



Online Information

www.heule.com/en/applications/cross-bores/



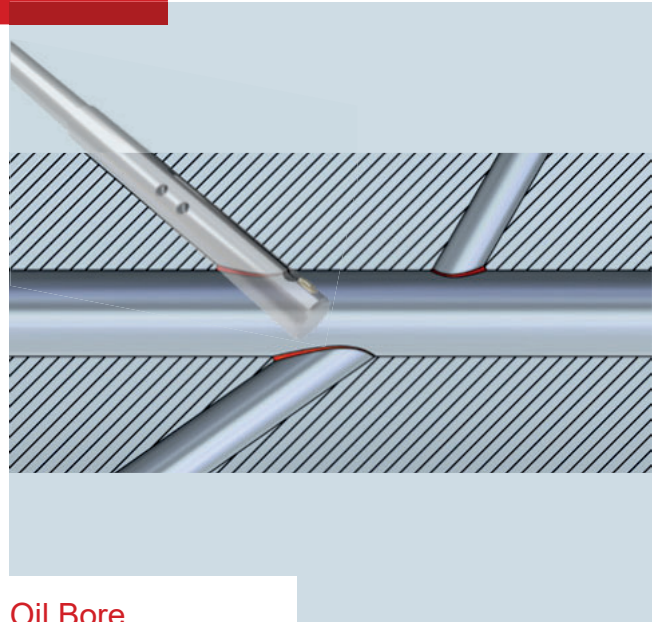
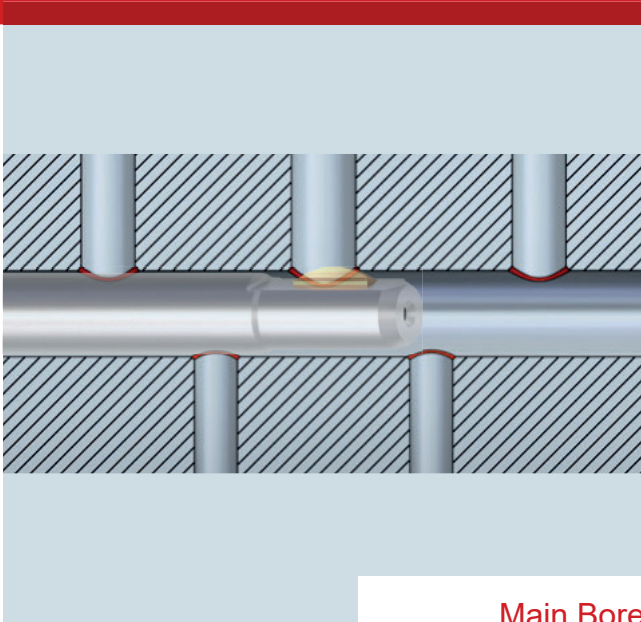
X-BORES

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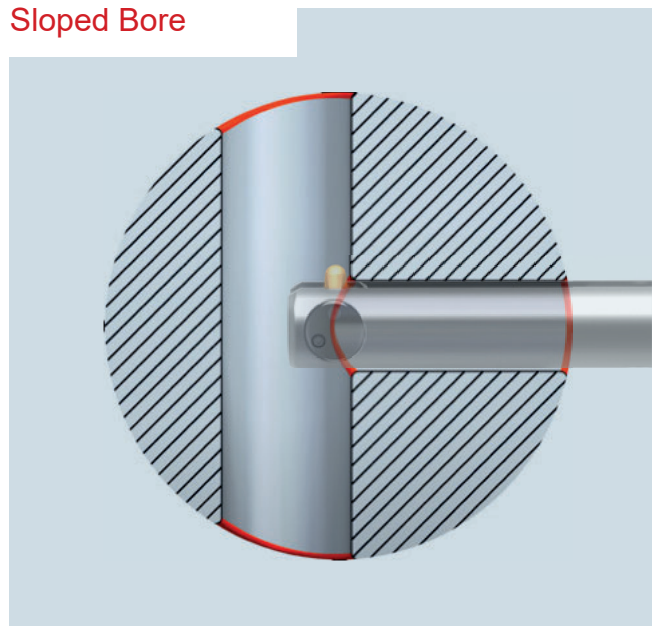
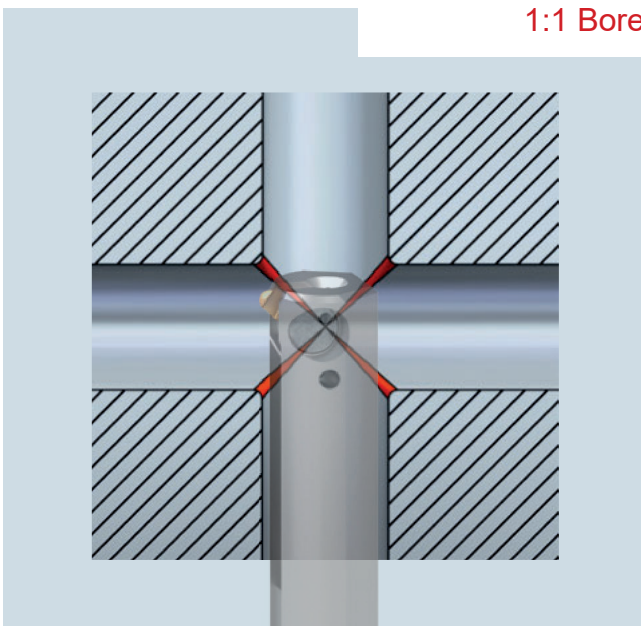
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X BORES

Deburring of Cross Bores.



