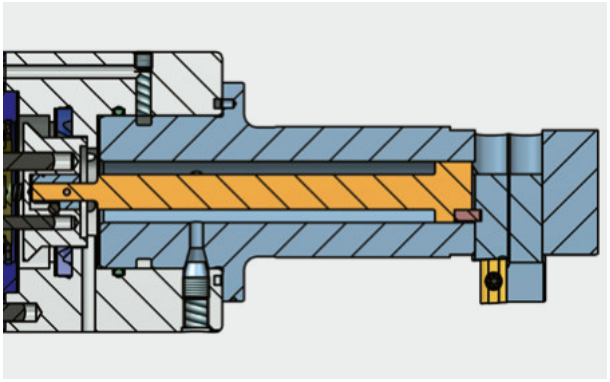


Image 2: SOLO2S Reinforced version

The use of bronze guide bushings is recommended for high transverse forces appearing at radii, chamfers and interrupted surfaces. In cases where the bore surface must not be damaged (i.e. soft materials or respective requirements on the bore surface) the use of guide bushings or rails should also be taken in consideration.

Bushings also help to avoid possible material build-up on the tool diameter. The fact that the relative circumferential speed of the bushing to the workpiece bore is equal to zero, spares the bore. This solution avoids undesired contact effects and guides the tool in an ideal manner. The resulting possible reduction of the tool diameter D1 down to the necessary shaft diameter creates additional space for chips.

Guide bushing behind the blade

The blade in the retracted position is not protected by the tool diameter D1 because the blade exceeds slightly the blade housing. A possible radial run-out on the tool (i.e. adaption or machine) may lead to a damage of the bore wall when the tool enters or later exits the bore again. If the counterbore ratio and the tool stability allow it, the eccentricity will be defined so that the retracted blade is at least -1.0 mm away from the bore diameter.

Guide bushings ahead and after the blade

In some cases however, this condition cannot be achieved. Then, a further guide bushing has to be placed ahead of the blade. Thus, the tool is guided permanently. By doing so, it has to be taken into account that adding a guide bushing weakens the blade housing. This fact again limits the use of guide bushings.

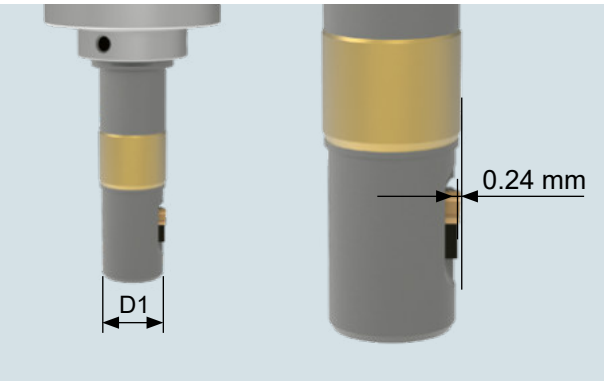


Image 1: SOLO with retracted blade that shows only an insufficient distance to the bore wall.

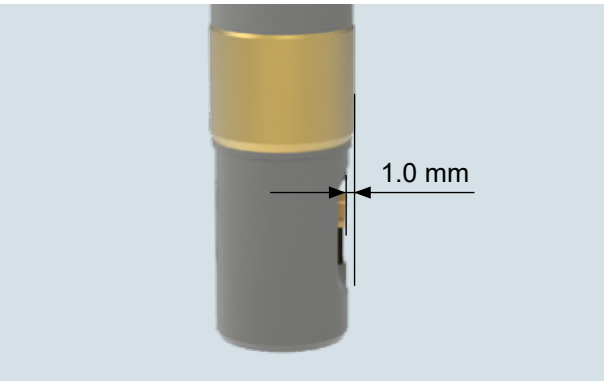


Image 2: In this example the distance between blade and bore wall is sufficient.

