



THE WORLD OF



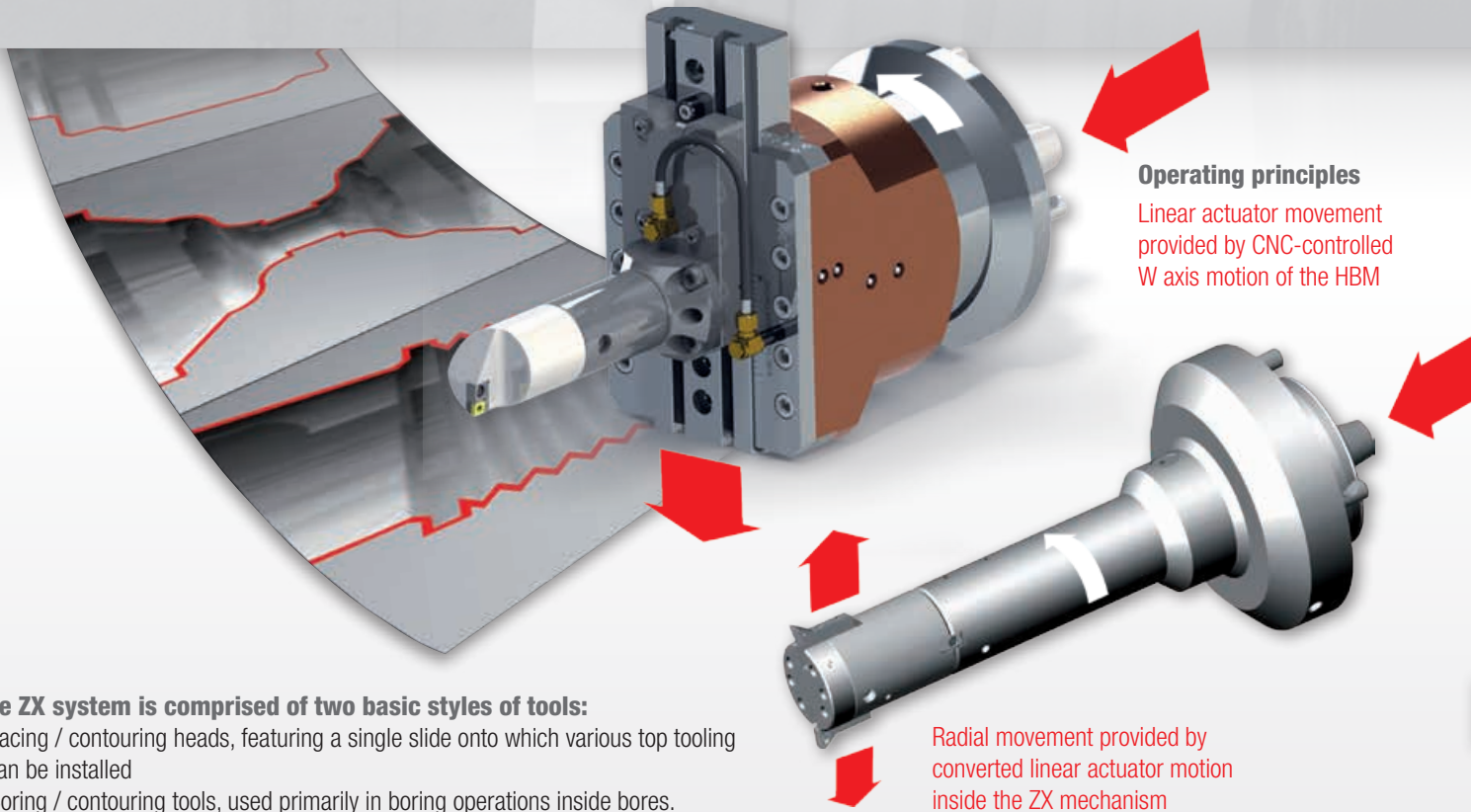
NO HORIZONTAL BORING MILL IS "COMPLETE"

WITHOUT THE ZX-TOOLING-SYSTEM

WWW.ZX-TOOLS.COM

OPERATING PRINCIPLES & APPLICATIONS

ZX-Tools perform accurate **lathe-type operations** on traditional and RAM type horizontal boring mills



The ZX system is comprised of two basic styles of tools:

- Facing / contouring heads, featuring a single slide onto which various top tooling can be installed
- Boring / contouring tools, used primarily in boring operations inside bores.

MECHANICAL ACTUATION

NO NEED OF ADDITIONAL ELECTRONIC INTERFACE, EXPENSIVE SOFT- OR HARDWARE TO PROVIDE RADIAL TOOL SLIDE MOTION

By programming simultaneous movement of two CNC axes (typically "W" and "Z") complex turning geometries can be machined on a horizontal boring mill.

Application samples:

Oil valves and blowout preventers, gearboxes, pump housings, compressors, engine housings, aerospace components (such as landing gear), large castings, and heavy equipment components.

ZX Tool Application: **External Operation**

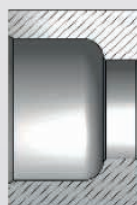
ZX Tool Application: **Internal Operations**



O/D Grooving



O/D Radii



Back Counter Bore and Chamfering



Threading



Grooving



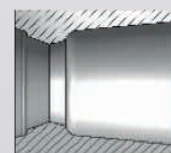
O/D Threading



O/D Turning and Facing



Bottle Bore



Tapers and Radii

MACHINE TOOL REQUIREMENTS

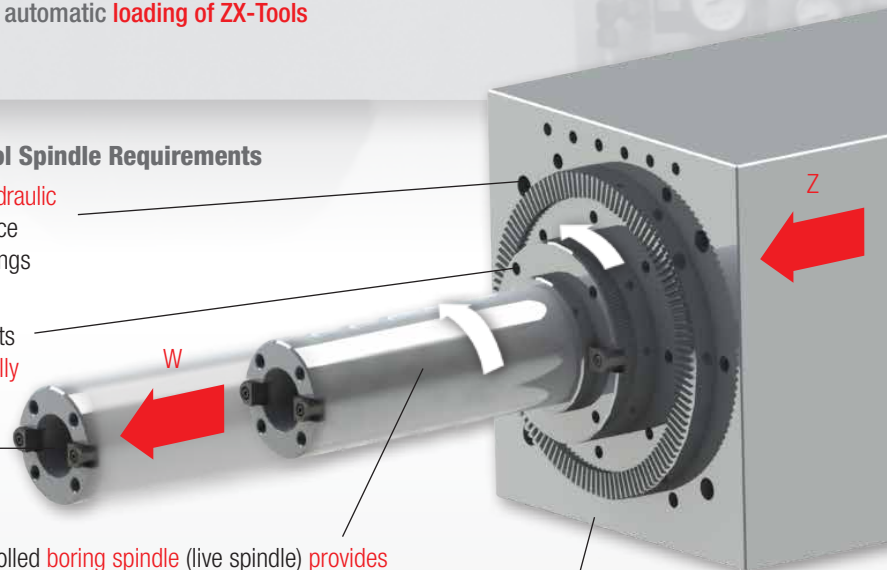
Manual and automatic loading of ZX-Tools

Machine Tool Spindle Requirements

Location of **automatic hydraulic clamping** & pick up device utilised by Rotary Couplings

Location to bolt on Cam Lock Bonnets on the rotating milling sleeve **manually**

Connection to ZX-Tool actuator



Rotating CNC-controlled **boring spindle** (live spindle) provides **linear moving motion** to the ZX-mechanism where it is converted into radial stroke.

