ROBOTIC PROCESSING

ROBOT CELLS FOR

grinding | deburring | milling | polishing

BERGER GRUPPE

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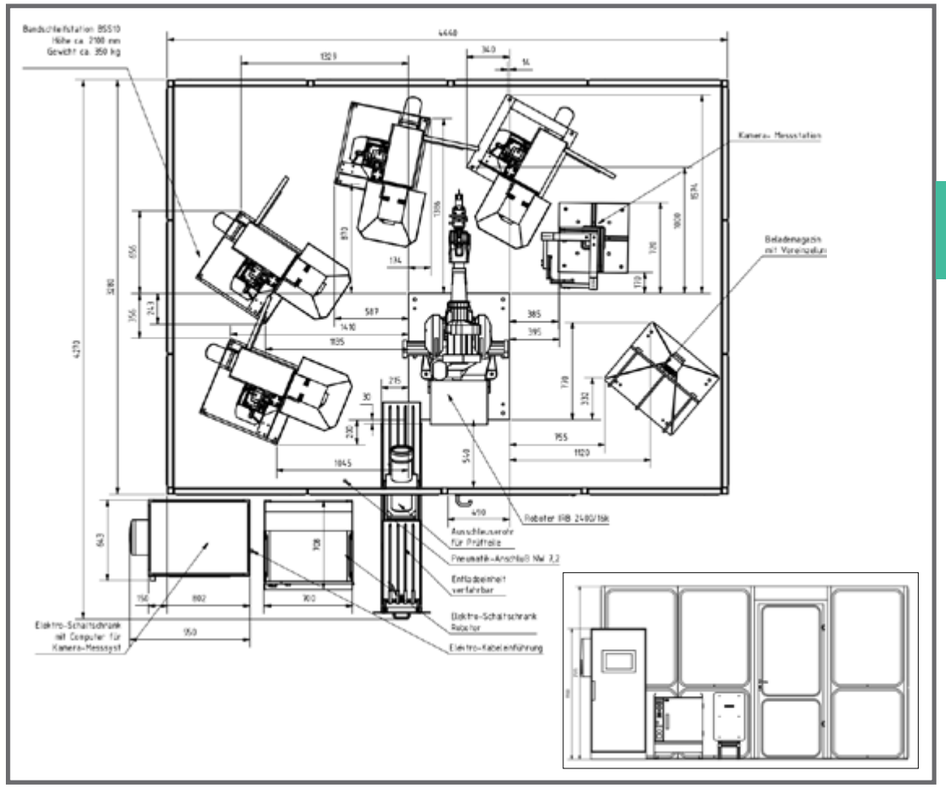
ROBOTIC

GRINDING AND POLISHING SYSTEMS

GRINDING AND POLISHING WITH ROBOTIC TECHNIQUE

The Berger Gruppe offers solutions for robotic machining of workpieces of various sizes and geometries.

The focus is on partly standardized robot cells with different conceptual approaches.



Depending on the nature of the workpiece, the robotic cell is equipped with different processing stations. Either the workpiece or the tool can be guided by the robot.

If the tool is robot-guided, the workpiece can be positioned via one or more rotary tables. Additional axes are integrated into the system so that all-round machining is possible without additional changeover time.

- robot grinding and polishing stations either integrated into existing production lines or designed as separate cells
- standard interfaces to all common robot manufacturers such as ABB, KUKA, Stäubli and Fanuc
- programming in touch-in mode or with a CAD/CAM interface
- integration of measuring systems for compensation of workpiece tolerances in position and dimensions
- different machining stations with different tools (e.g. grinding belts, grinding stones, polishing wheels) available

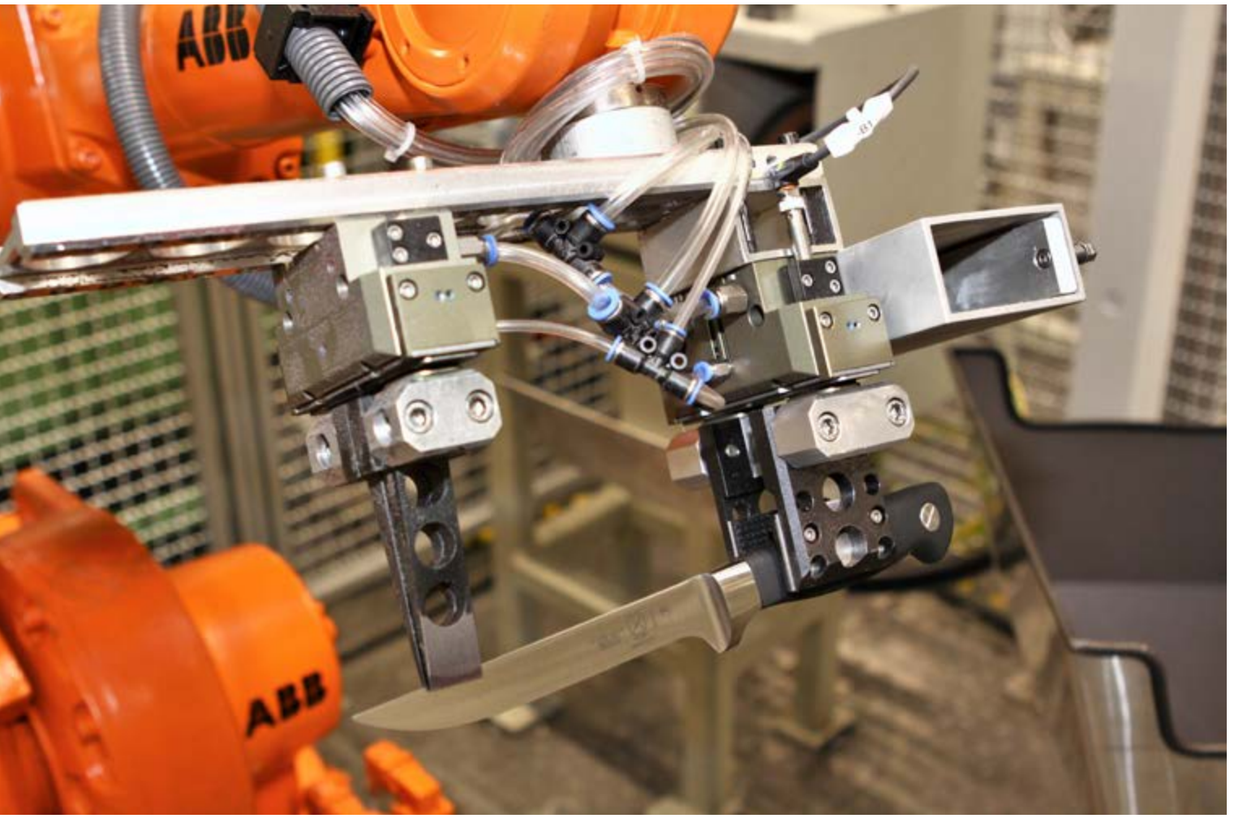
ROBOTIC CELLS

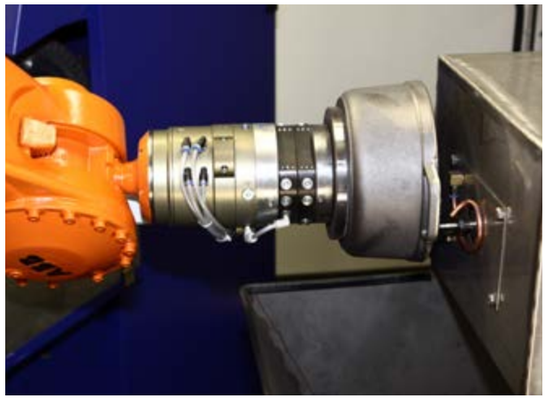
WITH ROBOT-GUIDED WORKPIECE

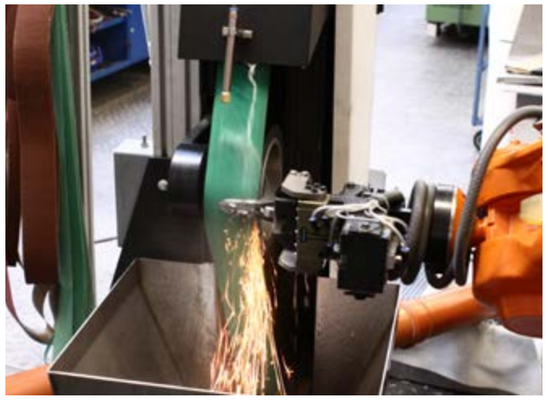
GRINDING AND DEBURRING WITH ROBOTIC TECHNIQUE

With the appropriate geometry, the workpiece can be guided by the robot.

The robot guides the workpiece to the appropriate processing stations and places it in a magazine after processing.







The processing takes place in the following steps:

- grabbing of the workpiece from magazine or disordered, e.g. from shepherd's box
- if necessary, measuring of the workpiece at the measuring station
- machining of the robot-guided workpiece at various machining stations
- deposit of the workpiece in the magazine

Depending on the requirements, the robotic cell can be equipped with the following processing stations:

- belt grinding stations
- polishing stations
- milling stations
- CNC milling stations
- grinding stations with headstock

The robotic cell can also be equipped with a CNC rotary table on which the various machining stations are mounted.

Thanks to a gripper changing system work-pieces of different geometries can be gripped or machined.

Further options:

- magazine systems
- measuring systems
- cleanings and cooling systems

ROBOT CELLS
WITH ROBOT-GUIDED WORKPIECE

Grinding and polishing of tongs and pliers

The Berger Gruppe offers robot cells for the processing of hand and garden tools. The robotic cell shown below is designed for the machining of tongs and pliers.

It is equipped as follows:

- four belt grinding stations of the series BSS10
- loading and unloading magazines for tongs and pliers
- camera measuring station

When machining hand and garden tools, the workpiece is guided by the robot. Here the workpiece is fed either via loading magazine or unordered as bulk material via Berger Feeder.

The robot grips the workpiece and feeds it to the individual processing stations. Depending on requirements, the processing cell is equipped with different processing stations, such as belt grinding or polishing stations.

The robot cell can also be equipped with a flat bevel grinding machine, which is loaded and unloaded by a robot.

Examples of use (pictures)

1. + 2. Grinding of tongs and pliers with robotic station RSP/4B/1M (pictures 1 and 2)

3. Robotic polishing of pliers (picture 3)

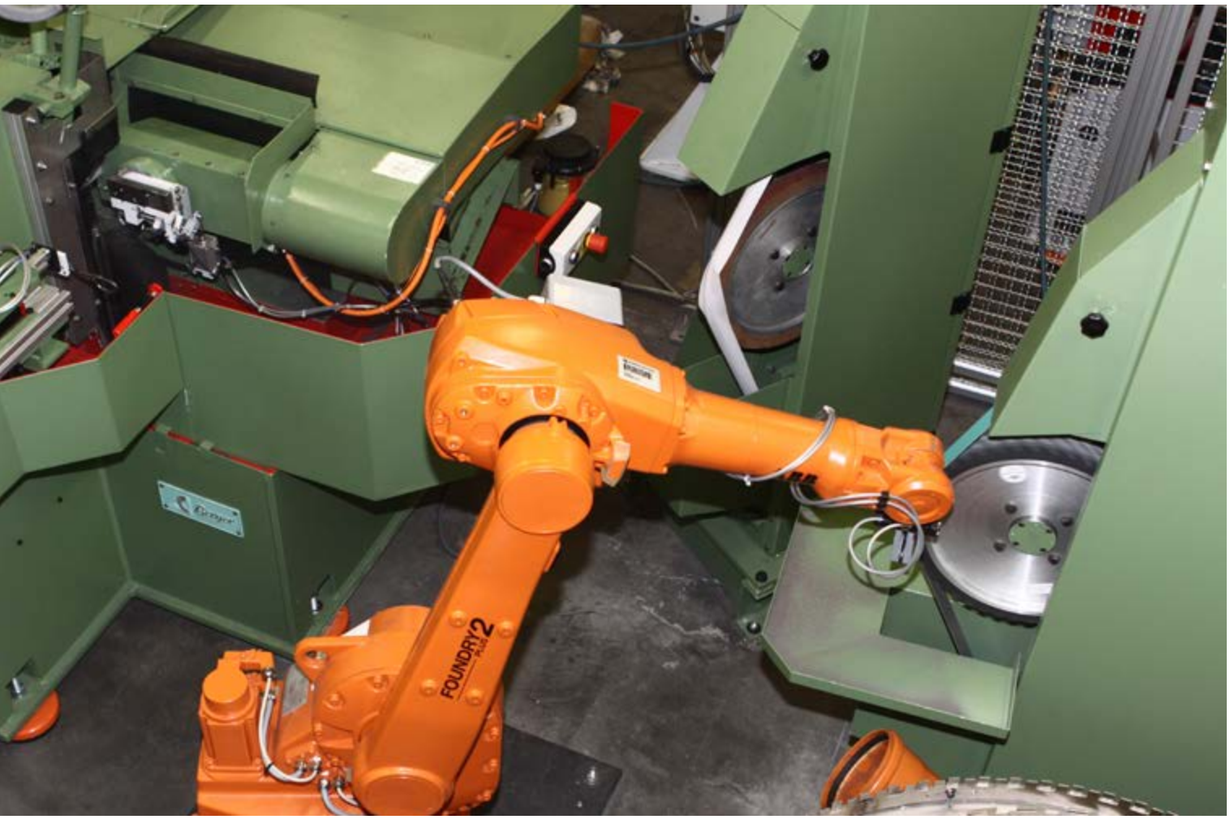
4. Camera measuring system for pliers integrated into a robotic cell (picture 4)

ROBOT CELLS
WITH ROBOT-GUIDED WORKPIECE

Grinding of garden shears

The robotic cell here below is equipped as follows:

- flat bevel grinding machine of the BG1/RH/NT series for surface and radii grinding of garden shears
- belt grinding station BSS10
- robtary magazine for garden shear parts
- camera measuring station



In robot cells for processing garden shears parts the workpiece is guided by the robot.

For grinding garden shears, the robot cell is often combined with flat bevel grinding machines of the series BG/RH/NT or DG/NT.

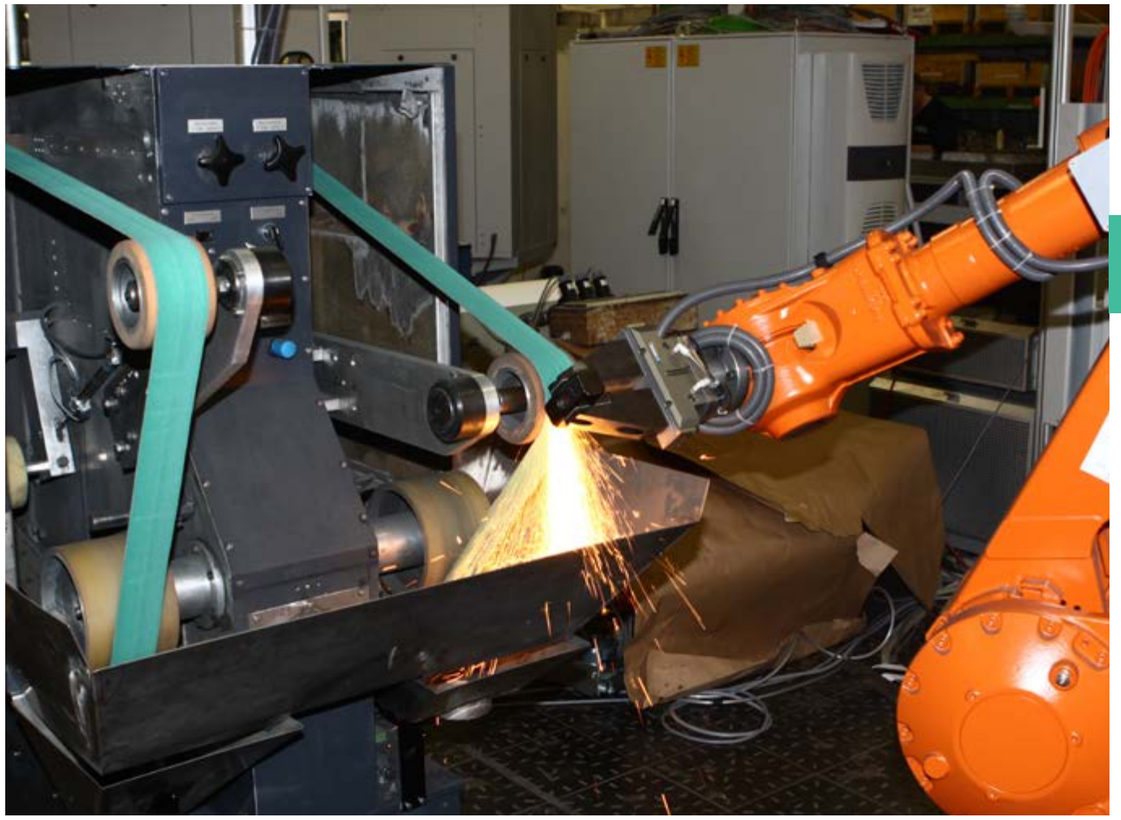
Examples of use (pictures)

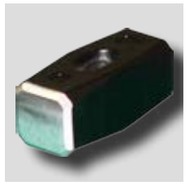
1. Back grinding of garden shears with belt grinding station BSS10 (picture 1)
2. Grinding the tip of garden shears with belt grinding station BSS10 (picture 2)
3. Belt grinding station for finishing the opposite side (picture 3)
4. Camera measuring table integrated in a robotic cell (picture 4)

ROBOT CELLS
WITH ROBOT-GUIDED WORKPIECE

Grinding of hammer heads

The robot cell can be equipped to perform double-sided processing of hammers, axes, hatchets and similar shaped workpieces.





The robotic cell shown here is designed for grinding hammer heads.

It is equipped as follows:

- double-sided belt grinding stations
- conveyor belt for loading and unloading

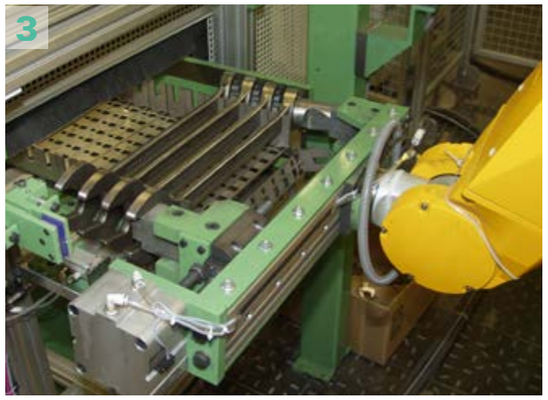
ROBOT CELLS
WITH ROBOT-GUIDED WORKPIECE

Grinding of wrenches

The robotic cell shown here below is designed for the machining of wrenches.

It is equipped as follows:

- two one-sided belt grinding stations
- two conveyor belts for loading and unloading of workpieces



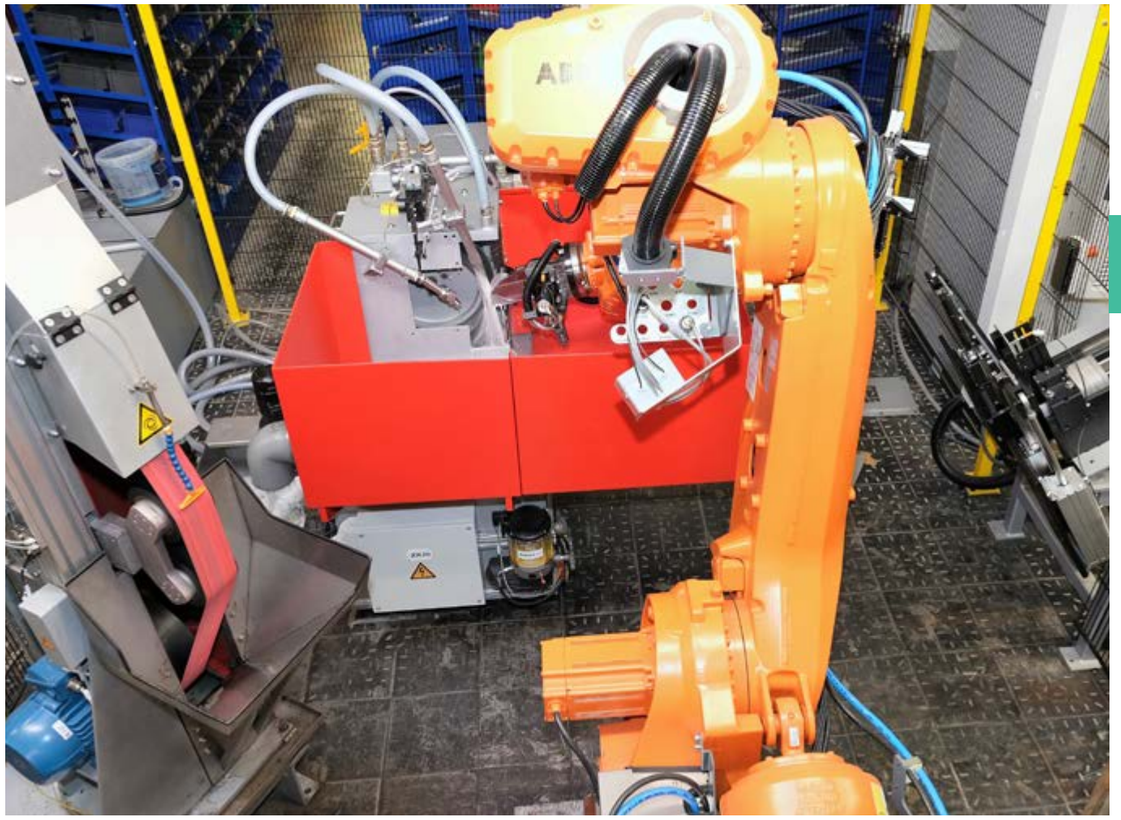
Machining of the edges of wrenches (pictures)

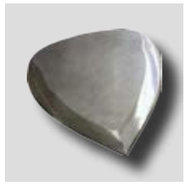
1. Spherical machining with oscillating belt (picture 1)
2. Straight machining (picture 2)
3. Storing in chain magazine (picture 3)

ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

Grinding of spades and garden tools

The presented robotic cell is designed for grinding spades and similar garden tools.