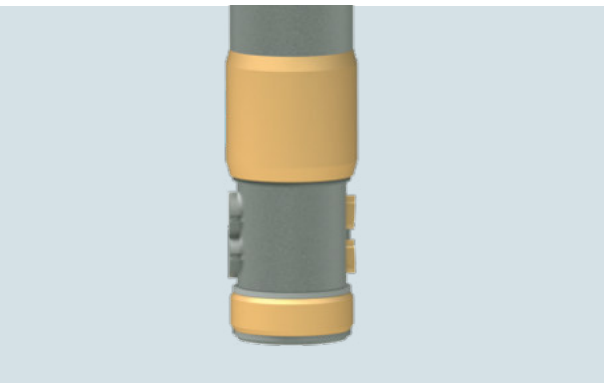


Image 3: SOLO with retracted blade protected by a guide bushing ahead and one after the blade.

Material	Designation / Material number
Bore	Bore diameter with tolerance Bore depth, working length
Counterbore / Countersink	Sinking width (Ø) resp. chamfer width (Ø) horizontally with tol. Sinking depth + if appl. geometric tolerances of the sinking
Chamfer	Chamfer angle with tolerance
Interfering edges etc.	Distances
Machine concept	Type Machining Center, feed unit, machine capability
Machining position	horizontally, vertically
Adaption to machine	Shank system
Production volume	Production quantity per year, lot size
Drawing workpiece	2D or 3D file (STEP, DXF, ...)

Technical Data and Settings

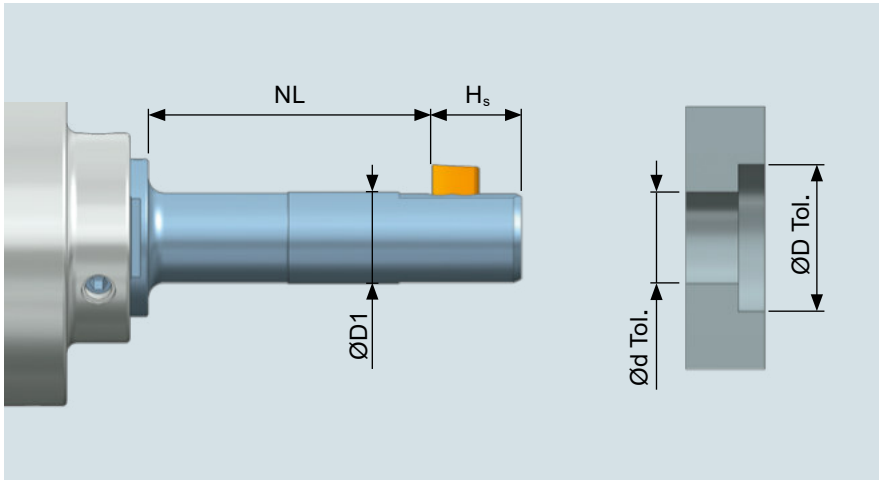
Cutting Data SOLO

Material	Condition	Tensile strength (N/mm^2)	**Cutting speed** (m/min)	**Feed** (mm/rev.)
Unalloyed steel		<500	50-90	0.03-0.1
Cast steel		500-850	50-90	0.03-0.08
Grey cast iron		<500	50-110	0.03-0.1
Ductile cast iron		300-800	50-90	0.03-0.08
Low alloy steel	annealed	<850	50-90	0.03-0.08
	tempered	850-1000	40-80	0.03-0.08
	tempered	>1000-1200	30-50	0.02-0.05
High alloy steel	annealed	<850	30-70	0.03-0.08
	tempered	850-1100	30-50	0.02-0.05
Stainless steel	ferritic	450-650	30-50	0.03-0.08
	austenitic	650-900	15-25	0.02-0.05
	martensitic	500-700	30-50	0.02-0.05
Special alloy (Inconel, titanium, …)		<1200	15-25	0.02-0.05
Wrought or cast aluminium alloys			100-200	0.03-0.12
Copper alloy	Brass		50-90	0.03-0.08
	Bronze short-chipping		30-70	0.03-0.08
	Bronze long-chipping		20-30	0.02-0.05

WARNING NOTICE
All listed cutting data are standard values only! The cutting values depend on the amount of slope of the uneven bore edge. (i.e. high slope ► low cutting value). The feed also depends on the sloping ratio. In case of hard to machine materials or uneven bore edges, we recommend to apply cutting speeds that are at the lower end of the range for uneven bore edges.