For all ZX-Tools the live spindle is essential.

Linear moving horizontal boring mill column or RAM. (In some cases the machine table moves parallel to the spindle)

Easy programming:
Internal ZX mechanism with 2:1 Ratio

TYPICAL MANUAL LOADING PROCEDURE OF ZX-EQUIPMENT ONTO A HORIZONTAL BORING MILL



HBM - spindle nose



1. Install Cam Lock Bonnet



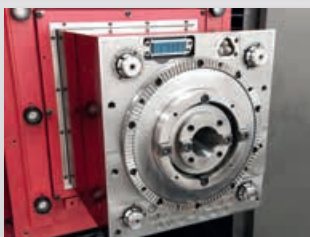
2. Load Contouring head



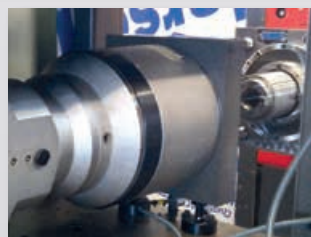
3. Engage and secure Cam Locks

A horizontal boring mill with a **programmable and linear movable inner spindle** that rotates in unison with the outer spindle or milling sleeve is required to use the ZX-Tooling adapted by the **manually attached standard Cam Lock Bonnet**. The Bonnet is directly bolted to the rotating milling sleeve and may remain on the sleeve even if the ZX-Tooling is removed.

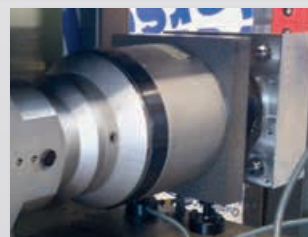
TYPICAL AUTOMATIC LOADING PROCEDURE OF ZX-EQUIPMENT ON A RAM TYPE BORING MILL FEATURING A TOOL PICK UP STATION



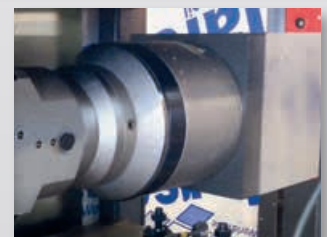
RAM - Spindle nose



1. Engage boring spindle

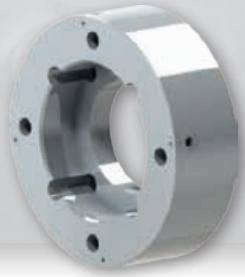


2. Engage hydraulic pull studs



3. Locked & ready for machining

A RAM-type milling machine with a rotating **programmable and linear movable inner spindle** surrounded by **hydraulic clamping devices** for automatic Head mounting on the RAM-face is required to use a ZX-Tool with already attached **Rotary Coupling** or a **Contouring Head with integrated Rotary Coupling**. The complete assembly of the ZX-Tooling and Rotary Coupler or ZX Contouring Head with integrated Rotary Coupler can be picked up from a tool stacker and operated **full automatically**.



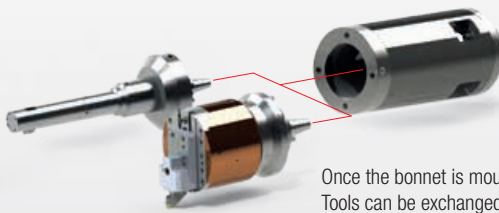
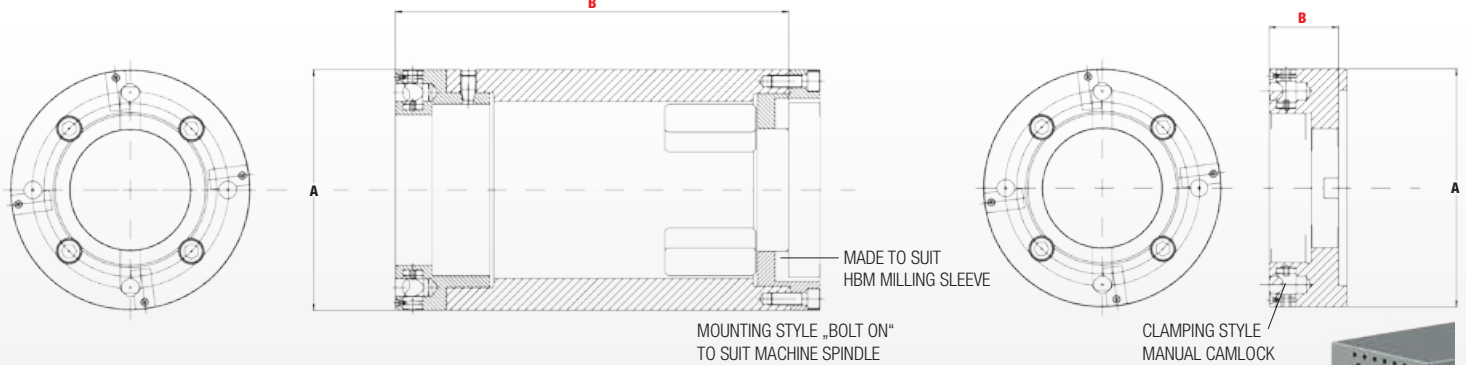
ZX-CAM-LOCK BONNETS

MANUAL ADAPTOR: Attach ZX-Tooling manually to a typical horizontal boring mill (HBM)

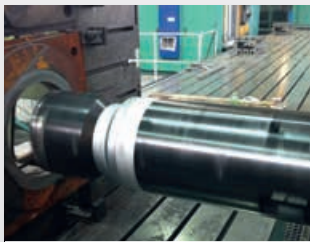
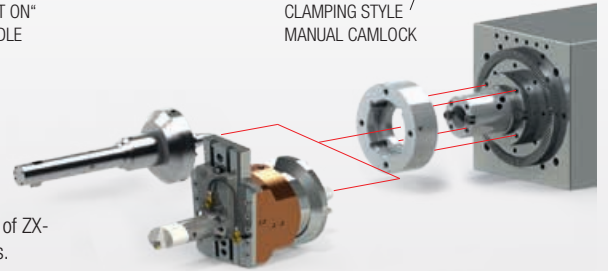
The ZX system features a quick-release mounting device called a Cam-Lock Bonnet. The Cam-Lock Bonnet is precisely machined to fit the specific horizontal boring mill on which it will be installed.

Extended length Cam Lock Bonnet **B**

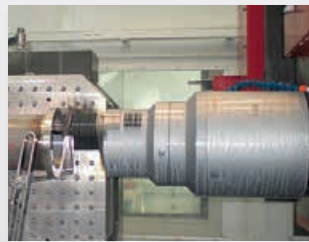
Standard length Cam Lock Bonnet **B**



Once the bonnet is mounted to the machine different types of ZX-Tools can be exchanged very quick utilizing the 4 cam locks.