The robotic cell is equipped as follows:

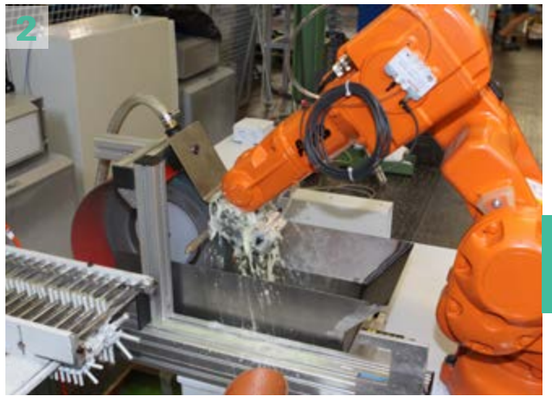
- handling manipulator of the ABB IRB 6700/2.7m/300kg series
- robot gripper with pneumatic clamping for spades and garden tools
- belt grinding station BSS10
- grinding station series SS1 for the use of grinding wheels with Ø 450 mm (17.7")
- cutting speed of the grinding wheel programmable between 25 and 45 m/s with frequency converter
- compensation of grinding wheel wear by CNC axis with 140 mm (5.5") stroke
- measuring control type BEM digital/diamond with tactile probe for stone wear measurement
- central grease lubrication
- stacking magazine with a loading capacity of 1 000 mm (43.3") for spades, stacking stroke adjustable to different dimensions, unloading in box

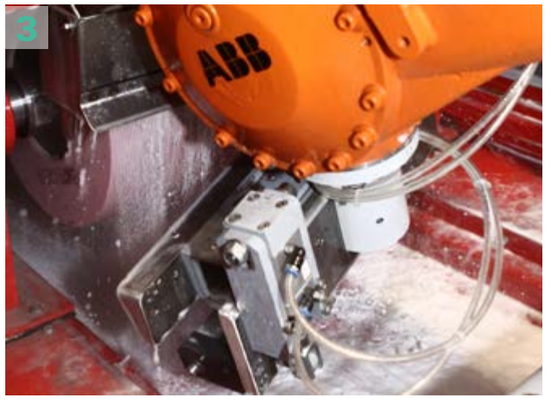
ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

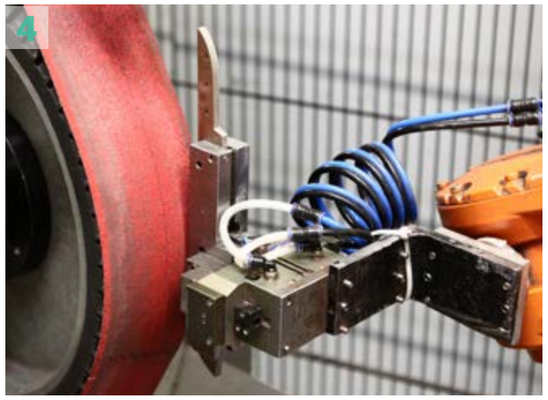
Sharpening of knife blades

With this universally applicable concept, cutting edges on knives and blades are sharpened and polished.

- design optimization of the gripper: robot gripper to hold the knife in the back and on the handle (picture below)
- polishing of the cutting edge with a one-sided polishing station, e.g. in conjunction with a leather disc
- measurement of workpieces
- contour programming optimized for sharpening and polishing of knives







Serrating of knife blades

The robot station presented here has been designed for the serrating of knife blades. The robot cell is equipped with a belt grinding station and a stacking magazine.

By means of a robot - in this case a 140F/ABB - the table knife blade is rolled on a straight, profiled chopper disc. The contour of the blade can be programmed according to the workpiece. (Pictures 1 and 2)

A robot of the IRB4400/60 KG series and a straight profiled grinding wheel are used to process workpieces with a maximum width of 360 mm (14.2"). (Picture 3)

Contour grinding of knife blades

The robot grinding station RSP/2B/1M achieves contour grinding on knife blades. (Picture 4).

The cell is equipped with two belt grinding stations and an indexing rotary table. (Picture 5)

ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

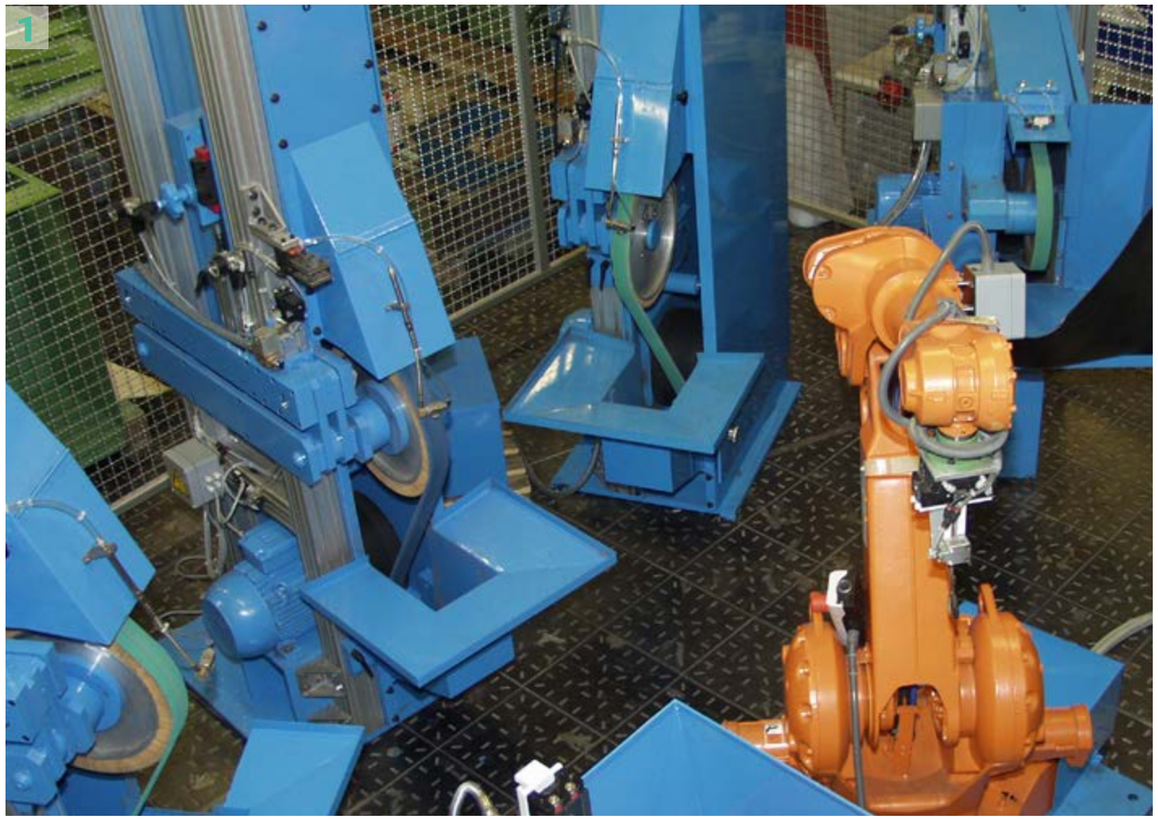
Machining of scissors

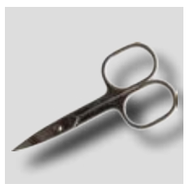
The robot grinding stations can be used to process hair scissors, garden scissors, nail scissors, surgical scissors and similarly shaped workpieces.

(For the machining of surgical scissors see also p. 30 f., for the machining of garden scissors see also p. 10 f.)

Depending on the shape of the workpiece and type of processing, the robot cell is configured with appropriate stations, such as:

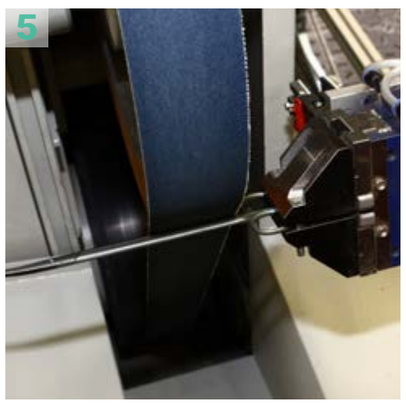
- belt grinding stations
- indexint rotary table magazines
- camera measuring systems





Examples of application (pictures)

1. Scissor grinding with four belt grinding stations (picture 1)
2. Contour grinding of scissors (picture 2)
3. Grinding of mounted scissors (picture 3)
4. Grinding of the outer edge with high material removal (picture 4)
5. Grinding and contour machining of scissors (picture 5)



ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

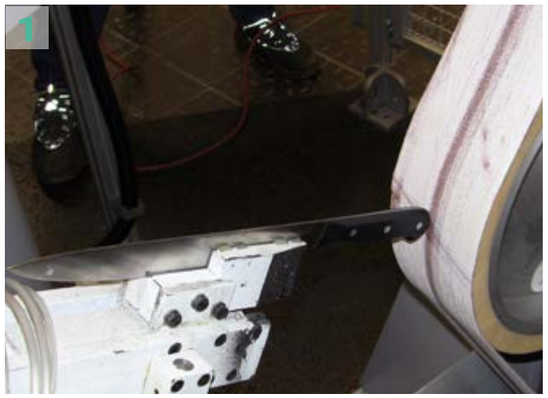
Grinding of knife handles

With a specially configured robotic cell, flat grinding of knife handles can be achieved.

- flat grinding of knife handles on both sides with two opposite belt grinding stations
- stations connected to each other by a special attachment for flat grinding on both sides
- grinding of handles by profiled grinding wheel

The robotic cell shown here below is configured as follows:

- two opposite belt grinding stations for flat grinding of knife handles (picture 2)
- belt grinding station for contour grinding of knife handles (pictures 1 and 3)
- indexing rotary table with adjustable stops for the reception of up to approx. 160 workpieces (picture 4)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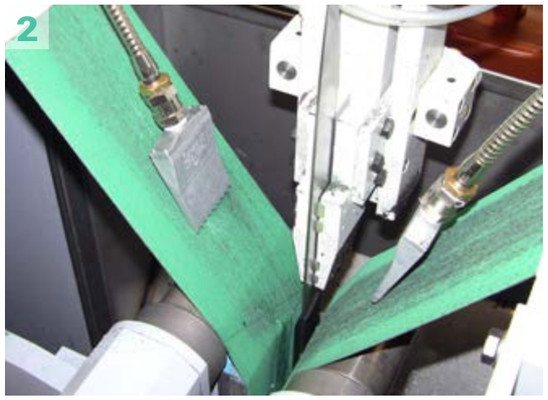
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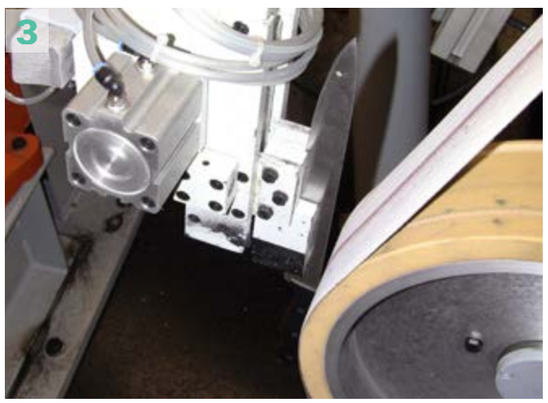

3


4

Polishing of knife handles

For polishing knife handles one-sided polishing stations are used.

Depending on the model, a polishing wheel with a width of 100 mm or 300 mm is recommended.

The polishing paste can be supplied in liquid or solid form.

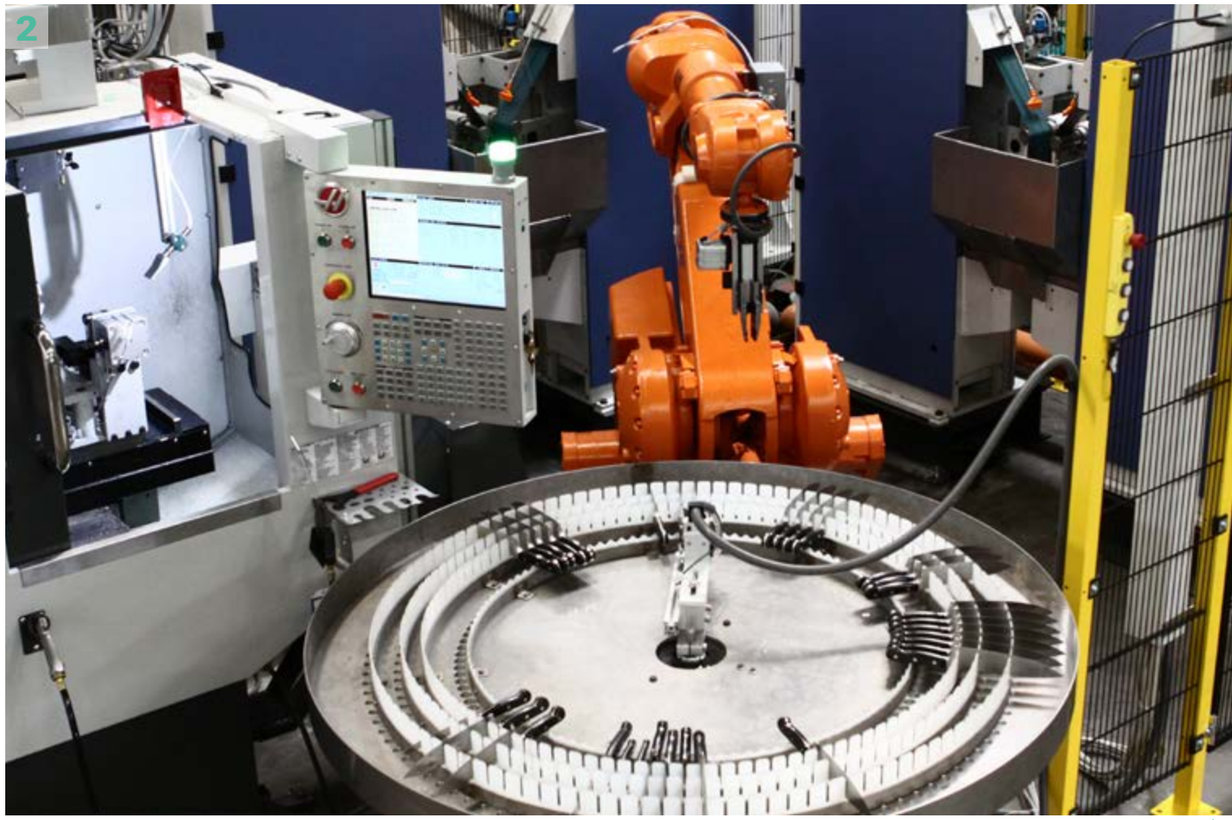
The robotic station shown here above is equipped with:

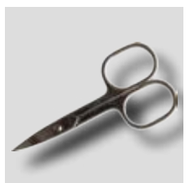
- three polishing stations of the series P1
- indexing rotary table for the reception of up to 160 workpieces

ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

All around milling and flat grinding of knife handles

The all around milling of the handle results in a repeatable contour for further grinding and polishing operations.





Robotic grinding and milling station for all around milling of handles and flat grinding of stainless steel rivet, consisting of:

- belt grinding station of the series BSS10
- two belt grinding stations of the series BSS14 for pregrinding
- two belt grinding stations of the series BSS14 for finish grinding
- milling station
- two laser measuring stations
- indexing rotary table

Examples of application (pictures)

1. Clamping in milling station (picture 1)
2. Robotic processing cell of the series RSP/5B/1F/2L with milling station and belt grinding stations for all around milling and flat grinding of knife handles (picture 2)
3. Two opposite belt grinding stations for flat grinding of stainless steel rivets at knife handles (picture 3)
4. Milling station (picture 4)

ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

Grinding of nail clippers

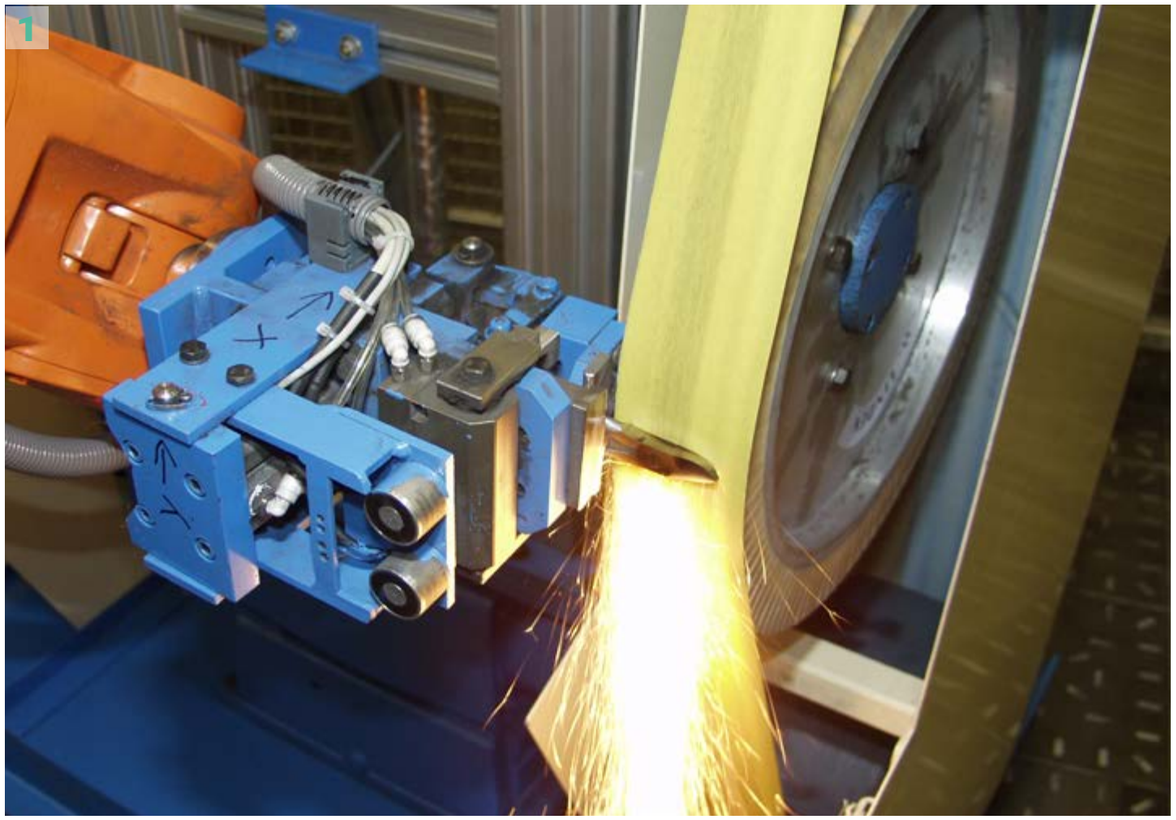
Robot grinding stations of the RSP series can be used for the processing of nail clippers and similar shaped workpieces.

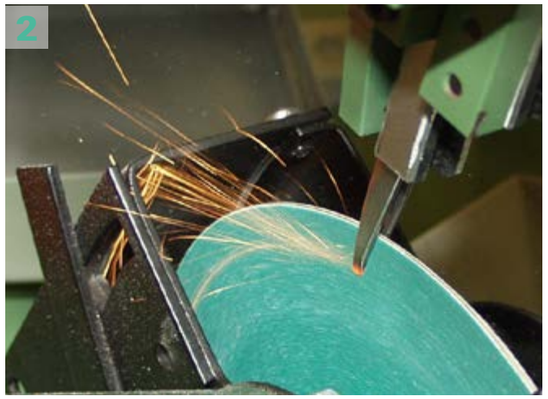
The configuration of the robotic cell depends on the workpiece and the required processing.