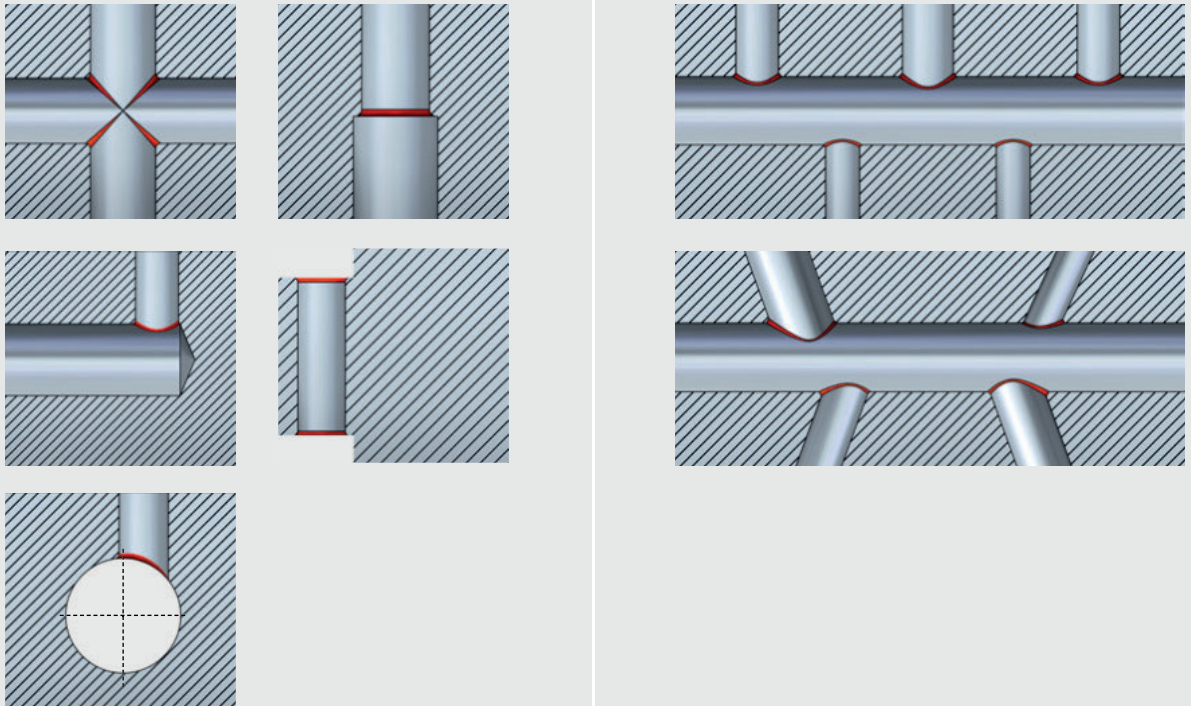
Main Bore Oil Bore
1:1 Bore Sloped Bore



With **X-BORES** HEULE takes up the challenge to provide solutions for the automated deburring of cross bores. Based on 4 different function principals we develop individual and optimized customer solutions. All systems are chip making tools that work with defined cutting edges to ensure a high process capability.

With X-BORES HEULE takes up the challenge.

Application situation



Challenge

Bores with an identical or almost identical diameter crossing each other, bores which merge into one another, crossing bores with center axis offset and interfering edges that shield the surface to be deburred indirectly.

The main bore is a central bore where several cross bores lead in. The cross bores usually have various diameters and lead into the main bore in different angles.

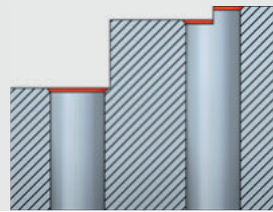
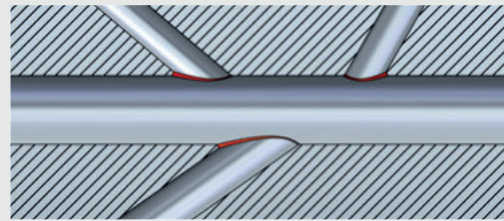
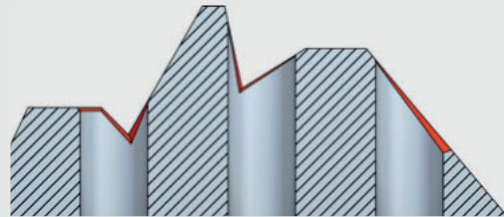
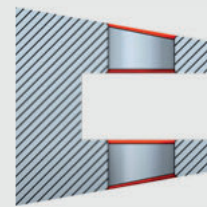
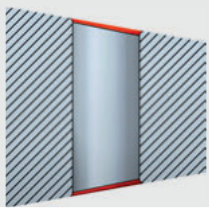
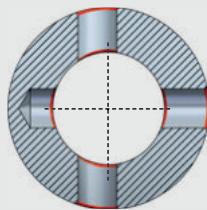
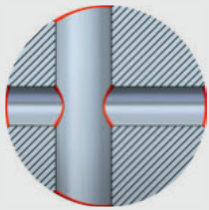
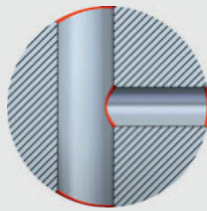
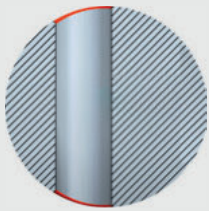
Solution approach

The 1:1 Ratio Bore Tool

With its COFA-X-System combined with today's machine capabilities HEULE possesses a new solution. This method enables the machining of contours that were inconceivable some years ago.

The Main Bore Tool

The Main Bore Tool SNAP-X is used for the deburring of cross bores leaving sharp edges. It penetrates through the main bore and deburrs the cross bores. In one single pass, several cross bores are machined right at the burr base.



Sloped, uneven or even surfaces and crossing bores with regard to the penetration angle.

Beside the classic oil bore, this category covers very complex intersecting bores one usually finds in toothing or steps and intersecting bores with a very flat penetration angle.

The Universal Efficiency Champion

COFA removes burrs on the front and back of a drilled through-hole on even and uneven surfaces in a single cycle. It radially removes the burrs without requiring the workpiece to be turned or the spindle to be stopped. This is why it is suitable for the deburring of cross bores.

The Cross Bore Tool

The CBD (Cross Bore Deburring Tool) has been developed to deburr oil bores. The tool penetrates the cross bore and deburrs the bore intersection in an absolute process-safe manner.



