



Dynamism in five axes

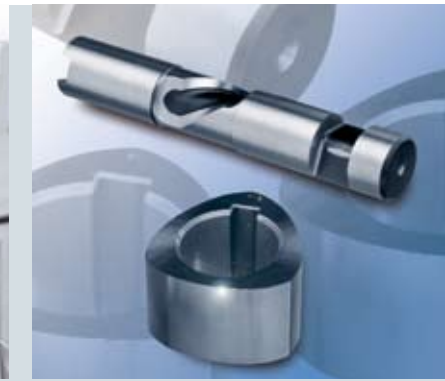
CNC-GRINDING WITH THE 305 SERIES



Areas of application: Medical equipment industry



Tool manufacture



Production



Easy to access and simple to set up

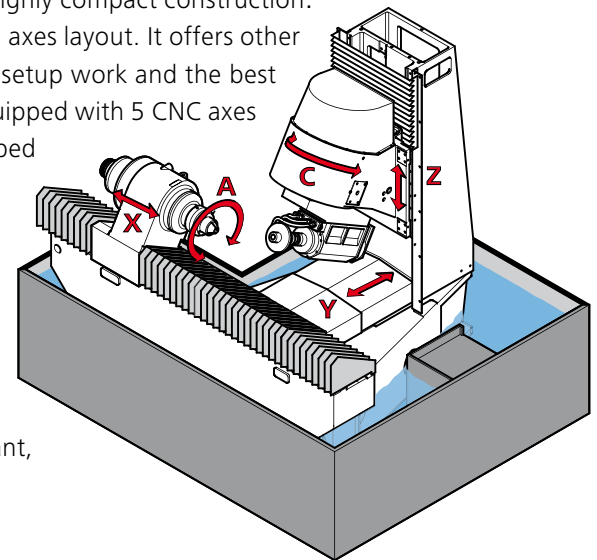
The 305 series – large machining area, small footprint

Compact and versatile

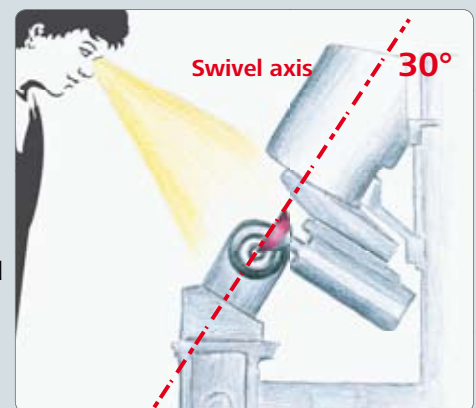
The 305 series of exceptionally flexible, high-precision, 5-axis CNC universal grinders are used in almost all sectors of modern industry and are as suitable for the manufacture and reshaping of cutting tools as they are for the pre- and finish-grinding of production components, including complex contours and geometries.

An important characteristic of the 305 series is its exceedingly sturdy and highly compact construction. The grinding spindle tilts at a 30° angle, which allows for a particularly rigid axes layout. It offers other advantages too: a large machining area, a small footprint, easy access for setup work and the best possible view of the grinding process. All machines in the 305 series are equipped with 5 CNC axes and state-of-the-art digital control technology. Schütte's in-house developed software, SIGS, ensures the machines are easy to operate and program.

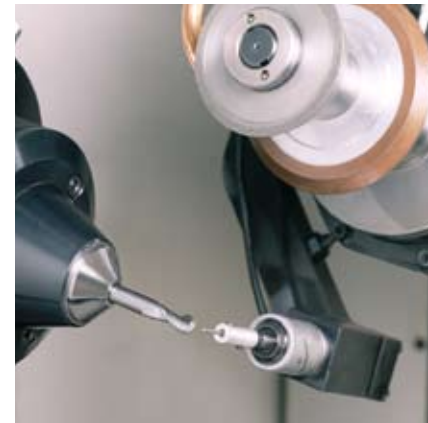
Thermostability is of vital importance for the high-precision machining operations carried out on the 305s. The machine construction takes account of this. Machine base and coolant tank form a single unit, with the latter holding 400 litres of temperature-controlled coolant. The heat sources in the machine, such as the powerful drive motors for grinding spindle, workpiece rotation and swivel axis, are all fluid-cooled, to maintain a constant, homogenous temperature level across the whole of the machine.



