ORIGINAL OPERATING INSTRUCTIONS

Active Pro

vhf
CREATING PERFECTION

Contents

1 WELCOME

These operating instructions were prepared to help you understand all functions of your new portal milling machine.

1.1 Target group

These instructions are intended and released for the following groups of people:

- End users
- Authorized resellers
- Authorized service technicians

1.2 Symbols used

Calls to action

» Specific or general instructions

1. Numbered action step

✔ Result

Other symbols

Cross reference

- List (first level)
  - List (second level)

1. *Numbered image labels*

✔ **Correct** or **Do this**

✖ **Incorrect** or **Do not let this happen** or **Do not do this**

User interface description

[Buttons]

<KEYS>

User interface text

Text that you need to enter

1.3 Signal words

The following signal words may be used:

DANGER

DANGER indicates a dangerous situation that will lead to severe physical injury or death.

WARNING

WARNING indicates a dangerous situation that can lead to severe physical injury or death.

CAUTION

CAUTION indicates a dangerous situation that can lead to minor physical injury.

NOTE

NOTE indicates a situation that can lead to material damage on the machine or in the vicinity of the machine.

1.4 Copyright

This document is published by:

vhf camfacture AG

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72119 Ammerbuch, Germany

2 GENERAL SAFETY INFORMATION

2.1 Intended use

The portal milling machines are CNC machines designed for milling or cutting materials, depending on the configuration. The machines are designed for commercial use.

» Only use additional equipment which is approved by vhf.

» Before each machine / program start, make sure that no other persons are in the immediate proximity of the machine's working area.

» If the following groups / persons are in the same room as the machine, always supervise these groups/persons and define further safety measures if necessary:

- Cleaning personnel, even if they have been instructed
- Persons who are not familiar with the machine
- Operators of other machines
- Employees who work in the immediate proximity of the machine
- Visitors
- Pregnant women
- Persons under 18 years of age

» Ensure that the following regulations for specific persons who handle the machine are observed:

- The person responsible for the machine (operator) and the persons who may work on the machine (operator) must be clearly defined.
- The responsibilities of the personnel for operation, conversion and maintenance must be clearly defined.
- Personnel to be trained may only work on the machine under the supervision of an experienced person.

Operators have the following obligations:

- inform themselves about the national and local laws on occupational health and safety and follow them.
- determine the risks arising from processing. Particularly in terms of material and shape of the workpieces used.
- take additional protective measures if necessary.

2.2 Approved materials

» Only process materials that have been approved for your machine by vhf:

- Aluminum and aluminum alloys
- Brass
- Copper
- Steel and stainless steel (up to 2 mm)
- Plastics: ABS, CFK, GFK, PA, PC, PE, PMMA, POM, PP, PVC-P, PVC-U
- Aluminum composite panels
- Cardboard and honeycomb cardboard
- Wood and wood-based materials
- Gasket material
- Tarpaulin material
- Foams
- Rubber
- Foils

» If you wish to process other materials, contact vhf support.

2.3 Incorrect operation of the machine

» Never use the machine with safety devices open or disabled. Do not use the machine with defective, manipulated or bypassed safety devices.

» Only carry out repair and maintenance works which have been approved by vhf in writing and which are described in the respective operating instructions.

» Before you install, start up and carry out maintenance on the machine, read all the documents provided for the machine.

» If it is unclear how to operate the machine in any way, do not use the machine and contact customer service.

» Make sure that every user has access to this document.

» Instruct every user of the machine on safe and proper machine handling.

» Ensure that unauthorized persons do not have access to the machine.

2.4 Personal injury

2.4.1 Electric shock

Electric shock from touching live parts

If you come into contact with electrically charged parts, you may receive an electric shock. Water significantly increases the risk.

- Only have qualified electricians work on any electric equipment.
- Make sure that a residual current fuse is installed.
- Run electric cables so that they cannot be damaged by sharp edges.
- Check the power cable for damage before every startup.
- Do not switch on the machine until all electrical connections and devices have been connected.
- In the following cases, disconnect the machine immediately from the electrical source and secure it against restarting:
  - When machine connections or electrical cables are damaged
  - When liquid is leaking
  - Before you check or lay electrical cables
- Never perform a troubleshooting while the machine is in operation.
- Have the machine repaired only by authorized service technicians.
- Replace damaged cables with original spare parts from the manufacturer.
- Install all electrical connections according to the specifications of vhf.
- Do not touch the machine and especially the cables with wet or damp hands.
- Immediately remove all spilled liquids near the machine.
- Do not place any containers with liquids on the machine.
- Never put any machines or devices which are powered by electricity underneath the machine.
- Do not apply power to the system until all equipment and electrical cables have been installed.

2.4.2 Fire hazard

Working with flammable and/or explosive materials such as aluminum without appropriate safety measures can lead to death or serious injury.

- Do not use the machine in potentially explosive areas.
- Ensure that the dust extraction is properly installed.
- Fill the tool cooling system with a suitable cooling lubricant and ensure that the system is working properly.
- Only use cooling lubricants recommended by vhf.
- During machining, check continuously that the tool is cooled. Stop machining immediately if cooling is insufficient.

2.4.3 Air extraction system

Respiratory diseases when working with materials that generate harmful dust

If you use materials that cause harmful dust formation without proper safety precautions, you can inhale harmful dust and damage your respiratory tract.

- Only mill these materials with activated suction.
- Avoid materials that are hazardous to your health.
- Use an extraction system with a suitable filter system.

2.4.4 Cooling liquid

Danger to health if of the cooling liquid is handled incorrectly

If you use the wrong cooling liquid or handle the cooling system incorrectly, the cooling liquid can damage your health.

- Use only those cooling liquids that are prescribed by vhf for the respective material.
- Before using the cooling liquid, read the safety data sheet that was supplied with the cooling liquid.
- When handling the cooling liquid, always wear suitable protective clothing.
- Always store cooling liquid in the original container.
- Do not open pressurized cooling liquid systems.

2.4.5 Housing

Danger of entrapment by moving housing parts

There is a risk of jamming at the moving parts of the enclosure, such as doors and flaps.

- If you move these housing parts, use only the designated grip points.
- Make sure that your hands are not trapped during movement.

2.4.6 Axis movements

Risk of crushing due to moving machine parts

Axis movements of the machine can cause bruises and contusions.

- Do not bypass or deactivate the safety devices of the machine.
- Check the machine regularly for damage, especially the safety devices.
- Have damaged safety devices repaired by an authorized service point only.
- Use only original manufacturer's equipment and original spare parts in the machine.
- Keep unauthorized persons away from the machine.

2.4.7 Tools and Spindle

Danger of cuts and burns from tools

If you touch tools or sharp edges on workpieces or the machine, you may get a cut.

- Only remove tools when the machining process is completed.
- Attach cutting protection (e.g., made of foam or Styrofoam) before changing / removing the tool.
- Do not grasp the tools by the cutting edge and wear suitable gloves during the tool change / assembly / disassembly.
- Use the machine only with an enclosure around the entire working area or with a correctly positioned dust extraction (approx. 1 mm above the workpiece surface) around the rotating tool.
- Check the machine regularly for damage, especially the safety devices.
- Have damaged safety devices repaired by a service technician, unless otherwise stated in this document.
- Use only original manufacturer devices and original spare parts in the machine.
- Keep unauthorized persons away from the machine.

Danger of burns on the spindle or the tool

If you touch the hot spindle body or hot tools, you may suffer from burns.

- Wear gloves when you perform manual work at the machine or with workpieces / tools.

Danger due to ejecting parts

- Use only carbide metal tools.
- Use the machine only with an enclosure around the entire working area or with a correctly positioned dust extraction (approx. 1 mm above the workpiece surface) around the rotating tool.
- For operation without enclosure: Start the machining process only from the workstation. Do not approach the machine until after the program has ended.
- For operation without enclosure and without air extraction: All persons within reach of the machine must wear protective goggles.
- For operation without enclosure and without air extraction: Do not reach into the machining area while the axes are moving and work is in progress.

2.4.8 Operating noise

Hearing loss and tinnitus due to regular loud working noises

- If loud working noises cannot be prevented, use an ear protector during machining.