Online Information

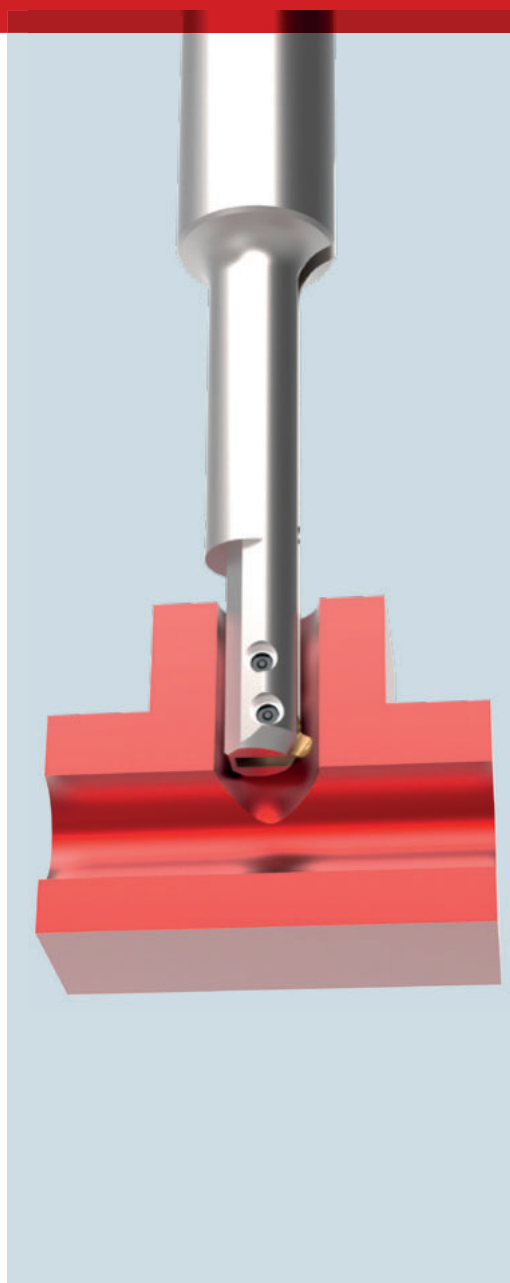
www.heule.com/en/products/deburring-tools/cofa-x



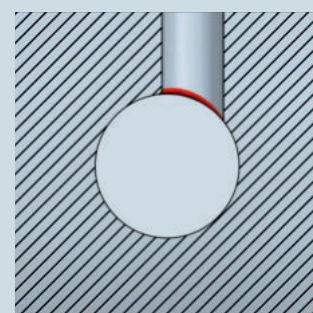
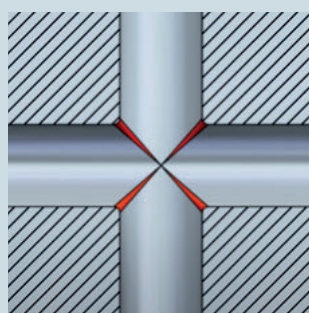
COFA-X

COFA-X

The mechanical deburring tool for cross bores with a diameter ratio of 1:1.



XBORES



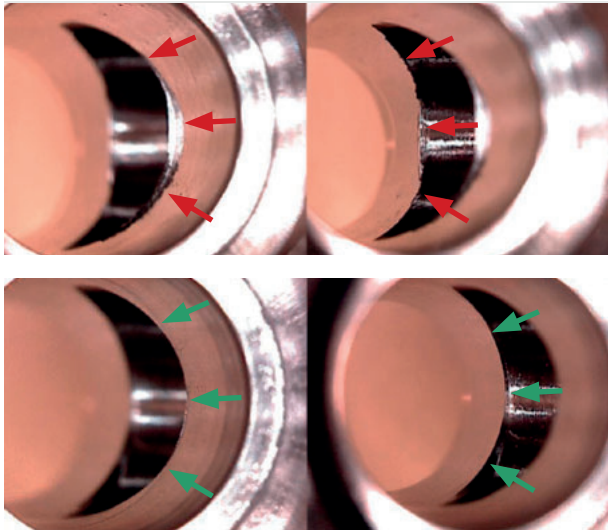


Image 1: Top row: Before deburring. Bottom row: After deburring. The bore edge is clean and completely free of burrs.

Cross bores with almost identical diameters show a very high unevenness. With the new COFA-X technology, it is possible to mechanically remove the burrs completely from these uneven surfaces in an automated process.

As a solution provider, we are making use of today's machine capabilities and combining them with a new tool, the COFA-X system, to solve the challenge of removing burrs from uneven surfaces.

The defined cutting process using a carbide blade is responsible for a complete edge break. In other words the edge is burr-free.

Function Principle and Possible Applications

Tool function

COFA-X is the first and only tooling system that removes the burrs from interior uneven bore edges in applications with large intersections. It works reliably in NC-operated applications. Its simple and mechanically-controlled function principle increases the process reliability and reduces your process costs remarkably at the same time.

The COFA-X application range starts with bore diameters of Ø5.0 mm and larger. In all cases, COFA-X tools are designed individually according to the customers' needs through a complete application description. With the right tool in place, the machining process using COFA-X does not allow any secondary burrs at all.

Each specific tool machines one diameter only. The machine requirements also play an important role for the reliable NC operation. The tool has to be entered into the bore with an offset (see image 2).

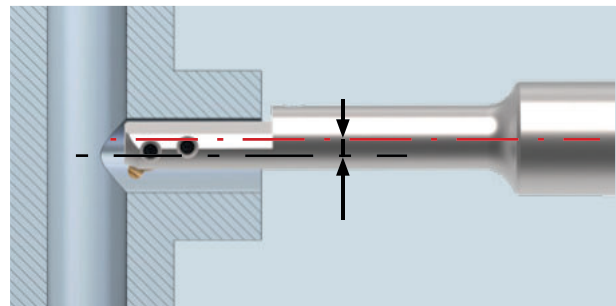


Image 2: The deburring tool accesses the T piece via the cross bore.

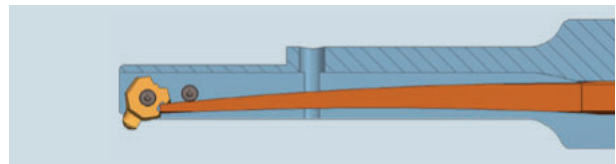


Image 3: The preloaded spring and the shaft with a recess enable the tool to deburr bores with a high degree of unevenness.

Blade function

The blades possess special geometries. They are designed either for front or back cutting only. In addition, the blades are pre-loaded by the spring. Accordingly, the blade position is different.



Image 4: Front cutting



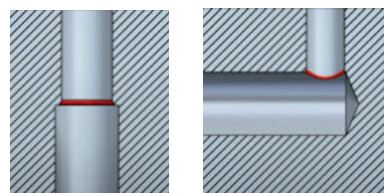
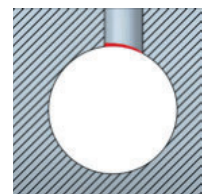
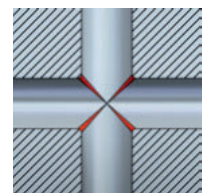
Bild 5: Back cutting

Scope of application

■ Intersecting bores up to a main bore - cross bore ratio of 1:1.

■ Crossing bores with center axis offset.

■ Bores with interfering edges that shield the surface (bore edge) to be deburred indirectly.