- Compact construction – small footprint and large machining area
- Direct view of the machining process – optimal cover design and no drip edges
- Open machining area – making access and setting up easy
- Rigid axis layout and optimal force transmission – tilted swivel axis
- A minimum of compensatory motions – optimised pivot point of the grinding spindle
- Thermostability – drives are being cooled and temperature of machine base maintained
- Simple to operate – with the operator-friendly Schütte software SIGS



**OPERATOR-FRIENDLY, STURDY AND SPACE-OPTIMISED –
THE 305 WITH ITS SPECIAL AXES LAYOUT**



A probe automatically defines the position of the raw-part

Automatic grinding wheel changer with appropriate coolant distributors

Powerful and flexible

Schütte's answer to the steadily growing demands on 5-axes machining made by component complexity and tightening tolerances, is a concept that optimally coordinates machine construction, drive technology, control system and software. Components of fundamental importance in this undertaking are the powerful precision drives.

All rotary drives are of the digital type and feature high-resolution direct measuring systems. The grinding spindle with its exceptional power rating of 15 kW can handle large chip removal volumes and may even be used for high-performance creepfeed grinding, an operation that calls for high grinding spindle torques. The HSK receptor for the grinding wheels guarantees a high degree of repeat accuracy and facilitates a rapid manual or automatic exchange of wheel sets. A speciality of Schütte: the coolant nozzles are exchanged together with the grinding wheel. This ensures an optimal coolant supply for the relevant grinding process when wheels are changed automatically.



The excellent concentricity and accuracy of pitch of the universal rotary workpiece axis ensure that highly demanding operations, such as helix grinding or the grinding of tool cone angles, are carried out efficiently, accurately and with process integrity. To achieve this, the axis has a large speed range: max 2,500 min⁻¹ as standard and, depending on machine variant, up to 4,000 min⁻¹ optionally. This ensures that operations such as external cylindrical profile grinding or lateral peelgrinding can also be accommodated. A measuring probe automatically defines the position and geometry of the clamped workpiece. min⁻¹.

- Freedom of movement – 5 CNC axes and the latest digital control technology
- Precision in processing – digital direct drives with high-resolution measuring systems for all rotary axes
- Freedom of choice – you choose between ball screw drives or linear motor technology in X, Y and Z, just as requirements demand
- Two for the price of one – the universal workpiece axis is suitable for cylindrical as well as helical grinding operations
- Optimal coolant supply even after a grinding wheel change, thanks to the pre-allocation of coolant distributors
- Modular and flexible – comprehensive range of workholding, -steading and -handling equipment

HIGH POWER DENSITY IN ALL DRIVES

305 – the universal basis

The 305 forms the basis and the starting point of the series. Its variants have been developed in the spirit of its original concept and optimised to cover different applications. The 305 is equipped with direct drives in all rotary axes and with ball screws in the three linear axes.

The main area of application for the 305 is in the manufacture and reconditioning of metal- and woodworking tools, but its versatility ensures that it can also be used for the manufacture of a diversity of production components.

The strength of the 305 is its comprehensive equipment range. Covering a multitude of applications is a choice of equipment for the holding, guiding and steadying of workpieces during machining. Depending on concentricity requirements, there are collet clamping mechanisms, automatic multi-range chucks and high-precision hydraulic expansion chucks. To increase precision, a mechanical eccentricity compensation for clamped workpieces is available for some workholding fixtures. Tailstocks and steadies – the latter either fixed, below the grinding position, or travelling – are available to support the component. Where the workpieces are loaded automatically, the steadies can be pneumatically tilted away and later repositioned.

Automatic loading of the various grinding wheels is a standard feature. As an option, the wheels can also be laser-calibrated and dressed on the machine. A pick-up loader – according to requirements equipped with a single or a twin-gripper – is available for the loading and unloading of workpieces.