2.4.9 Falling objects

Risk of injury from falling objects

Falling objects can cause injuries.

- Before starting the machining process, make sure that the workpiece is properly fixed.
- Safety shoes must be worn during operation and when loading workpieces.
- Do not place any objects, except the workpiece, on the machine.

2.4.10 Pneumatic components

Risk of injury from loose pneumatic components under air pressure when connections are open

Loose pneumatic components can move extremely fast and unpredictably and may cause injury.

- Before you run the pneumatic hoses, close the external air supply.
- Before you check the pneumatic hoses and pneumatic connections, set the air the pressure to the lowest possible value.
- In case of defective machine connections and pneumatic hoses, disconnect the machine from the external compressed air supply and the electrical source.
- Contact customer service if connections are damaged or defective.

2.4.11 Tripping, falling and slipping hazards

- Lay cables and hoses such that people cannot trip over them.
- Keep the work environment and the installation site clean.

2.4.12 Maintenance

Increased risk during maintenance

» Only carry out the maintenance work that is described in the operating instructions of the machine. Otherwise, you may be injured or your machine may be damaged.

» Do not step on the machine table.

Risk of injury in the event of malfunctions due to inadequate maintenance

Failure to maintain the machine as specified may cause malfunction, which could result in personal injury.

» Clean and maintain the machine as necessary. This is the only way that the machine can achieve a long service life.

» Observe the intervals and conditions specified in the maintenance table in the operating instructions. Carry out the respective maintenance work accordingly.

2.5 Material damage

2.5.1 Spindle

» Do not use any tools with high imbalance at high rotational speeds. Such an imbalance puts a great strain on the spindle's ball bearings, which can damage the ball bearings.

» When defining the machining parameters, pay attention to the maximum speed of each tool.

2.6 Operation of the machine via software

You operate the machine via a specially developed manufacturing software that is supplied with the machine.

» Always use the latest version of the manufacturing software that supports your machine.

» Read the manufacturing software documentation before using the machine.

3 TRANSPORT AND INSTALLATION

The machine will be delivered and installed by vhf. The operator is responsible for ensuring that a suitable forklift (as specified in the information leaflet) is available.

Only use the forks of the forklift at suitable places, otherwise the machine may be damaged.

The following conditions must be observed during the entire transport process and/or storage:

- Ambient temperature: between 0 °C and 32 °C
- Relative humidity: max. 80%, non-condensing

» Always transport the machine in the horizontal position.

» Take appropriate measures against corrosion when transporting the machine overseas.

3.1 Installation site

The requirements for the installation site are specific to each individual machine.

vhf clarifies critical points regarding the installation and the transport of the machine before delivery, (e.g. the accessibility of the installation site or the space conditions at the installation site).

You will receive an installation plan for your machine before delivery. With the floor plan you can ensure that all requirements for use are met (e.g. necessary electrical connections, compressed air connections).

» Select the installation location according to the following criteria:

- No potentially explosive atmospheres
- Firm and level ground, must bear the weight of the machine
- Room temperature:
  - between 10 °C and 32 °C
  - ideally between 18 °C and 25 °C
- Relative humidity: max. 80%, non-condensing
- Power supply: according to installation plan
- At least 1,000 mm clearance around the machine.
- Compressed air supply (if required for the plant), in accordance with the installation plan:
  - 6.5 bar – 8 bar available pressure

    On machines with automatic tool change, the compressed air supply is monitored. If the available pressure is too low, the machine goes into emergency stop mode. This cancels a machining operation that is currently in progress.
  - Quick coupling with an inner diameter of 6 mm
  - Air purity in accordance with ISO 8573-1:2010 (3-4-3)

» If you have further questions about the Installation site, contact customer service to ensure trouble-free installation of the machine.

3.2 Installation plan

Required safety distance (light gray area) with free access to the machine. Figure not to scale.

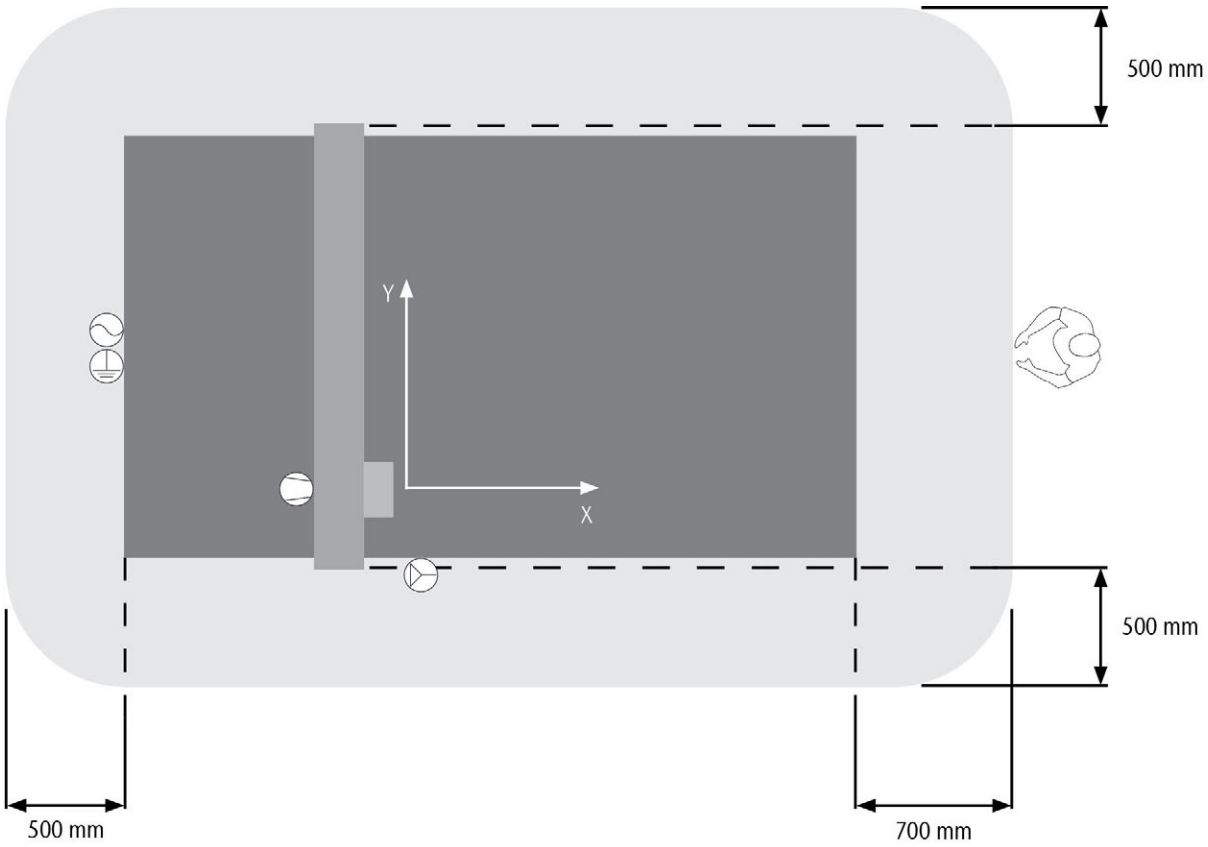


FIG. 1

Ground wire

Power supply

Dust extraction

Compressed air supply: 6 – 8 bar

You can find detailed information regarding connections in the leaflet Technical Data.

Depending on the equipment, you can place individual machine sides directly against a wall to prevent access. The safety distance at the respective machine side can be neglected.

For a placement directly against walls you need to ensure that all control elements of the machine can be reached.

4 GET TO KNOW YOUR MACHINE

Portal milling machines from vhf have a modular design. Depending on the configuration chosen, this chapter will describe modules that are not installed on your machine.

4.1 General machine overview

FIG. 2

1. *Portal head*
2. *Portal*
3. *Machine table*
4. *Machine designation*
5. *Machine leg*

4.2 Machine axes

For easier understanding, the sides of the machine are specified. These designations are retained throughout the entire manual.