In comparison with the standard COFA system, COFA-X possesses a pre-loaded blade and the tip of the tool body shows a recess. This recess is necessary in order to enter the bore with an offset so that the blade does not suffer.

The tool itself is characterized by its simple setup. The exchangeable spring is held safely in the tool body by two split pins. It controls the movement of the blade and resets it to the initial position after machining.

The multiple use of blade and spring within a series is given. Only the tool body has to be selected according to the bore diameter.

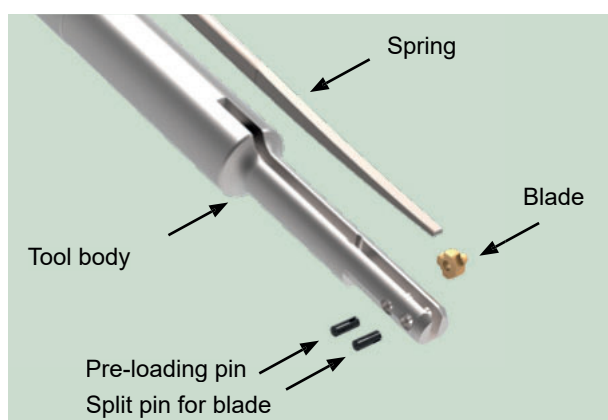
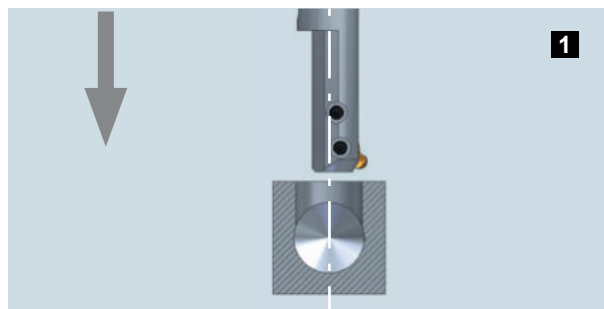


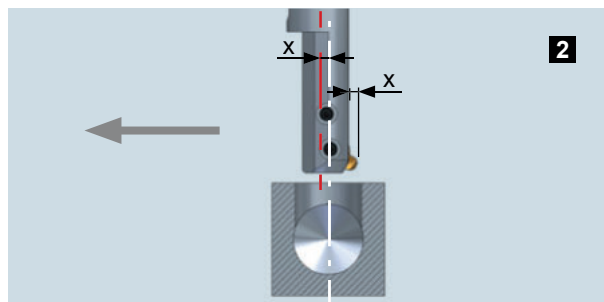
Image 4: To change the blade only remove the front split pin and swivel it out of the spring.

Information / data required by HEULE to examine the feasibility of your application.

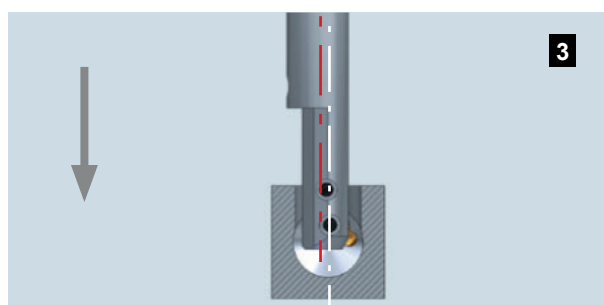
- ☐ Main bore-Ø including tolerance
- ☐ Cross bore-Ø including tolerance
- ☐ Bore depth
- ☐ Material
- ☐ Penetration angle
- ☐ Offset
- ☐ Production volume per year
- ☐ Cycle time
- ☐ Machine (NC / others)
- ☐ Solution / process today
- ☐ Particular requirements
- ☐ STEP drawing



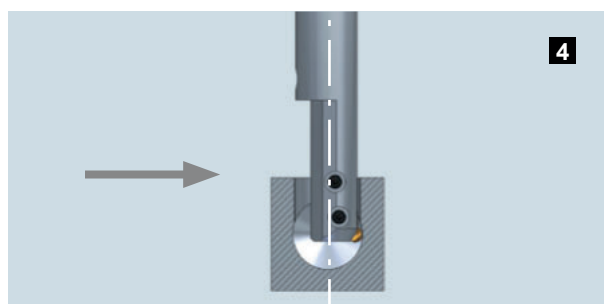
Approach with spindle stopped, orientated and offset 0



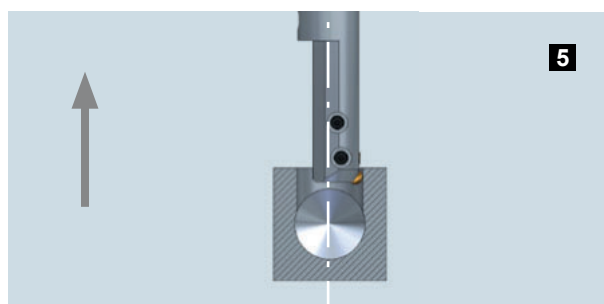
Approach offset dimension x. Value depends on the distance of the blade exceeding the tool body.



Travel down until the blade has fully entered the main bore and is behind the bore edge to be deburred.



Move back to offset dimension 0.



Spindle ON. Execute deburring in working feed backwards.