The robotic cell shown here consists of:

- four belt grinding stations of the series BSS10
- indexing chain magazine for conical material (loading capacity 2.000 mm (78.7"))

(More information about robotic processing of pliers see p. 8 et seq.)





Grinding and sharpening of manicure tweezers

Due to a special configuration, manicure instruments such as nail scissors or tweezers can be sharpened and ground in the robotic cell.

The robot cell shown here consists of:

- two belt grinding stations
- sharpening station
- laser measuring station
- Circumferential bar magazine for tweezers with position recognition via bearings

(For more information on robot processing of tweezers, see page 29)

Examples of application (pictures)

1. Grinding of nail clippers with belt grinding station (picture 1)
2. Sharpening of manicure tweezers (picture 2)
3. Grinding of the tip of tweezers (picture 3)
4. Robot grinding station of the series RSP/4B/1K/1L with indexing chain magazine for conical workpieces, here nail tongs (picture 4)
5. Robot grinding station RSP/2B/1S/1L with rotating bar magazine for tweezers (picture 5)

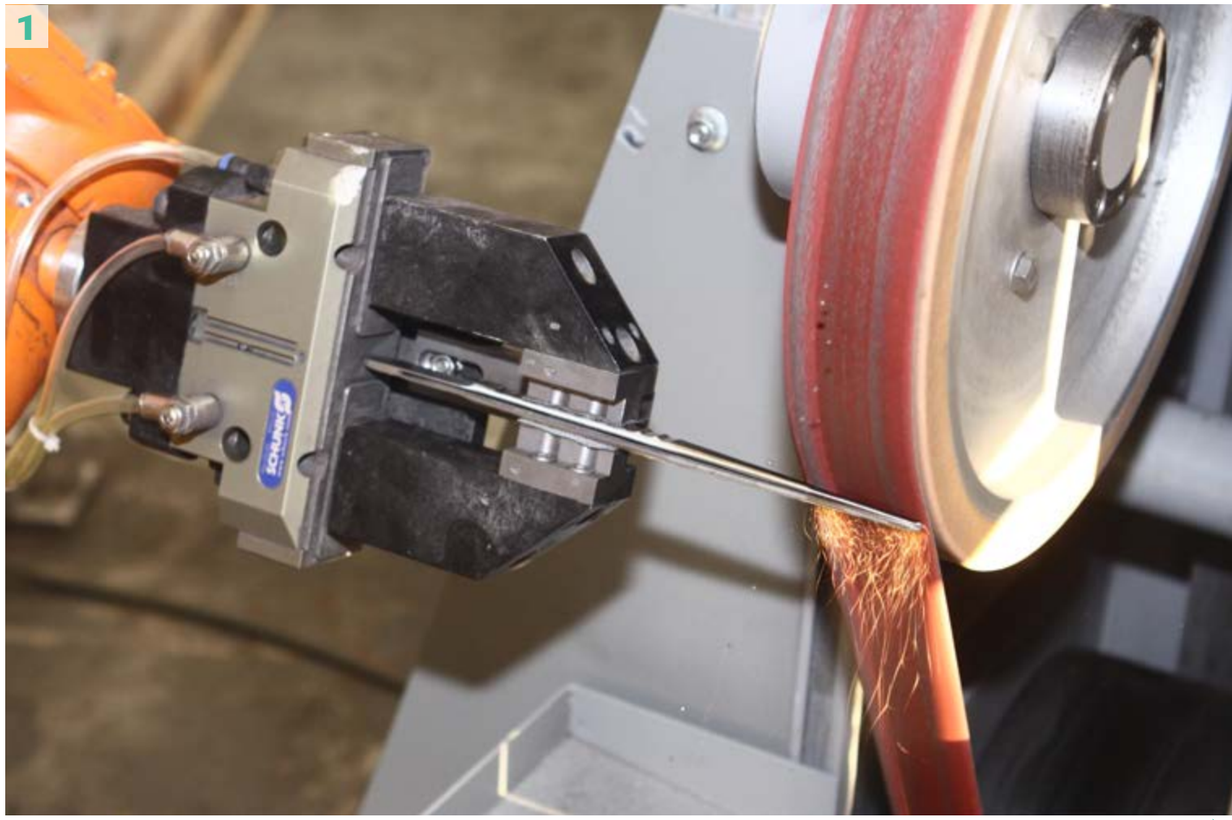
ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

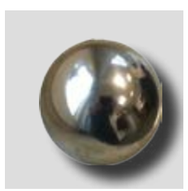
Rough and final polishing of artificial hip joints and prostheses

The robot polishing station of the RSP/2P series processes artificial hip joints, prostheses and similar shaped workpieces.

- two polishing stations of the series P3
- robotic polishing station either intgrated into an exitng production line or constructed as a separate cell
- programming in touch-in mode or with a CAM/CAD interface
- integration of measuring systems for compensation of workpiece tolerances in position and dimensions
- various processing stations with
- different tools (e.g. grinding belts, grinding stones and polishing wheels) available

1





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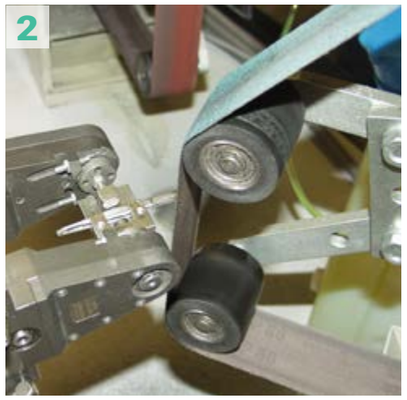


3

All-round machining of surgical forceps

For the production of forceps, the robotic system can be assembled in such a way that an all-round machining of the workpiece is possible.

- machining the forceps tip and spring on belt grinding station of the BSS series
- gripping station for all-round machining
- seal grinding of the forceps tip on grinding wheel

Examples of application (pictures)

1. Grinding of surgical forceps with belt grinding station (picture 1)
2. Gripping station (picture 2)
3. Robotic cell for all-round machining of forcepts (picture 3)

ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

Facet cut on surgical scissors

The robot cell shown here is designed for processing surgical scissors. The robot station is configured to achieve a facet cut on mounted, coated scissors.

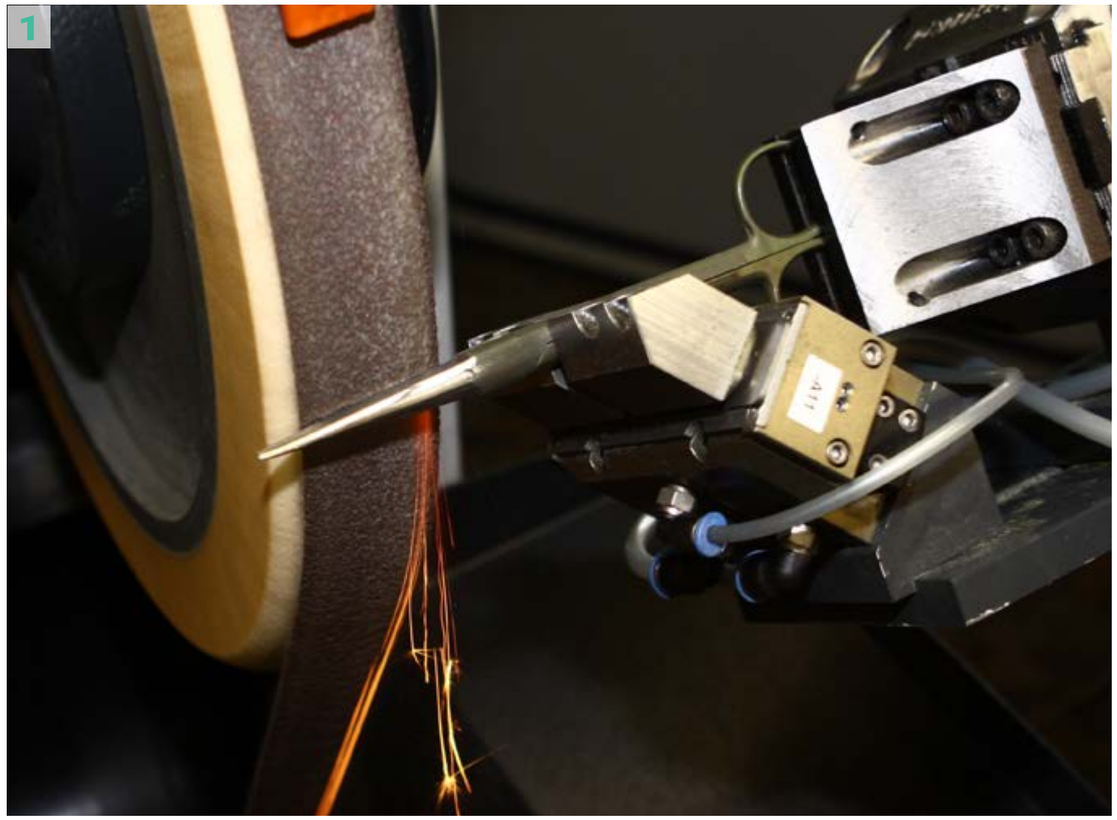
The robot cell of the RSP/4B/1K/1M series shown here consists of:

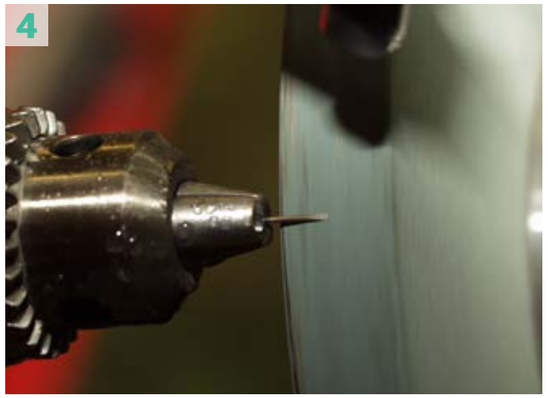
- four belt grinding stations of the series BSS10
- vertical rotary table magazine
- camera measuring station with two cameras

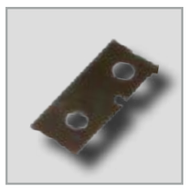
Sharpening of micro scissors

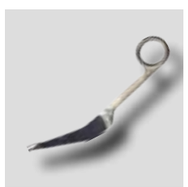
The robot sharpening stations of the RSP/1S series shown here are designed for double-sided sharpening of disposable micro scissors and disposable blades.

- double-sided sharpening station DS
- workpiece oriented programming
- robot gripper with holder for dresser







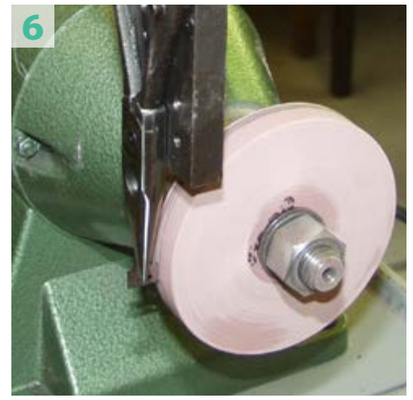


Examples of application (pictures)

1. Grinding of facet cut on surgical scissors (picture 1)
2. Sharpening of disposable micro scissors (picture 2)
3. Sharpening of disposable micro blades (picture 3)

4.–5. Grinding of lancets with robot grinding station (pictures 4 and 5)

6. Robot deburring of blades for eye surgery (picture 6)

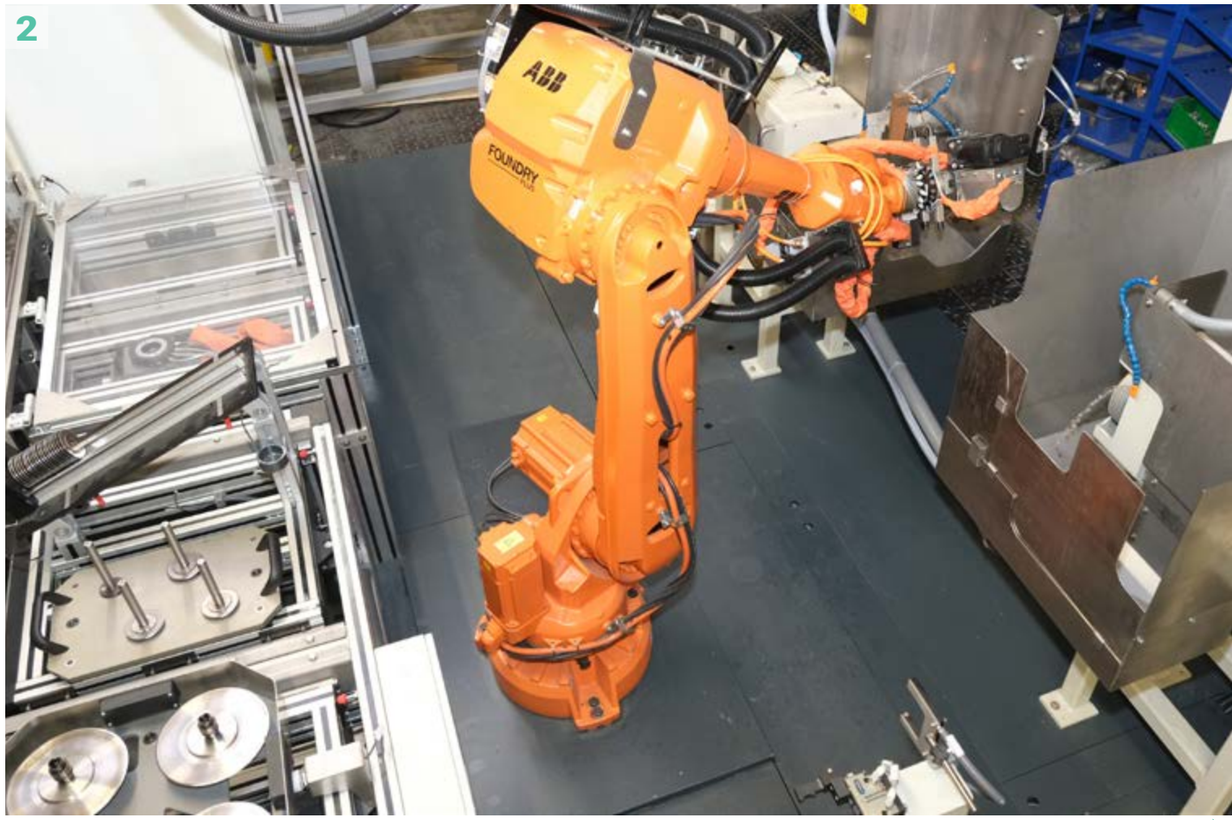


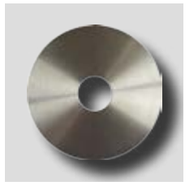
ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

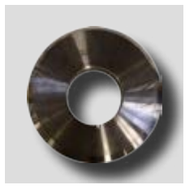
Re-sharpening / sharpening of circular blades or squeezing knives

The RSP/2S robot grinding station shown here has a modular design and is designed for machining circular knives with a diameter of 70 to 200 mm (2.7" to 7.87").

The outer diameter is measured with a laser measuring station.







- one-sided machining station with diamond grinding wheel of the P3/T series and subsequent deburring (see also machining stations p. 67)
- magazine is placed via stacking magazine with subsequent deposit on mandrel
- workpiece spindle for holding the circular blade for continuous turning after measuring the outer diameter
- automatic change system für workpiece spindle

Examples of application (picture)

1. Processing station P3/T (picture 1)
2. Robotic cell RSP/2S for the machining of circular blades (picture 2)
3. Storing via stacking magazine (picture 3)
4. Workpiece spindle with workpiece (picture 4)

ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

Serrating of circular blades

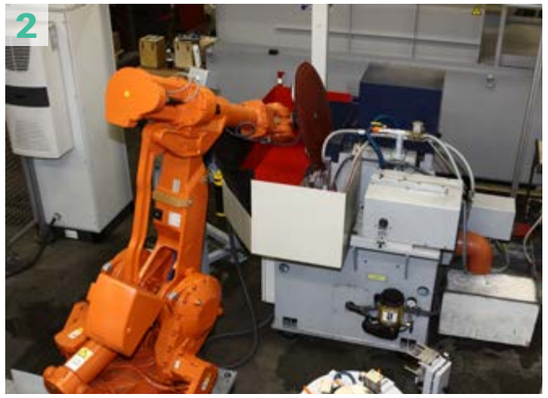
The robot grinding station shown here is designed for serrated grinding and brushing of circular blades.

A peripheral grinding machine of the WS4 series and a brushing station of the SM2 series are integrated in the robot cell.

A robot picks up the workpiece from a stacking magazine, feeds it to a machining/measuring station and places it finally in another stacking magazine.

1

2



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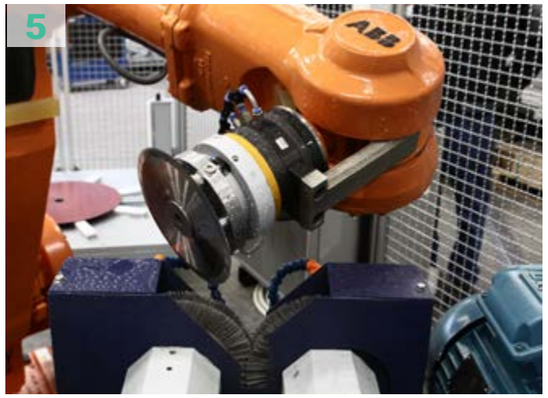


- processing robot with vacuum robot gripper for picking up circular blades up to 35 kg/ piece
- peripheral grinding machine WS4
- max. grinding width 100 mm (3.34")
- grinding wheel Ø 300 mm (11.8")
- measuring station with probe to detect the outer diameter
- two vertical stacking magazines for holding circular knives up to Ø 1 000 mm (39.37")
- magazine for holding circular knives of Ø 300 mm (11.8")with a stacking height of 500 mm (19.69")
- processing machine of the SM2 series with spiral brushes

Examples of use (pictures)

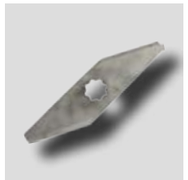
1. Serrated grinding of circular knives with peripheral grinding machine WS4 (picture 1)
2. Robot feeding of a circular knife (picture 2)
3. Stacking magazine for circular knives with cylinder for lifting the workpiece (picture 3)
4. Measuring station to measure the outer diameter (picture 4)
5. Processing station SM2 with two spiral brushes (picture 5)

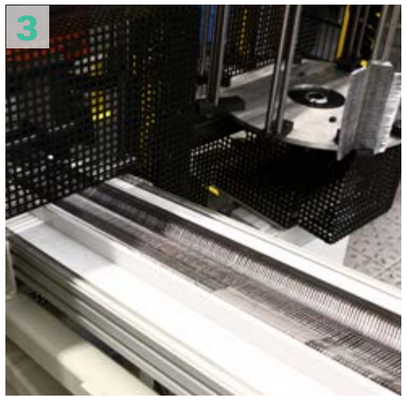
ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

Sharpening of machine knives

The modular RSP/2B robot grinding station shown here is designed for sharpening machine knives.

The robot cell consists of two belt grinding stations and a processing robot. The workpieces are provided by a conveyor belt.





