

SERIES PART 95

VGrind 340S 5-axis CNC tool-grinding machine from Vollmer Werke

Big precision on a small scale

The VGrind 340S was launched in 2019 and adds to the VGrind series with its ultra-precise grinding capabilities for solid carbide tools of diameters as small as 0.3 mm.

Tried-and-tested system assemblies combined with innovative design bring many benefits: Vibration-resistant base design, universal dynamic direct drives in all axes, productive machining design with two grinding spindles, ultra-precision clamping of blanks, competent calibration process for the axes and user-friendly controls with ergonomic machine access.

Machine construction

The machine base is made of polymer concrete and is topped with a solid grey cast iron unit (wall concept) designed using FEM as a carrier for the cross slide unit (X- and Z-axis) and bolted-on guide rails for the grinding unit (Y-axis). This structural design has been the standard at Vollmer for many years. The grinding carriage, a grey cast iron assembly, which can rotate 215° (C-axis), has been designed for optimum weight and rigidity and carries the two grinding spindles in a vertically arrangement on top of each other. The cross slide contains the workpiece

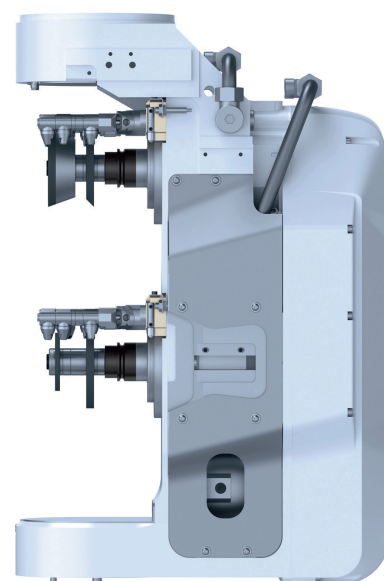
spindle (A-axis) with the integrated collet chuck. This can machine tools with outside diameters between 0.3 mm and 12.7 mm.

All linear and the rotary axes (A-, and C-axis) are universally fitted with direct drives, which makes the entire machine kinematics more dynamic. In designing the machine, Vollmer moved away from the conventional linear technology of ballscrew drives to showcase the efficiency of direct drives.

Vollmer stands out for its commitment to building a machine for first-class grinding. This is evident in the machine layout of various assemblies. All linear axes are fitted with the highest quality glass scales. The cross slide (X-, Z-axis) is fitted with a counterweight to ensure that no load is placed on the Z guide when positioning the workpiece spindle centrally between the grinding spindles, which is an important factor for precision machining. When moving, the load increases linearly, depending on the path. This is achieved using a helical spring that requires no maintenance and inputs no energy.



The VGrind 340S 5-axis grinding machine grinds carbide tools with diameters as small as 0.3 mm. It has been designed to provide maximum workspace accessibility and operability.



The C-axis has two vertically arranged grinding spindles with the pivot point located in the C-axis.

The Y slide is guided by three guide rails, whereby a rail that bears the grinding forces is attached to a solid, fixed carrier. This, together with the eight guide shoes on the axis, also improves the rigidity.

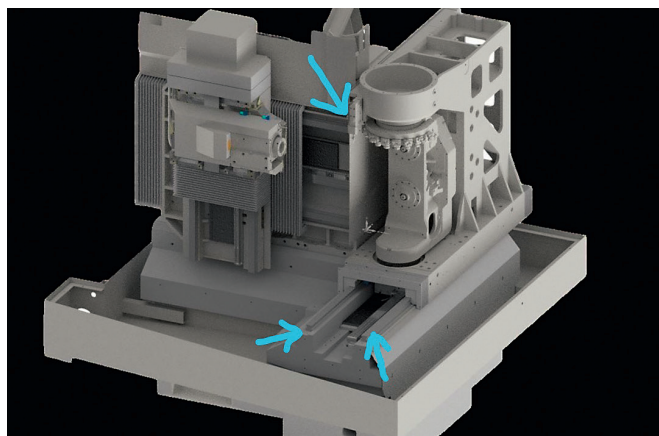
When grinding intricate tools with diameters measuring < 1 mm, the concentricity deviation on the ground shape must be $< 3 \mu\text{m}$ in order to ensure the tool a good operating life at high speeds. The slightest deviations on individual cutting edges in the radius area result in increased wear or lead to tool breakage. As such, the clamping accuracy of the blanks and the support of the tool shanks when grinding is hugely important. Vollmer provides a solution to this in the form of an intelligent in-house development, the shank steady rest. This provides support in two ways. Firstly, it supports the tool shank directly behind the collet chuck, and secondly it provides support for tools with a longer overhang by means of a steady rest that can be positioned manually. In the shank steady rest, the tool is pushed into a permanently fixed carbide V-block by a pneumatically operated pressing finger with 50 kg, the steady rest is operated by motor. The customer's requirements can be met by configuring the drives of