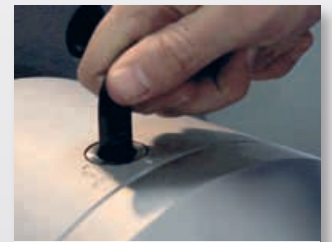
Ext. Bonnet 750 w. ZX-300



Ext. Bonnet 250 w. ZX-200



Ext. Bonnet 500 w. MBT-125



Cam Lock: Locked by a 90° turn

SPINDLE ADAPTORS / BONNETS MANUAL CLAMPING OF ZX-TOOLS

| TECHNICAL DATA | UNITS | Standard Bonnet | Bon. Ext. 250 | Bon. Ext. 500 | Bon. Ext. 750 |
|----------------|-------|-----------------|---------------|---------------|---------------|
| 'A' | mm | ø 305 | ø 305 | ø 305 | ø 305 |
| 'B' | mm | 90 | 250 | 500 | 750 |
| Maximum speed | RPM | 800 | 500 | 300 | 200 |
| Weight | KG | 50 | 75 | 120 | 164 |

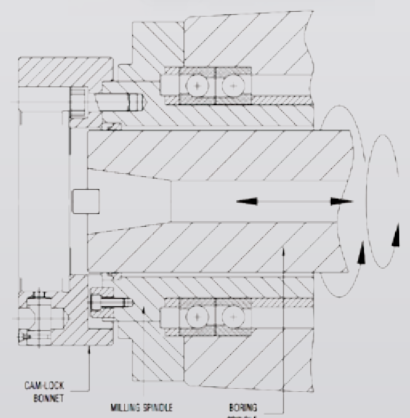
Maximum speed may vary with the size of the ZX Tool mounted on the extended bonnet and the load on the spindle bearings. Maximum speed is for bonnet only on the spindle, see page 6 for ZX Contouring Heads maximum speeds.

The bonnet bolts to the outer spindle of the machine, and features four cam-locking pins to retain the ZX tool on the bonnet.

A simple 90-degree rotation of the cam-locking mechanism is all that is required to securely retain the head. A generous engagement surface between the bonnet and head provides maximum support and rigidity. When the head is installed, it literally functions as part of the machine.

Options that may be ordered with a cam-lock bonnet include:

- Chip cover plates with wiper seals to keep the mounting surfaces clean
- Proximity switch plates to actuate automatic software switches on machines that are so equipped.

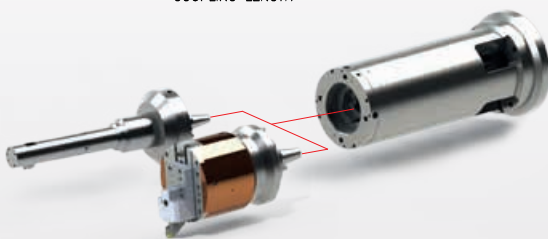
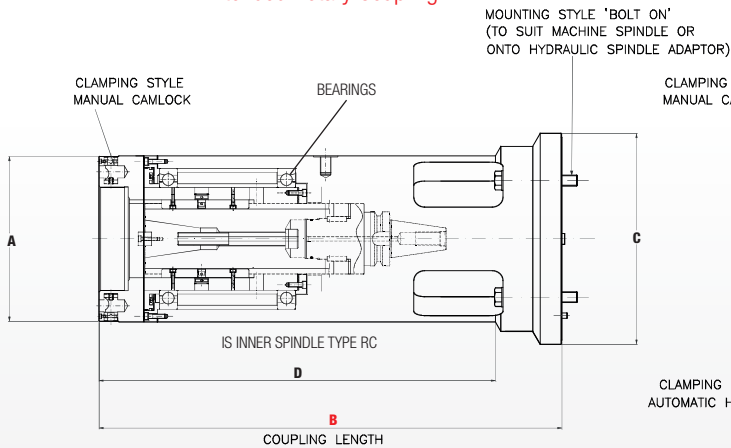


ZX-ROTARY COUPLINGS

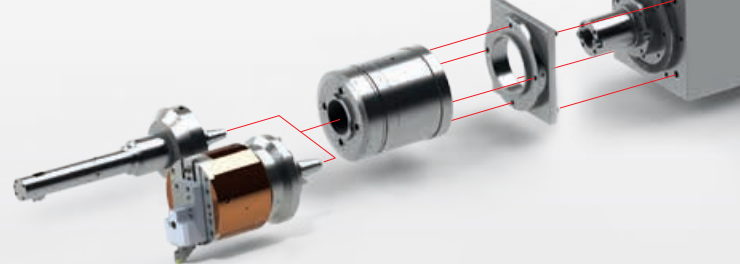
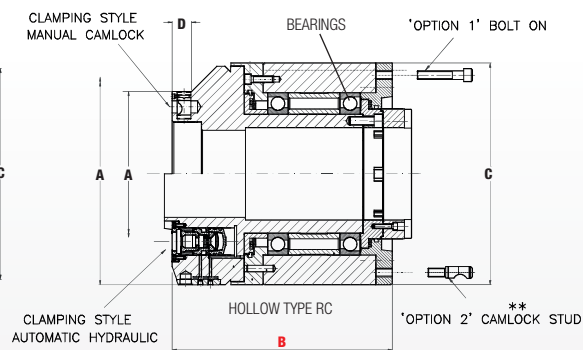
AUTOMATIC ADAPTOR: Enable RAM type HBMs to pick up and attach ZX-Tool & Rotary Coupling Assemblies automatically.



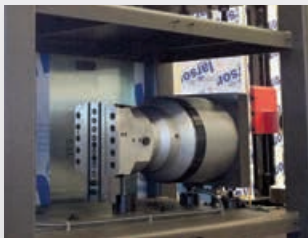
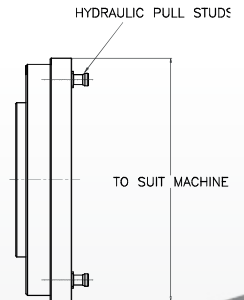
Extended Rotary Coupling



Standard Rotary Coupling



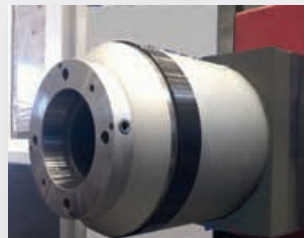
Spindle Adaptor Plate



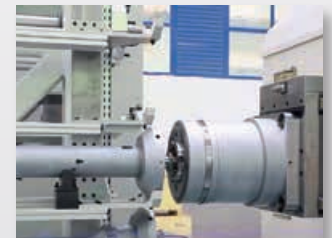
RC 410-AB-400-C with ZX-420



Special RC application



RC 410-AB-400



RC 410-AC-407-H Autom.