- A comprehensive range of auxiliary equipment ensures the machine can be used for a variety of applications
- Flexibility in the choice of workholding systems from a range of options
- Variety in steadying and guiding the workpieces, either with tailstock or steady
- Automatic loading and unloading of the workpieces by pick-up loader
- Automatic definition of workpiece position and geometry with 3D measuring probe
- Laser-calibration and dressing of the grinding wheels on the machine

VERSATILE IN ITS APPLICATION, WITH A WIDE RANGE OF ACCESSORIES



Profile punches



Multi-functional tools



Profile plates



305linear – dynamic drive technology

Where the demand is for precision coupled with high output rates, the 305linear is top of its class. Its 5 CNC axes are equipped with anti-backlash AC direct drives, with X-, Y- and Z-axis being driven by linear motors. This makes the machine exceptionally fast, dynamic and accurate, resulting in a better grinding performance, a better surface finish and greater precision.

This drive technology is particularly efficient in the machining of demanding workpieces, such as tools with all-round profile, which can sometimes be asymmetrical as well, or the variety of orthopaedic implants used in the medical equipment industry.

Extremely high axis accelerations of 1g and speeds of, for instance, up to 48 m/min in X, make it possible to use the pin chasing method for the multi-axis, linear grinding of these complex contours. This increases output and reduces tooling costs, as the process uses simple wheel geometries rather than expensive profile wheels.

A fluid-cooling system that supplies all axes, and the temperature controlled, micro-filtered coolant, ensure that the other preconditions for a high-precision, technologically optimised grinding process are met. Five magazine positions for grinding wheels as standard and a grinding speed that, as an option, can be increased to max 24,000 min⁻¹, lend the machining process great versatility.

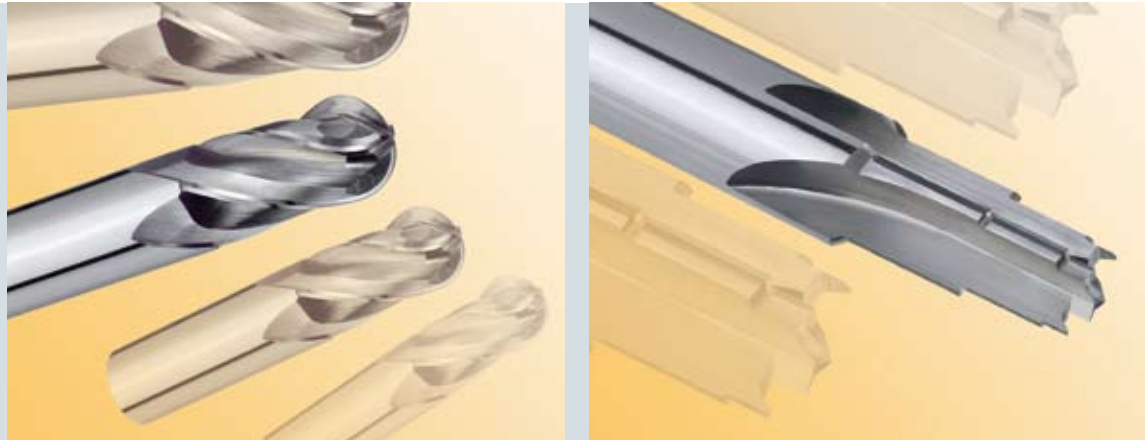


- Impressive productivity levels with accelerations of up to 1g and speeds of up to 48 m/min
- Backlash-free direct drives in all axes guarantee dynamism and precision
- Precise, fast contouring, with excellent dynamic rigidity and damping in all infeed axes
- Constant quality through repeat accuracy in positioning and motion of the axes
- Constantly maintained dimensional accuracy as a result of a thermostable machine construction and the fluid-cooling of all drives
- Temperature-controlled, micro-filtered coolant for best possible grinding quality

Dynamic and with great contour integrity – the 305linear is ideal for the machining of free-form surfaces