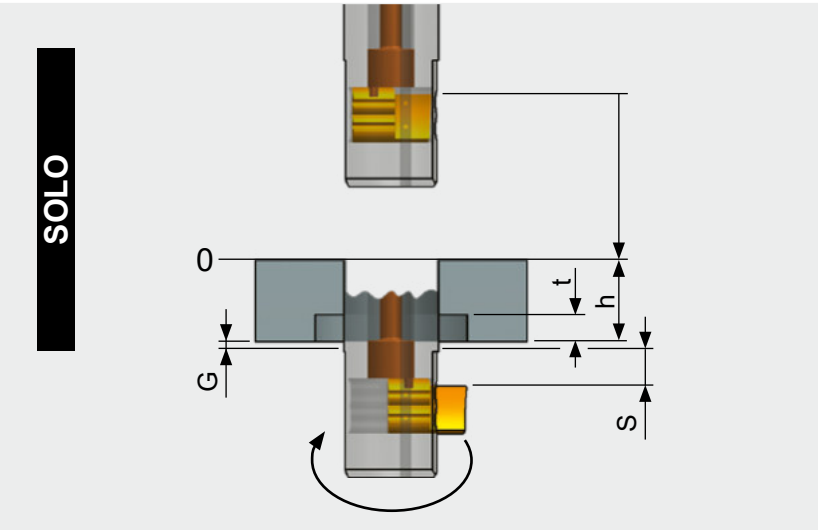
Application tolerances

Bore-Ø Tolerance	$^{+0.1}_{0}$ mm	$^{+0.2}_{0}$ mm
Counterbore-Ø Tolerance	±0.2 mm	±0.3 mm



Ød	Bore-Ø
ØD	Counterbore-Ø
Ød1	Tool-Ø
NL	Working length
H_s	Blade height

NOTE
Please observe the recommended value for the tolerance of the bore diameter (d). The larger the tolerance is chosen, the more side effects can occur (damaged bore, enlargening, counterbore-Ø gets smaller).



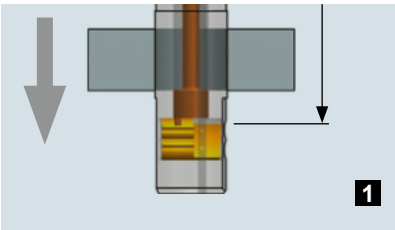
0 Zero line

G Burr height

h Workpiece thickness

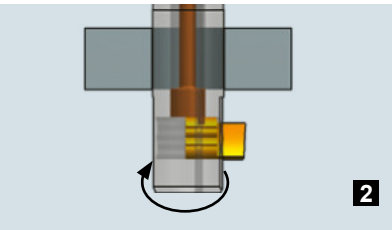
t C'sinking depth

S Clearance distance



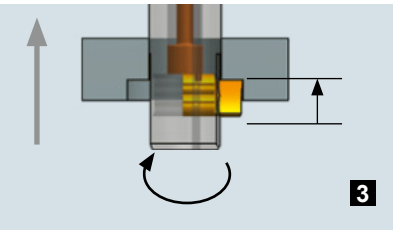
After spindle stop (Speed = 0, blade retracted), rapid traverse through the workpiece.

Position: h + G + S



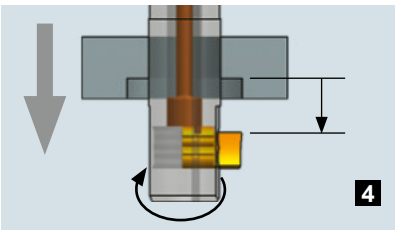
Activate spindle clockwise. Select correct activation speed to extend blade.

Attention: Dwell time 1 sec. at least. Increase speed to working speed. Switch coolant on.
Position: h + G + S



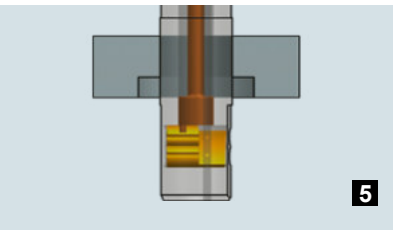
Machine workpiece backwards in working speed.

Position: h - t



Travel out of countersink in rapid traverse. Switch off coolant.