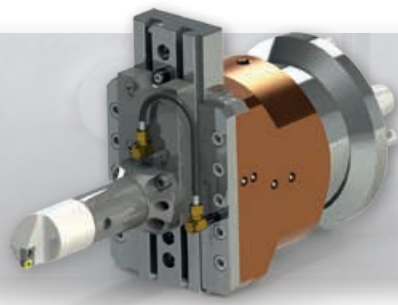
ROTARY COUPLINGS AUTOMATIC CLAMPING OF ZX-TOOLS

| TECHNICAL DATA | UNITS | RC 410-AB-400-C | RC 410-AC-600-C | RC 305-AB-350-C-IS | RC 305-AB-856-C-IS | RC 305-AB 1156-C-IS | RC 410-AC-407-H |
|------------------------|-------|------------------|------------------|--------------------|--------------------|---------------------|------------------|
| RC LENGTH TYPE | | STANDARD | EXTENDED | STANDARD | EXTENDED | EXTENDED | STANDARD |
| INTERNAL TYPE | | HOLLOW | HOLLOW | INNER SPINDLE | INNER SPINDLE | INNER SPINDLE | HOLLOW |
| ADAPTER PLATE MOUNTING | | CAMLOCK OR BOLTS | CAMLOCK OR BOLTS | CAMLOCK OR BOLTS | CAMLOCK OR BOLTS | CAMLOCK OR BOLTS | CAMLOCK OR BOLTS |
| ZX-TOOL MOUNTING | | CAM LOCK MANUAL | CAM LOCK MANUAL | CAM LOCK MANUAL | CAM LOCK MANUAL | CAM LOCK MANUAL | HYDRAULIC AUTOM. |
| 'A' | mm | ø 305 | ø 305 | ø 305 | ø 305 | ø 305 | ø 305 / 410 |
| 'B' | mm | 400 | 600 | 350 | 856 | 1156 | 407 |
| 'C' | mm | ø 410 | ø 410 | ø 390 | ø 390 | ø 390 | ø 410 |
| 'D' | mm | 36 | 40 | 733 | 1033 | - | - |
| Maximum speed* | RPM | 800 | 500 | 800 | 150 | 150 | 800 |
| Weight | KG | 273 | 310 | 282 | 230 | 268 | 305 |

* Maximum speed may vary with the size of the ZX Tool mounted on the extended bonnet and the load on the spindle bearings.

** Option 2, Camlock Interface might be required if the bolt on style is not possible with a hirth coupling

Utilising the Cam Lock system all standard ZX-Tools can be attached manually to the standard Rotary Coupling. A special hydraulic clamping version is available. Depending on the spindle adaptor plate the Rotary Coupler can utilise the Cam Lock System or bolts to connect. The Spindle Adaptor Plate to be supplied by the machine tool builder.



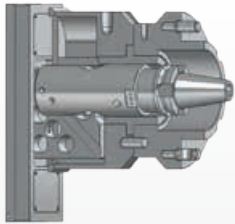
ZX-CONTOURING HEADS

A complete size range of ZX Contouring Heads featuring Cam Lock Studs for **manual connection** to Cam Lock Bonnets or Rotary Couplings.

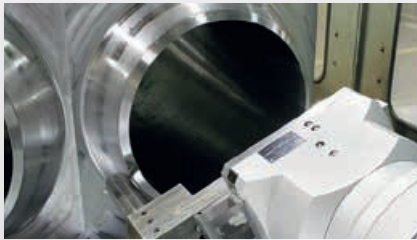
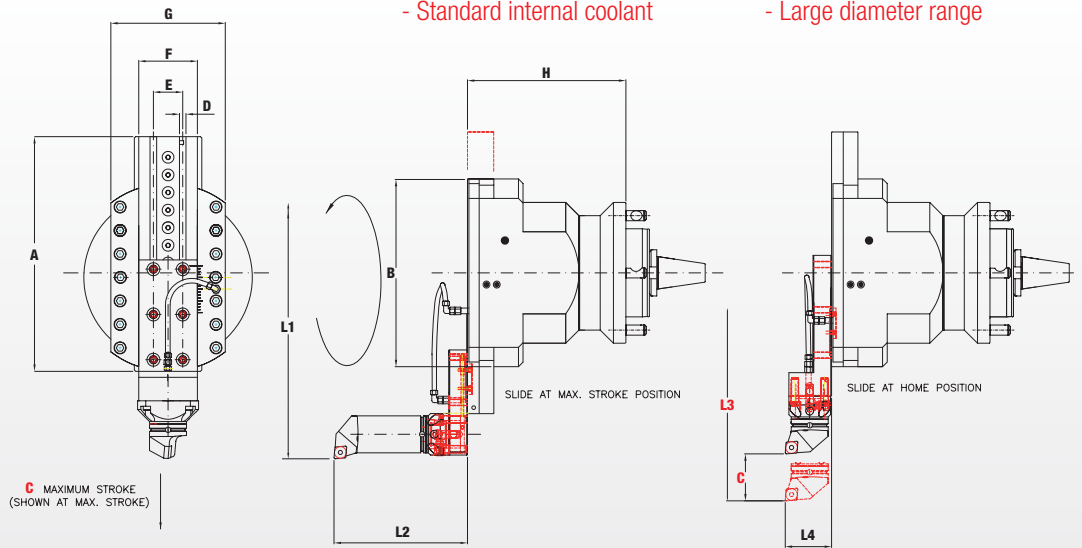
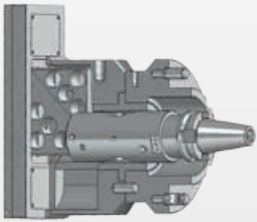
ZX Contouring heads offer the greatest versatility of all ZX tools. These heads have a single tool slide onto which top tooling is mounted into qualified locating holes. This provides repeatable set-ups. With appropriate top tooling, these heads can perform lathe-type operations on horizontal boring mills.

ZX Contouring heads featuring following benefits that increase your productivity:

- High material removal rates
- Extremely rigid and durable design
- Standard internal coolant
- High quality for long working life
- Backlash-free operation
- Large diameter range



Internal ZX mechanism with 2:1 Ratio for easy programming.