**AT THE SPEED OF LIGHTENING AND WITH GREAT PRECISION –
THROUGH LINEAR TECHNOLOGY**

Typical tools, sharpened on a Schütte 305trend Grinder



The 50-position chain magazine forms part of the package



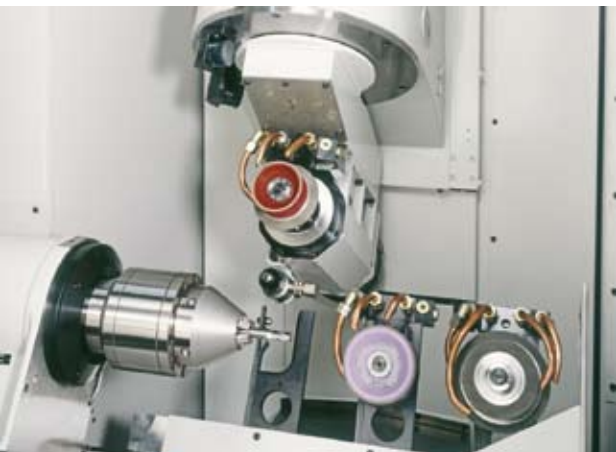
305trend – cost-effective resharpening

The *305trend* is a finely tuned package of machine, equipment and peripherals designed for the resharpening of cutting tools. Although their price is highly competitive, the machines of the 305 family are characterised by their high technological merit. Basic design, kinematics, machining area, the 5 CNC axes, machine control system and software are all identical. The economical advantage of the *305trend* lies in the fully automatic processing of the most diverse resharpening jobs.

The spectrum of workpieces that can be resharpened coincides to a large extent with the wide range of workpieces covered by the other 305s. However, the power ratings of its drives have been chosen to suit the particular criteria of tool sharpening. The grinding spindle, for instance, has a rating of 8 kW and a maximum speed of 12,000 min⁻¹.

The package includes an integral chain loader with 50 workpiece positions. The workpieces are clamped in a multi-range chuck. This allows for the machining of not only a variety of tools, such as drills, milling cutters or step tools, but also for the resharpening of tools with different shank diameters in "mixed lots". The **SIGS** software, developed by Schütte, helps to simplify the task of allocating and processing the tools supplied by the chain loader.

The machining process is supported by having three different sets of grinding wheels complete with appropriate cooling nozzles on stand-by. As on all machines of the 305 series, the cooling nozzles are changed together with the grinding wheels. The package is complemented by an oil mist extractor and a coolant processing unit.



- High technological standard, with all the design features and associated advantages of the 305 machine
- Process flexibility, provided by the automatic exchange of three grinding wheel sets with up to 9 wheels
- Unattended production, using a 50-position tool store that forms part of the integral pick-up loader
- The flexibility to machine different tool diameters, using a pneumatically controlled multi-range chuck
- Complete package, including oil mist extractor and coolant processing unit

A COMPLETE, ECONOMICALLY PRICED PACKAGE OF MACHINE, EQUIPMENT AND AUTOMATION FOR THE RECONDITIONING OF TOOLS



Left:
Workpiece sample:
medical drill

Right:
The 305*micro* grinds micro-
tools from 20 µm upwards



The patented work guide system WFS provides optimal guidance even for workpieces with a large L/D ratio (e.g. deep-hole drills)



Cutting edge preparation on the machine, using the magnet-finishing process

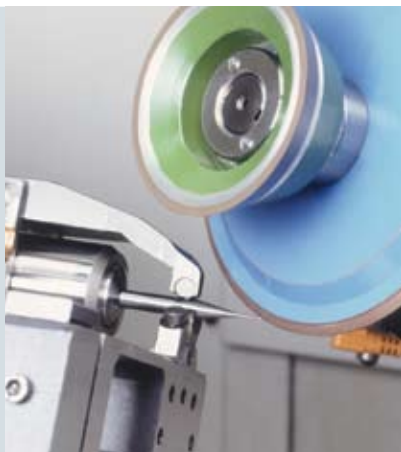
305*micro* – very big in coping with small things

The manufacture of micro-tools makes particular demands on the machine technology. Schütte's answer to these demands is the 305*micro*, a machine that impresses with some innovative solutions for the grinding of the smallest tools.

The preconditions for a micro tool's good performance are an excellent surface finish on the cutting edges and absolute concentricity between cutting edges and tool shank. The 305*micro* offers optimal preconditions for the fulfilment of both criteria. The Schütte-patented work guide system WFS guarantees accurate, play-free, rigid clamping of the workpiece and a low-vibration grinding process – that includes long, thin workpieces. It is achieved by having the workpiece at all times supported very close to the grinding point. The use of linear motors ensures that the grinding process is precise and highly dynamic and that machining times are kept short. The grinding performance is no less impressive in the case of the cylindrical grinding of the smallest diameters: the rotary axis for the workpiece offers speeds of up to 4,000 min⁻¹.