- conveyor belt of 2000 mm (78.7") length for a correct positioning of the workpieces
- separating and centering station
- vertical bar magazine
- processing and loading/unloading robot
- parallel gripper for workpiece fixture including 180° rotation module
- two one-sided belt grinding stations of the BSS10 series

Examples of use (pictures)

1. Robot processing cell designed for sharpening machine knives (picture 1)
2. Belt grinding station of the series BSS10 (picture 2)
3. Conveyor belt for workpiece positioning (picture 3)
4. Robot gripper with 180° rotation module (picture 4)

ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

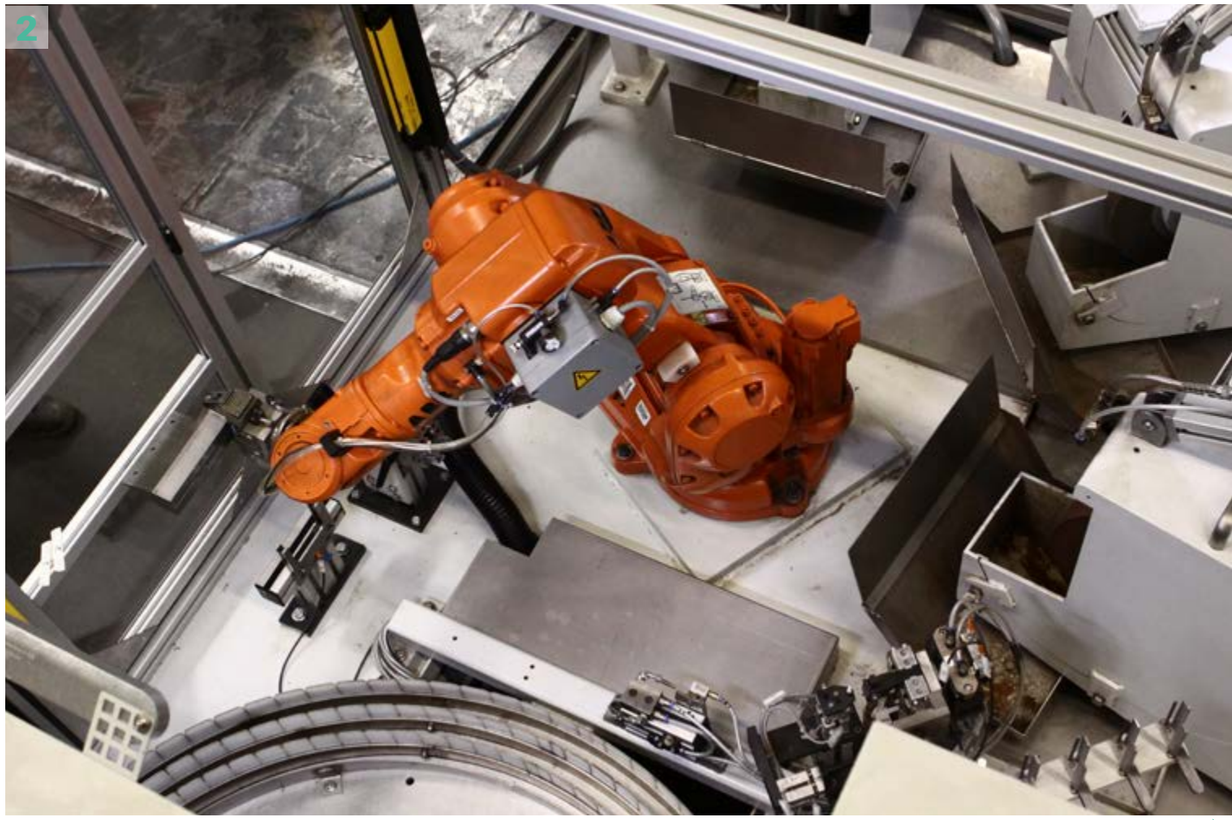
Sharpening and polishing of machine knife blades

The robot cell shown here is designed for sharpening and polishing machine knife blades and similarly shaped workpieces.

The cell is equipped with three processing stations of the P3 series as well as a stacking magazine used for loading and separating the workpieces. The workpieces are placed on a rotary transfer magazine after processing.

1

2

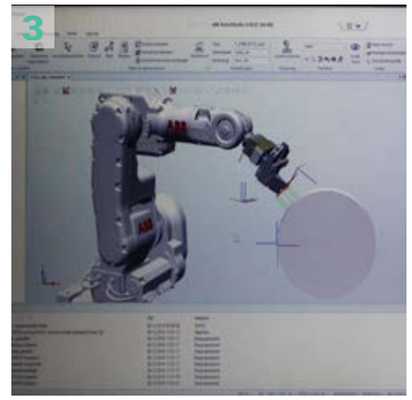


- indexing rotary table magazine with Ø of 1 200 mm (47.24") for 80 workpieces
- vertical stacking magazine for loading and separation of the workpieces
- robot with stirrup bearing for measuring of new blades or position check in the gripper
- three single-sided machining stations of the P3 series
- coolant system

Examples of use (pictures)

1. RSP/3P/1M robot processing cell for processing machine knives (picture 1)
2. Integration of three processing stations of the P3 series for sharpening and polishing the blades (picture 2)
3. Simulation via RobotStudio (picture 3)

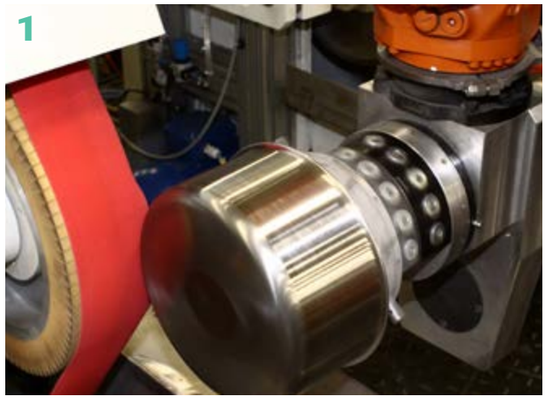
3

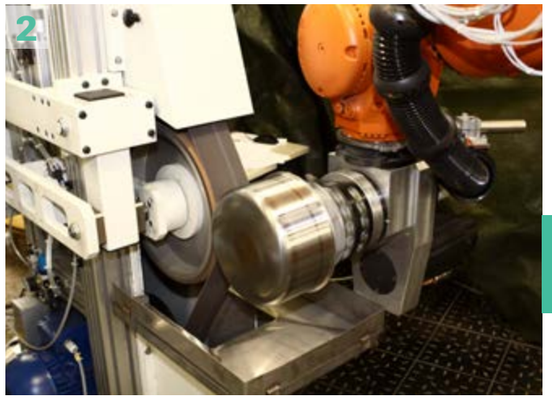


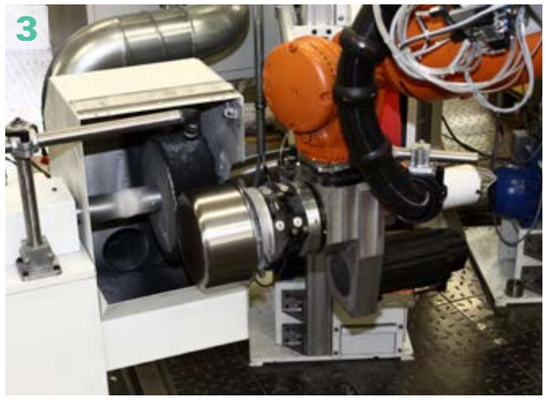
ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

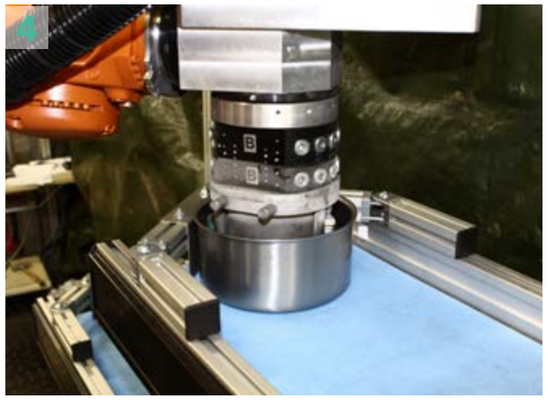
Grinding and polishing of hollow-ware

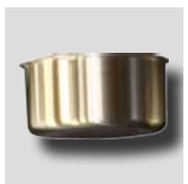
The robot cell shown here is a specially developed solution for polishing pots on the outer surface in combination with two grinding belts and a polishing wheel.











The robotic cell here shown is equipped as follows:

- two belt grinding stations of the series BSS14
- polishing station of the series P5
- automatic gripper changing system
- indexing conveyor belt system

Examples of application (pictures)

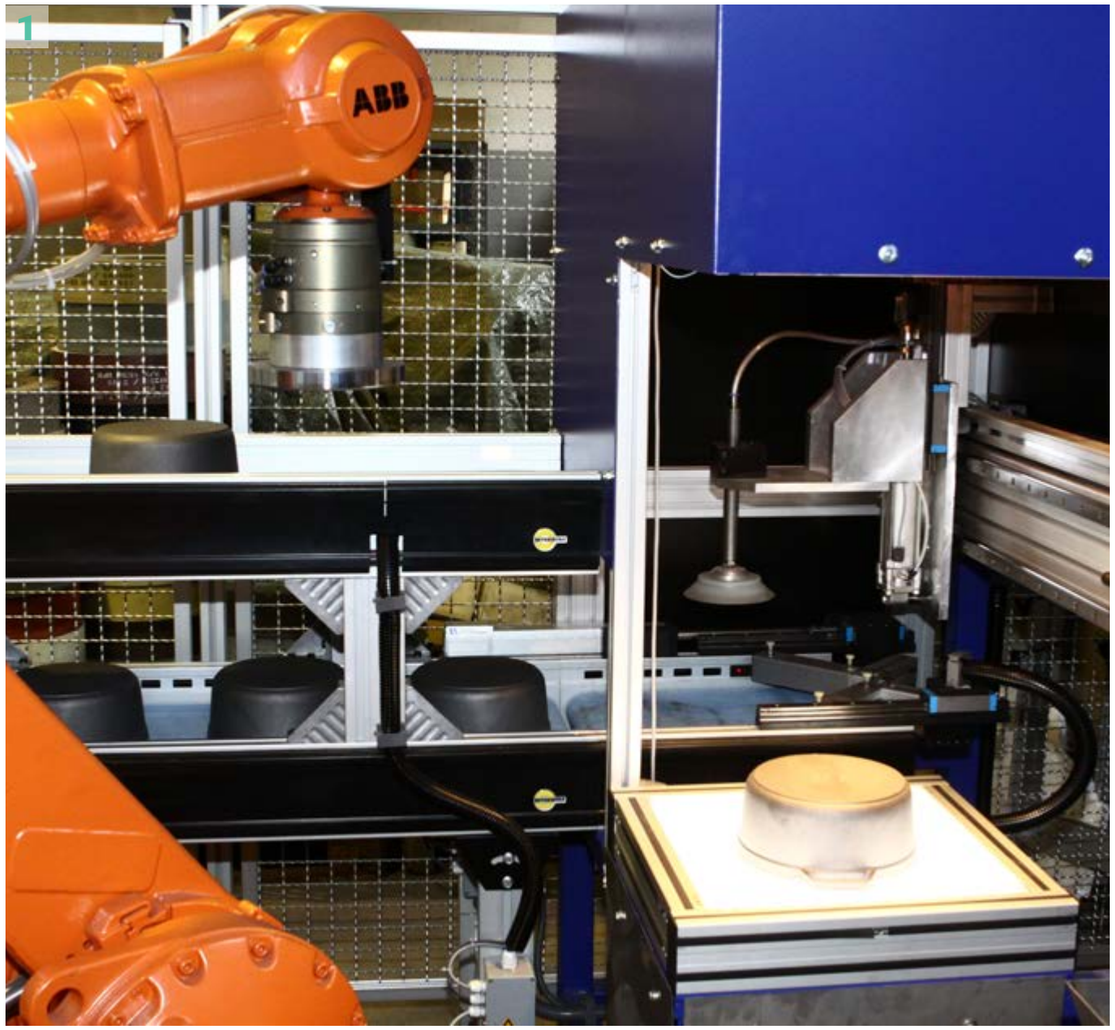
1. Grinding of the outer surface with belt grinding station BSS14 (picture 1)
2. Finish grinding of the outer surface with belt grinding station BSS14 (picture 2)
3. Polishing of the outer surface with polishing station P5 (picture 3)
4. Gripping of the workpiece with especially designed robot gripper (picture 4)
5. Grinding and polishing of hollow-ware with robotic grinding and polishing system of the series RSP/2B/1P (picture p. 26)

ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

Grinding and deburring of hollow-ware made of spheroidal graphite iron

The modular robot grinding and polishing cell RSP/2B/1F/1K shown here is designed for the processing of cast parts.

1



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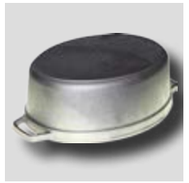

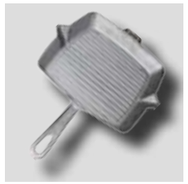

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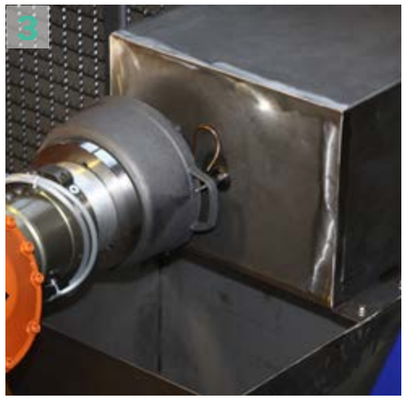

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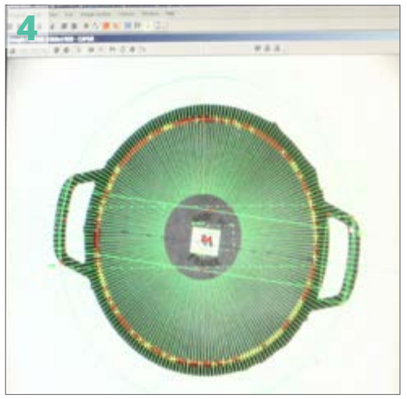


The robotic cell consists of:

1. Feeding via conveyor belt and positioning on camera measuring table (picture 1)
2. Fettling of the outer surface with 2 belt grinding stations of the series BSS14 (picture 2)
3. Deburring of the inner side of the handle with high frequency motor spindle (picture 3)
4. Compensation of workpiece tolerances by camera measuring system (picture 4)

ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

Deburring and milling of workpieces made of cast steel

The robot cell of the RSP/5F series shown here is designed for deburring and milling cast and forged parts.

The workpiece positioned on the loading table is gripped by the robot.

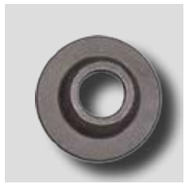
The workpiece is aligned and measured by means of a camera measuring station and a demo 3D probe.

The workpiece is machined at a milling station with a fixed milling spindle.

(For machining with a fixed milling spindle, see also p. 43)

1

2



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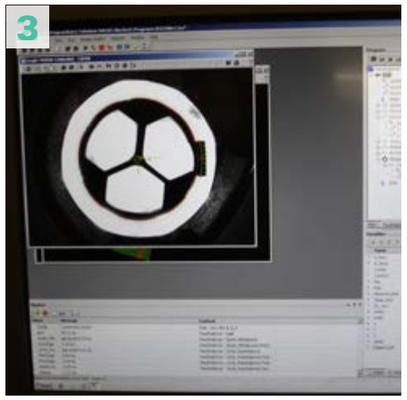


4

- rotary table for loading and unloading of workpieces with Ø 2.000 mm (78.74"), reception of up to 30 workpieces
- milling station with pneumatic spindle for the use of milling burr
- camera measuring system with lighting and lens
- 3D measuring probe

Examples of application (pictures)

1. Milling of cast steel with fixed milling spindle (picture 1)
2. Measuring the workpiece with a camera measuring system (picture 2)
3. Measuring with camera system (picture 3)
4. 3D measurement with probe (picture 4)

ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

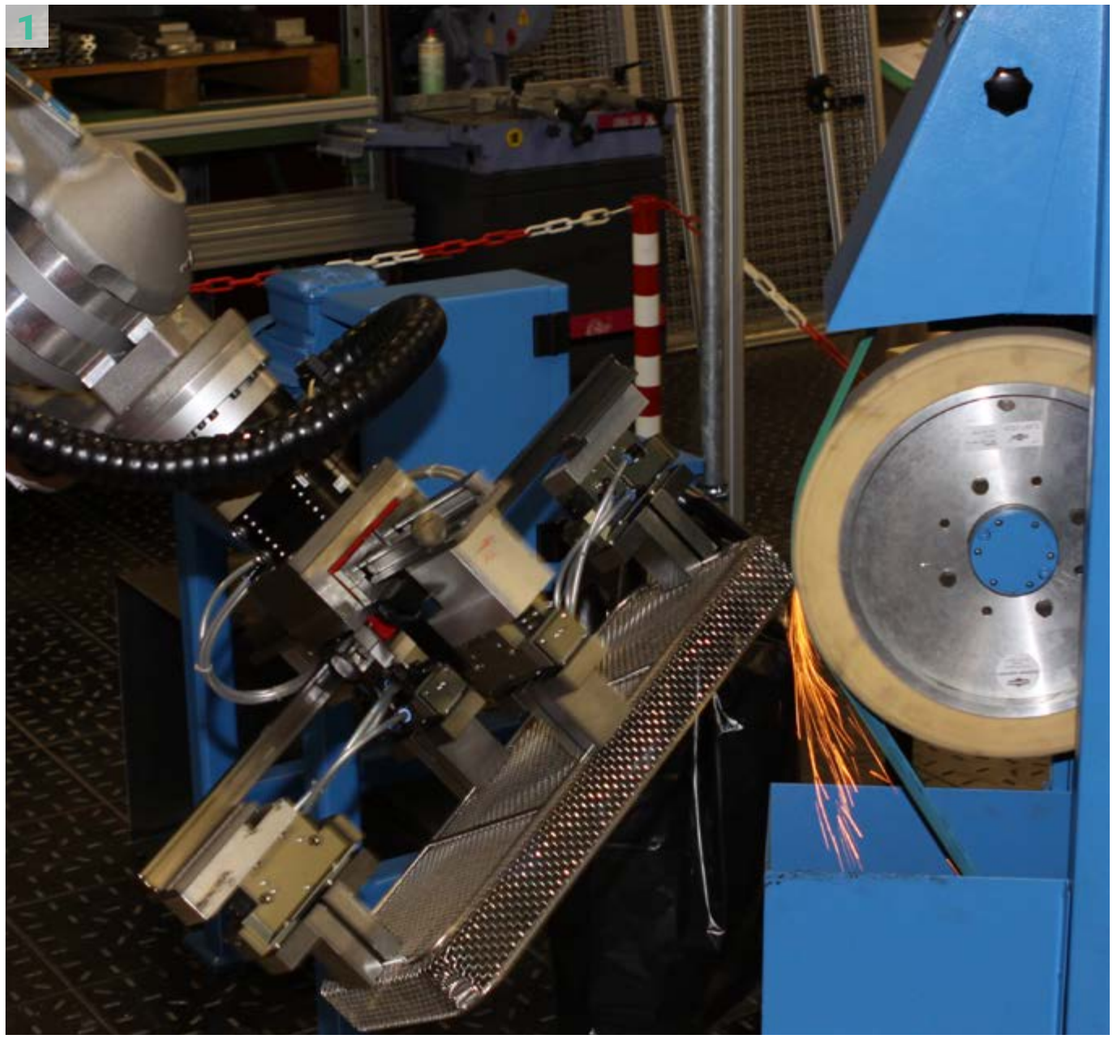
Grinding and deburring of screen baskets

The robot grinding and deburring station of the RSP/1L/1B/1P series shown here is designed for processing screen baskets.

The robotic cell consists of:

- belt grinding station
- deburring station
- laser measuring system

1



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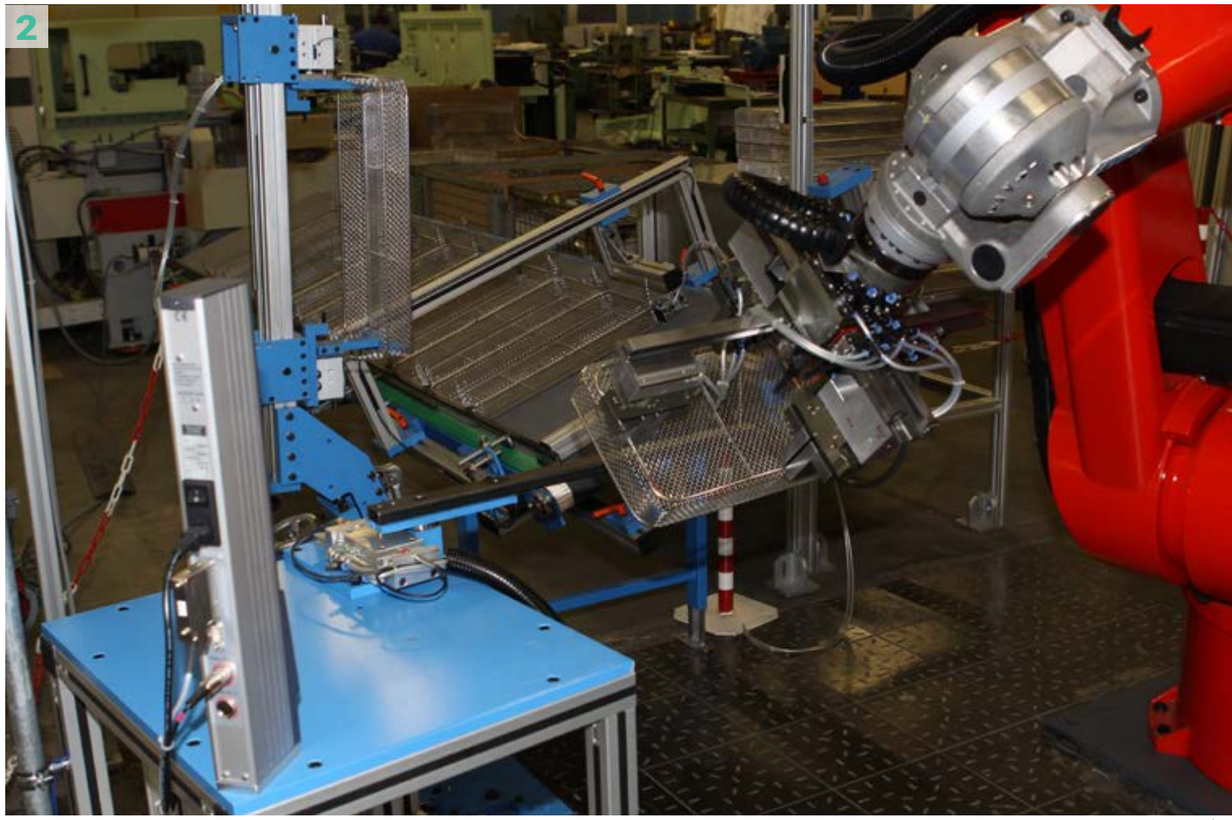
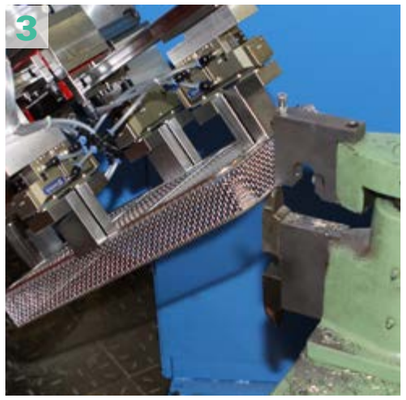


Examples of application (pictures)

1. Grinding of screen baskets with belt grinding station (picture 1)
2. Gripping of the workpiece from conveyor belt and measuring with laser measuring system (picture 2)
3. Deburring of the outer edge of screen baskets with deburring station (picture 3)

3



ROBOTIC CELLS
WITH ROBOT-GUIDED WORKPIECE

Robotic machining with CNC rotary table

The robot cell is equipped with five processing stations mounted on a rotary table. The workpiece is guided by the robot.