In my view

The VGrind 340S is a perfect addition to the Vollmer portfolio. It combines a reliable, innovative and effective grinding process with „µm-precise grinding capabilities“. The thermostability and cooling concept are integral to this processing accuracy. Various functional solutions, some of which are in-house designs, such as those seen in the multi-level machining system, in the replaceable dressing unit or in the shank steady rest or steady rest, highlight the process-oriented approach to engineering. The global application of linear and torque drives are testament to the machine's dynamics. The NUM control system is logically structured and intuitive to operate. The service-engineer deployment times are second to none. The digitalisation is driven by the implementation of visual tools for troubleshooting and the availability of databases containing the latest data on all series.

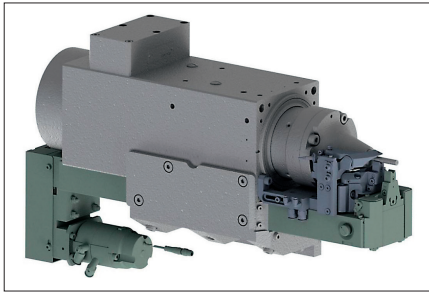
Edwin Neugebauer



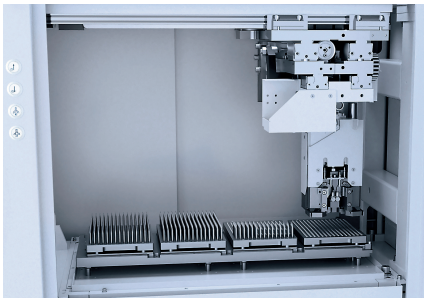
MACHINE CHECK RESULTS

The detailed table is available at www.fertigung.de	Maximum no. of points	No. of points Vollmer VGrind 340S
Commissioning of machine	25.00	22.25
Time required up to 1st job	12.50	10.00
Evidence of machining quality	2.50	2.25
Axis measurement	2.50	2.50
User instruction	7.50	7.50
Ease of maintenance	100.00	94.50
Accessibility for maintenance work	25.00	22.50
Accessibility in the event of incidents	35.00	35.00
Time to replace main spindle	15.00	15.00
Time to replace feed components	15.00	12.00
Automatic monitoring functions	10.00	10.00
Automation	100.00	97.00
Machine start-up/reference run	30.00	30.00
Operation/loading	40.00	40.00
Cost of workpiece clamping/transporting parts	30.00	27.00
Control system	50.00	50.00
Control system/comfort functions	30.00	30.00
Collision issues	20.00	20.00
Ease of retooling	50.00	45.00
Tool/workpiece clamping	25.00	20.00
Cost of set-up	15.00	15.00
Multiple clamping/model mix	10.00	10.00
Service	75.00	67.50
Availability of service personnel	30.00	30.00
Stock of spare parts/production of spare parts	15.00	13.50
Archive of drawings of parts;	22.50	18.00
Internet availability	85.00	78.20
Maintenance agreements	15.00	13.50
	7.50	6.00
TCO	85.00	78.20
Cost driver analysis available	34.00	30.60
Assessment and numbers for downtime/repair time	34.00	34.00
Machine supplier CIP upon notification of failure	17.00	13.60
Form of contract	15.00	12.00
Warranty period	5.00	4.00
Payment terms	5.00	4.00
TCO process specified	5.00	4.00
Total	500.00	466.45

All linear and rotary axes are supported by a „wall concept“. The Y-axis is triple guided.