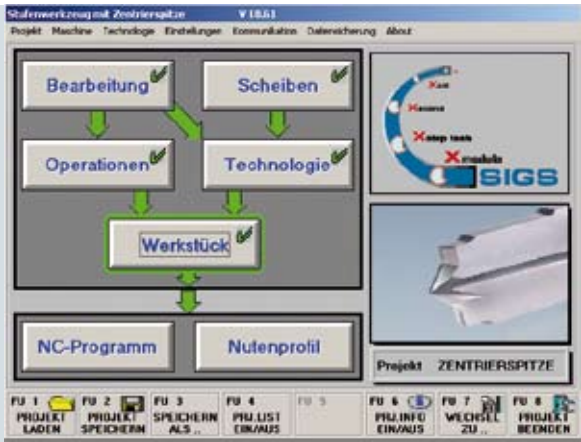
For such small tools especially, a clearly defined, reproducible preparation of the cutting edges is most important. Schütte is the first grinding machine manufacturer to include magnet-finishing equipment in their modular concept. Without the need to re-clamp the component, the fully-automatic finishing process produces a clearly defined, evenly rounded off surface in the µm range all along the cutting edges – irrespective of the tool geometry.

The Schütte work guide system makes the accurate alignment of workpieces a comfortable process. Support prism and clamped workpiece are fine-adjusted as one unit. The flexure hinge for the required fine adjustment, the overhead guide and the base holder are then aligned – again as one unit – with the workpiece rotary axis.

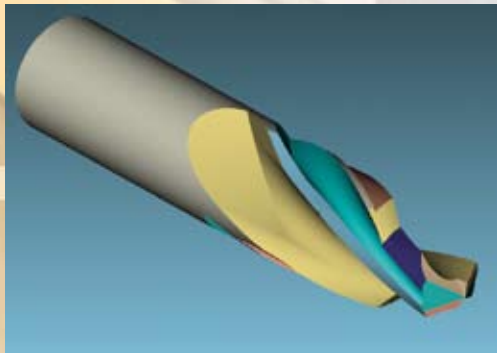
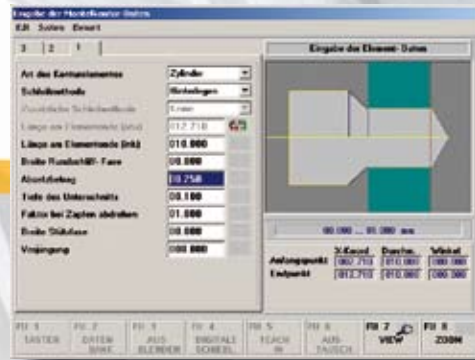
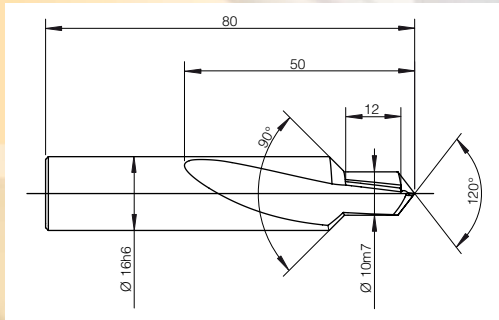


- Highest precision through backlash-free direct drives with closed-loop control in all axes
- Accurate, play-free workpiece guidance with patented work guide system WFS
- Simple alignment of the workpiece without having to unclamp it
- Setting the machine is made more comfortable by menu-driven calibration cycles for workpiece positioning and alignment
- Excellent surface finishes on the tool through low-vibration grinding process, achieved by using the WFS
- Constantly maintained quality through thermostability, as a result of fluid-cooling the drives
- Precision grinding with temperature-controlled, micro-filtered coolant

**ACCURATE GUIDANCE AND LOW-VIBRATION GRINDING PROCESS
THROUGH USE OF PATENTED WORK GUIDE SYSTEM**



Siemens 840-D control system with SIGS user interface



SIGS offers optimal support from drawing to finished tool

SIGS – impressively simple

Ease of operation and programming are not impossibilities when dealing with complex kinematic processes. Schütte proves this with their comfortable, in-house developed operator and programmer interface SIGS (Schütte Integrated Grinding Software). This software of modular design offers the user extensive support and is continuously being developed, with still greater flexibility in mind, to cover new applications.