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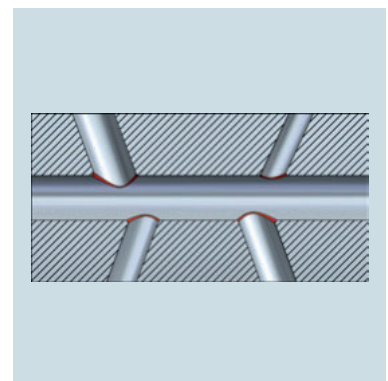
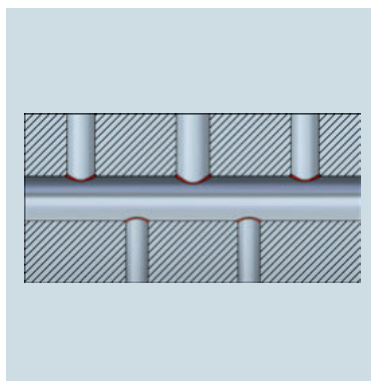
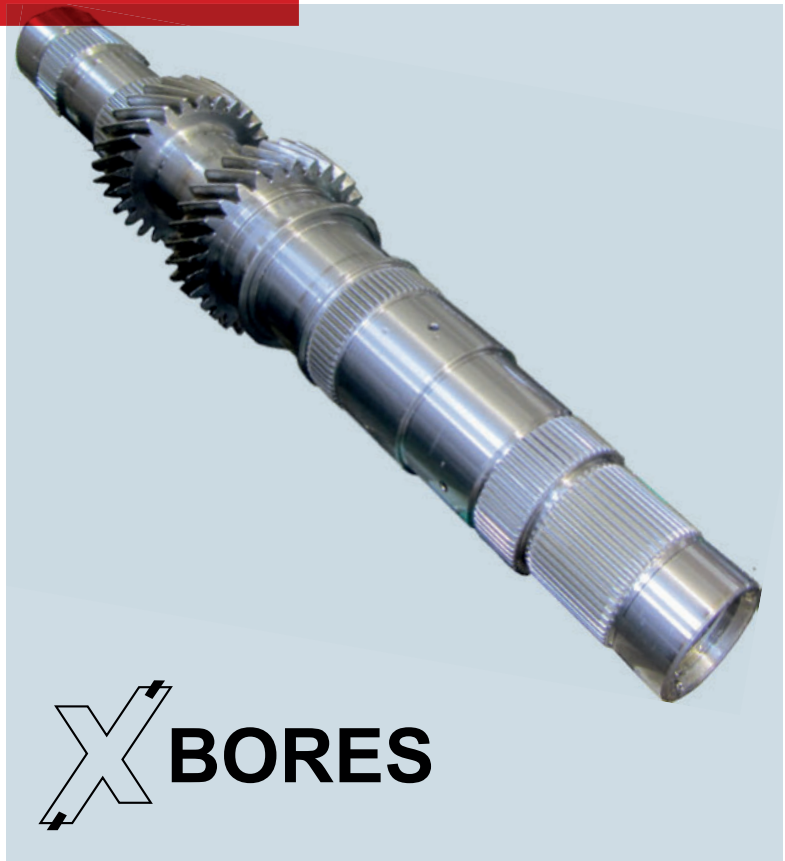
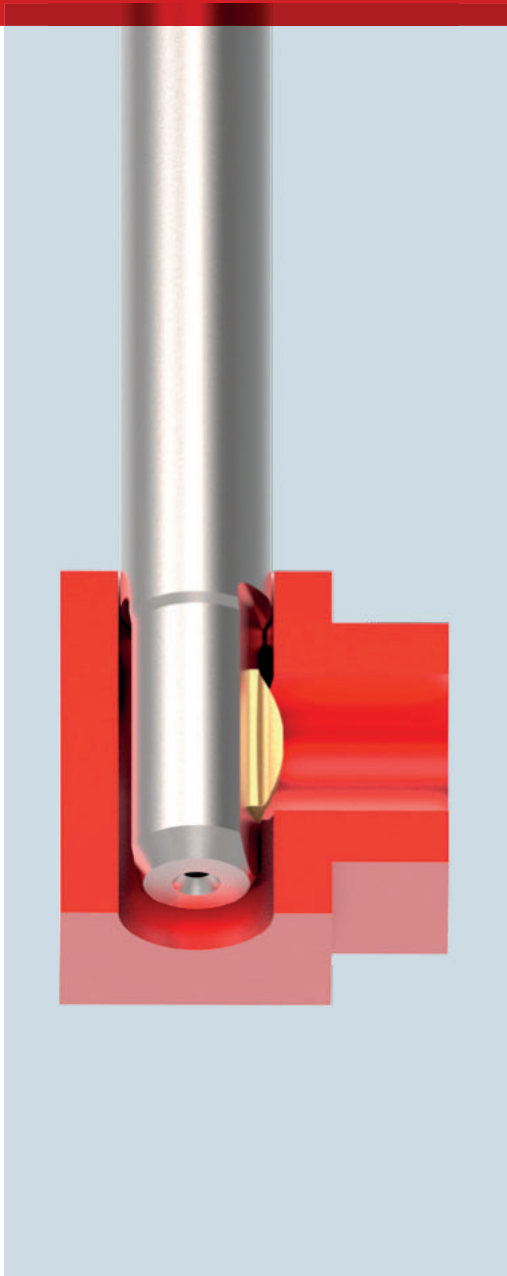
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SNAP-X

SNAP-X

Deburring tool for main bores.



With SNAP-X HEULE advances into uncharted technical territory that has been out of reach so far. This special tool penetrates by the main bore and deburrs the entering cross bores. In close cooperation with the customer, our R&D team examines the feasibility and develops a tailor-cut tool for the specific application.

The mainbore solution is based on the proven SNAP system. SNAP-X has been conceived for NC operation and for large production runs. The exchange of the blades is extremely simple and can be carried out by hand in no time.



Image 1: Process capable for large production runs - as an example, drive shafts for a manual gearbox machined on a transferline by SNAP-X.

Function Principle and Possible Applications

Setup and function principle

The radially supported and spring-loaded SNAP-X blade penetrates the cross bore in work feed and deburrs it, no matter what the diameter of the cross bore is. The especially ground blade fulfills its work while moving forward as well as backward where the direction of the spindle rotation is reversed.

When leaving the cross bore, the guiding edge of the SNAP-X blade moves it back into the tool body in a controlled manner. A especially designed gliding section prevents the main bore from being hurt.

Process description

The tool blade is positioned in rapid feed in front of the cross bore to be deburred. In work feed forward and with work speed the edges of the intersection are being machined. With clockwise rotation all intersecting bores are deburred now in one single pass. In order to assure the best possible deburr result, the spindle rotation is switched to anti-clockwise rotation and all crossbores are machined a second time on the tools way out of the mainbore.

The tool body shows a recess in the most important cutting direction (feed direction). This prevents the burrs from being pushed down or bent into the cross bore in advance.

In general, extra long tools are usually assembled (multi-piece construction) and require an adequate guidance in the mainbore direction as well as a generously dimensioned chamfer. It is strongly recommended not to activate the tool/spindle without guidance.

Blade function

The blade is built with a clockwise and an anti-clockwise working cutting edge. Its form is convex and adapted to the crossbore. It enters the crossbore to the extent limited by the geometry/radius of

the blade edge and the blade length. Given by the constellation of the two circle segments (crossbore and blade) the blade is able to work its way out continuously and at the same time, it carries out the deburring in a skinning way of cutting.

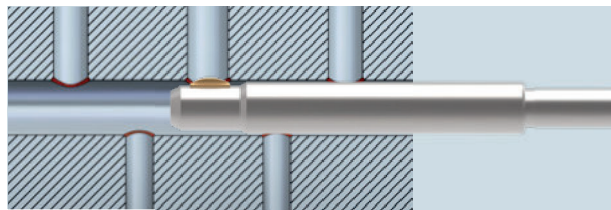


Image 2: Several cross bores are deburred in one single pass through the main bore.