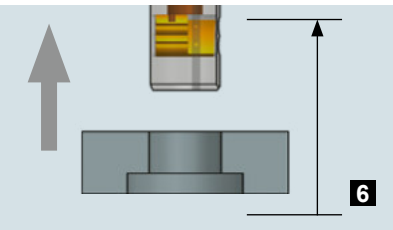
Position: h + G + S



Stop the spindle. Select speed rate = 0 to retract blade.

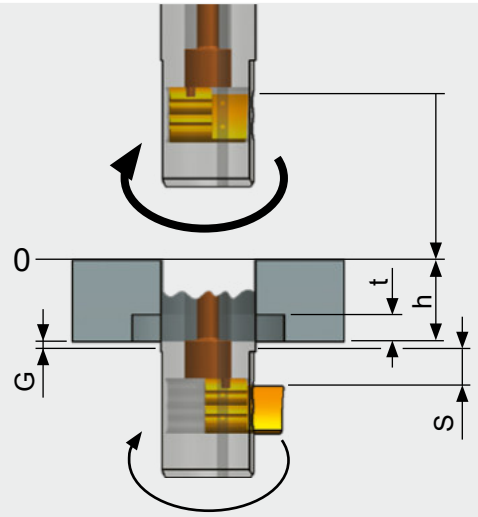
Attention: Dwell time 1 sec. at least.

Position: h + G + S



With stopped spindle (speed rate = 0) and in rapid traverse withdraw the tool from the workpiece.

SOLO 2



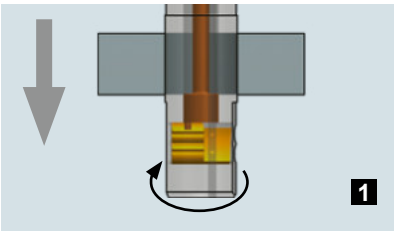
0 Zero line

G Burr height

h Workpiece thickness

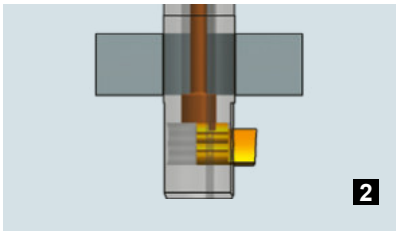
t C'sinking depth

S Clearance distance



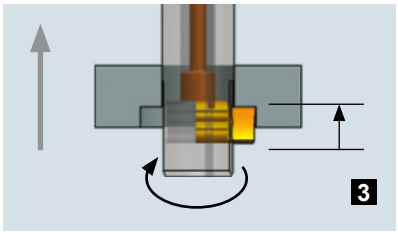
Activate spindle clockwise with retraction speed (speed = 1900 rev./min. minimum). The blade retracts. Travel through workpiece with rotating spindle and in rapid traverse.

Position: h + G + S



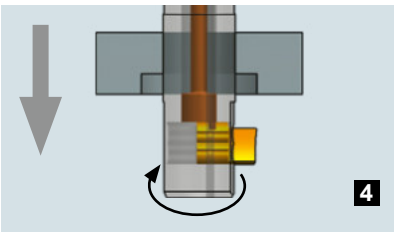
Stop the spindle. Dwell time 1 sec. at least. Switch on coolant. Set the speed to working speed.

Position: h + G + S



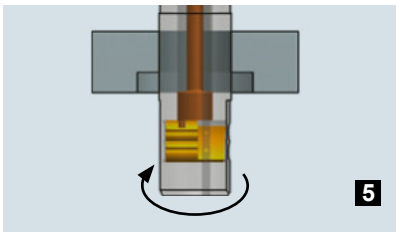
Machine the workpiece backwards in working speed and with working feed.

Position: h - t



Travel out of countersink in rapid traverse. Switch off coolant.

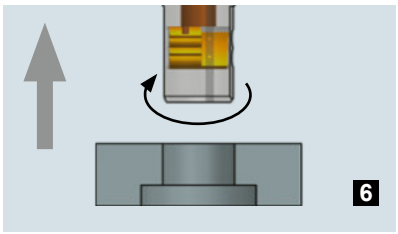
Position: h + G + S



Retract blade by increasing spindle speed to 1900 rev./min. minimum.

Attention: Dwell time 1 sec. at least.