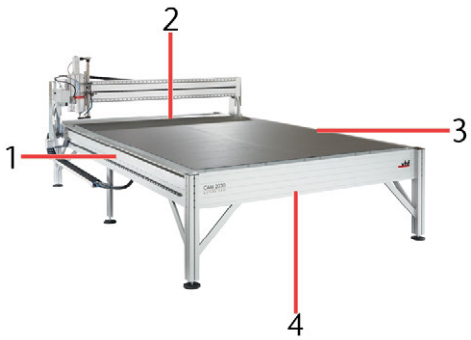


FIG. 3

1. *Left side*
2. *Back*
3. *Right side*
4. *Front*

This machine can be configured so that it can be operated from the front or from the left side.

- Operation from the front: The X-axis is parallel to the portal and the Y-axis is parallel to the sides of the machine.
- Operation from the left side: The Y-axis is parallel to the portal and the X-axis is parallel to the sides of the machine.

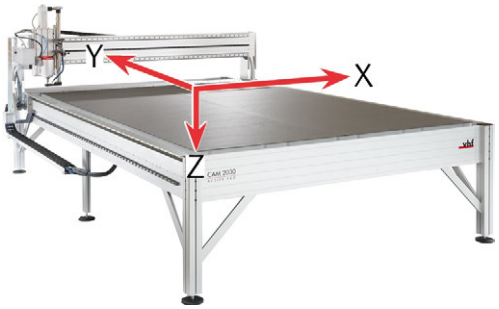


FIG. 4

FIG. 5

The machine has a defined machine zero point. The zero point of the Active Pro is located above the rear left corner of the machine table. All axes (X-axis, Y-axis and Z-axis) are at 0 when approaching the machine zero point.

4.3 Name plate

The type plate of the Active Pro is located on the back of the machine. The type plate of the machine contains information such as the serial number, the weight of the machine, the machine designation and the year of production.

Structure

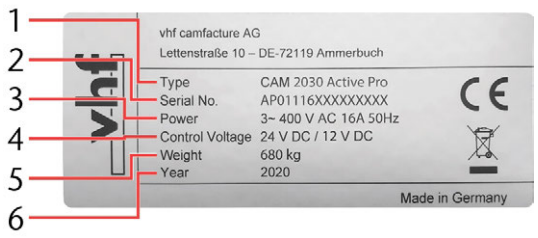


FIG. 6

1. *Machine designation(Here: CAM 2030 Active Pro)*
2. *Machine specific serial number*
3. *Power connection (here: 3~ 400 V AC 16 A)*
4. *Control voltage (here: 24 V DC / 12 V DC)*
5. *Weight (here: 680 kg)*
6. *Year of production (here: 2020)*

4.4 Main power switch

The machine's main switch is located on the electrical box on the back of the machine. You disconnect and connect the power supply to the machine and all components that are supplied with power via the machine there.

FIG. 7

4.5 Emergency stop button

The emergency stop button is connected to the machine control unit and interrupts the control of the axes and of the spindle in an emergency or to prevent a hazard. After actuation, the emergency stop button locks. The original state can be restored by turning it. After unlocking, the machine does not restart by itself.

The emergency stop button is located on the system cabinet. If there is no system cabinet, there is a corresponding control element on the machine.

FIG. 8

4.6 Machine table

The machine table of the Active Pro is a vacuum table onto which workpieces are sucked and held in place by a vacuum.

Alternative as well as additional clamping methods and further extra equipment are available for the machine table.

The machine is equipped with several vacuum suction units that generate the required vacuum. The machine table is divided into lanes running lengthwise to the machine. The vacuum can be switched on and off separately for each web. The machine table must be covered with a vacuum fleece or a cutting pad, depending on the application.

FIG. 9

4.6.1 Extra equipment machine table

The machine table of the Active Pro can be extended with various optional extra equipment.

Tool magazine

Tools can be changed either manually or automatically. For automatic tool change, a tool magazine is installed next to the machine table. The tools are automatically placed and picked up here. The tool magazine includes a tool length measuring probe that automatically measures the length of the tool after it has

been picked up. The type of tool magazine depends on the installed spindle.

Fast-frequency spindles (SF):

Automatic tool change is possible on all pneumatically opening fast-frequency spindles with index **P**. All tools used must be equipped with a stop ring on the shank so that the spindle can grip the tools correctly.

Three-phase spindles (SPC):

Automatic tool change is not possible for all kinds of three-phrase spindles. The tool is placed in the tool magazine with a clamping cone. The tool magazine is raised and lowered pneumatically.

Workpiece stoppers

Depending on the definition of the axes, the workpiece stoppers are either at the front or rear end of the machine table. There are 2 workpiece stoppers located at the front and rear left corners of the machine table, respectively: one at the front side of the machine table and one on the left side. The workpiece stoppers can be pneumatically extended and retracted together. The workpiece stoppers can be used to align the workpiece precisely.

Front clamping area

The front clamping range consists of a T-slot table mounted vertically at the front end of the machine table. Workpieces that are too high can be secured onto the T-slot table by using clamping devices, such as positioning levers. This makes it possible to machine high workpieces. The front clamping range is as wide as the width of the travel range.

T-slot table

The T-slot table consists of T-slot profiles. The T-slot table can replace part of the vacuum table or the complete vacuum table. Workpieces that cannot be fastened onto the vacuum table can be secured onto the T-slot table by using clamping devices, such as positioning levers.

4.7 Portal head

The portal head contains the spindle, tool cooling and dust extraction. Other machining units and additional components are available depending on the equipment. The portal head travels along the portal. The spindle moves up and down.

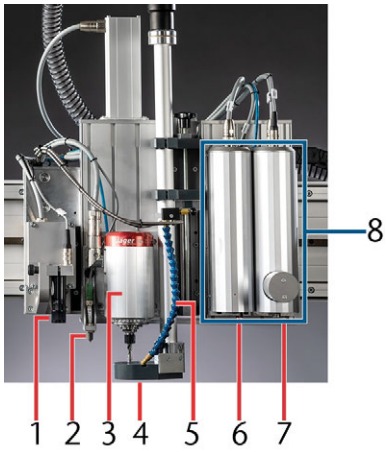


FIG. 10

1. *Optical workpiece recognition*
2. *Workpiece leveling*
3. *Spindle*
4. *Suction shoe including Dust extraction*
5. *Tool cooling*
6. *Universal head*
7. *Oscillating tangential cutting head*
8. *Multi unit*

4.7.1 Spindle

The spindle is used for milling. In the Active Pro, different spindle types can be installed. The spindle types vary in power, clamping range and maximum speed. There are three-phase spindles (SPC...) and high-frequency spindles (SF...).

Spindle cooling

There are different types of spindle cooling. Depending on the spindle, cooling is provided either by a fan, compressed air or cooling liquid. If the spindle is cooled with cooling liquid, a compressor cooling unit is installed in the system cabinet.

Compressor cooling unit (Spindle cooling)

The compressor cooling unit is automatically switched on when the machine is switched on. The compressor cooling unit pumps cooling liquid through the spindle in a closed circuit. The cooling liquid is constantly cooled. The system is pressurized when switched on.

If the compressor cooling unit is not sufficiently filled with cooling liquid, or the flow in the system is too low, the machine goes into emergency stop mode. This may abort machining or cause the machine to fail to start properly. The cooling liquid must be checked annually and refilled if necessary.

For more information on filling the system, see here:

Refilling the compressor cooling unit (spindle cooling) (Page 38).

4.7.2 Dust extraction

The dust extraction system consists of the suction unit, the suction hose and the suction shoe. The suction shoe ensures targeted suction of the chips directly at the milling cutter and protects against tampering and thus possible injuries. The suction shoe must always be mounted for machining with the spindle.

If the machine does not have an enclosure or laser scanner, the suction shoe is monitored electronically.

Depending on the application, three different types of suction units are available:

- Dust class L
- Dust class M
- Dust class M with ATEX approval

4.7.3 Tool cooling

Cooling and lubrication of the tool with cooling liquid promotes longer tool life and better machining results at the same time. Many materials (e.g. aluminum) require continuous cooling during machining.

There are the following systems for tool cooling:

Minimum quantity lubrication

The minimum quantity lubrication works according to the atomization principle. Each nozzle has 2 supply lines. The first supply line supplies the cooling liquid, the second supply line supplies the compressed air. The nozzle atomizes the cooling liquid with the help of compressed air and sprays it onto the tool. This type of tool cooling significantly reduces the need for cooling liquid and only a very small film of cooling lubricant is formed on the workpieces.