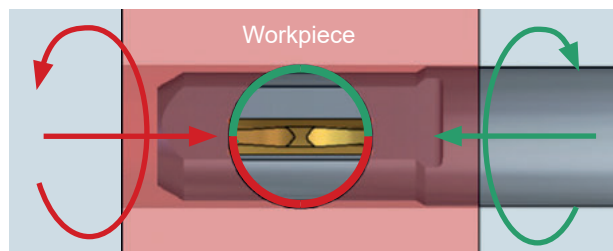
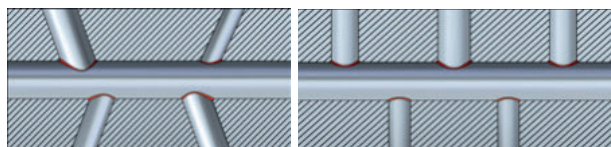


Image 3: The blade is conceived for forward and backward cutting. Before moving back out, the direction of the spindle rotation is changed to machine the bores a second time with the backward cutting side assuring the required process capability.

Scope of applications

- Mainbores
- Intersecting bores in different diameters up to a ratio of close to 1:1
- Several crossbores lead into a mainbore in different angles and diameters.



The tool is characterised by its simple design. It consists of very few components with one screw only. The blade is kept movable in the tool body via a control bolt held under spring pressure. The blade has a special ramp-shaped recess where the control bolt engages in. While machining, the bolt glides up the ramp and increases the pressure on the blade. This brings the blade back to the starting position when exiting the bore again.

The blade can be exchanged by hand within no time and without any tools.

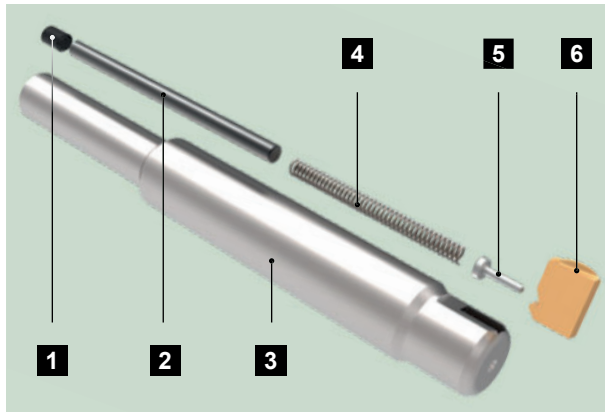
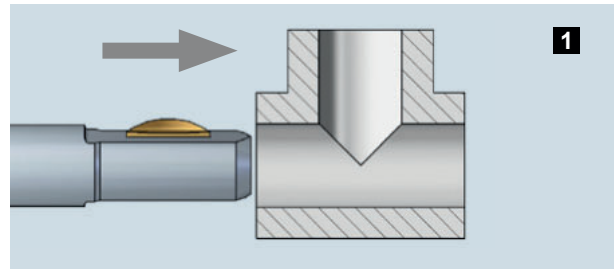
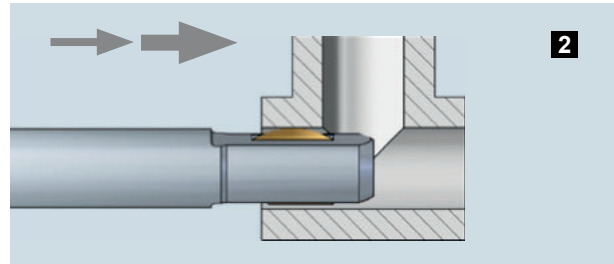


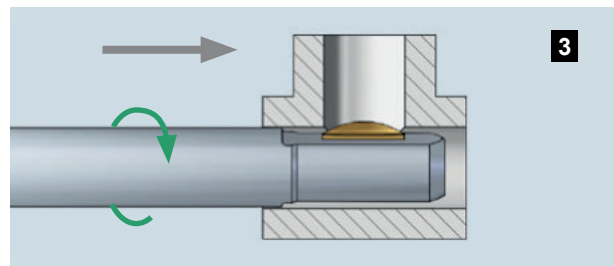
Image 4: 1-Set screw, 2-Distance pin, 3-Tool body, 4-Spring, 5-Control bolt, 6-Blade



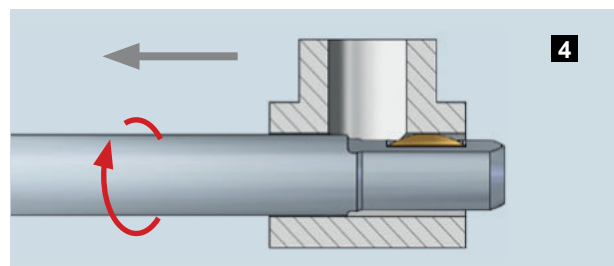
First, in rapid traverse and with the spindle stopped, move the tool head 0.5 mm ahead of the main bore entrance.



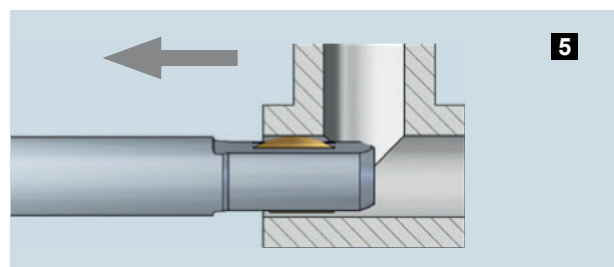
In working feed, insert the tool/blade into the main bore. Then, continue in rapid traverse to the first cross bore. Stop immediately ahead of the bore.



Machine the cross bore in working feed and the spindle rotating clockwise. Once finished, move in rapid traverse and the spindle still rotating to the next cross bore.



After the last cross bore, change the rotation direction of the spindle to anti-clockwise and repeat all operation procedures on the way back.



Once finished machining the last cross bore, stop the spindle rotation and move out of the main bore in rapid traverse.