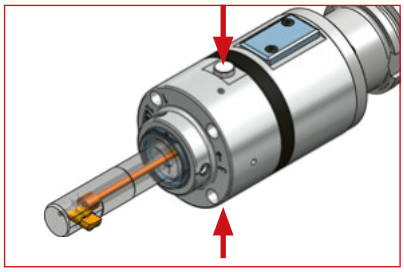
Position: h + G + S



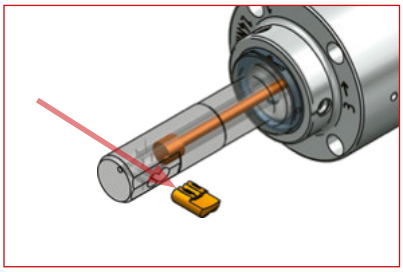
Travel through workpiece with retraction speed (Speed rate 1900 rev./min. minimum) and in rapid traverse and with retracted blade.

Maintenance and Servicing

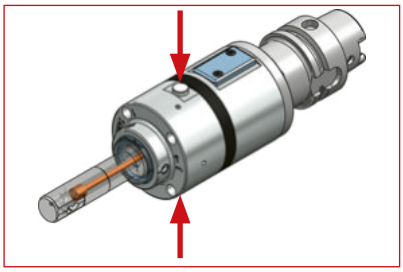
Blade change



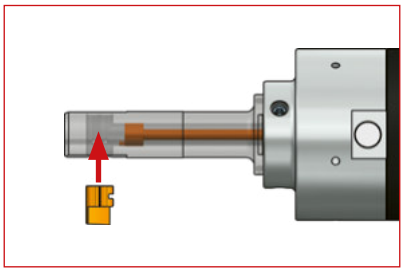
Dismantling of blade:
Push both buttons of the control unit at the same time. The blade control and the blade control pin will be retracted. Thus, the blade is released.



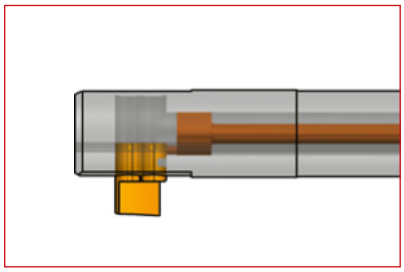
Push out the blade. Keep the buttons pressed until the blade is completely removed.



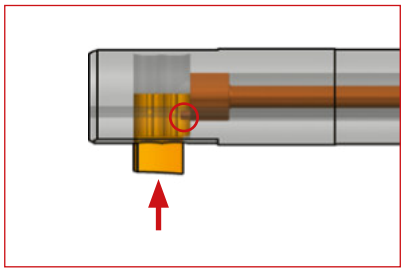
Insertion of blade:
Push both buttons of the control unit at the same time.



Insert blade in blade window to the extent that the cutting part of the blade remains fully visible. To do this keep on pushing the buttons of the control unit.

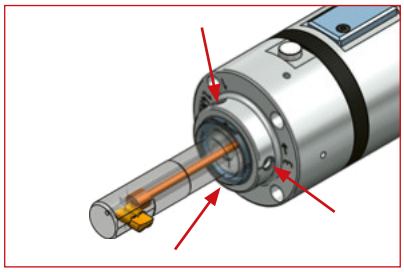


Release the buttons. Make sure that the buttons are extended fully.

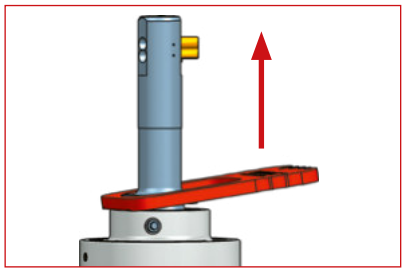


Position the blade in the blade window so that the blade control pin audibly engages into the blade.

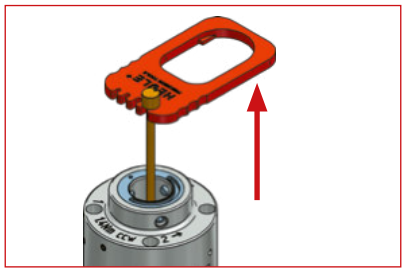
NOTE
Attention: Please check the position of the blade control pin. If the blade housing or/and the blade control is assembled in the wrong way there is a danger of the cutting edge of the carbide blade being hit.