In a pressureless state, the cooling liquid can be completely drained off via a discharge screw on the underside of the tank of the minimum quantity lubrication.

Cooling and spraying unit

The cooling and spraying device works according to the displacement principle. The nozzle has 2 supply lines, one for compressed air and one for cooling liquid. The cooling liquid is drawn from the cooling liquid tank by the compressed air through the displacement principle, atomized in the nozzle and sprayed onto the mold.

4.7.4 Automatic Z adjustment

Before machining, the workpiece height is measured with the automatic Z adjustment. This measurement is taken via a contact between the tool tip of an electrically conductive tool and the Z-adjustment plate. Automatic Z adjustment cannot be used during cutting operations.

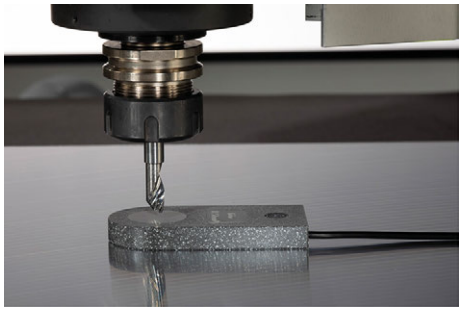


FIG. 11

4.7.5 Multi unit

The multi unit is a combination of an *oscillating tangential cutting head* and *universal head* and is used for cutting operations. The multi unit is mounted to the right of the spindle and makes it possible to perform cutting and milling operations without further assembly work.

The *oscillating tangential cutting head* is used for cutting soft or slightly fraying materials. The tool moves up and down continuously during the cutting process.

The *universal head* is used for straight cuts, kiss-cuts and V-cuts as well as for machining with creasing wheels. For this purpose, the universal head is equipped with various attachments for the respective process.

A pneumatic lifting cylinder lowers the machining units of the multi unit into the working position for the cutting process. During milling, the multi unit stays in its idle position.

As an alternative to the multi unit, the machine can be equipped with the *tangential cutting head* or the *oscillating tangential cutting head*. These individual machining units for cutting are mounted instead of the spindle.

4.7.6 Optical fiducial recognition

The optical fiducial recognition of the machine is controlled by a camera. The camera optically detects fiducial marks printed on the workpiece and compensates for inaccuracies caused by the printing process.

The camera for optical fiducial recognition is necessary in order to set the workpiece zero point precisely.

4.7.7 Workpiece leveling

Workpiece leveling is used on uneven workpieces to detect irregularities in the workpiece thickness and take them into account during machining to obtain a uniform result.

4.8 Control components

The control components include the machine control (CNC) and the frequency converter (SFU) of the

spindle. Depending on the equipment of the machine, these components can be installed in the system cabinet or in the base of the machine.

4.8.1 Machine control (CNC)

The machine control is responsible for implementing the machine movements stored in the job file.

A status LED on the front panel indicates the status of the control unit.

X-axis / Y-axis / Z-axis / T-axis

Green: Axis movement

Red: Reference point approached

Status

Blue (flashing): Machine is ready for operation

Emergency stop

Orange: Emergency stop mode is active and the emergency stop button is pressed. The axes cannot be moved. The emergency stop button must be released and the machine must be referenced.

An error of the compressor cooling unit leads to the same status, without a pressed emergency stop button. The error must be fixed and the machine must be referenced.

Red: Emergency stop mode is active and the emergency stop button is released. The machine can be referenced, then the axes can be moved freely again.

Stop

Orange: Machine is in stop

Power Driver

Yellow: The temperature of the power output stages is in the critical range. To avoid a forced shutdown, machining should be interrupted until the temperature has dropped.

Red: Power output stages shut down (e.g. due to overheating or short circuit)

Spindle

Yellow: Spindle is ready for operation

Red: Spindle error

4.8.2 Frequency converter (SFU)

The frequency converter enables control of the spindle by controlling the speed of the drive. In addition, the frequency converter monitors the clamping mechanism of the spindle.

A status LED on the front panel indicates the status of the frequency converter.

Power

Blue: Frequency inverter is ready for operation

Motor

Green: Spindle rotates

Yellow: Spindle is switched off

Cone locked

Green: Clamping cone is gripped

Red: No clamping cone gripped

Error

Red: An error has occurred

Communication

Yellow (flashing): Machine control communicates with the frequency converter

4.8.3 System rack

All control components are housed in the system cabinet. In addition, there is a monitor and the production computer, a keyboard and mouse in the upper part of the system cabinet. Below the screen there is an emergency stop button as well as controls for controlling certain machine functions, depending on the equipment of the machine. Here, for example, the vacuum suction units are switched or the laser scanner is acknowledged after an entry into the safety area. The lower part contains the control components, the compressor cooling unit and the CAM system switch.

1. *Screen*
2. *Emergency stop button and other control elements*
3. *Keyboard and mouse*
4. *Production computer*
5. *Machine control*

6. *CAM system switch for switching the machine on and off*
7. *Frequency converter (Spindle control)*
8. *Compressor cooling unit (Spindle cooling)*

Machines with a laser scanner have a status display with RGB colors on the system cabinet that shows the status of the machine.

- No color: Normal operation active
- Blue: Setup mode active
- Green: Active spindle
- Red: Interrupted job, activated emergency stop switch, person or object in the safety area of the laser scanner

In setup mode, the colors Green and Red may also appear turquoise and purple, as they can overlap with Blue.

4.8.4 Laser scanner

The laser scanner is a safety device of the machine. It is mounted under the machine table and scans the area under and around the machine. This area is called the safety area. If a person enters the safety area or an object is in the safety area, the laser scanner is activated. The laser scanner must not be switched off or bypassed. The status of the laser scanner is displayed via the LED on the top of the system cabinet.

The exact mounting position of the laser scanner is marked in the installation plan of the machine.

Switching between setup mode and normal mode

To measure the workpiece height, for maintenance work or other work on the machine, it may be necessary to switch to setup mode. To do this, turn the key on the front of the system cabinet from **1** to **0**. After the work is done and machining can be started, turn the key back to **1**.

Triggering the laser scanner in normal mode

If a violation of the safety area is detected during the machining process, the laser scanner automatically switches the machine to a stop. This must be acknowledged before machining can continue. Acknowledgment is only possible if there are no persons or objects in the safety area.

Triggering the laser scanner in setup mode

During setup (setting the workpiece zero point, maintenance work, other work on the machine without starting a job), the safety area can be entered without the machine coming to a stop.

Safety area

The safety area of the scanner is 1.0 meters around the machine. If the machine is placed against a wall, the side facing the wall is usually not part of the safety area. Nevertheless, for safety reasons do not enter the area during machining. Furthermore, the areas behind the machine feet are not part of the safety area.

The exact safety area of your machine is marked in the machine installation plan.

Further information on the laser scanner and the operating instructions can be found at: www.leuze.com.

4.8.5 Control panel

The control panel is extra equipment that can be used to move the machine. In addition, during machining the spindle speed and feed rate can be adjusted via the control panel.

With the control panel it is possible to be directly at the machine during the process and to determine the position of the machining unit well visually. This enables you to approach the desired workpiece zero point precisely.