ZX 420-TC w. Tool Slide Adaptor



ZX 900-TC w. Tool Slide Adaptor

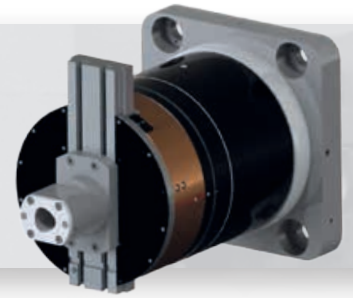


ZX 420-TC w. Tool Slide Adaptor

| TECHNICAL DATA | UNITS | ZX 200-TC | ZX 300-TC | ZX420-TC | ZX500-TC | ZX700-TC | ZX900-TC |
|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 'A' | mm | 200 | 300 | 420 | 500 | 700 | 900 |
| 'B' | mm | 200 | 300 | 305 | 400 | 500 | 700 |
| 'C' radial traverse | mm | 38 | 75 | 102 | 102 | 127 | 127 |
| 'D' | mm | 14,29 x 1 | 14,29 x 2 | 14,29 x 2 | 14,29 x 2 | 14,29 x 2 | 14,29 x 2 |
| 'E' | mm | Centre | 63,5 | 63,5 | 63,5 | 63,5 | 63,5 |
| 'F' | mm | 70 | 127 | 127 | 127 | 127 | 127 |
| 'G' | mm | 200 | 248 | 248 | 248 | 250 | 250 |
| 'H' | mm | 307 | 343 | 343 | 343 | 370 | 370 |
| L1 | mm | ø 381 | ø 650 | ø 770 | ø 850 | 1120 | 1500 |
| L2 | mm | 210 | 270 | 310 | 310 | 310 | 310 |
| L3 | mm | ø 500 | ø 800 | ø 980 | ø 1060 | ø 1330 | ø 1700 |
| KM/Capto Adaptors | | | | | | | |
| L4 | mm | 65 | 102 | 102 | 102 | 102 | 102 |
| Maximum speed | RPM | 800 | 500 | 350 | 300 | 250 | 150 |
| Stroke ratio | | 2 to 1 | 1 to 1 | 1 to 1 | 1 to 1 | 1 to 1 | 1 to 1 |
| Feed | mm/Rev | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 |
| Max. Torque | da Nm | 100 | 800 | 800 | 800 | 1000 | 1000 |
| Weight | Kg | 107 | 168 | 175 | 205 | 170 | 200 |
| Repeatability accuracy | mm | 0,003 | 0,003 | 0,003 | 0,003 | 0,003 | 0,003 |
| Backlash | mm | +/- 0,025 | +/- 0,025 | +/- 0,025 | +/- 0,025 | +/- 0,025 | +/- 0,025 |
| Boring accuracy | | H7 | H7 | H7 | H7 | H7 | H7 |
| Max. chip removal on Ø80M46 steel | | | | | | | |
| Facing | D.O.C./mm | 3 | 4 | 4 | 6 | 6 | 6 |
| Boring | D.O.C./mm | 3 | 4 | 4 | 6 | 6 | 6 |
| Rapid traverse | M/min | 0,4 | 0,4 | 0,4 | 0,4 | 0,5 | 0,5 |
| Roughness | Ra | 1,6 | 1,6 | 1,6 | 1,6 | 1,6 | 1,6 |

ZX-RC CONTOURING HEADS

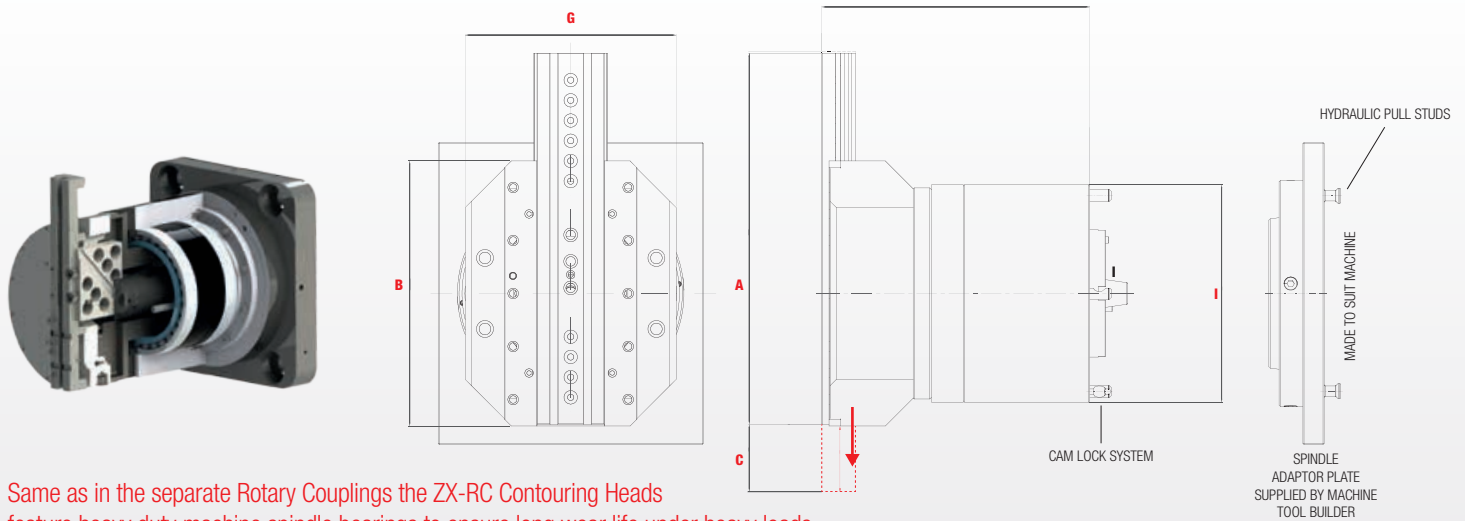
The new ZX Contouring Head range featuring an **integrated Rotary Coupling** for **automatic pick up and clamping** to RAM type HBM machine spindles.



The **ZX-RC Contouring Head** is a compact all in one solution for RAM type milling machines featuring a live spindle. These kind of Heads can be stored in the tool stacker or in the **pick up station** used for milling head auto exchange.

Regardless of ZX Contouring Head type, the proven **mechanical ZX actuation mechanism** converts linear live spindle motion into radial cutter movement. This sturdy design is based on the “sliding inclined wedge” principle for **backlash-free operation**; no gears or bell cranks are used.

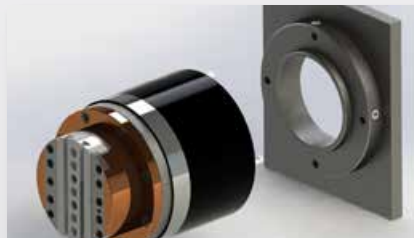
All parts are hardened and ground for lasting accuracy and durability.



Same as in the separate Rotary Couplings the ZX-RC Contouring Heads feature heavy duty machine spindle bearings to ensure long wear life under heavy loads.



ZX 500 TC-RC in Tool Stacker



ZX 300 TC-RC & Adaptor Plate



ZX 500 TC-RC on RAM-type HBM

The ZX-RC Contouring Heads are connected to the spindle adaptor plate with Cam Locks.

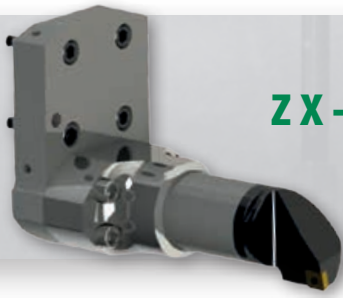
The Spindle adaptor plate is build to suit the square RAM face and is supplied by the machine tool builder.