The shank steady rest and steady rest assembly is a Vollmer in-house solution.



The HP 160 pallet magazine can be loaded with up to 900 tools.

the two grinding spindles. A belt drive or even a direct motor spindle is feasible, and therefore flute grinding on spindle 1 and finish-grinding of the cutting geometry on spindle 2 can be optimally configured.

Another innovative idea is the in-house development of a „replaceable dressing unit“. It is manually positioned in the

machine and indexed, and does not work in the V-block area so as to avoid contamination there. An adaption interface is available, allowing the dressing unit to be used on other machines as well.

The thermal economy of the machine is controlled by a plate heat exchanger. It is connected to the customer's coolant circuit, so that the machine does not require its own chiller unit. All drives, the grinding spindles and the A and C-axis are cooled. The grinding oil is used as a coolant, which is unproblematic in the event of leaks. Both circuits run at the same temperature, making the machine thermostable. Many deflector plates are applied to the coolant outlet in the machine's operating area in order to prevent any thermal influence on the polymer concrete base.

Cost-effectiveness is a result of the combined effect of the rigid vibration-damping construction, the process which reduces idle time (short distances between the spindles), and the longer service life of the grinding wheels. Quality is the result of fewer grinding wheel changes, the grinding pressure, which is always applied to the fixed bearing end on the grinding spindle, temperature stability achieved by temperature control in the drive components and in the grinding/cooling oil, and the rigid overall construction. The position of the working plane on both grinding wheels, directly on the pivot point of the C axis, requires very small compensation distances for the linear axes when all axes are moving around in space, thus improving the grinding results.

FACTS+FIGURES

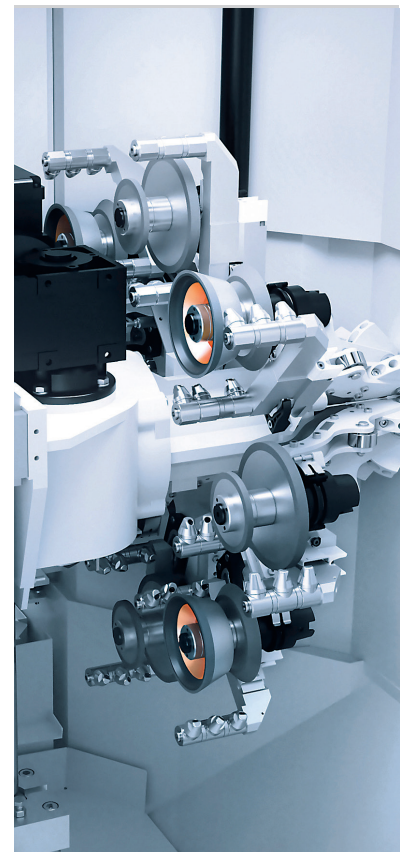
Machine data Vollmer VGrind 340S	
Operating area (X/Y/Z axis) (mm)	330 x 450 x 500
Rapid traverse (X/Y/Z axis) (m/min)	max. 20
C axis, angle of rotation	+15° /-200°
Grinding spindle holding shaft	HSK 50
Grinding spindles	0 bis 10 500min ⁻¹ ; 10 kW Motor spindle; 11 kW Belt drive
A axis	360°; 450 min ⁻¹
Workpiece holding fixture A axis	Collet chuck/hydraulic expansion chuck
Tool changer	In-house build
Grinding-wheel magazine	8 grinding wheel set
Max. grinding wheel diameter	150 mm
Tool change time	Parallel with grinding wheel: 25 s
Control system	NUMROTOplus
Floor area	2790 x 2622 mm
Weight	4,9 t
Price of standard machine	Depends on version

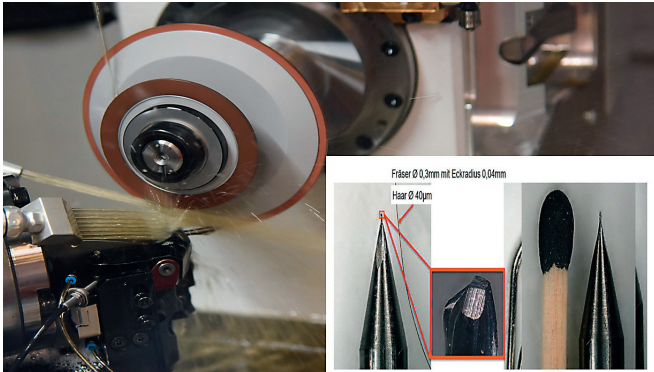
At a glance VGrind 340S from Vollmer Werke