FIG. 12

4.9 Technical specifications

Three-phase spindles

	Unit	Value
Model		SPC 1500
S1	W	1,500
S6	W	1,900
Pmax	W	4,100
Speed range	rpm	min. 5,000 / max. 30,000
Tool change		Manual
Sealing air		Yes
Spindle cooling (Cooling liquid)		No
Clamping range	mm	up to 10

	Unit	Value
Model		SPC 1500P
S1	W	1,500
S6	W	1,900
Pmax	W	4,100
Speed range	rpm	min. 5,000 / max. 30,000
Tool change		Pneumatic, WK 19
Sealing air		Yes
Spindle cooling (Cooling liquid)		No
Clamping range	mm	up to 10

	Unit	Value
Model		SPC 2300P
S1	W	2,300
S6	W	2,600
Pmax	W	3,500
Speed range	rpm	min. 5,000 / max. 40,000
Tool change		Pneumatic, WK 19
Sealing air		Yes
Spindle cooling (Cooling liquid)		Yes
Clamping range	mm	up to 10

High frequency spindles

	Unit	Value
Model		SF 650P
S1	W	650
S6	W	830
Pmax	W	1,200
Speed range	rpm	min. 5,000 / max. 60,000
Tool change		Pneumatic
Sealing air		Yes
Spindle cooling (Cooling liquid)		No
Clamping range	mm	up to 6

	Unit	Value
Model		SF 1300P
S1	W	1,300
S6	W	1,500
Pmax	W	2,500
Speed range	rpm	min. 5,000 / max. 60,000
Tool change		Pneumatic
Sealing air		Yes
Spindle cooling (Cooling liquid)		Yes
Clamping range	mm	up to 6

- S1: mechanical output power at continuous load of the spindle (100% machining time)
- S6: mechanical output power during a simulated machining cycle (60% machining time, 40% positioning time)
- Pmax: maximum mechanical output power of the spindle

Oscillating tangential cutting head

	Unit	Value
Oscillation frequency	Hz	116 (corresponds to about 7,000 strokes per minute)
Stroke	mm	about 3
Lance length	mm	min. 5, max. 70

Dust extraction

	Unit	Value
Model		CTL 36 AC, CTL 48 AC CTM 36 AC, CTM 48 AC
Dust class		*CTL:* L (maximum permissible concentration at the workplace >1 mg/m³) *CTM:* M (maximum permissible concentration at the workplace >0.1 mg/m³)
Area of application		*CTL:* Extraction of dusts that are not explosive and not hazardous to health *CTM:* Extraction of dusts from wood, ceramics, printed circuit boards, etc.
Power consumption	W	max. 1,200 W
Flow rate	l/min	max. 3,900 l/min
Negative pressure	bar	max. 0.24 bar
Filter surface	cm²	6,318 cm²
Filter cleaning		Automatic main filter cleaning
Container size	l	36 l, 48 l
Pipe outer diameter	mm	40 mm

	Unit	Value
Model		CTM 48 EC / B22
Dust class		M (maximum permissible concentration at the workplace >0.1 mg/m³)
Area of application		Extraction of aluminum and other combustible dusts ATEX approval, zone 22
Power consumption	W	max. 1100 W
Flow rate	l/min	max. 3,400 l/min
Negative pressure	bar	max. 0.23 bar

	Unit	Value
Filter surface	cm^2	6,318 cm^2
Container size	l	48 l
Pipe outer diameter	mm	40 mm

Minimum quantity lubrication

	Unit	Value
Number of nozzles		2
Position of nozzles		Freely positionable
Volume of container	l	1, optional: 4
Max. pressure of the tank	bar	6 (recommended: 1.5)

Cooling and spraying unit

	Unit	Value
Number of nozzles		1
Position of the nozzles		Freely positionable

Vacuum suction unit (per unit, number depends on machine size)

	Unit	Value
Nominal voltage	V	230 V
Power consumption	W	1,200 W
Lifetime		approx. 1,000 hours
Suction volume	m^3/h	144 m^3/h at 220 mbar

Workpiece stoppers

	Unit	Value
Number of workpiece stoppers		3
Lifting range	mm	20

Optical workpiece recognition

	Value
Camera type	CCD camera
Focal length	9 – 22 mm
Lens	Waterproof lens

Workpiece leveling

	Value
Detection	Precision measuring sensor
Accuracy	±0.01 mm

Tool magazine Three-phase spindles

	Value
Tool magazine size	4, 9 or 14 tool positions
Maximum tool diameter	10 mm

Tool magazine Fast frequency spindles

	Value
Tool magazine size	9, 19, 29 or 39 tool positions
Maximum tool diameter	6 mm
Accuracy of the measuring sensor	0.01 mm

Safety laser scanner

	Value
Angular range	270°
Laser class	1 (IEC / EN 60825-1:2007)
Laser light wavelength	905 nm
Repetition frequency	90 kHz
Width of the safety area	3 m
Protection class	III (EN 61140)

Machine control

	Unit	Value
Output power	V	80 V each
Maximum current	A	8 A

Front clamping area

	Value
Size	500 mm
Passage, stroke	Passage: 200 mm, stroke: 160 mm Passage: 300 mm, stroke: 260 mm

5 OPERATING THE MACHINE

5.1 Starting the machine

1. Make sure that no liquid is leaking and all cables and hoses are connected.
2. Make sure that there are no persons or objects in the safety area.
3. Remove all objects from the machine table with which the portal can collide during travel.
4. Switch on the main switch at the rear of the machine.
5. Switch on the machine via the CAM system switch in the system cabinet. If you do not use a system cabinet, the machine is switched on directly with the main switch.
6. Switch on the manufacturing computer.
7. Check the displays of the machine control and the frequency converter.
8. Check the display of the compressor cooling unit.
   Compressor cooling unit (Spindle cooling) – unten
9. Check the pressure at the main pressure control valve of the machine. The inlet pressure must be 6.5 – 8 bar (recommended 7 bar).
10. Check the pressure of the minimum quantity lubrication. The tank pressure should be 1.5 bar.
11. Check the level of the minimum quantity lubrication with the help of the ascending hose next to the pressure tank.
12. Check the safety devices.
13. Start the manufacturing software.
    Make sure that no liquid is leaking and all cables and hoses are connected.

If the spindle is not in operation for a longer period (more than 4 days), break in the spindle such that the grease is evenly distributed in the spindle bearings.

5.1.1 Compressor cooling unit (Spindle cooling)

If the compressor cooling unit of the spindle cooling is not sufficiently filled with cooling liquid, or if the flow in the system is too low, the machine goes into emergency stop mode. This may abort machining or cause the machine to fail to start properly. The cooling liquid must be checked annually and refilled if necessary.

1. Before switching on the machine, check the level on the compressor cooling unit in the system cabinet.
2. Refill with cooling liquid if necessary.
   Refilling the compressor cooling unit (spindle cooling) (Page 38)
3. If the machine does not start properly although the level in the compressor cooling unit is sufficient, contact vhf support.

5.1.2 Starting the machine with the tool in the machining unit

It may happen that a tool is in the spindle when the machine is started. This tool is not automatically recognized and must be removed on machines with automatic tool change before the machining process can be started. The tool is removed in the same way on all spindles with automatic tool change.

1. Start the machine as described here:
   Starting the machine – oben
2. Move the portal to a position where you can remove the tool from the spindle by hand.
3. Close the shut-off valve of the collet chuck in the compressed air supply line above the spindle. To do this, turn the valve transverse to the line direction (horizontally).

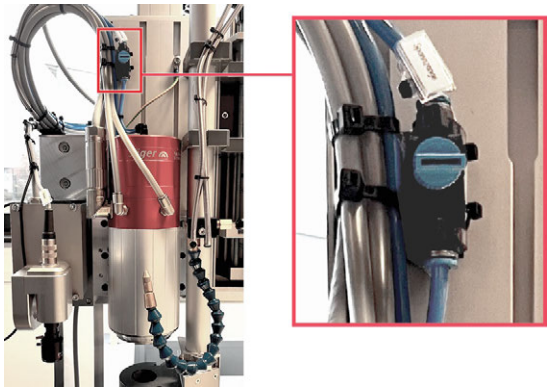


FIG. 13

4. Open the collet chuck in the manufacturing software.
5. Hold the tool with one hand so that it does not fall onto the machine table and get damaged in the next step.
6. ⚠ **CAUTION!** Open the shut-off valve of the collet chuck. To do this, turn the valve in the direction of the line (vertically).

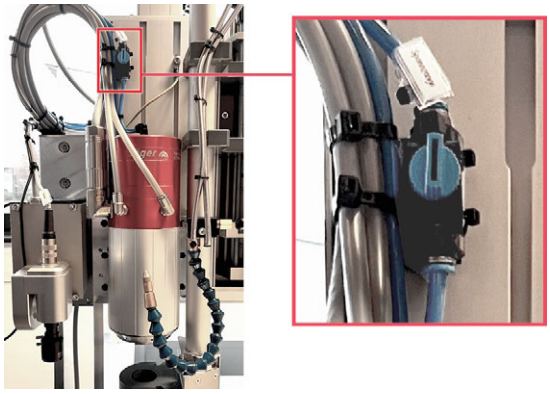


FIG. 14

7. ⚠ **CAUTION!** Remove the tool from the spindle and place it at the corresponding position in the tool magazine.