A special version of the ZX-RC Contouring Head for hydraulic full automatic top tool change is available.

| TECHNICAL DATA | UNITS | ZX300 TC-RC | ZX500 TC-RC | ZX700 TC-RC |
|--|-----------|-------------|-------------|-------------|
| Auto Tool clamp | mm | - | available | available |
| 'A' | mm | 300 | 508 | 700 |
| 'B' | mm | 300 | 400 | 500 |
| 'C' radial traverse | mm | 75 | 102 | 127 |
| 'G' | mm | ø 300 | ø 408 | 398 |
| 'H' | mm | 472 | 472 | 505,5 |
| 'I' | | ø 410 | ø 410 | ø 410 |
| Maximum speed | RPM | 500 | 300 | 250 |
| Stroke ratio | | 1 to 1 | 1 to 1 | 1 to 1 |
| Feed | mm/Rev | 0,4 | 0,4 | 0,4 |
| Max. Torque | da Nm | 800 | 800 | 1000 |
| Weight* | Kg | 376 | 410 | 422 |
| Repeatability accuracy | mm | 0,003 | 0,003 | 0,003 |
| Backlash | mm | +/- 0,025 | +/- 0,025 | +/- 0,025 |
| Boring accuracy | | H7 | H7 | H7 |
| Max. chip removal on O80M46 steel | | | | |
| Facing | D.O.C./mm | 4 | 6 | 6 |
| Boring | D.O.C./mm | 4 | 6 | 6 |
| Rapid traverse | M/min | 0,4 | 0,4 | 0,5 |
| Roughness | Ra | 1,6 | 1,6 | 1,6 |

* All weights without spindle adaptor plate.

All Contouring Heads with feature through coolant facility.



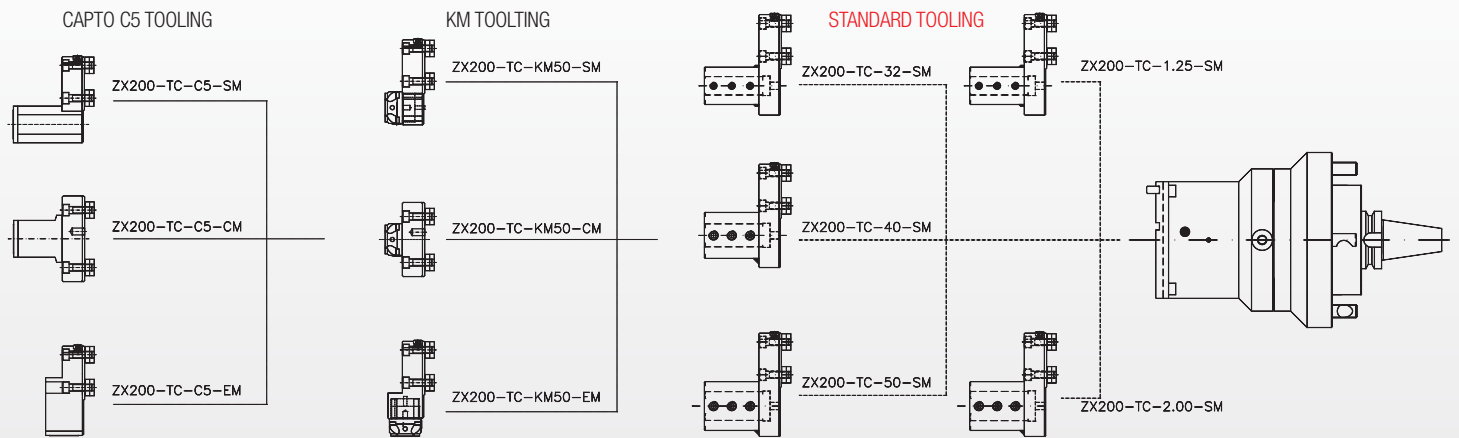
ZX-INDUSTRY STANDARD TOP TOOLING

Contouring heads, featuring a single slide onto which **various top tooling can be installed**

Modular **top tooling components are available** to meet the machining requirements of most components. Tool slide adapters are also offered to allow the **use of commercially available tooling** systems such as **Capto®** and others.

External turning, grooving, taper boring, radius forming, chamfering, recessing and threading can all be finished in one set-up without removing the component from the machining table.

ZX-200-TC CONTOURING HEAD TOP TOOLING SAMPLE:



Special tool slide adapter



Side mount Capto C6



End mount Capto C6



Tool slide extension plate



Central Mount 'KM'



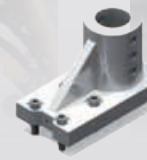
End Mount 'KM'



Side Mount 'KM'



Central Mount
Open Ended Square Shank



Side Mount
Cylindrical Shank



Central Mount
Cylindrical Shank

| ZX-Tool | Capto | | | KM tooling | | | Cylindrical 32 mm | Cylindrical 40 mm/KM50 | Cylindrical 50 mm | Cylindrical 60 mm | Square 25 mm |
|----------|-------|----|----|------------|------|------|----------------------|---------------------------|----------------------|----------------------|-----------------|
| | C5 | C6 | C8 | KM50 | KM63 | KM80 | | | | | |
| ZX200-TC | • | | | • | | | • | • | • | | |
| ZX300-TC | | • | • | | • | • | | | • | • | |
| ZX420-TC | | • | • | | • | • | | | • | • | • |
| ZX500-TC | | • | • | | • | • | | | • | • | • |
| ZX700-TC | | • | • | | • | • | | | • | • | • |
| ZX900-TC | | • | • | | • | • | | | • | • | • |

Many other different types of top tooling are available on demand, such as **tool slide extension plates** to extend the diameter range of your Contouring Head.

SPECIAL ZX-TOOLS

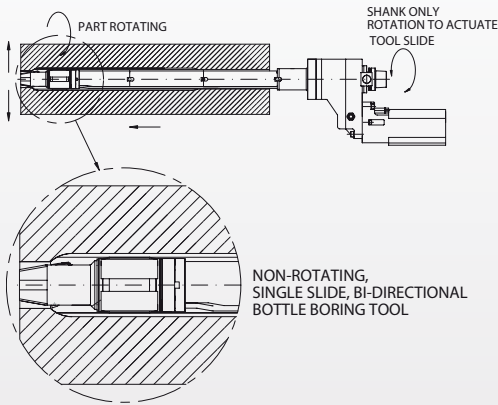
The advantage of the ZX-principle can be utilised on **many other different types of machine**



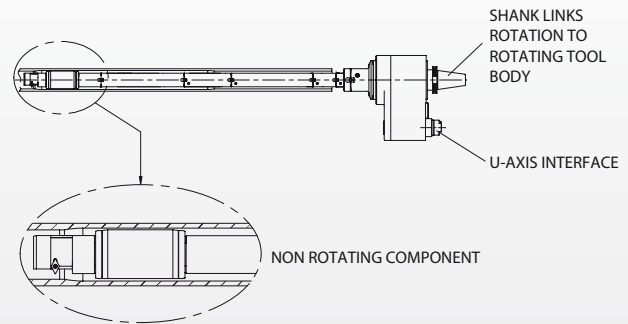
ZX tooling is generally used by the metal cutting industries who utilize Horizontal Boring Machines where components are too large to be machines on a lathe. The ZX Boring Tools can also be adapted to Deep Hole Drilling machines, Mill/Turn machines and Horizontal and Vertical machining centres, to produce internal extended reach cavities, seat pockets and bottle shaped contours including roughing and finishing operations in one set-up.