Information / data required by HEULE for the feasibility study of your application:

- ☐ Main bore-Ø including tolerance
- ☐ Cross bore-Ø including tolerance
- ☐ Position of the cross bore in relation to the main bore (drawing or model)
- ☐ Working length
- ☐ Material
- ☐ Shank-Ø (possibly with special shank length)
- ☐ Interfering edges (Drawing of machine situation and clamping situation)
- ☐ Required deburring quality (i.e. residual burr)
- ☐ Production volume per year
- ☐ Cycle time deburring
- ☐ Machine (NC / others / cooling)
- ☐ Particular requirements
- ☐ STEP drawing



Online Information

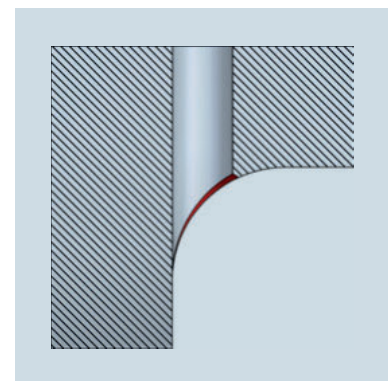
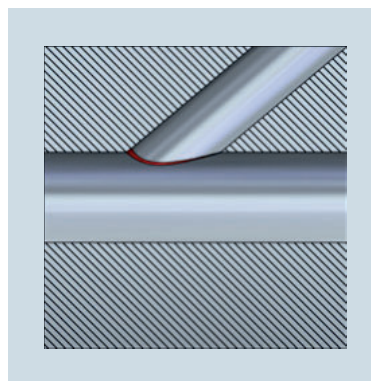
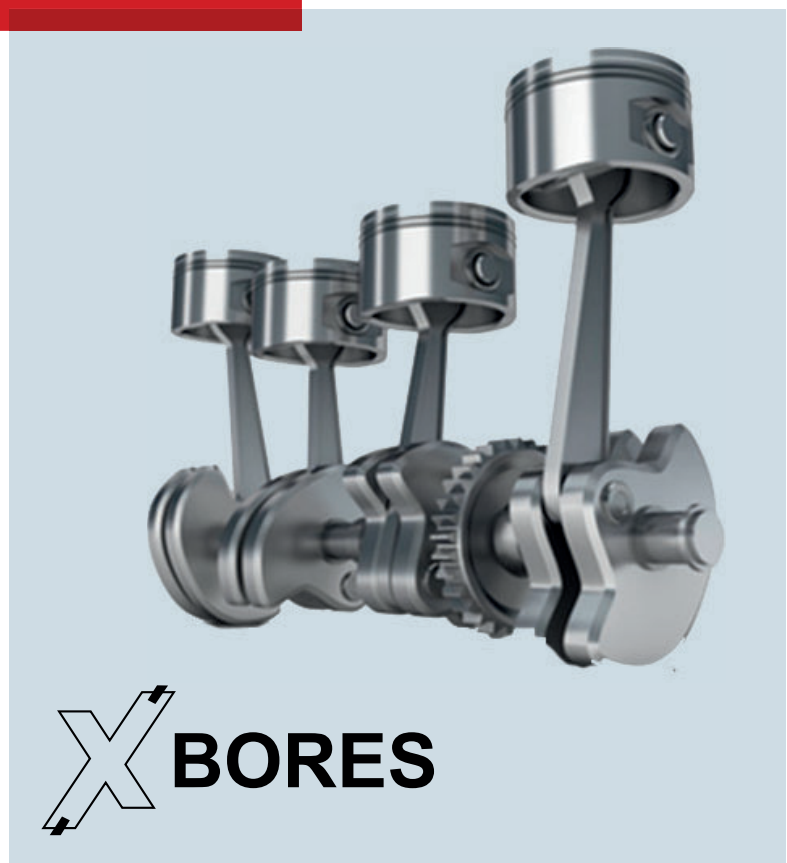
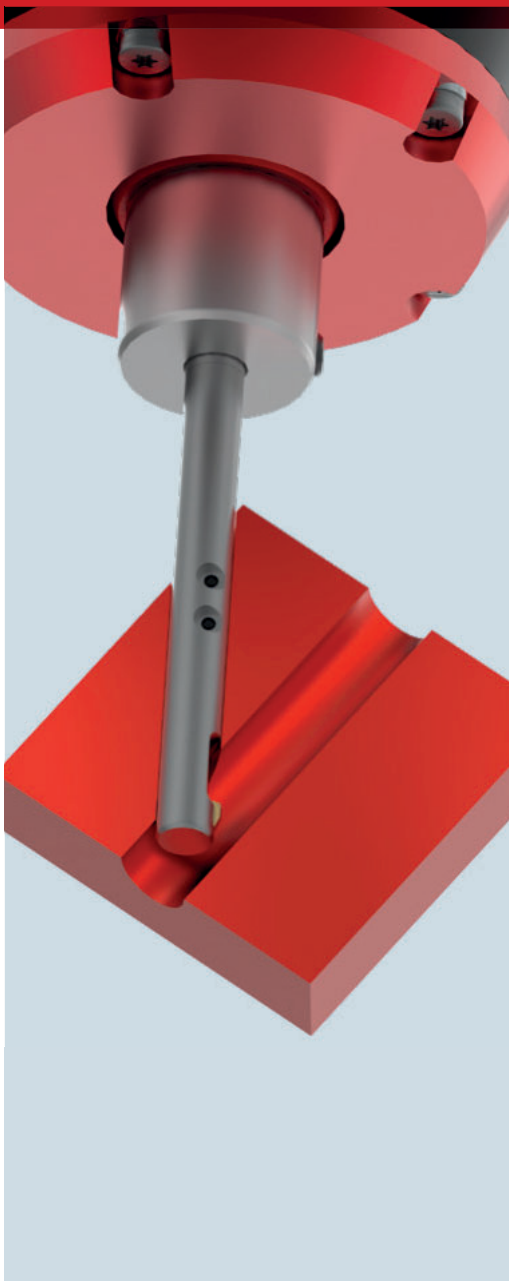
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CBD

CBD

The unique deburring tool for oil bores from Ø5.0 bis Ø10.0 mm.



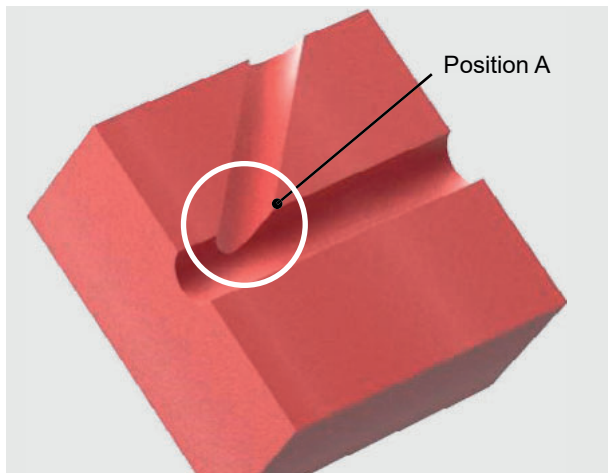


Image: Intersecting bores with minimal ratio of the main to the cross bore and flat penetration angle

The existing deburring tools are limited when it comes to deburr intersecting bores with a minimal ratio of the main to the cross bore or with a very flat penetration angle of the cross bore. They do not achieve a fully satisfying deburr result because of the shape of the intersection. In particular, the present systems regularly fail to remove the burr at position A thoroughly.