SIGS supports the operation and, in particular, programming of the machine. Based on machine, grinding wheel, technology and workpiece data SIGS will generate an NC program within seconds. Program management and parameter input are modelled on the Windows format and not difficult to learn. The associated graphics make parameter inputs easier to understand. For many parameters there are also default values that can be retrieved from a data bank. The particular strength of SIGS is to be found in the programming of complex cutting tools. In fact, SIGS covers market demands that go far beyond those for standard tools.

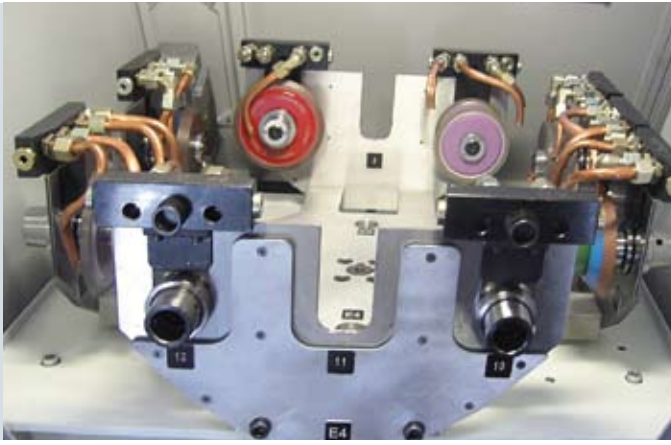
The software also allows the grinding of workpieces characterised by free-form surfaces, such as knee joint implants for the medical equipment industry. For surfaces that cannot be parameterised, SIGS offers an interface to CAD/CAM systems, where tool travels are generated on the basis of a 3D model. Free NC programming is available for those users who want to employ the machine for other grinding processes. And they do not have to forego the comforts of the SIGS user interface.

- Comprehensive, comfortable, operator-friendly control system interface
- Simple to learn, with intuitive, Windows-orientated menu navigation
- Extensive support in the generation of programs and the selection of technologies, especially for tool grinding
- The possibility to work concurrently with a work station in production engineering
- Further flexible development, to cover other customer requirements and new machine functions
- Free programming, with the operator comfort SIGS provides
- CAD/CAM coupling, and simulation



MODULAR SOFTWARE TO SIMPLIFY OPERATION AND PROGRAMMING

Left:
12-position grinding wheel
changer



Right:
Chain-type workpiece
magazine



Automatic loading and un-
loading of the workpieces by
pick-Up loader

Efficiency through automation

Output rates are not only increased by the use of efficient grinding processes but also by a greater degree of automation. This calls for flexible concepts in two particular areas: automatic grinding wheel changeover, for on-the-spot provision of the various technologies required, and workhandling, to allow for unattended operation. For both scenarios Schütte offers innovative and tailor-made solutions.

The automatic grinding wheel exchange utilises the machine axes for an accurate approach to the transfer position. An HSK interface in the spindle ensures μ -range positioning of the grinding wheel. The coolant distributors are exchanged with the wheels, to guarantee an optimal coolant supply for every grinding process. A comprehensive range of grinding wheels is held on stand-by in an adjacent magazine, for which diverse configuration levels provide almost unlimited flexibility: there is a choice of 3, 4, 5, 12 or 24 wheel positions.

Workpiece loading and unloading is done by pneumatically operated swivel arm. Where the arm is equipped with a twin-gripper, both activities can be carried out back-to-back. The swivel arm collects the workpieces from the chain magazine or from different size pallets – with a capacity of max 170 workpieces in the former and, dependent on workpiece diameter, max 400 positions in the latter. As an alternative to the pick-up system the workpiece rotary axis can also be directly loaded by robot. This is of advantage where short loading times and large workpiece buffers are the order of the day. A robot cell also allows for the integration of other processes, such as laser-marking.