The machining cell is designed for all-round machining of workpieces.

Grinding and deburring of steel cast parts

- CNC rotary table for the reception of five processing stations
- five one-sided grinding machines of the series P3, designed for wet grinding with nozzles for intensive cooling
- CNC dressing unit with two CNC axes
- measuring station for workpiece measurement, consisting of two U-shaped lasers, a double laser distance sensor and a tactile Tesa probe
- turning and centering station
- 180° loading table
- robot with gripper changing system
- gripper changing for the machining of the other side of the workpiece

Examples of application (pictures)

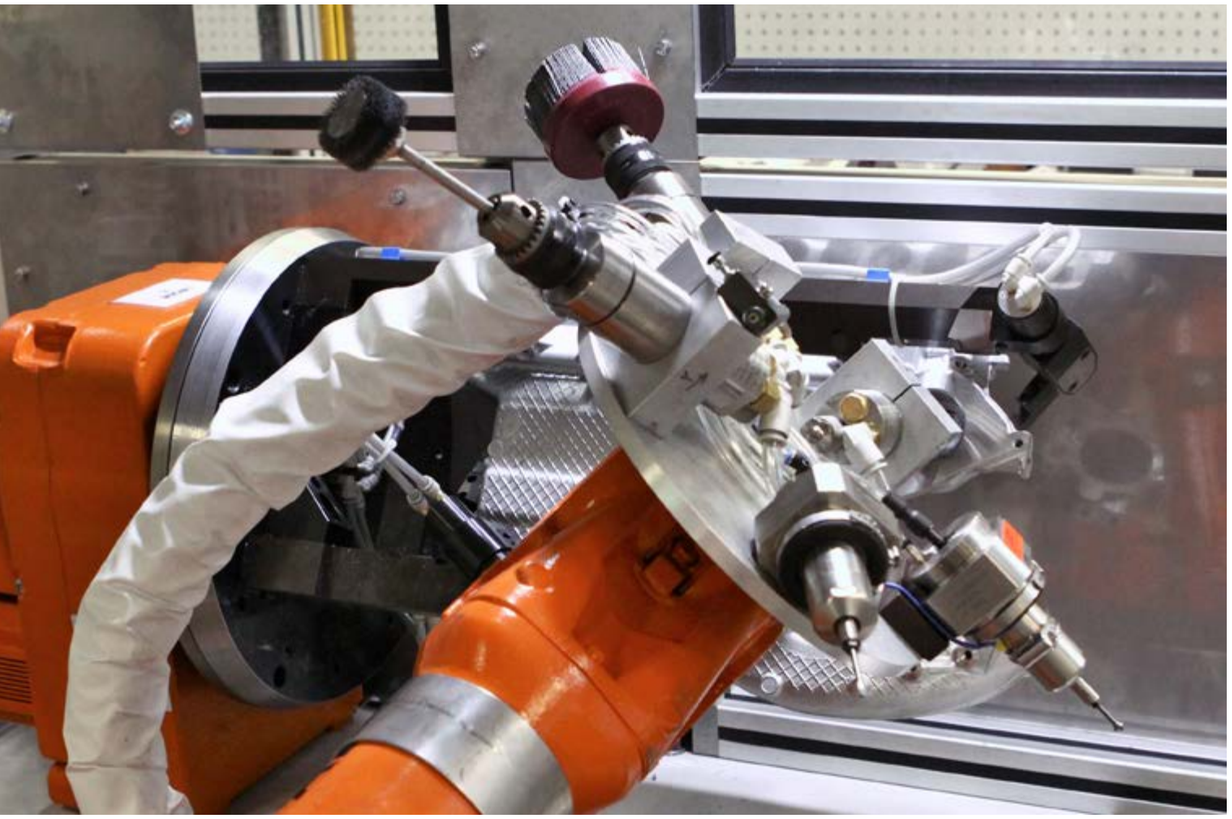
1. One-sided grinding machine of the series including dressing system P3 (picture 1)
2. Measuring station with Tesa probe (picture 2)
3. Turning and centering station (picture 3)
4. 180° loading table (picture 4)
5. CNC rotary table with processing stations (picture p. 48)

ROBOTIC CELLS

WITH ROBOT-GUIDED TOOL

ROBOT PROCESSING WITH MULTI-TOOL HEAD AND CNC ROTARY TABLE

When large and/or heavy workpieces as well as workpieces with special geometries have to be machined, it is recommended to machine the stationary workpiece with a robot-guided tool.

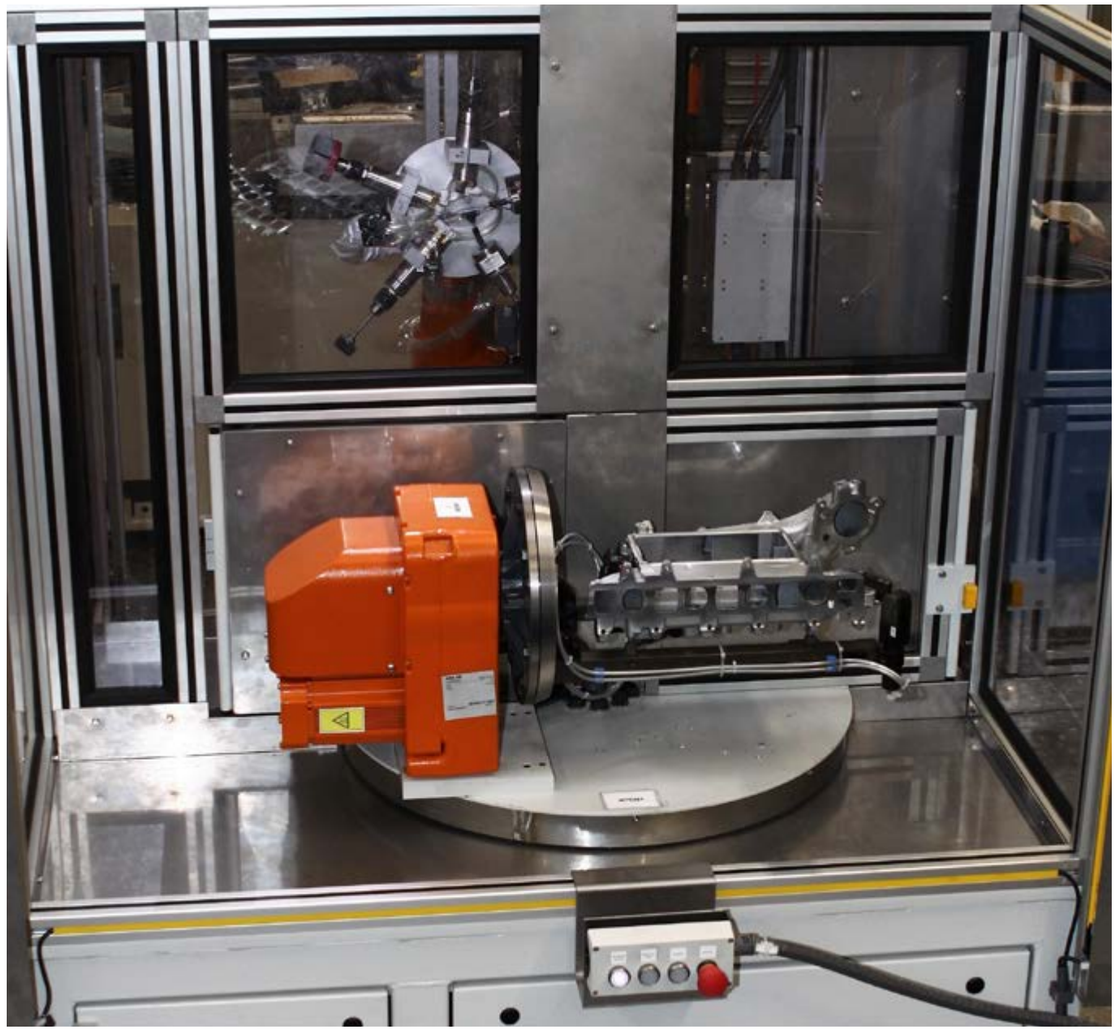


- fixing of the workpiece or feeding via a CNC rotary table
- measuring of the workpiece, e.g. using a 3D probe integrated in a multi-tool head
- machining of the workpiece with a robot-guided tool or with several tools installed on a multi-tool head
- workpiece pick-up via CNC rotary table with one machining and one loading and unloading position
- CNC rotary table with additional rotary axis integrated in the robot control for repositioning the workpiece

ROBOTC CELLS
WITH ROBOT-GUIDED TOOL

Robot machining with multi-tool head

If the workpiece is too large or difficult to move, the robot cells are designed so that the work-piece is fixed or mounted on a rotary table with CNC axis so that it can be machined with one or more robot-guided tools.



Deburring and milling of aluminium gravity die casting

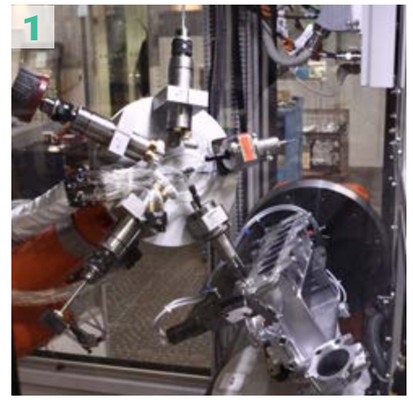
The standard robot cell shown here is designed for machining gravity die castings.

The workpieces whose feeding is supplied by the customer are picked up by a CNC rotary table with one processing position and one loading and unloading position. This allows loading, unloading and machining to be carried out in parallel.

An additional rotary axis integrated into the robot control system is used to reposition the workpiece during machining (picture p. 52).

Five tools are mounted on a multi-tool head, which are selected depending on the machining operation.

Programming is done offline, for example using RobotStudio. A measurement of the workpiece is integrated into the system.



The robot cell of the RSP/5F/3R series shown here contains:

- two robots for loading and unloading
- positioning of workpieces for machining robots via CNC rotary table
- multi-tool head holding five tools, in this case five pneumatically driven precision spindles (picture 1)

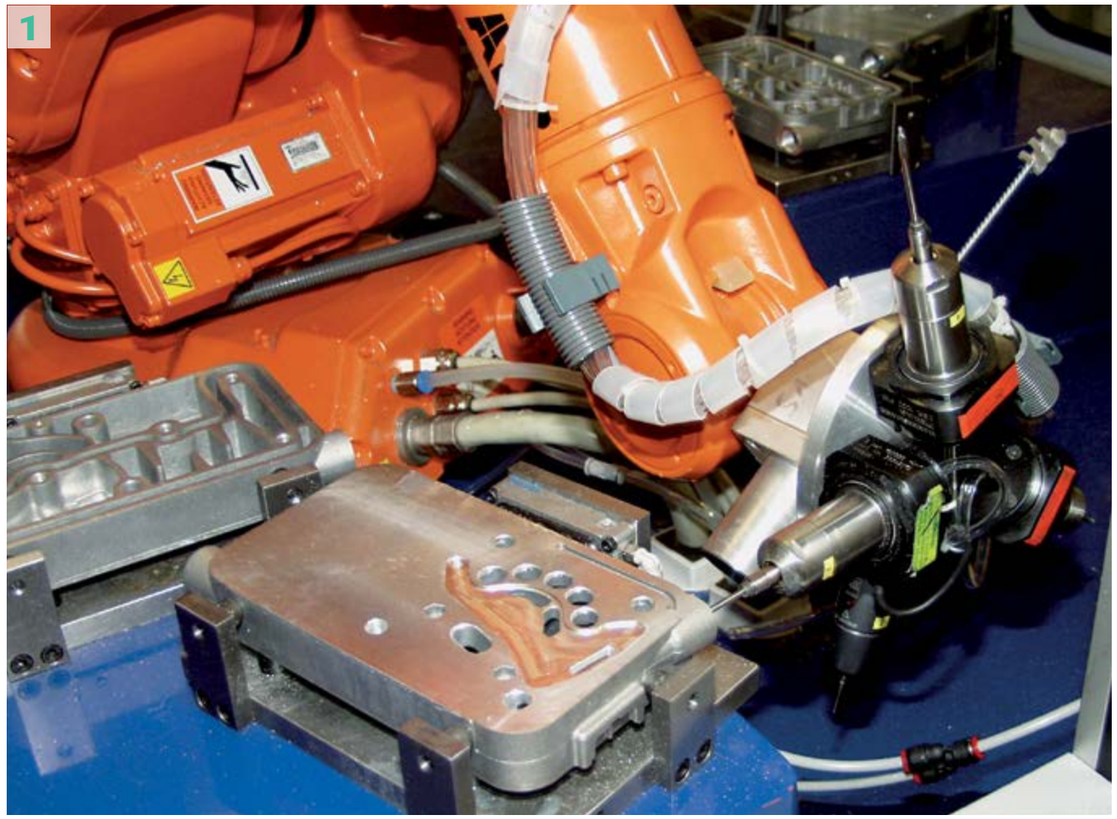
ROBOTC CELLS
WITH ROBOT-GUIDED TOOL

Robot processing with multi-tool-head

The robot deburring of aluminium castings can be realized by means of various tools. The main tools used are rotationally driven tools such as milling and grinding pins, abrasive flap discs or brushes.

The selection of the tools depends on the accuracy requirements, the material, the surface and the amount of material to be removed. During machining, either the tool or the workpiece can be guided.

- mounting of various tools in three pneumatically driven milling spindles and brushing spindle via tool turret head
- tool change time: 0,4 s
- execution of programmed curves in geometric order
- shortest machining paths
- mounting of up to four tools
- calibration of complete workpieces or individual contour elements for programming and checking the workpiece position in the process via integrated 3D measuring key
- increased tool durability and improved surface finish during deburring due to wet processing with liquid from a spray attached to the tool turret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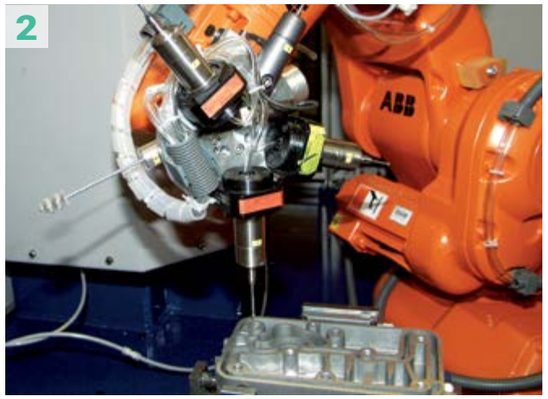
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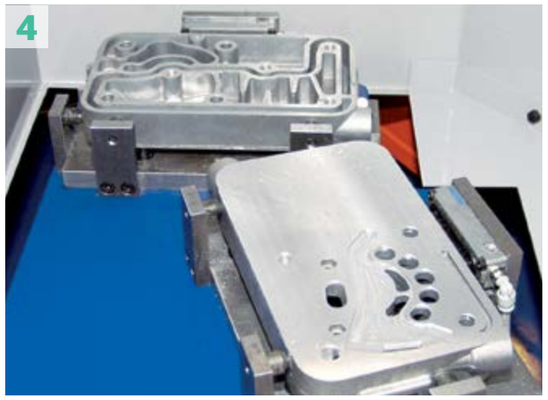
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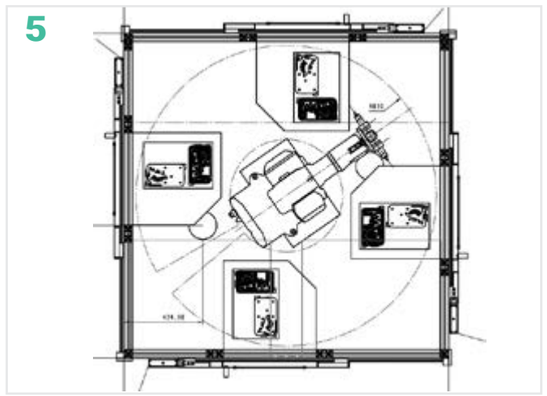
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Deburring of aluminium pressure die castings

When machining die-cast cylinder heads, for example, precise, defined and secondary burr-free deburring is crucial.

The deburred edges should be 0.2 to 0.4 mm (0.0079" to 0.0157") wide to ensure maximum size of the sealing surfaces.

Special milling tools have been developed to reliably produce these uniform and narrow deburring edges for aluminium. The milling tools guarantee a long durability and are designed to limit penetration into the workpiece.

Offline software is supplied for programming the robot, with which drawing data is tapped and the curves to be deburred are assembled as radius and line elements.

Examples of application (pictures)

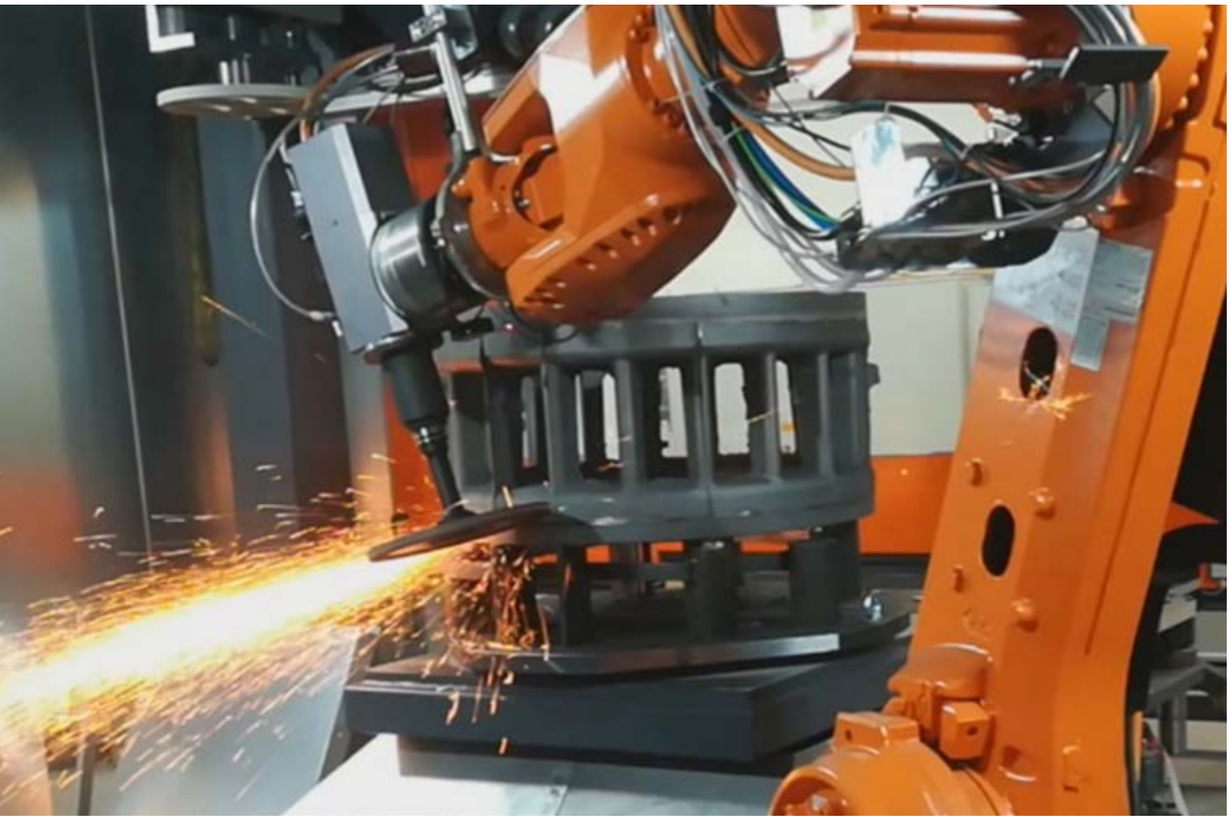
1. Tool turret head with three pneumatically driven milling spindles, one pneumatically driven brush spindle and one 3D measuring probe (picture 1)
2. Machining of pressure die castings with tool turret (picture 2)
3. RSP/5F robotic cell for processing die cast parts (picture 3)
4. Interchangeable workpiece holder (fixture) with defined reference points (picture 4)
5. Layout plan of the robotic cell RSP/5F (drawing 5)

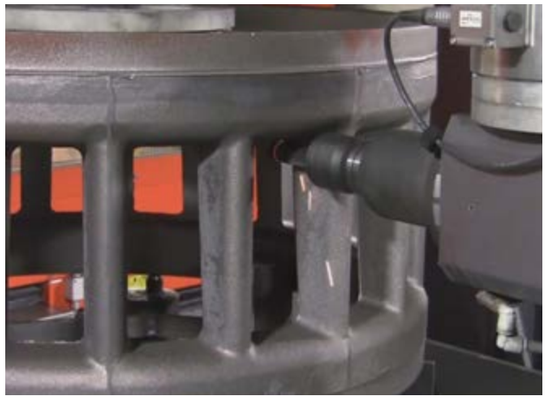
ROBOTC CELLS
WITH ROBOT-GUIDED TOOL

Deburring of large workpieces

The fully automated robotic cell is designed for deburring large workpieces.