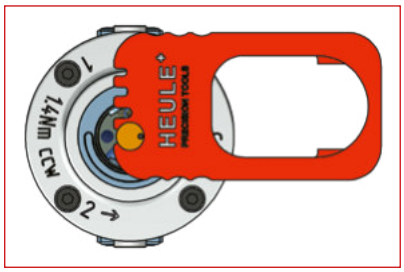
Dismantling:
Loosen the 3 clamp screws of the control unit and unscrew them only partly.



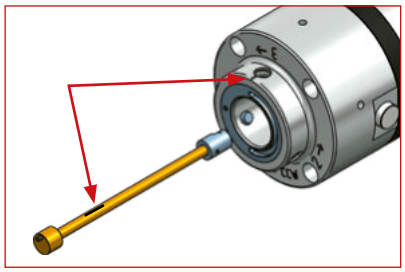
Pull the blade housing forward - away from the control unit. The blade house wrench simplifies the disassembly and should be used always.



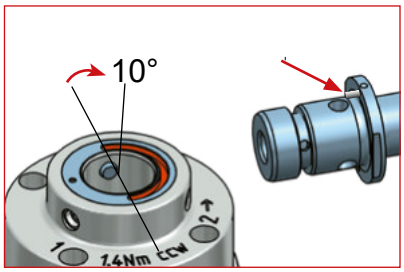
Pull forward the blade control too by applying some force but without unscrewing anything.



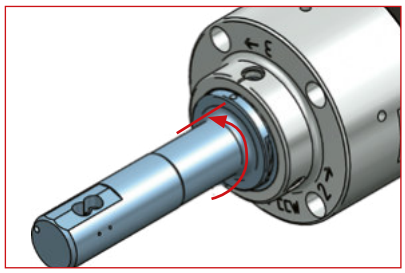
Please use the blade house wrench in case of small diameter and/or short working length.



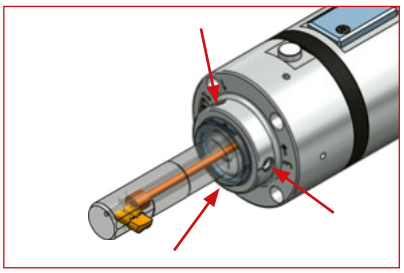
Assembly: Push blade control (snap mechanism + seal) well positioned with some force into the control unit.
Attention: Please make sure that the mark on the blade control and the mark on the control unit are aligned.



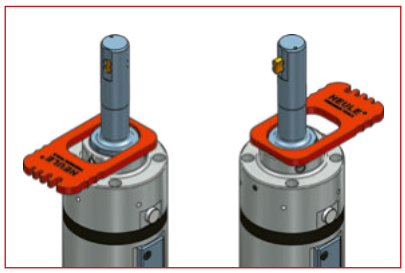
Mount the blade housing onto the control unit. Please make sure that the blade control bolt is mounted with a twist of approx. 10° into the clearance groove of the blade housing.



Then, align the mark of the blade housing with the mark of the control unit.



Screw the 3 clamp screws tightly. For this, please observe the torque value and screw order indicated on the control unit housing.



ATTENTION: Before setting to work after a change of blade housing and/or blade control, a function check is compulsory (refer to page 233).

Maintenance Intervals / Services

Compulsory maintenance interval: after 18 months or 200‘000 strokes.

All service work requiring the opening of sealed screws has to be carried out by authorized personnel that has been certified by HEULE Werkzeug AG.

HEULE Werkzeug AG offers support and services for all products.

Professional maintenance work and timely service intervals assure a process safe functioning.

Compulsory Maintenance and Warning Notices

The maintenance work upon reaching the service interval is mandatory. HEULE Werkzeug AG would like to point to the fact that the maintenance **has to be** carried out by HEULE or a certified partner.

Only the following three procedures can be carried out by the customer:

- Blade change
- Change of blade housing
- Change of blade control

IMPORTANT: The control unit may be opened **by certified and authorized personnel exclusively.** HEULE Werkzeug AG rejects any responsibility after opening by a non-authorized body.

NOTE
If this provision is not complied with, there is a **risk of severe injuries**.