   NOTICE! Make sure that the shut-off valve of the collet chuck remains *open* after the tool is removed, do *not*close the valve. Otherwise, damage to the spindle and the tool magazine may occur during machining.

8. Close the collet chuck in the manufacturing software.

5.2 Tools

5.2.1 Milling tool

Depending on the spindle, the tool must be prepared differently in order to be inserted into the machining unit.

SF 650P – SF 1300P

Tools for fast-frequency spindles are equipped with a stop ring before they are inserted either into the tool magazine or directly into the spindle.

As an alternative to ringing your tools yourself, you can also have tools ringed directly by vhf. For further information, please contact the vhf tool consulting service.

1. Clamp the ringing plate in a vice.
2. ⚠ **CAUTION!** Ring the tools as follows:
   a. Place the stop ring onto the ringing plate. The inner bevel of the stop ring must point upwards.
   b. Position the tool *straight* in the opening of the stop ring.

      NOTICE! Make sure that the tool is inserted exactly straight. Otherwise, you may damage the tool.

   c. Carefully tap the tool through the stop ring with a hard rubber mallet until the stop ring is seated on the tool shank.

      NOTICE! Push the tool through the stop ring such that approx. 3 mm distance remains between the stop ring and the flutes in the tool.

   d. Remove the ringed tool from the ringing plate.
3. Insert the ringed tool into the tool magazine. Make sure to insert the tool with the cutting edge facing down.

SPC 1500

Tools for three-phase spindles without a pneumatic tool change must be inserted into the spindle manually. A collet chuck with a swivel nut is used for this purpose.

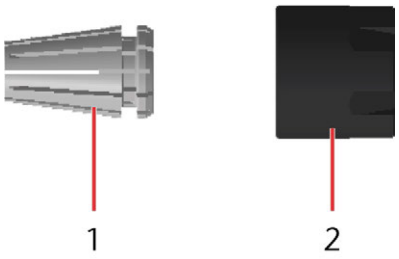


FIG. 15

1. *Collet chuck*
2. *Swivel nut*

1. Insert a collet chuck into the swivel nut. Press the collet chuck into the swivel nut until you hear a click. The click means that the collet chuck is locked in the swivel nut.
2. Loosely screw the swivel nut onto the spindle.
3. ⚠ **CAUTION!** Insert the tool into the collet chuck. Tighten the swivel nut slightly by hand.

   NOTICE! Push the shank of the tool into the collet chuck such that approx. 3 mm distance remains between the collet chuck and the flutes in the tool.

4. Tighten the swivel nut with the hook wrench. Counter the spindle with an open-end wrench on the flat surfaces of the spindle shaft.
5. When you have finished machining, remove the tool from the spindle. Use the hook wrench and the open-end wrench.

SPC 1500P – SPC 3800P

Tools for three-phase spindles with a pneumatic tool change must be inserted manually into the tool changer. A clamping cone with collet chuck and swivel nut is used for this purpose.

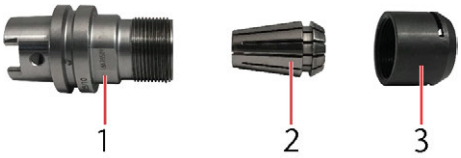


FIG. 16 IMAGE SIMILAR

1. *Tool cone*
2. *Collet chuck*
3. *Swivel nut*

1. Insert a collet chuck into the swivel nut. Press the collet chuck into the swivel nut until you hear a click. The click means that the collet chuck is locked in the swivel nut.
2. Loosely screw the swivel nut onto the clamping cone.
3. ⚠ **CAUTION!** Insert the tool into the collet chuck.
4. Tighten the swivel nut by hand.
5. Insert the clamping cone into the mounting aid on the machine.
6. Tighten the swivel nut with the roller bearing wrench. Take care not to tighten the swivel nut too much.
7. Insert the clamping cone into the tool changer with the tool facing downwards. Make sure that the tool position matches the tool position in the virtual tool changer of the manufacturing software.

5.2.2 Equipping the tool magazine

1. Prepare the tools accordingly.
2. Switch on the machine.
3. Open the tool magazine via the manufacturing software.
4. Remove machining residue from the tool magazine.
5. Insert the tool into the tool magazine with the cutting edge facing downwards.
   - You will be informed of the order of the position numbers in the tool magazine during the instruction session at the machine.
6. Close the tool magazine via the manufacturing software.
7. If you do not start machining: Switch off the machine.

5.2.3 Cutting tool

Cutting tools are used with the *multi unit*, they *cannot* be used with the spindle. The attachments for straight cut, V-cut and kiss cut are secured to the universal head. Cutting lances are clamped into the oscillating tangential cutting head.

NOTE **Tool falling out during machining**

If the tool is not mounted correctly, it can loosen during machining or even fall out of the holder.

» Make sure that the tool is mounted correctly.

» Tighten the grub screw with a suitable tool.

Straight cut

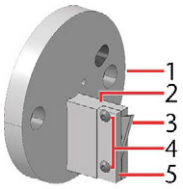


FIG. 17

1. *Holder*
2. *Knife holder*
3. *Knife*
4. *Clamping plate*
5. *Screws*

1. ⚠ **CAUTION!** Secure the cutting edge of the knife [3] with a piece of Styrofoam or foam.
2. Unscrew the 2 screws [4] to remove the old knife [3].
3. Hold the knife [3] with one hand while removing the clamping plate [4].
4. ⚠ **CAUTION!** Insert the knife [3].
5. ***NOTICE!*** Make sure that the knife [3] is correctly aligned. Insert the knife [3] into the recess in the knife holder [2].
6. Fixate the knife [3] with the clamping plate [5] and the 2 screws [4].
7. ⚠ **CAUTION!** Remove the blade guard of the knife [3].

V-cut

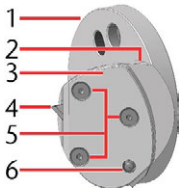


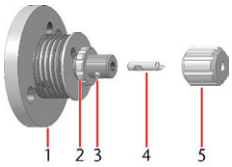
FIG. 18

1. *Holder*
2. *Knife holder*
3. *Clamping plate*
4. *Knife*
5. *Screws*
6. *Positioning pin*

1. ⚠ **CAUTION!** Secure the cutting edge of the knife [4] with a piece of Styrofoam or foam.
2. Unscrew the 3 screws [5] to remove the old knife [4].
3. Hold the knife [4] with one hand while removing the clamping plate [3].
4. ⚠ **CAUTION!** Insert the knife.

5. ***NOTICE!*** Make sure that the knife [4] is correctly aligned. Place the knife [4] onto the positioning pin [6] and in the recess in the knife holder [2].
6. Fixate the knife [4] with the clamping plate [3] and the 3 screws [5].
7. ⚠ **CAUTION!** Remove the blade guard of the knife [4].

Kiss cut



1. *Holder*
2. *Lock nut*
3. *Grub screw*
4. *Knife*
5. *Spacer sleeve*

FIG. 19

1. Unscrew the spacer sleeve [5] from the kiss-cut attachment.
2. ⚠ **CAUTION!** Secure the cutting edge of the knife [4] with a piece of Styrofoam or foam.
3. Loosen the grub screw [3].
4. ⚠ **CAUTION!** Remove the old knife [4].
5. ⚠ **CAUTION!** Insert the new knife [4].
6. ***NOTICE!*** Make sure that the knife [4] is correctly aligned. The side clamping surface in the shaft of the knife [4] must point in the direction of the grub screw [3] so that it can clamp the knife [4].
7. Tighten the grub screw [3] again.
8. Screw the spacer sleeve [5] onto the kiss-cut attachment.
9. ⚠ **CAUTION!** Adjust the immersion depth via the lock nut [2]:
   - » Push the spacer sleeve [5] backwards in the direction of the holder [1] to check the immersion depth.
   - » Turn the lock nut [2] to change the immersion depth.
10. Screw the spacer sleeve [5] tight.