The feeding is carried out by the customer via a loading and unloading position. From then on, the workpiece is machined fully automatically.





Positioning via CNC rotary table

The workpiece is positioned on a CNC rotary table for machining within the production center. The rotary table axis is fully integrated into the robot control system.

The workpiece is machined with various rotating tools such as grinding wheels or milling cutters.

A tool change is carried out depending on the machining task and takes place from a change magazine.

The machining is prepared by means of offline programming - e.g. via RobotStudio.

The robot is equipped with a force-torque sensor, so that an almost seamless machining of contours is possible.

Thanks to additional measurement technology, this robot cell can be offered as a turn-key solution.

ROBOTC CELLS
WITH ROBOT-GUIDED TOOL

Grinding of large-volume workpiece

The robot grinding station shown here is a special solution for machining large parts.

The workpiece is positioned via a CNC rotary table.

Processing with robot-guided grinding unit

The inside of the workpiece is processed with a robot-guided grinding unit, which can be equipped with grinding wheels and/or grinding belts.

The grinding belt is changed automatically.

1

2

3

4

- machining of the inner surface of large parts with robot-guided grinding unit
- robot with tool changing system
- integration of an additional CNC rotary table for workpiece positioning
- use of force-torque sensors
- simulation in combination with RobotStudio
- use of grinding wheels and/or grinding belts
- automatic grinding belt change

Examples of application (pictures)

1. CNC rotary table for tool positioning (picture 1)
2. Grinding of large-volume workpieces with robot-guided grinding unit (picture 2)
3. Machining of the inner surface with grinding unit (picture 3)
4. Automatic grinding belt change (picture 4)

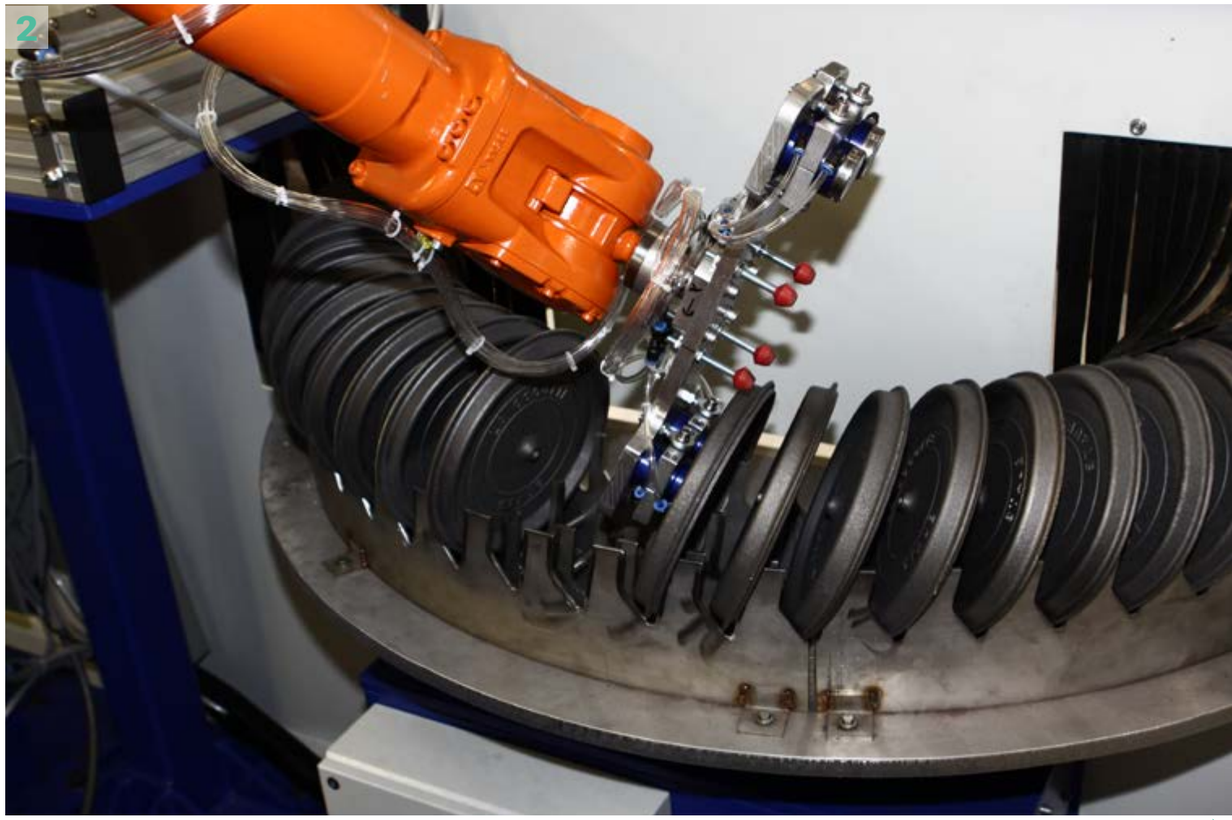
ROBOTIC FEEDING OF THE WORKPIECE

TO CNC PROCESSING MACHINES

PROCESSING WITH CNC TECHNIQUE

Deburring of spheroidal graphite cast iron

The modular robot cell is designed for machining cast iron pot lids and similarly shaped workpieces.



- robot gripper designed as double gripper for handling two lids including change parts for a pot family
- belt grinding station BSS10 with pneumatic belt tensioning and belt breakage control
- polishing station P3 with CNC axis for plunging the grinding belt against the pot lid; design with ball screw, AC servo motor and SERCOS interface
- frequency converter for infinitely variable regulation of the spindle speed of the station BSS10/P3

Examples of application (pictures)

1. Belt grinding station BSS14 for machining lids (picture 1)
2. Rotary table for the reception of up to 60 workpieces (picture 2)
3. Robot gripper designed as double gripper (picture 3)
4. Grinding machine with enclosure (picture 4)

FULLY AUTOMATED

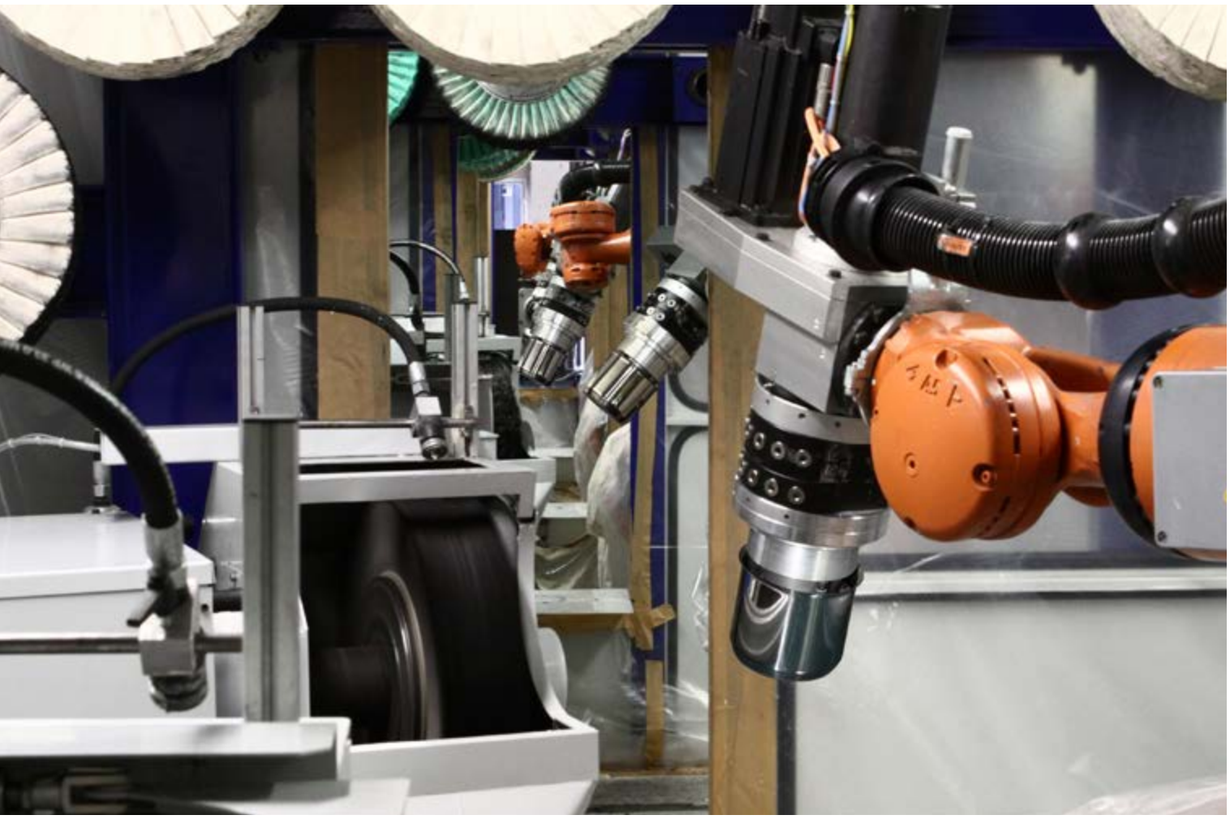
ROBOTIC SYSTEM

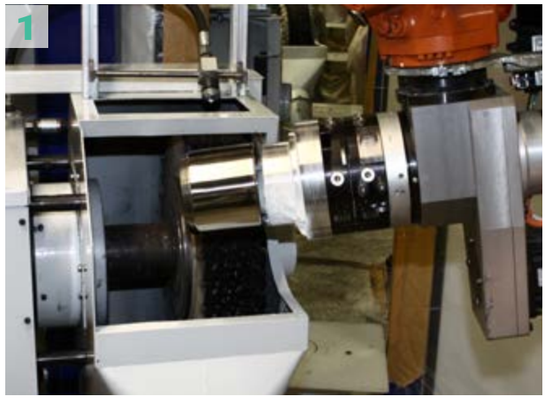
ROBOTICS AWARD 2018

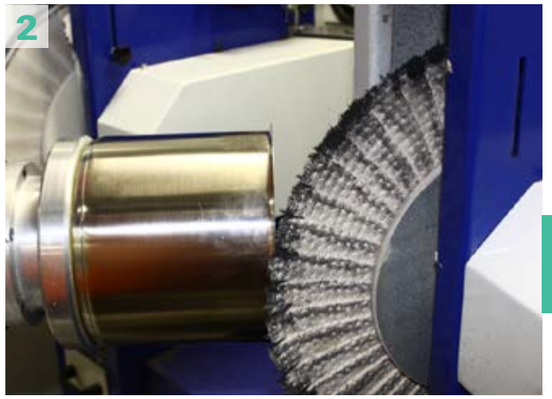
ROBOTIC SYSTEM WITH 33 INTERACTING ROBOT CELLS

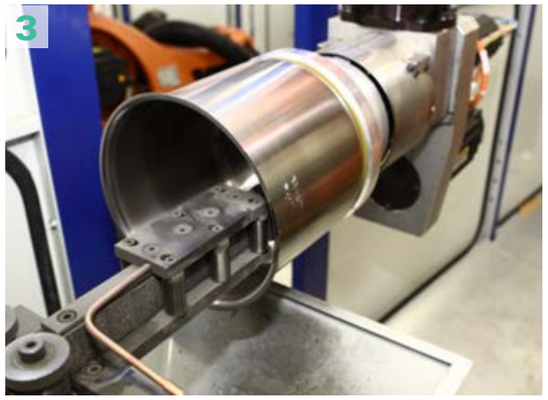
Grinding, polishing and deburring of stainless steel

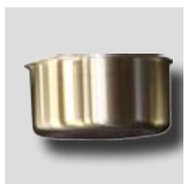
Fully automated robotic system for polishing the inside and the outer surface and for deburring the edges of hollow goods.











Decentralized, intelligent systems decide on the basis of input signals and sensor technology what kind of actions are to be carried out.

This is achieved both in the area of networked control technology and in the area of intelligent spare parts supply.

The robot system is equipped with 33 interacting robots. The robots communicate with each other, request raw materials or display consumables – each as an independent, intelligent unit.

For the supply of spare parts and preventive maintenance, the machines communicate worldwide as an independent system with the control center in order to display the current machine status and required wear parts.

The robotic cell is equipped as follows:

- feeding via conveyor belt system
- modular design of the system
- separate lines for in- and outside machining
- automatic gripper changing system
- tool changing system
- control station for monitoring the entire plant
- CNC adjustment of the paste gunle
- final polishing of the outer surface (picture 1)
- polishing of the pot rim (picture 2)
- when grinding the inside surface, the robot holds the pot over the vacuum system (picture 3)
- fully automatic change of polishing discs (picture 4)

ACCESSORIES

PROCESSING STATIONS FOR ROBOTIC CELLS

Various processing stations such as polishing and grinding stations or CNC controlled sharpening machines can be integrated into a robot cell and combined with each other.

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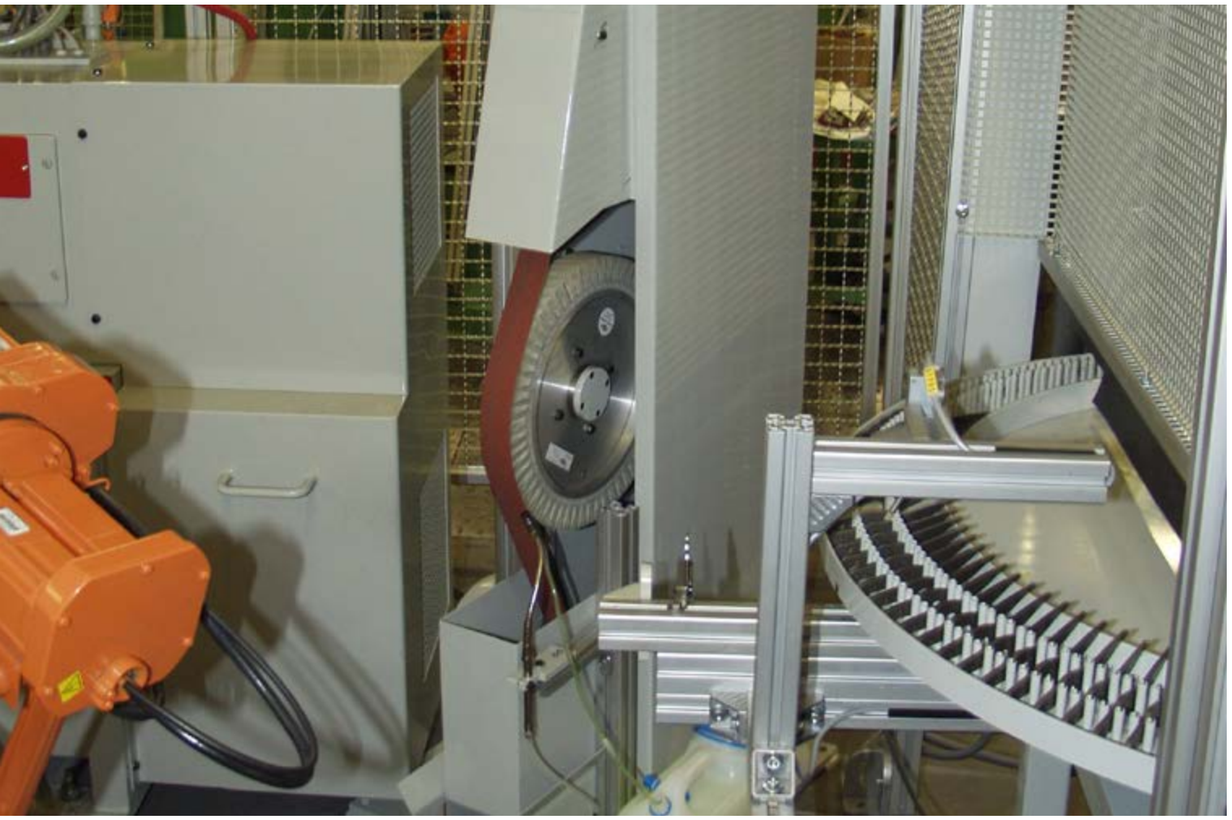
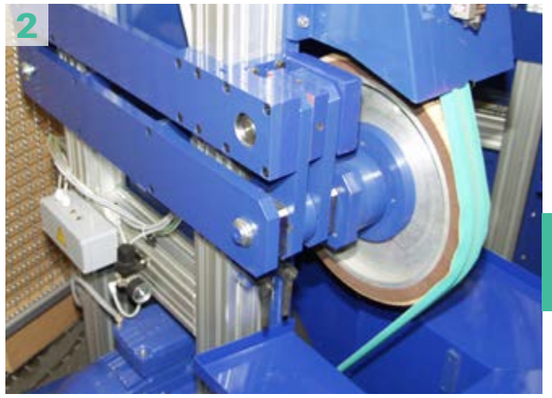




Belt grinding stations BSS

Belt grinding stations BSS are designed for use in robotic cells.

- pneumatic belt tensioner
- belt breakage control
- preparation for customer provided suction
- preparation for connection 400 Volt/50 Hz, single control cabinet or central control point
- minimum quantity cooling (optional)
- robot control with 16 belt speeds programmable (optional)

Examples of application (pictures)

1. One-sided belt grinding station BSS12 with revolver head (picture 1)
2. One-sided belt grinding station BSS14 with pressure control (picture 2)
3. One-sided belt grinding station BSS20 with horizontal abrasive belt (picture 3)
4. One-sided belt grinding station BSS22 with oscillating movement (picture 4)

Model	BSS10	BSS12	BSS14	BSS20	BSS22
Main control (kW)	4,0	4,0	4,0	4,0	4,0
Contact roll Ø	80–400 mm 3.14"–15.7"	100–200 mm 3.9"–7.87"	150–400 mm 5.9"–15.7"	50–150 mm 1.97"–5.9"	50–150 mm 1.97"–5.9"
Contact roll width	10–130 mm 0.39"–5.12"	10–130 mm 0.39"–5.12"	10–130 mm 0.39"–5.12"	10–130 mm 0.39"–5.12"	10–130 mm 0.39"–5.12"
Weight	150 kg	180 kg	350 kg	200 kg	200 kg
Dimensions - Length - Width - High	850 mm (33.46") 650 mm (25.5") 2,100 mm (82.7")	900 mm (35.4") 800 mm (31.49") 2,100 mm (82.7")	1,200 mm (47.2") 600 mm (23.6") 2,100 mm (82.7")	1,500 mm (59") 600 mm (23.6") 1,500 mm (59")	1,500 mm (59") 600 mm (23.6") 1,500 mm (59")

ACCESSORIES

Grinding and polishing stations

The Berger Gruppe offers grinding and polishing stations of various types. Polishing, grinding and belt grinding stations can be combined in a robotic cell.

Picture below: Polishing wheel change system integrated in a robot grinding and polishing system for hollow goods (see also p. 62 f.).