SPECIAL APPLICATION SAMPLES

ZX Bottle Boring Tool with attached special non rotating drive unit



ZX Bottle Boring Tool with attached special rotating drive unit and U-Axis interface



Bottle boring tool on a lathe



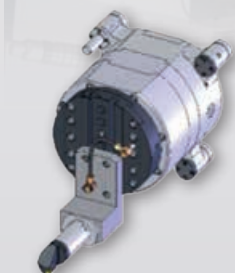
MBT Tool on a vertical lathe



ZX-Tool on milling/turning machine



ZX-Tool on Deep hole drilling m.

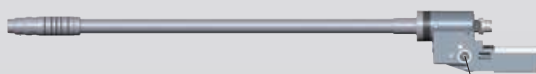


Special ZX Contouring Head featuring an integrated Drive Unit for U-Axis interface and spider clamping for use on multi tasking machine.

MBT-Bottle Boring Tool mounted to **special non-rotating drive unit** featuring a dove tail clamping system. Spindle rotation is converted inside the drive unit into linear motion to actuate the ZX-mechanism inside the tool.

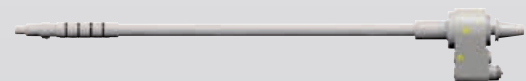


ZX Contouring Head with integrated drive unit **featuring an interface for U-Axis connection** next to the machine spindle which provides the rotation that is converted inside the drive unit into linear motion to actuate the ZX-mechanism inside the Contouring Head.



MBT Bottle Boring Tool mounted to a **special rotating drive unit** featuring a dove tail clamping system. The spindle rotation provides the tool rotation. A separate U-Axis on the machine provides rotation which is converted inside the drive unit into linear motion to actuate the ZX-mechanism inside the tool.

U-AXIS INTERFACE



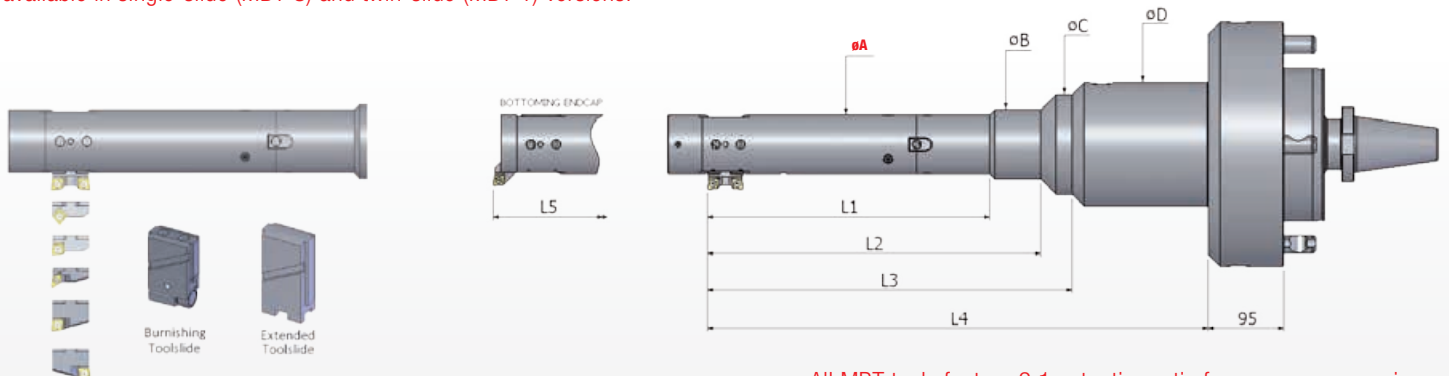
MBT Bottle Boring Tool with attached drive unit featuring an interface for U-Axis connection next to the machine spindle which provides the rotation that is converted inside the drive unit into linear motion to actuate the ZX-mechanism inside the MBT Tool.



ZX-MODULAR BORING TOOLS

The ZX MBT Tools are dedicated to machine **any kind of contours inside bores** and are available with **single or twin tool slides** to achieve balanced cutting forces for high feeds and high material removal rates.

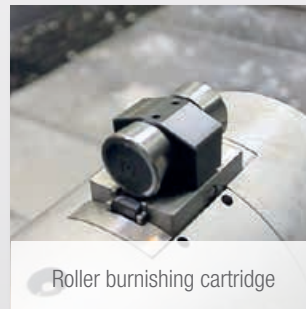
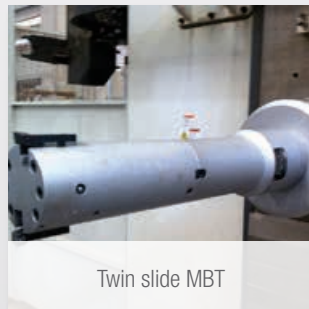
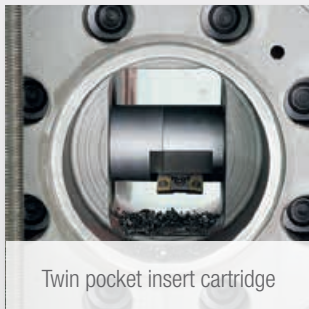
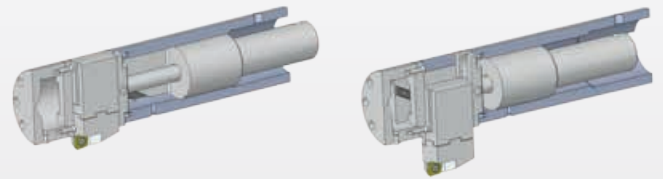
ZX Modular Boring Tools (MBT) offer versatility and economy when machining bores, counter-bores, tapers, threads, and complex contours inside components, over a wide range of diameters. These tools offer the highest cutting speeds and material removal rates available. **The MBT series is available in single-slide (MBT-S) and twin-slide (MBT-T) versions.**



All MBT tools feature 2:1 actuation ratio for easy programming.

Insert Cartridges and Toolslides

- **Broad size range:** Each tool has a long tool slide stroke that is supplemented by using different cartridges and toolslides to cover an ever wider diameter range. No need to change the toolslide(s) or remove the head from the machine
- **Other special cartridge designs available on request:** e.g. Burnishing Slide