HEULE set the goal to close this gap and has developed the CBD **C**ross **B**ore **D**eburring tool. A new unique system that works 100% mechanically and that deburrs a 1:1 intersection by a chip making machining process. The defined cutting process ensures a complete edge break which results in a burr free bore edge.

Function Principle of the CBD tool

Usually the rotation axis defines the working direction of a deburring tool whereas the longitudinal axis serves as feed direction (COFA principle). For the new concept (CBD principle), HEULE changed this working method. Now, the longitudinal axis serves as the working direction and the rotation axis works as an axial feed direction. The machining process is carried out through the cross bore into the main bore.

In this case, the bore intersection will be cut segment by segment by the blade. This offers the advantage that the blade can reach every point of the intersecting contour and that the burr will be removed including its root.

Blade function

When entering the cross bore the blade slides over the retract surface and moves into the tool body preloading the spring at the same time. When moving through the bore, the slide radius prevents the bore surface from being damaged. The tool overtravels the bore edge to be deburred and the blade is pushed back by the preloaded spring into its initial position.

During the reverse stroke the cutting edge of the blade removes a segment of the bore edge with the burr. The control surface is responsible that the blade slides back into the tool body. The tool body will then rotate by a defined angle (around its rotation axis) and the process will be repeated. This procedure continues until the complete circumference of the bore is free of burrs.

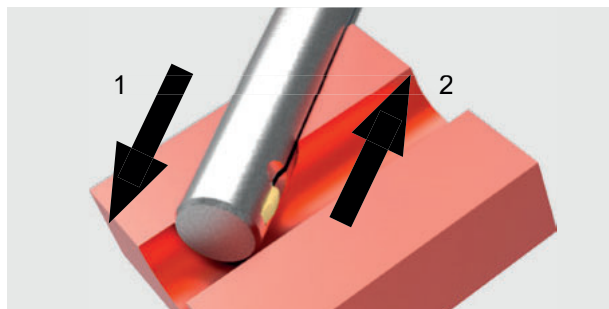
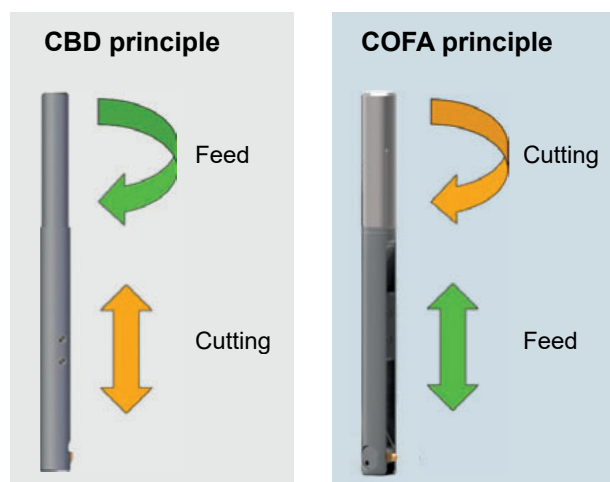
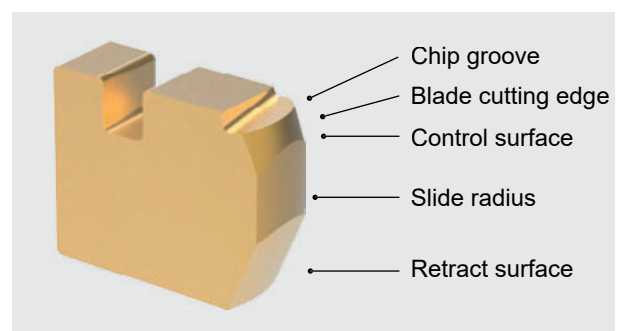


Image 1: - Stroke movement over the bore edge with the burr into the main bore 2 - Reverse stroke = cutting movement



Control unit

In order to achieve the necessary working speed and also to spare the machine tool itself, HEULE has designed a control unit. It generates the oscillating cutting movement as well as the rotating feed movement.

The stroke length and the feed are defined by the application. This means that each control unit is configured individually with standardized components according to the parameters of the application. An example: At a spindle speed of 900 rev/min the control unit generates 1800 strokes/min, respectively 30 strokes/sec and a feed of 10 rev/min. The NC anti rotation device permits an automatic tool change. It has to be adapted to the machine tool herefor.

Tool

The tool is distinguished by its simple set-up. The spring is held loss protected in the tool body by two split pins. The spring controls the blade and pushes it back into the initial position while working.

The blade and the spring are applicable for different diameters. Only the tool body has to be chosen according to the bore diameter. For changing the blade the front split pin has to be removed to be able to swing out the spring.

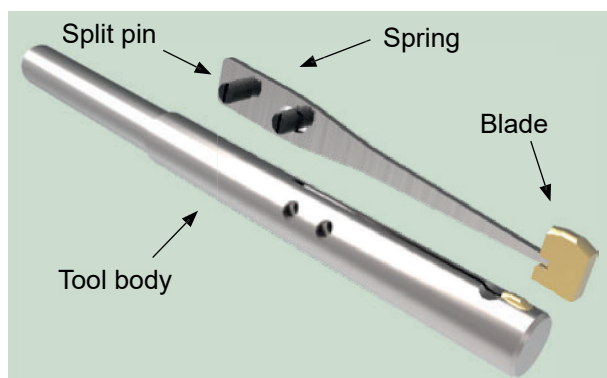


Image 3: - Replacing the carbide blade can be done manually and within no time.

Required application data by HEULE:

- ☐ Main bore-Ø including tolerance
- ☐ Cross bore-Ø including tolerance
- ☐ Bore depth
- ☐ Material
- ☐ Penetration angle
- ☐ Offset
- ☐ Distance anti rotation device
- ☐ Distance gauge line
- ☐ Production volume per year
- ☐ Cycle time
- ☐ Machine (NC / other)
- ☐ Applied solution today
- ☐ Particular requirements
- ☐ STEP drawing data