Polishing stations P1 (picture 1)

- polishing wheel Ø: 500 mm (19.69")
- polishing width: 100 mm (3.94")
- drive: 5.5 kW, 750 rpm
- optional with frequency converter

Grinding and polishing stations P3 (picture 2)

- grinding and polishing wheel Ø: 300 mm (11.8")
- wheel width: 100 mm (3.04")
- drive: 3 kW, 2,800 rpm
- spindle speed frequency controlled

Polishing stations P5 (picture 3)

- polishing wheel Ø: 500 mm (19.69")
- polishing width: up to 300 mm (11.8")
- drive: 7.5 kW, 2,000 rpm
- spindle speed frequency controlled

Polishing stations P3/T (picture 5)

- mounting cup wheel, Ø 200 mm (7.87")
- drive 1.5 kW; 1,400 rpm
- spindle speed frequency controlled

Grinding stations SS1 (picture 4)

- grinding with headstock
- grinding wheel Ø: 450 mm (17.7") (cup wheel)
- spindle drive: as required 15–22 kW

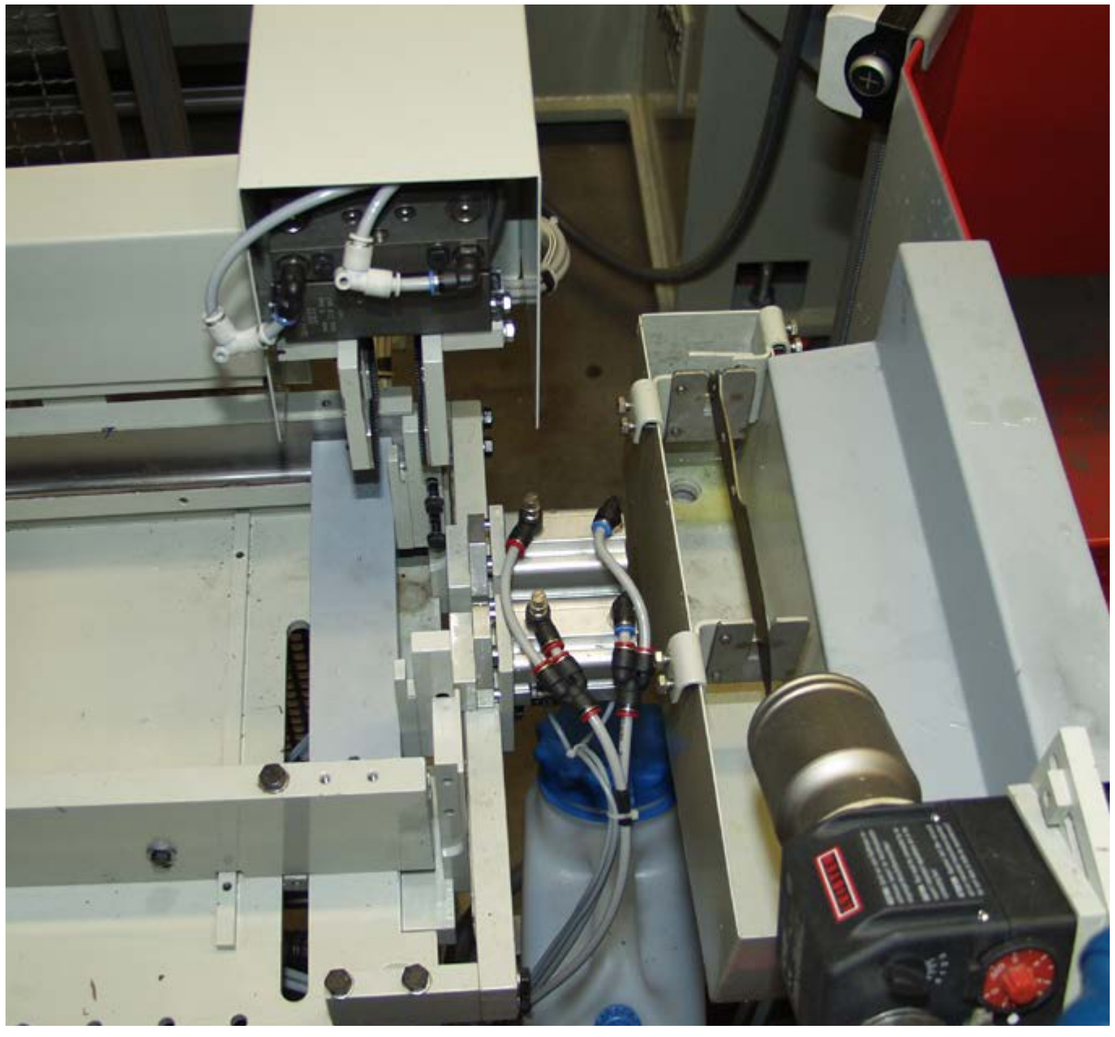
ACCESSORIES

Cleaning systems

Berger grinding machines can be combined with various cleaning systems. The workpiece is positioned in the transport chain.

Cleaning and drying take place in different stages.

As an alternative, the workpiece can also be placed in one position by the loading/unloading robot. Here the workpiece is cleaned and dried and then stacked in a sliding magazine.



Cooling systems

In combination with Berger machines, a large number of different cooling water installations for grinding emulsion are offered. The design of these systems depends primarily on the requirements for water quantity, water pressure and degree of purity.

Use of different cleaning stages:

- magnetic pusher
- paper and/or fleece filter
- ultra-fine filter

These components can be combined as required. Depending on requirements, water recooling must also be taken into account.

Additionally can be installed:

- flow monitor for monitoring the coolant flow level
- magnetic switch (water stand-/stop)
- float switch for level monitoring
- cooling unit for constant temperature of coolant

ACCESSORIES

Magazine systems

The robot cells can be equipped with magazine systems for stackable and non-stackable workpieces.

Design of the magazine systems depends on:

- shape of the workpiece (flat, conical ...)
- required magazine capacity
- variety of workpiece shapes
- orientation of workpieces

(Picture below: Berger Feeder – disordered feeding via conveyor belt in connection with camera system)

A wide range of magazine systems is available, including

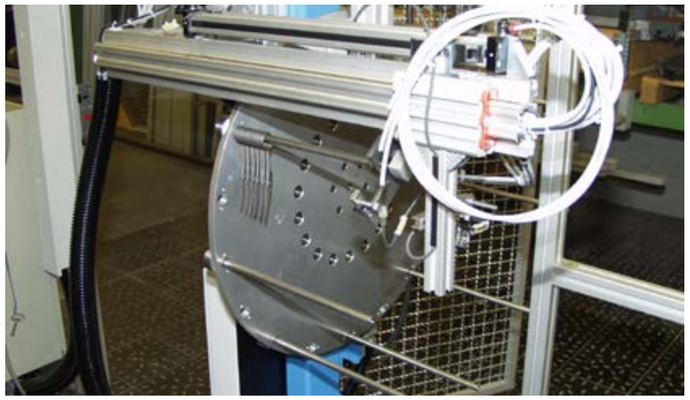
- indexing rotary table magazine
- indexing chain magazine for conical material
- indexing vertical rotary table magazine
- rotary bar magazine
- guiding of bulk material via
  - circular conveyors
  - Berger Feeder

1

Indexing rotary table magazine for knives

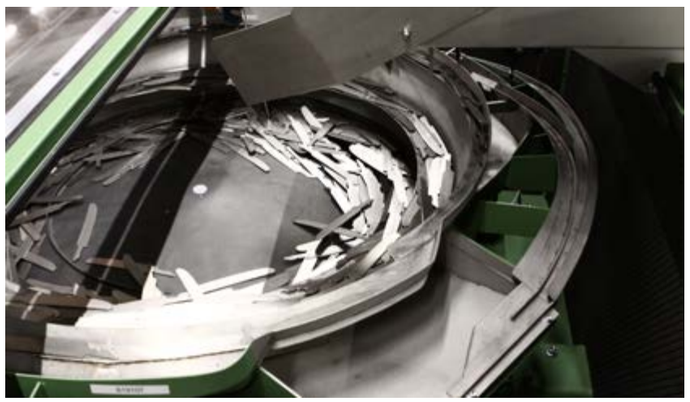
2

Circulating chain magazine



3

Indexing vertical rotary table magazine for scissors



4

Circular conveyor for bulk material

ROBOTIC PROCESS TECHNOLOGY /

AUTOMATION

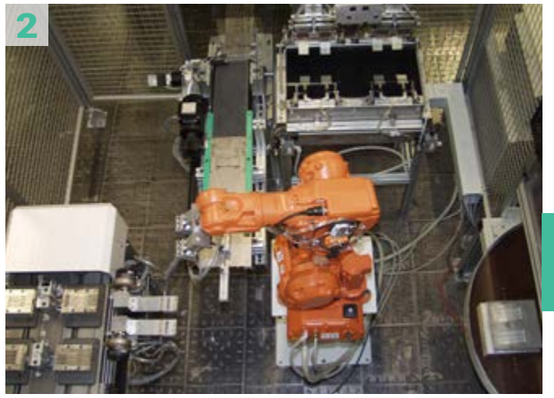
INTEGRATION OF PRODUCTION PROCESSES

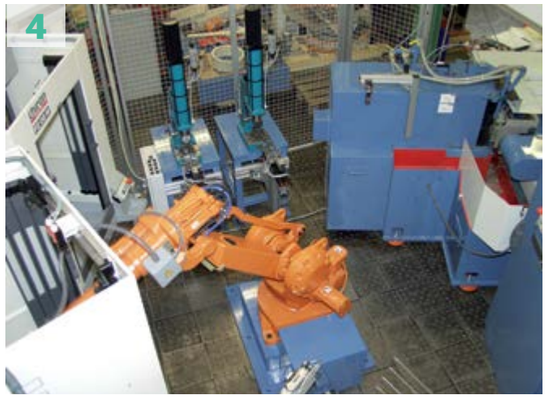
Sorters

The sorting units of the SE series magazine workpieces from cut material or feed them to a magazine.

The workpieces are separated from a bunker and fed via a conveyor belt.

The position of the workpiece is detected by a camera. The position data is transmitted to a robot control system. The robot picks up the workpiece and places it in the correct position for storage.





Integration of production processes

- overlay welding
- bending presses
- drilling / Countersinking
- hardening facilities
- painting facilities
- packaging machinery

Examples of application (pictures)

1. Robot loading of a marking laser (picture 1)
2. Painting, poling, packing of jigsaw blades (picture 2)
3. Robot feeding / robot welding (picture 3)

Integration /Automation of CNC mill centes

- preparation of workpieces for subsequent grinding processing
- special device for CNC milling centres for centering, drilling, tapping and milling the carbide recess of surgical instruments
- fixture construction and development
- robot automation and process connection with grinding or bending station

Examples of application (pictures)

4. Integration of two milling centres, two bending presses and a grinding machine type BG1/NT in combination with an indexing vertical rotary table magazine (picture 4)

PROCESS AUTOMATION HANDLING TECHNOLOGY

Robot technique for loading and unloading

For over 20 years, the Berger Gruppe has been using robots for loading and unloading conventional and CNC controlled machines.

Depending on the requirements, there is a multitude of possibilities, e.g. loading of a single machine, several machines or integration of a grinding machine into a production cell.

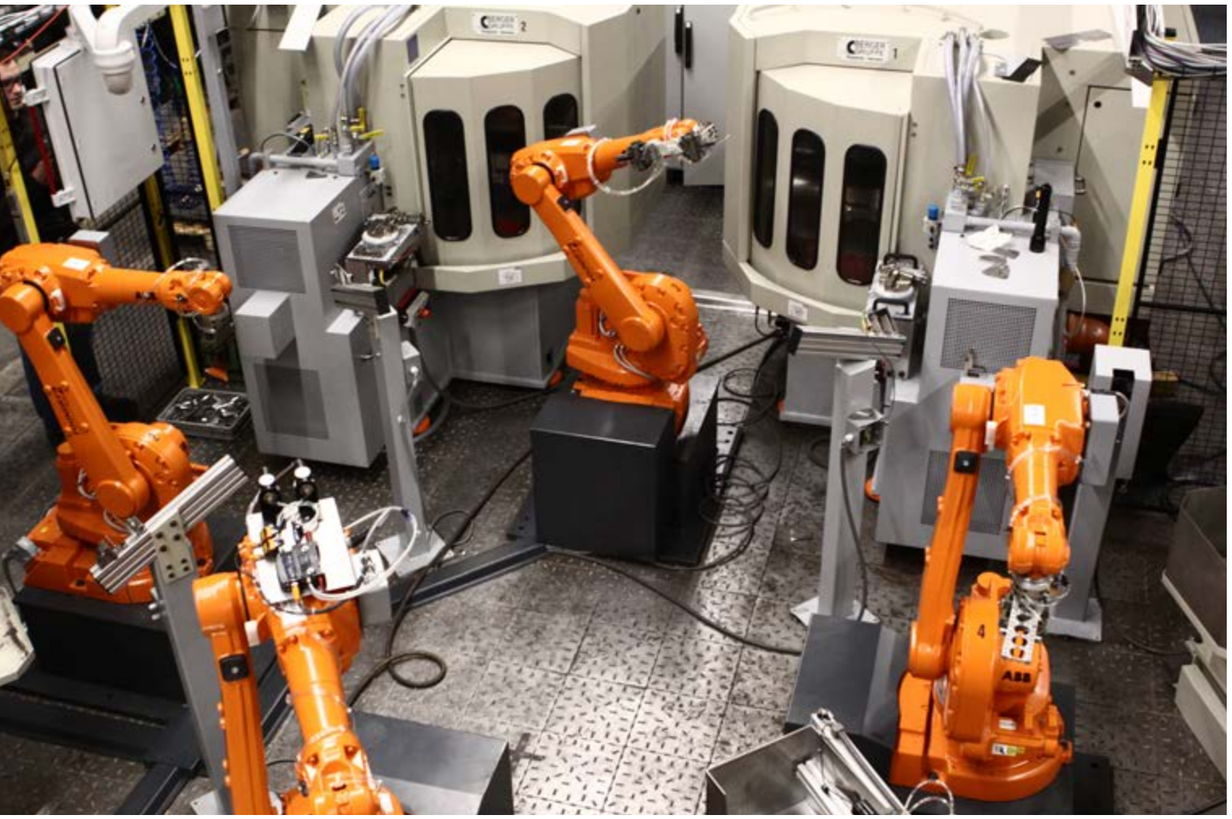
MITSUBISHI, FANUC, ESPON, KUKA, ABB, DENSO, STÄUBLI or other robot types and models are used.

Examples of application for robot loading

- surgical scissors with rotary magazine
- tools, garden shears or circular knives with vertical stacking magazine
- pocket knife blades with step conveyor

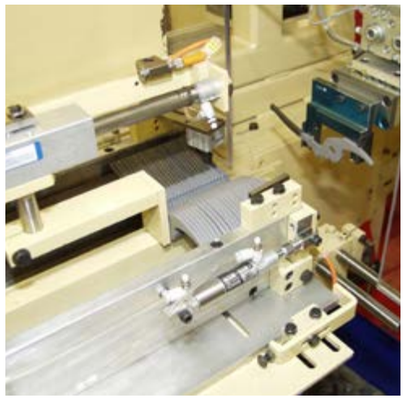
Examples of application for robot

- sharpening and/or deburring of knife blades from a magazine with sharpening machines series SM



CNC feeding systems for loading and unloading

- CNC control of horizontal and vertical transfer and loading axes
- position-accurate approach via brushless AC servo drives
- simple programming of paths and positions with the workpiece program
- freely programmable approach speed up to 100 m/min
- stable, low-wear and low-maintenance axes with toothed belt or ball screw spindle
- large loading capacity for several hours of non-stop production
- space-saving, clear design with free access to all sides of the machines
- magazine tower, chain magazine, stacking magazine, rotary indexing table, step conveyor available
- Interlinking of different machine types
- NC servo axes 180° with electromagnetic gripper, e.g. for loading of rotary table grinding machines RTS2/3 (picture above)
- Short changeover times through recall of programmed positions and paths



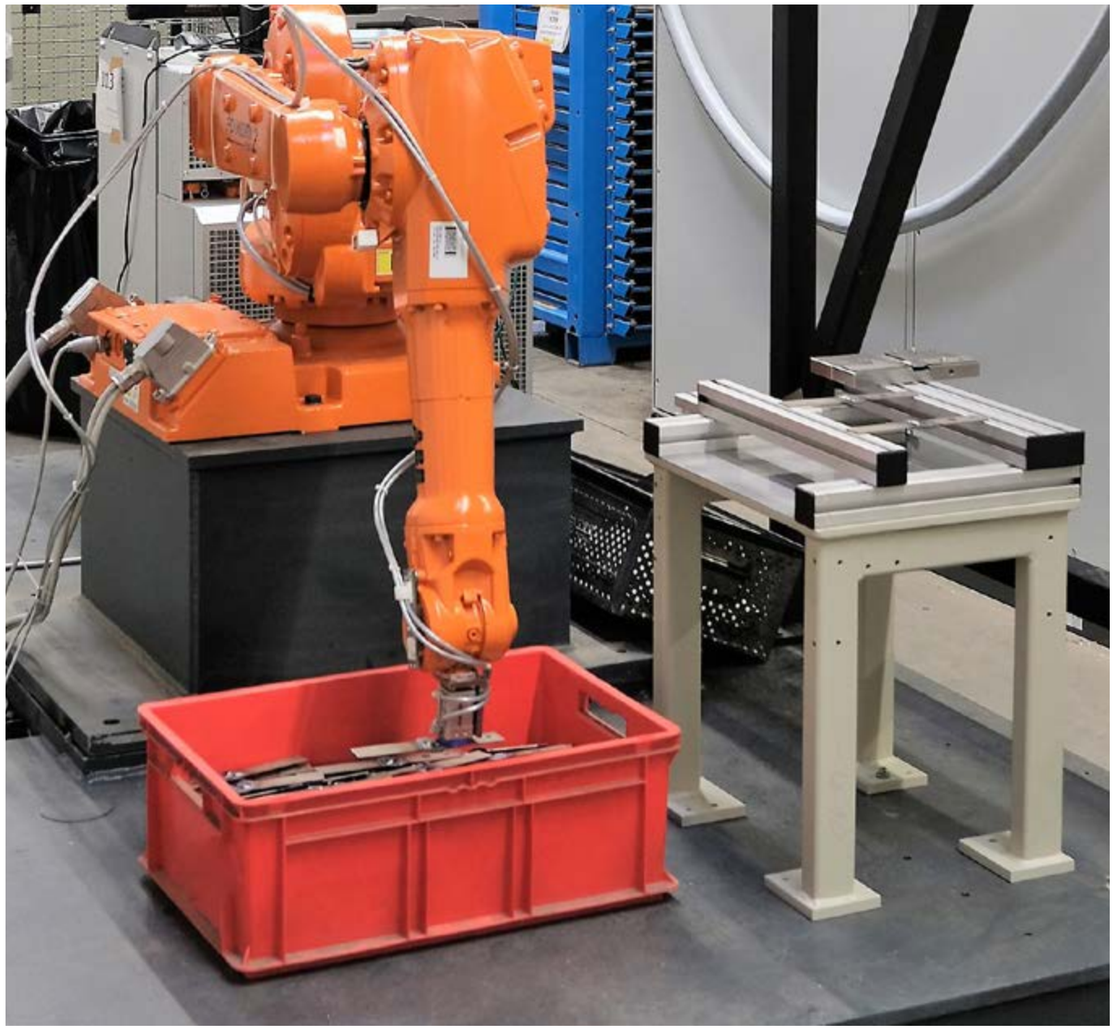
Pneumatic feeding systems for loading, transfer and unloading

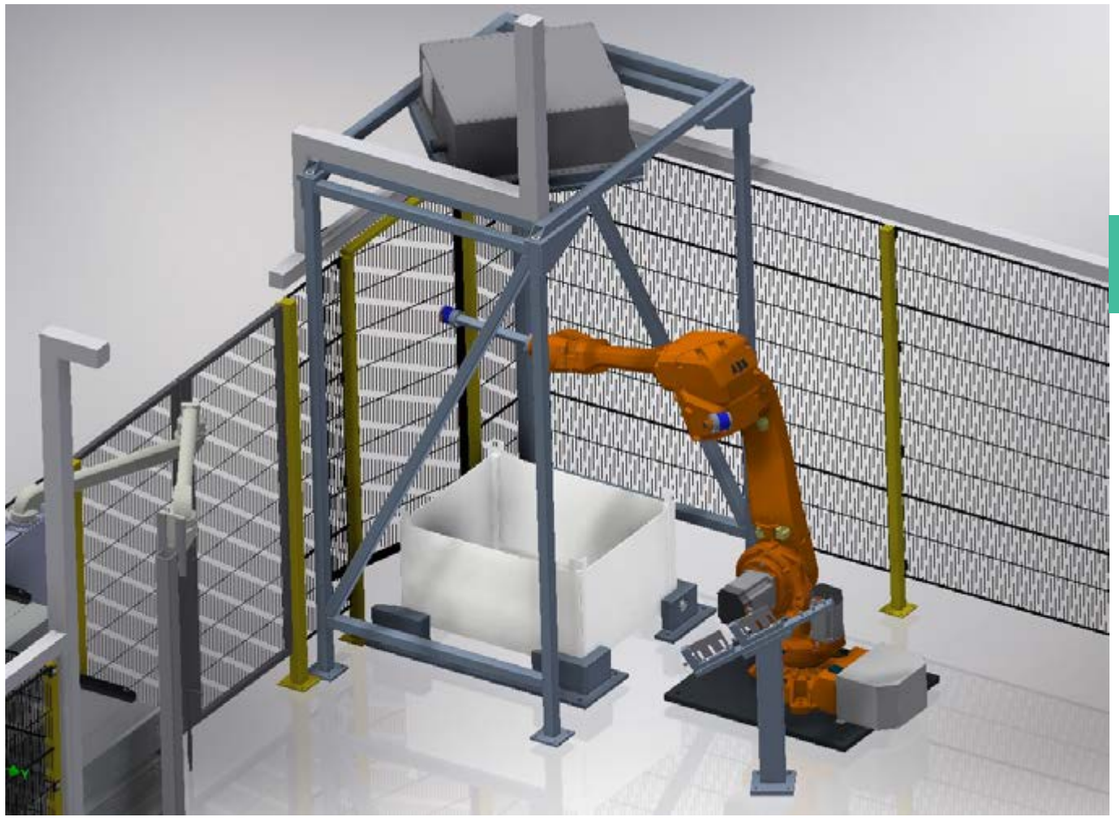
- in conjunction with conventional and CNC controlled machines using pneumatic cylinders
- various solutions available
- storage system

BIN PICKING

Handling of non-sorted workpieces

A camera system with high-resolution cameras – in this case from Keyence – detects the position of the workpieces, which are lying disorderly in a skeleton box or Schäfer box, and passes the data to the handling robot.