Strengths:

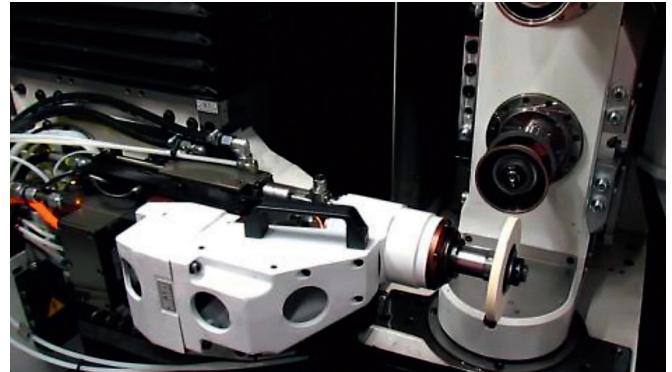
- Rigid, vibration-dampening construction
- Dynamic axes
- Innovative, productive grinding concept
- Thermostability
- µm-precise grinding
- Viable in-house solutions
- Functional, user-friendly control system
- Ergonomic workplace
- Excellent service-engineer deployment times
- Digitalisation of service functions

The grinding wheel changer can hold eight grinding wheel packages, including coolant nozzles.





During the machine check, a small carbide tool was ground with a corner radius of 0.04 mm. Max. radius deviation: 0.0004 mm.



The grinding wheel dressing unit is positioned and fixed manually, and can also be used on other machines.

Machining

During the machine check, the production process for a carbide tool of 0.3 mm diameter and a cutting edge radius of 0.04 mm was demonstrated. The subsequent microscopic measurements and evaluations revealed a maximum deviation of 0.0004 mm from the target radius. An astonishing level of accuracy.

Grinding-wheel magazine

The grinding wheel changer confirms a construction principle of great importance to Vollmer, namely that, where possible, functionality should be achieved mechanically. As a rule, mechanical solutions are less susceptible to faults due to the absence of various electrical components.

When the grinding wheel is changed, the Y axis moves to a grinding wheel-change position, in which the clamping chucks for the grinding-wheel sets are pressed mechanically. The grinding wheel packages balanced to G1 balance quality are then passed via the in-house changer to the machine's HSK holding fixture, force-controlled over curved segments. The grinding wheel magazine has eight spaces. A special feature is the pro-

cess-optimised, parallel-running exchange of grinding wheel and workpiece. This saves 9 seconds.

Loading the workpieces

The loading of the machine using a double gripper arm is also an in-house innovation. The compact pallet magazine holds up to 900 workpieces, which means production can be unmanned. The workpiece can also be changed using robots.

Control system

Where control systems are concerned, NUMROTOplus from NUM is the only choice. The control system provides all the functionality needed for the grinding of tools. It can be operated via touchscreen or mouse and is fitted with an HMI panel by Vollmer. The layout of the control desk, the sliding action and the access to the machine have all been designed with ergonomics in mind. The control system features a calibration program for the machine, which can be used to periodically check and correct the movement accuracy of the axes. This is done by means of a measuring sensor fitted in the operating area.

Service and TCO

The service hotline is manned for 11 hours each working day, and the technician will arrive on site (in Germany) within 24 hours of receipt of the incident report. The technicians' service reports are checked by service management and then entered into a database (SAP system). In the case of machine checks, service management has demonstrated convincingly how the service data is used in evaluations and analyses. In particular, the fact that all technicians worldwide have access to the latest data, series-specific modifications and experience reports all saved in the cloud network helps with fault remediation on site. Vollmer works with a tool for this – Oculavis – to further improve transparency and the customer-related support service. New services were added in March 2020.



The surface of the NUMROTOplus control system has a logical layout and is operated via touchscreen.

Contact

www.vollmer-group.com