- Process flexibility through automatic grinding wheel changeover
- Optimal coolant supply and lubrication, as grinding wheel and coolant distributor are exchanged together
- Versatility in technology application, provided by different sizes of grinding wheel magazines
- A choice of workhandling equipment: pick-up loader or robot
- A choice of workpiece buffer: chain magazine or pallets
- Flexible job processing with software support

Grinding wheel with dedicated coolant distributor



Left:
24-position grinding wheel changer

Right:
Optimal software support
– also for peripherals



Make your money overnight

A highly flexible, fully automated grinding centre combines the components for the automatic handling of both grinding wheels and workpieces. The grinding centre shows how new levels of productivity can be explored by combining individual, high-performance machine modules into an impressive whole.

A 12- or 24-position wheel changer ensures on-the-spot availability of the tools for a wide range of grinding processes that generate a variety of workpiece geometries. A chain loader with the capacity to accommodate 170 workpieces provides an extraordinarily large buffer for automatic processing. Unattended production during the night shift, for instance, is one way of increasing productivity levels.

The flexibility in accommodating a variety of workpiece diameters is of decisive advantage in the re-sharpening of cutting tools. On the 305, tools of different diameter are automatically loaded – either by fitting spacer sleeves before stacking them in the chain loader, or by separately loading clamping sleeves for the required diameter changes. Working with clamping sleeves results in a higher degree of machining accuracy, as it involves high-precision hydraulic expansion chucks.

Depending on the degree of flexibility demanded, the software supports a diameter-dependent workpiece bundling or job-oriented processing, and even a mix of both.



- Instant availability of a variety of grinding technologies, provided by large wheel magazines
- Unattended night production, utilising large workpiece buffers
- Software support in job management and for peripherals
- Flexible, diameter-oriented workholding and –handling
- Flexibility and accuracy, provided by multi-range chucks with mechanical eccentricity compensation
- Highest precision, achieved by using hydraulic expansion chucks

The chain loader with a capacity of 170 workpieces provides a formidable buffer for unattended production

THE FULLY AUTOMATED GRINDING CENTRE



Rough grinding



Milling



Belt grinding



Polishing



Schütte 305 – more than just grinding

The integration and consolidation of process streams frees considerable potentials for optimisation and cost reduction in production. However, there are often no machine tools capable of handling the different machining technologies of a process stream. This is different, where the 305 series is concerned – Schütte's application of the principle of process integration makes the complete-machining of complex workpieces economically viable. The fact that there is no need to re-clamp the component leads to an improvement in its precision.

Complex medical components, such as artificial knee joints, make great demands on accuracy and surface finish, as they have to fulfil their function inside a human body – hopefully, for the rest of its life. Schütte has integrated the manufacturing processes for orthopaedic implants into its 305*linear*, with which they are able to complete-machine these complex workpieces:

- rough and finish grinding,
- milling, with endmills and ball nose cutters,
- multistage belt grinding,
- multistage polishing.

The 305*linear* grinds the 3D contours linear. As the external contours are ground using the single-point method, the whole component family can be ground with the same set of wheels. This reduces tooling costs and setup times. Contours, pockets and cut-outs that cannot be ground for technological or economical reasons, are milled with carbide milling cutters – on the same machine. Multistage belt grinding prepares the surfaces for the subsequent polishing operation that produces highly polished surfaces with an R_a value of below $0.05 \mu\text{m}$ on the contact surface of the knee joint.