Cutting lances

1. ⚠ **CAUTION!** To replace the cutting lance, do the following:
   a. Secure the cutting edge of the inserted cutting lance with a piece of Styrofoam or foam. Hold the cutting lance with one hand.
   b. With the other hand, loosen the grub screw in the holder on the oscillating tangential cutting head and remove the cutting lance.
   c. Align the cutting lance you are inserting so that the side clamping surface faces the grub screw.
   d. Insert the cutting lance into the holder on the oscillating tangential cutting head. Hold the cutting lance with one hand.
   e. With the other hand, secure the cutting lance with the grub screw.

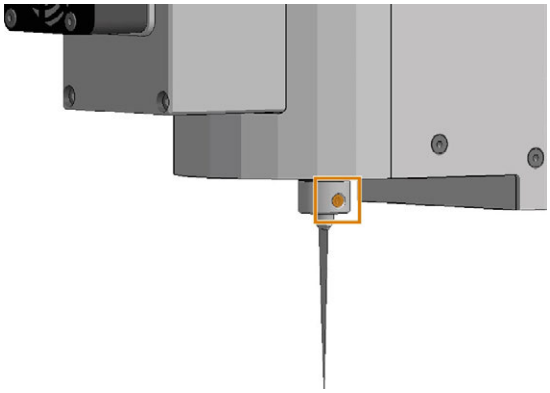


FIG. 20 GRUB SCREW MARKED ORANGE

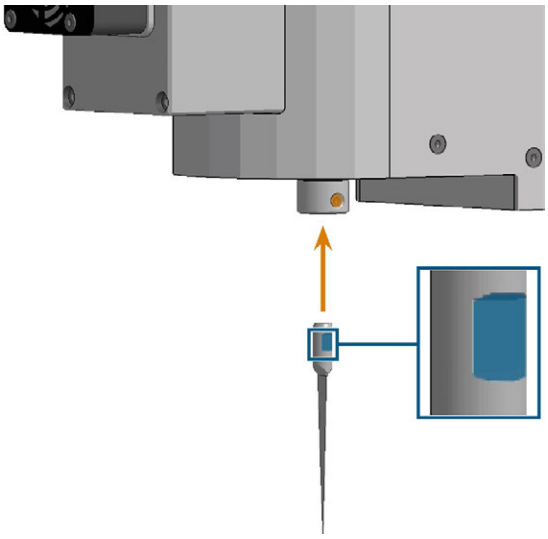


FIG. 21 ALIGNING THE CUTTING LANCE

5.3 Tool cooling

NOTE **Damage caused by machining with unsuitable cooling liquid**

Machining without a suitable cooling liquid can damage the machine, tools and workpieces.

- » Before doing any job, make sure the cooling liquid is clean, does not flocculate, and that the fluid level is adequate.
- » Only use cooling liquids that meet the requirements listed below.

5.3.1 Refilling the cooling liquid

The machine requires a cooling liquid that meets the following requirements:

- Cooling liquid suitable for the application (View table)
- No added chlorine
- No carbonated water

Suitable cooling liquids

We recommend the use of TecLiquid Pro, regardless of the cooling liquid system installed in your machine. Other listed cooling liquids can be used optionally.

	Material	Mixable with drinking water
TecLiquid Pro	Nonferrous metals, steels	Mixing ratio 1:19, concentration 5%
Alu-N	Nonferrous metals	No
AquaTec® *	Nonferrous metals, steels	Mixing ratio 1:17 – 1:14, concentration 6 – 7%
WSP 20 **	Nonferrous metals, steels	No

* Not for minimum quantity lubrication

** Only for minimum quantity lubrication

⚠ **CAUTION!** Handle the cooling liquid carefully and wash your hands thoroughly afterwards. Have the cooling liquid and contaminated items disposed of properly. Observe the safety data sheet of the cooling liquid.

» Check the cooling liquid regularly before machining.

» Refill the cooling liquid when the cooling liquid level is below the min mark. Make sure you use the same type of the cooling liquid.

» Replace the cooling liquid if it is flocculated or contaminated

Minimum quantity lubrication

⚠ CAUTION Risk of injury from escaping compressed air

Opening the refill opening of the minimum quantity lubrication system without switching off the compressed air supply and without venting the system can lead to serious injuries.

» Turn off the compressed air supply before filling the system.

» Vent the system via the vent valve of the pressure vessel.

» Do not switch on the compressed air supply while the vent valve of the pressure vessel is open.

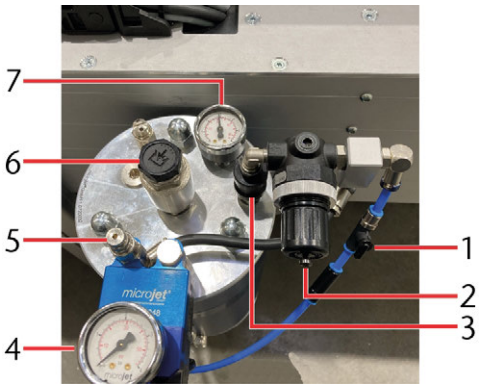


FIG. 22

1. *Shut-off valve*
2. *Rotary knob for compressed air regulator of tank pressure*
3. *Vent valve*
4. *Atomization pressure gauge*
5. *Rotary knob for compressed air regulator of atomization pressure*
6. *Refill opening*
7. *Tank pressure gauge*

1. Switch off the minimum quantity lubrication in the manufacturing software.
2. Close the shut-off valve [1] of the compressed air supply line. To do this, turn the valve transverse to the line direction (horizontally).
3. ⚠ **CAUTION!** Carefully pull the vent valve [3] up to depressurize the container.
4. Unscrew the cap of the refill opening [6].
5. Screw the funnel onto the refill opening [6].
6. Carefully fill the cooling liquid to the maximum level. Make sure that the mixing ratio of the cooling lubricant is correct.
7. Unscrew the funnel.

8. Remove any leaked cooling liquid with a cloth.
9. Screw the cap onto the refill opening [6].
10. Press the vent valve [3] down.
11. Open the shut-off valve [1] of the compressed air supply line. To do this, turn the valve in the direction of the line (vertically).
12. Check whether the pressure gauge of the tank pressure [7] indicates the desired pressure (recommended: 1.5). If not, make sure that the shut-off valve [1] is fully open. If necessary, adjust the pressure using the rotary knob [2] of the compressed air regulator.
13. Activate the minimum quantity lubrication in the manufacturing software.
14. Set the knob [5] of the compressed air regulator such that the atomization pressure gauge [4] is on 1.5 bar.

The indicated pressures are guide values that provide good results for many applications. You can still vary the pressures to adjust the amount of cooling liquid (tank pressure) and droplet size (atomization pressure).

Cooling and spraying unit

Refilling the cooling liquid

1. Open the container of the new cooling liquid and place it next to the empty container under the machine table.
2. Remove the hose from the empty container.
3. Insert the hose into the full container.
4. Remove any leaked cooling liquid with a cloth.

5.3.2 Aligning the spray nozzles

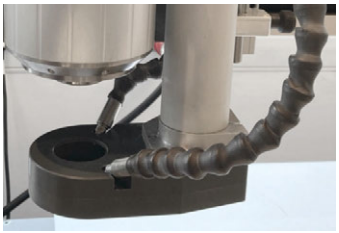


FIG. 23

1. Remove the yellow protective caps on the spray nozzles.
2. Insert the nozzles into the side openings on the top of the suction shoe.
3. Orient the nozzles so that they cool the tool tip.

5.4 Suction shoe

Correct alignment

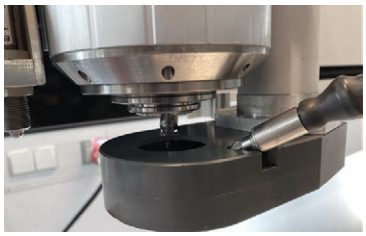


FIG. 24

1. Before milling, make sure that the suction shoe is mounted below the spindle.
2. Lift up the suction shoe and check the concentric alignment using the spindle opening.
3. If necessary, correct the alignment:
   a. Open the screw on the suction tube.
   b. Turn the suction shoe until it is flush with the opening in the spindle.
   c. Tighten the screw on the suction tube again.
4. If the suction shoe is electronically monitored, pay attention to the following additional steps.