| TECHNICAL DATA | UNITS | MBT50 | MBT75 | MBT100 | MBT125 |
|--|-----------|-----------|-----------|-----------|-----------|
| 'A' | mm | 50 | 75 | 100 | 125 |
| 'B' | mm | N/A | 86 | N/A | N/A |
| 'C' | mm | N/A | 125 | 125 | N/A |
| 'D' | mm | 155 | 155 | 155 | 155 |
| Through type End Cap Radial Stroke | mm | 23 | 32 | 45 | 54 |
| Bottoming End Cap Radial Stroke | mm | 12 | 22 | 23 | 30 |
| Total Range of tool with | mm | 50-118 | 75-194 | 100-230 | 125-272 |
| Slide and Cartridge change | | | | | |
| L1 max. | mm | 305 | 350 | 454 | 524 |
| L2 max. | mm | N/A | 414 | 486 | N/A |
| L3 max. | mm | N/A | 454 | N/A | N/A |
| L4 max. | mm | 521,3 | 622 | 622 | 692 |
| L5 max. | mm | 557 | 658 | 684 | 725 |
| Maximum speed | RPM | 800 | 800 | 800 | 800 |
| Stoke ratio | | 2 to 1 | 2 to 1 | 2 to 1 | 2 to 1 |
| Repeatability accuracy | mm | 0,003 | 0,003 | 0,003 | 0,003 |
| Backlash | mm | +/- 0,025 | +/- 0,025 | +/- 0,025 | +/- 0,025 |
| Boring accuracy | | H7 | H7 | H7 | H7 |
| Max. chip removal on 080M46 steel | | | | | |
| Facing | D.O.C./mm | 3 | 3 | 3 | 3 |
| Boring | D.O.C./mm | 3 | 6 | 7 | 7 |
| Rapid traverse | M/min | 100 | 100 | 100 | 100 |
| Roughness | Ra | 0,8 | 0,8 | 0,8 | 0,8 |

Special MBT Tools are also available in larger and smaller diameter sizes or equipped with special tool slides operating in bi-directional ways (for roughing and finishing without need to change the cartridge).

ZX-BOTTLE BORING & VALVE SEAT POCKET TOOLS

Specially adapted ZX Modular Boring Tools feature **piloted cutter support** for use in machining seat pocket areas in oil valves and other extended reach applications.



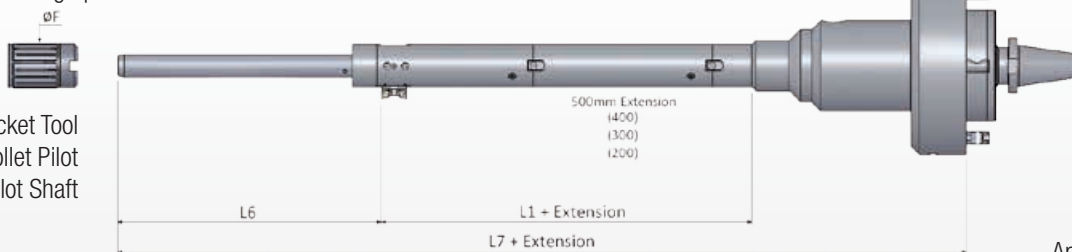
Extended and supported long-reaching ZX Modular Boring Tools called ZX Bottle Boring or Valve Seat Pocket Tools are dedicated to machine cavities or different geometries inside deep bores. ZX Bottle Boring Tools feature a rotating, O-Ring, or spring loaded pilot located behind the tool slide.

Valve Seat Pocket Tools feature an end cap mounted pilot shaft which feeds inside a collet pilot, mounted inside the bore for accurate support during machining operation.



Bottle Boring Tool with O-Ring Pilot

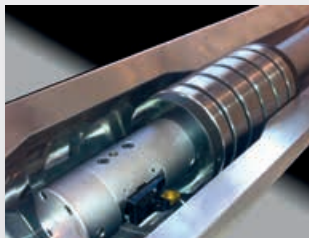
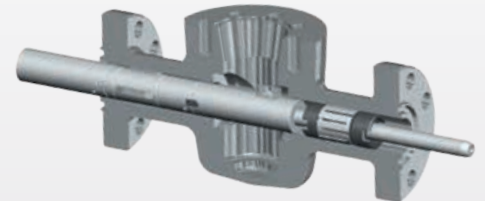
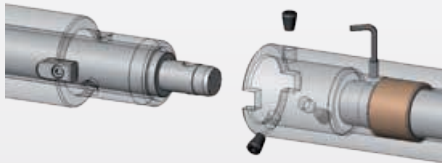
Valve Seat Pocket Tool w. Collet Pilot and Pilot Shaft



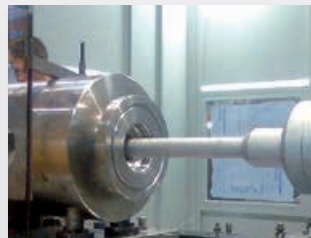
Application: valve body

Extension Coupling

Modular design and construction: Makes adjustment of length and configuration fast and easy, greatly enhancing the versatility of the tool. Some sizes can be converted for extended-reach applications with piloted support.



Bottle boring tool inside cavity



Application: valve body



Recessing inside pump housing



Machining seat pocket

| COLLET SIZE (øF) | | COLLET SIZE (øF) | | MBT75 | | MBT100-S | | MBT125-S | |
|------------------------|----------------------|------------------|----------------|---------------|-----------------|---------------|-----------------|---------------|-----------------|
| 2.060" | 52.32mm | 2.050"-2.130" | 52.07-54.10 mm | | | | | | |
| 2.560" | 65.02mm | 2.550"-2.630" | 64.77-66.80 mm | | | | | | |
| 3.000" | 76.20mm | | | 2.990"-3.070" | 75.95-77.98mm | | | | |
| 4.060" | 103.12mm | | | 4.050"-3.070" | 102.87-106.43mm | 4.050"-4.190" | 102.87-106.43mm | | |
| 5.125" | 130.18mm | | | 5.110"-5.250" | 129.79-133.35mm | 5.110"-5.250" | 129.79-133.35mm | 5.110"-5.250" | 129.79-133.35mm |
| 6.375" | 161.93mm | | | | | 6.360"-6.500" | 161.54-165.10mm | 6.360"-6.500" | 161.54-165.10mm |
| 7.060" | 179.32mm | | | | | | | 7.050"-7.130" | 179.07-181.10mm |
| TOOLSLIDE SLIDE RADIUS | CARTRIDGE CUT RADIUS | | | | | | | | |
| | 16.5mm | 21.0mm | 23.0mm | 35.5mm | 23.0mm | 35.5mm | 27.0mm | 44.0mm | |
| 8.5mm | 50.0-96.0mm | 59.0-105.0mm | | | | | | | |
| 15.0mm | 63.0-109.0mm | 72.0-118.0mm | | | | | | | |
| 14.5mm | | | | | | | | | |
| 27.0mm | | | 75.0-139.0mm | 100.0-164.0mm | | | | | |
| 39.5mm | | | 100.0-164.0mm | 125.0-189.0mm | | | | | |
| 56.5mm | | | 125.0-189.0mm | 150.0-214.0mm | 100.0-190.0mm | 125.0-215.0mm | | | |
| 35.5mm | | | | | 125.0-215.0mm | 150.0-240.0mm | | | |
| 52.5mm | | | | | 159.0-249.0mm | 184.0-274.0mm | | | |
| 62.0mm | | | | | | | 125.0-233.0mm | 159.0-267.0mm | 159.0-267.0mm |
| | | | | | | | 178.0-286.0mm | 212.0-320.0mm | 212.0-320.0mm |
| L6 | | 325mm | | 448mm | | 608mm | | | 325mm |
| L7 | | 846mm | | 1070mm | | 1263mm | | | 846mm |



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