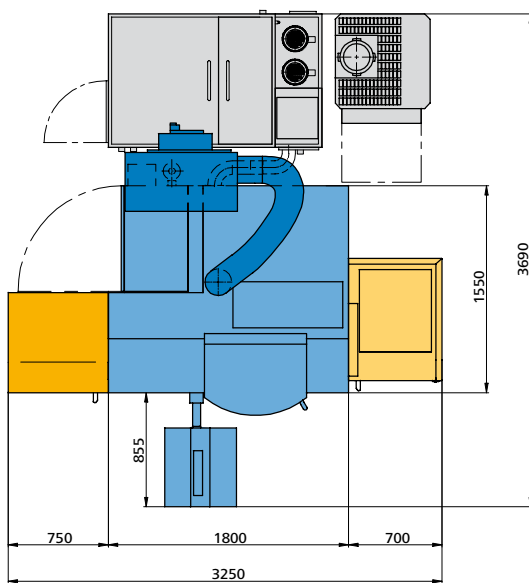
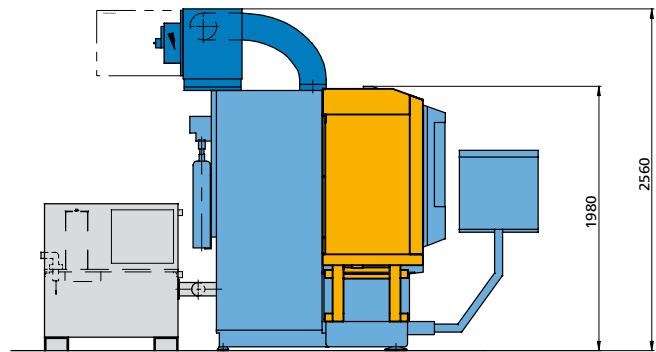
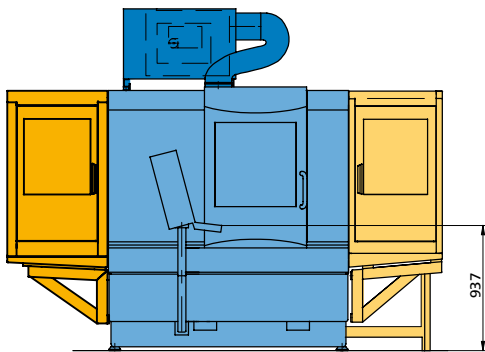
- Process integration on a single machine
- Greater productivity through complete-machining
- Greater precision, as re-clamping is unnecessary
- Fully automatic job-processing with 170-position chain loader and 24-position grinding wheel magazine
- Use of simple grinding wheel geometries for single-point contour grinding operations

Integrated polishing operation with automatic dosing of the polishing compound

COMPLETE-MACHINING IN A SINGLE SETUP

| MACHINE | | 305 | 305linear | 305trend | 305micro |
|---|-------------------|----------|-----------|----------|----------|
| Linear axes | | | | | |
| Travel: | | | | | |
| X-axis (longitudinal motion) | mm | 400 | 400 | 320 | 400 |
| Y-axis (lateral motion) | mm | 250 | 250 | 250 | 250 |
| Z-axis (vertical motion) | mm | 250 | 250 | 250 | 250 |
| Resolution: | | | | | |
| X-, Y- and Z-axis | µm | < 0,1 | < 0,1 | < 0,1 | < 0,1 |
| Max. feedrate: | | | | | |
| X-, Y- and Z-axis | m/min | 24 | 24 (48) | 18 | 24 |
| Rotary axis for workpiece (A-axis) | | | | | |
| Resolution in dividing mode | degrees | < 0,0001 | < 0,0001 | < 0,0001 | < 0,0001 |
| Max. speed as rotary axis | min ⁻¹ | 200 | 200 | 200 | 200 |
| Max. speed as universal rotary axis | min ⁻¹ | 2500 | 2500 | 2500 | 4000 |
| Reception bore | | SK 50 | SK 50 | SK 50 | HSK 50 E |
| Max. torque | Nm | 88 | 88 | 88 | 25 |
| Swivel axis for grinding head (C-axis) | | | | | |
| Swivel range | degrees | 225 | 225 | 225 | 225 |
| Resolution | degrees | < 0,0001 | < 0,0001 | < 0,0001 | < 0,0001 |
| Max. swivel speed | degrees/s | 360 | 360 | 360 | 360 |
| Grinding spindle (motor spindle) | | | | | |
| Max. speed | min ⁻¹ | 12000 | 12000 | 12000 | 12000 |
| Max. power rating | kW | 15 | 15 | 8 | 8 |
| Spindle taper | | HSK 50 E | HSK 50 E | HSK 50 E | HSK 50 E |
| Optional grinding spindle | | | | | |
| Max. speed | min ⁻¹ | 24000 | 24000 | 12000 | 24000 |
| Max. power rating | kW | 8 | 8 | 15 | 8 |
| Spindle taper | | HSK 50 E | HSK 50 E | HSK 50 E | HSK 50 E |
| Control system | | | | | |
| CNC | SIEMENS | 840D | 840D | 840D | 840D |
| Drive technology | SIMODRIVE | 611D | 611D | 611D | 611D |

Technical Data



- Grinding centre based on 305linear
- with 12-position grinding wheel changer and 170-position chain-type magazine
- Filter system, oil cooler
- Extractor



SERIES 305

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