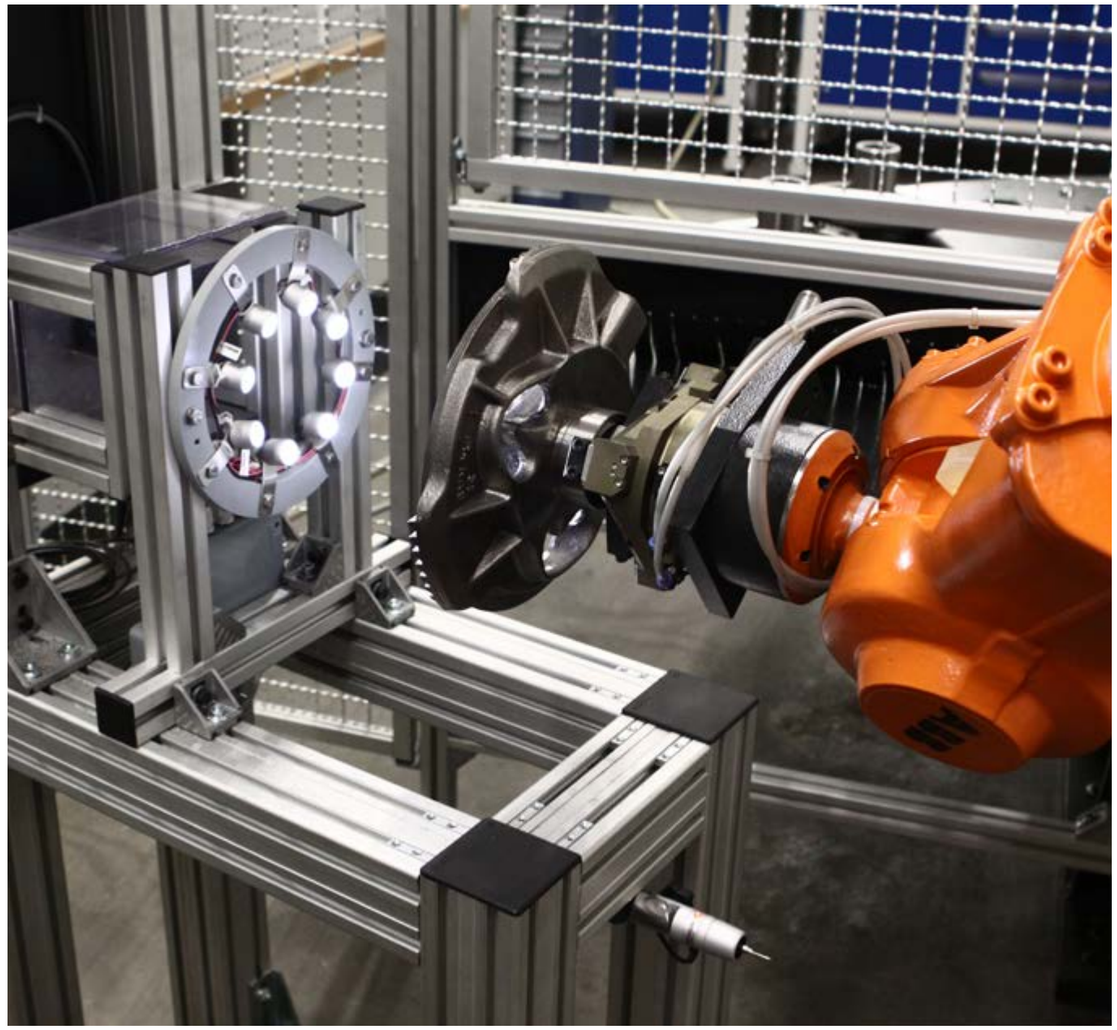


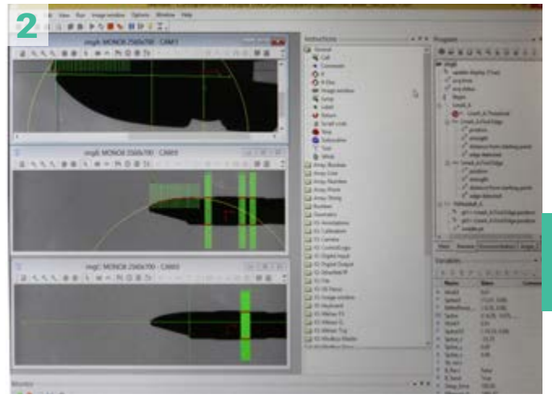
- provision and feeding of disordered workpieces with bin-picking from two KLT boxes
- docking stations for KLT containers with repeatable positioning via stops
- bin-picking robot ABB
- double gripper with two magnetic grippers with adjustable magnetic force for removing workpieces from KLT box
- 3D robot vision
- camera-controlled turning and centering station
- 3D position detection via camera measuring system with high-resolution cameras
- automatic calculation of the optimal robot path
- special robot gripper depending on the workpiece
- loading robot with adjustable magnetic force for loading and unloading the grinding machine and loading the cleaning and drying station

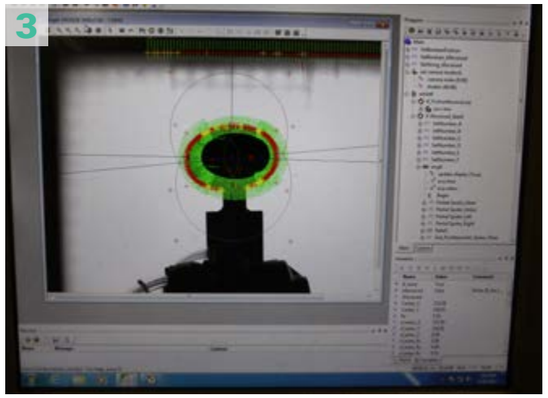
MEASURING TECHNIQUE

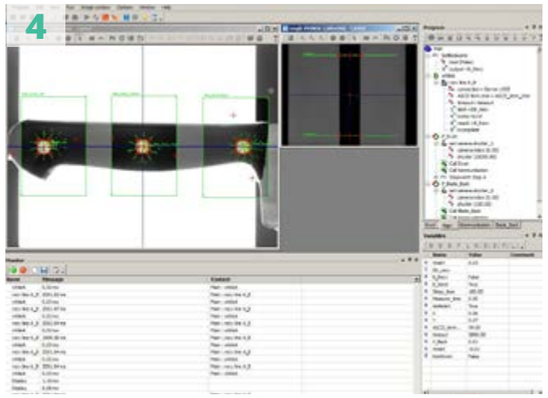
Measurement of workpieces with camera and laser measurement technology

By means of cameras, laser or mechanical probes, the workpieces can be measured before or after machining and thus the machining program can be influenced.









Examples of application (pictures)

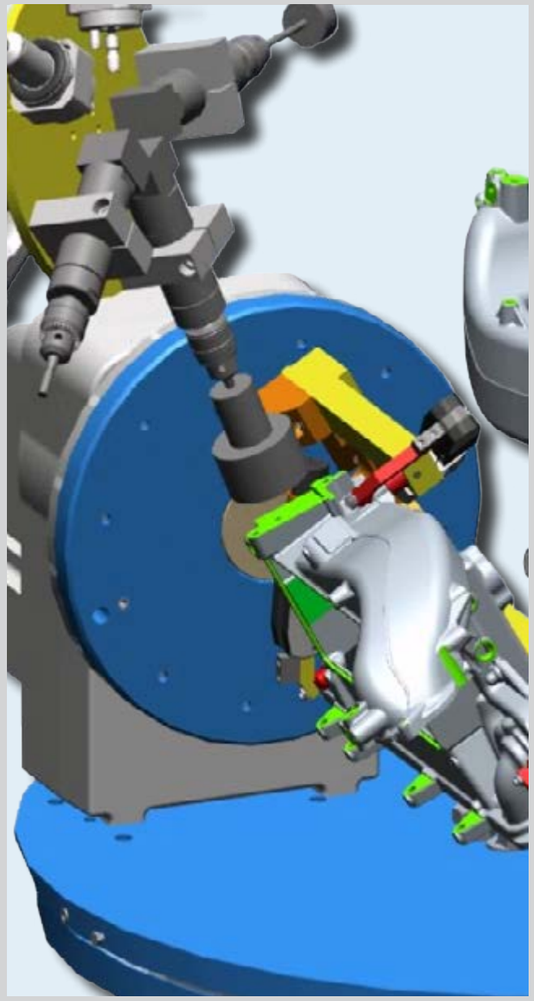
1. 3D measurement with probe (picture 1)
2. Compensation of workpiece tolerances by camera measuring system (picture 2)
3. 3D-measurement with camera (picture 3)
4. Camera measuring system with graphic interface for part measurement (picture 4)

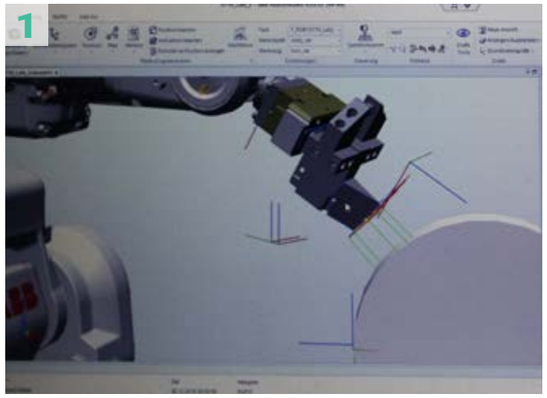
PROGRAMMING / SYSTEM MONITORING

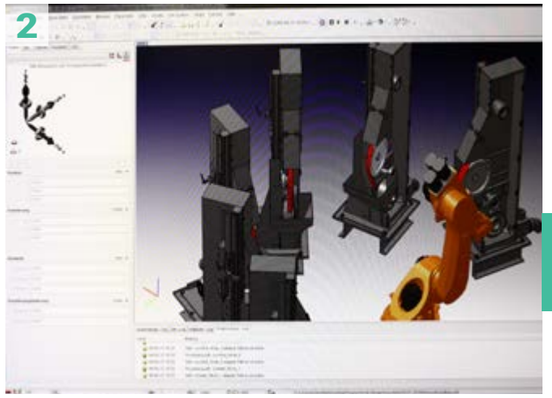
Programming

The programming can be done offline with appropriate software – e.g. RobotStudio (pictures below).

The processes can also be simulated or the machining times determined.







System monitoring

The system states can be monitored by means of an app for monitoring system states with e-mail notification or in conjunction with a central PC.

Warnings are shown on the display or sent by e-mail.

Examples of application (pictures)

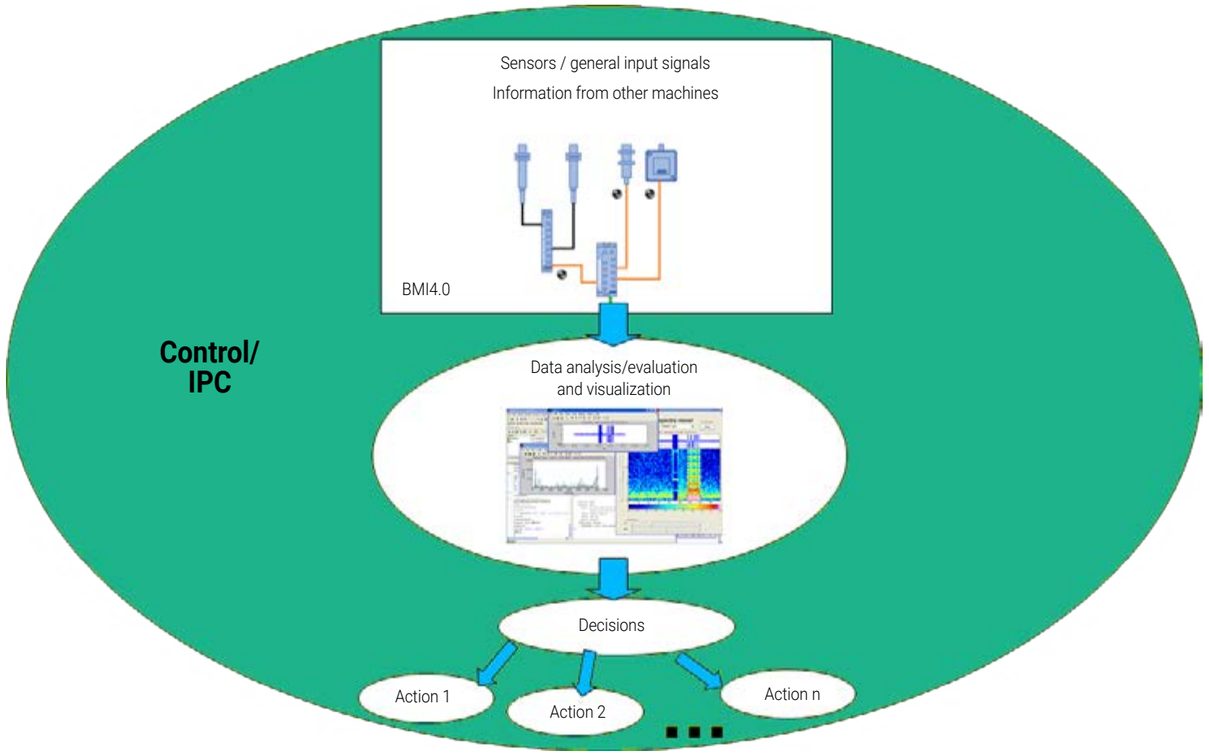
1. Robot programming in conjunction with RobotStudio: guiding of the workpiece (picture 1)
2. 3D offline programming in conjunction with KUKA robots (picture 2)
3. Monitoring of the system status with a central computer (picture 3)
4. Monitoring of the system status with e-mail monitoring (picture 4)

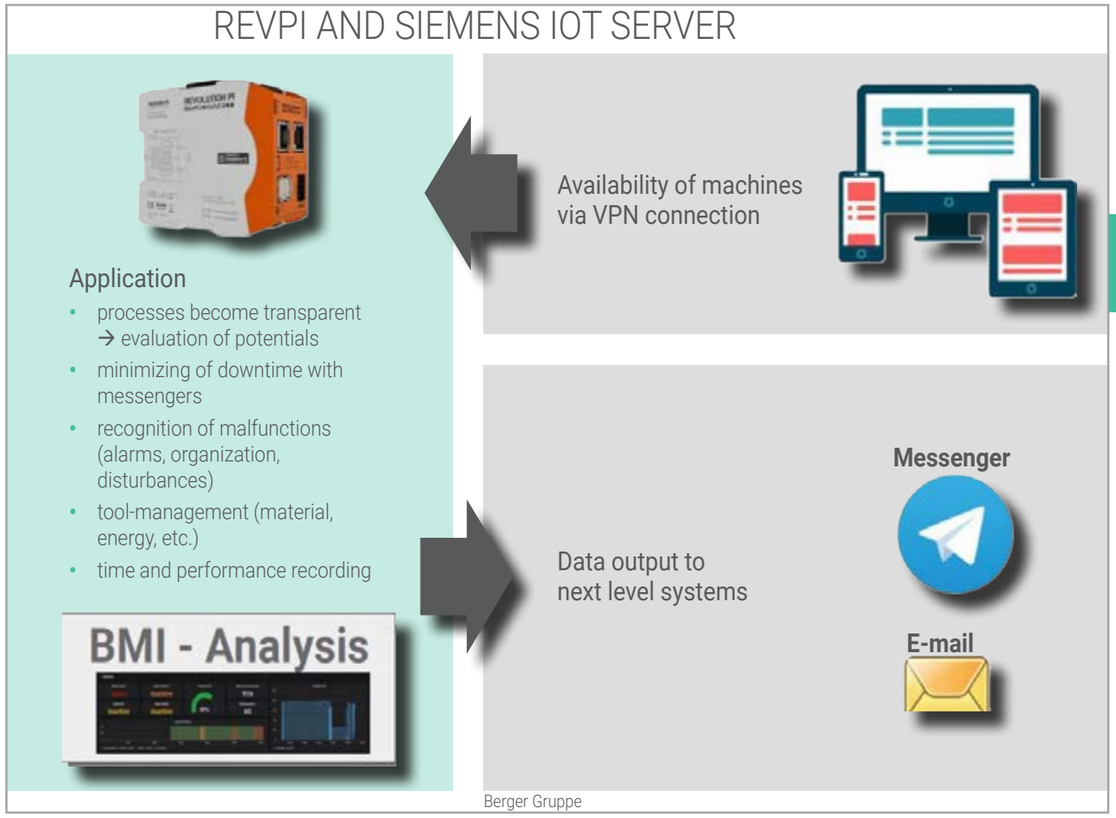
BERGER MACHINE INTERFACE 4.0

SENSOR TECHNOLOGY, DATA EVALUATION/REDUCTION AND RESOURCE CONTROL WITH ACTIONS

Functions of BMI4.0

- universal bus-based detection of sensor signals at a machine such as coolant temperatures, engine load, AE signals for spindle monitoring, air pressure and volume
- data reduction and visualization with evaluation software
- networking with IOT or company network
- programming of interfaces for individual connection to existing BDE or ERP systems with OPC server





Advantages of BMI4.0

- prerequisite for Intelligent Resource Management (IRP)
- prerequisite for preventive maintenance and real-time monitoring of the machine park
- acquisition of process data for process optimization and recognition of process dependencies
- optimization of downtimes and set-up times, thus optimal capacity planning

Industry 4.0

Robotics and KI, IO-Link system description: Sensor Signal Acquisition

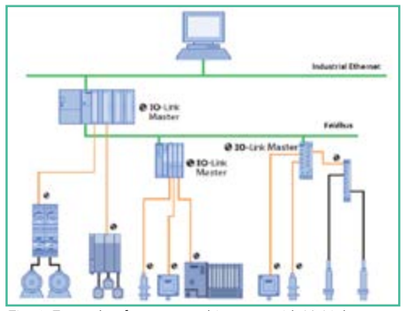


Fig. 1: Example of system architecture with IO-Link

Examplel: Berger Maschine Type RFS4/NT
Application O-Link for the detection of sensor signals

db888.dbd18	Spindle flow rate (l/min)	F	16.0000
db888.dbw4	Flow rate grinding water (%)	D	128
db888.dbd18	Temp. grinding water (°C)	F	34.0000
db888.dbd22	Temp. spindle water (°C)	F	29.7932
db888.dbd26	Total air consumption (m³)	F	4984.9510
db888.dbd38	Act. air consumption (m³/h)	F	4.3000
db888.dbd34	Temp. compressed air (°C)	F	38.6000
db888.dbd44	Temp. control cabinet	F	32.2000
db888.dbd54	Hydraulic pressure (bar)	F	0.0000
db888.dbd48	Hydraulic temperature (°C)	F	31.9000

REQUEST FOR QUOTATION

QUESTIONNAIRE FOR TECHNICAL DATA

Company	_____
Contact	_____
E-Mail	_____
Phone/Fax	_____

WORKPIECE	Workpiece			
	Lot size			
	Batch size			
	Number of types			
	Sample			
	Drawing			
PROCESSING	Contour milling	Polishing		
	Back grinding	Scalloped grinding		
	Flat grinding	Serrated grinding		
	Flat bevel grinding	Bolster Machining		
	Hollow grinding	Handle Machining		
	Glazing	Sharpening		
MACHINE	Automatic loading/unloading	central	decentralized	
	Autonomy, capacity magazine			
	Coolant system			
	Flow Control for coolant supply			
	Magnet valve for coolant flow start/stop			
	Chiller for coolant system			
	Coolant tank	single-shell	double-shell	
	Exhausting device			
	Connection	central	decentralized	
	Full enclosure			
	Safety fence			
	Tension			
	Preferences control	Andron	Bosch	Siemens
	Preferences robot	ABB	KUKA	
	Starting up	customer's site		
	Transport			
	Guarantee extension			

Please send the questionnaire to sales@bergergruppe.de.

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