Negative effects from long periods of non-use

After not using the tool for a longer period of time, a manual function check MUST be carried out. During a longer period of non-use, residues of coolant and dirt dry up. This may lead to the blade and blade control sticking together. This sticking effect may cause a malfunction or prevent the blade from being activated. In order to ensure proper functioning again, the tool has to be manipulated manually before setting to work.

Function Check

SOLO offers the possibility to check the function of the tool (extending and retracting of the blade) while it is standing still.

Procedure:
1 - Loosen the three clamp screws.
2 - Insert wrench over the blade housing.
3 - SOLO: Turn wrench clock wise, SOLO2: turn wrench anti-clock wise.

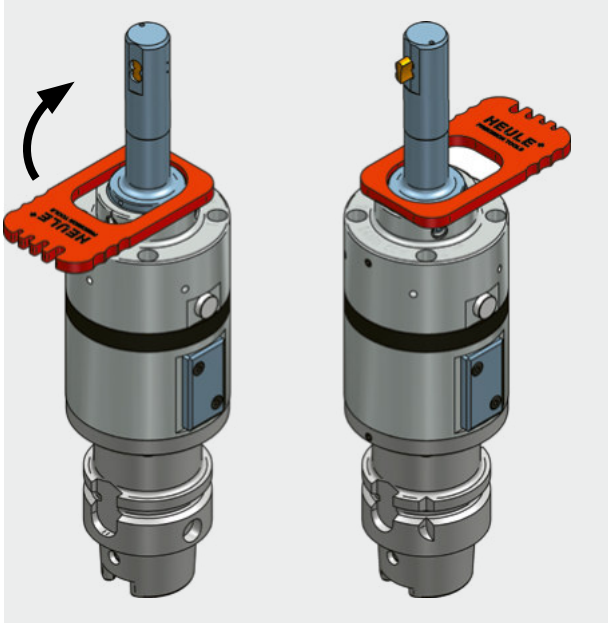


Image 1: SOLO

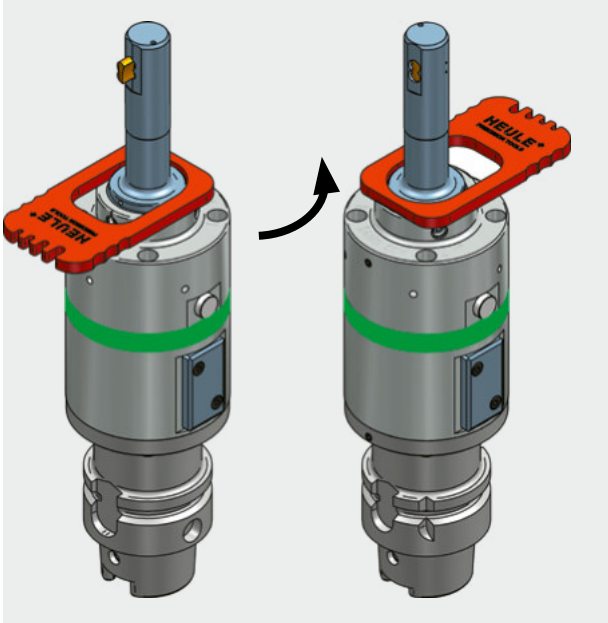


Image 2: SOLO2

4 - Please note that the blade extends if it is SOLO. If it is SOLO2 the blade will retract.
5 - After the Function Check, the SOLO wrench has to be turned back in the opposite direction until the positioning bolt hits the control unit at the start mark again. Then the blade housing is aligned with the groove in the control unit again.
6 - It is compulsory to remove the SOLO wrench before use - **if omitted there is a risk of severe injury**.
7 - Re-tighten the clamp screws again. **Please make sure to observe the correct order of screw tightening and torque value (values are marked on the tool).**
8 - The tool is ready for use now.
9 - Activate the tool 2 - 3 x in the machine.

WARNING NOTICE
Please carry out all SOLO wrench-swivel movements by hand gently in order to be able to recognize possible faults and malfunctions of the blade. The function check is recommended if:

- the tool has not been used for a longer period of time
- after blade change
- after change of blade housing
- after change of blade control
- a malfunction is evident or supposed
-

Before you start with the setting to work in the machine, make always sure that:

- all screws have been tightened,
- all auxiliary tools have been removed and that
- the blade housing sits firmly in the control unit.

In case of questions please contact your competent agent or HEULE directly.