   If the machine does not have an enclosure or laser scanner, the suction shoe is monitored electronically. The suction shoe must be correctly mounted and the correct mounting must be confirmed on the system cabinet before machining.

5. Make sure that the suction shoe (marked blue) fits tightly against the counterpart (marked orange) with the sensor and that there is no soiling in the gap.
6. At the system cabinet confirm that the suction shoe is correctly mounted. To do this, press the push-button and the rotary switch at the same time. If there is no system cabinet, there is a corresponding control element on the machine.
7. If the spindle does not start when machining is started, check the assembly of the suction shoe again. If necessary, reconfirm that the suction shoe is correctly mounted.

   ⚠ **CAUTION!** The spindle may start up and injure you.

FIG. 25 ELECTRONICALLY MONITORED SUCTION SHOE

FIG. 26 SYSTEM CABINET

FIG. 27 CONTROL ELEMENT WITH EMERGENCY STOP AND ACKNOWLEDGMENT BUTTON

5.5 Positioning workpieces

5.5.1 Vacuum table

You can freely place workpieces on the machine table or align them to the edges of the machine table.

In addition, you can use the workpiece stoppers to align the workpieces.

1. Remove all objects from the machine table.
2. If you want to use the workpiece stoppers, use the pushbuttons on the front of the system cabinet to extend the workpiece stoppers.

   NOTICE! The workpiece stoppers must be retracted before machining to prevent damage from collisions.
3. Position the workpiece and align it with the workpiece stoppers or the edges of the machine table.
4. Switch the vacuum on.

   Switching the vacuum on / off – unten
5. If you have used the workpiece stops, use the pushbuttons on the front of the system cabinet to retract the workpiece stoppers.
6. Set the workpiece zero point via the manufacturing software.
7. Measure the workpiece height by using one of these methods:
   - Automatic Z adjustment: *Automatic Z adjustment* – auf der gegenüberliegenden Seite
   - Manual measurement: *Manual measurement of the workpiece height* – auf der gegenüberliegenden Seite

5.5.2 Switching the vacuum on / off

Switching on the vacuum

1. Place the workpiece onto the vacuum table and align it with the workpiece stoppers or the edges of the vacuum table.
2. Make sure that the switches directly on the vacuum suction units at the back of the machine are turned on.

   If you do not use a system cabinet, the corresponding vacuum suction units start up directly. Only switch on the vacuum suction units in the area that contains the workpiece.
3. Switch on the vacuum suction units via the pushbuttons on the front of the system cabinet. Only switch on the vacuum suction units that contain the workpiece.
4. Cover the free surfaces of the vacuum table to optimize the vacuum generated and thus the holding force on the workpiece.

Switching off the vacuum

1. Switch off the vacuum suction units via the pushbuttons on the front of the system cabinet. If you do not use a system cabinet, switch off the switch directly on the respective vacuum suction unit.

5.5.3 Other clamping methods

1. Remove all objects from the machine table.
2. If you want to use the workpiece stoppers, use the pushbuttons on the front of the system cabinet to extend the workpiece stoppers.

NOTICE! The workpiece stoppers must be retracted before machining to prevent damage from collisions.

3. Position the workpiece and align it so that you can fasten it securely.
4. Fasten the workpiece into its final position.
5. If you have used the workpiece stops, use the push-buttons on the front of the system cabinet to retract the workpiece stoppers.
6. Set the workpiece zero point via the manufacturing software.
7. Measure the workpiece height by using one of these methods:
   - Automatic Z adjustment: *Automatic Z adjustment* – unten
   - Manual measurement: *Manual measurement of the workpiece height* – unten

5.5.4 Defining the workpiece height

Automatic Z adjustment

NOTE **Machine damage due to incorrect tool for automatic Z adjustment**

If diamond-coated tools attachments are used for the automatic Z adjustment, the machine will not detect the height. It continues to move in Z direction without braking.

» Do not measure the workpiece height with diamond-coated or diamond-tipped tools.

» Only measure the workpiece height with milling cutters.

1. Place the workpiece onto the machine table and fasten it into its final position. Make sure that you do not move the workpiece after measuring the workpiece height, otherwise the measured value will be falsified.
2. ***NOTICE!*** Insert a tool into the spindle.
3. Move the tool over the workpiece. Make sure that the measuring plate of the automatic Z adjustment can be placed completely on the workpiece. Align the measuring plate such that the tool tip hits the measuring plate on the metal part.
4. ⚠ **CAUTION!** Start the automatic Z adjustment via the manufacturing software.

✔ The Z-axis moves down until there is contact between the tool and the measuring plate.

✔ The Z axis moves up again.

5. Remove the measuring plate immediately after measuring to prevent a collision.

Manual measurement of the workpiece height

If the automatic Z adjustment is not available or not possible, you must measure the workpiece height manually.

1. Place the workpiece onto the machine table and fasten it into its final position. Make sure that you do not move the workpiece after measuring the workpiece height, otherwise the measured value will be falsified.
2. ⚠ **CAUTION!** If applicable: Remove the blade guard.
3. If applicable: Start the oscillating tangential cutting head.
4. Move the tool over the workpiece.
5. ⚠ **CAUTION!** Slowly move the Z-axis down until the tool tip touches the workpiece.
6. Use the current position of the Z axis as the start position. Set the workpiece zero point in the manufacturing software.

5.6 Control panel

FIG. 28

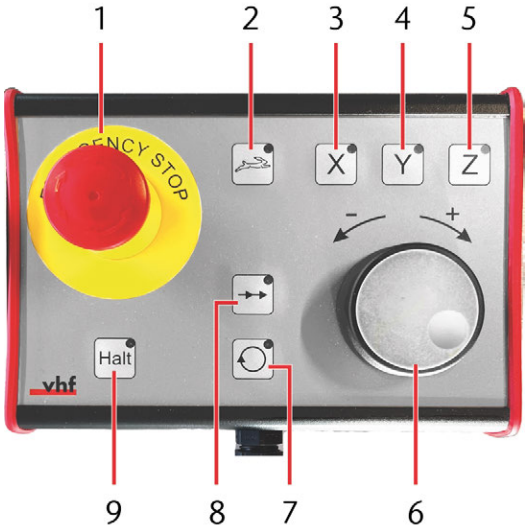


FIG. 29

1. Remove the control panel from its bracket on the system cabinet.
2. To select the axis you want to move, press the [3], [4] or [5] key.
3. If you the movement should be rapid, press the [2] key.
4. To move the selected axis in the positive direction, turn the rotary knob [6] to the right.
5. To move the selected axis in the negative direction, turn the rotary knob [6] to the left.
6. If you want to change the spindle speed or feed rate during machining, do the following:
   a. Press the key [7] for the spindle speed, or the key [8] for the feed rate.
   b. Turn the rotary knob [6] to the right (<+>) or to the left (<–>).
7. To stop the machine, press the [9] key.
8. In case of danger, press the emergency stop button [1] *immediately*.
9. After the procedure, place the control panel in its bracket on the system cabinet.
10. If necessary: After the procedure, accept the current position of the axes in the manufacturing software.

5.7 Changing the machining unit

5.7.1 Switching from spindle to oscillating tangential cutting head

1. Start the machine as described here:
   Starting the machine with the tool in the machining unit (Page 20)
2. If available: Remove the tool from the spindle.
3. Press the emergency stop button.
4. Change the device file in the manufacturing software.
5. Turn off the machine.
6. If the spindle is cooled with cooling liquid, disconnect the gray cooling liquid hoses from the spindle. Collect any leaking cooling liquid. If possible, seal the hoses with a plug.

   ⚠ **CAUTION!** Handle the cooling liquid carefully and wash your hands thoroughly afterwards. Have the cooling liquid and contaminated items disposed of properly. Observe the safety data sheet of the cooling liquid.
7. Disconnect all electrical and pneumatic connections to the spindle.
8. Loosen the screw of the suction shoe (marked red) and hold the suction shoe with one hand.
9. Pull the suction shoe downwards from the suction tube.
10. Unscrew the 4 black screws (marked red) that secure the spindle plate. Hold the spindle with one hand.

    ⚠ **CAUTION!** Pay attention to the weight of the spindle. A falling spindle can cause injuries and material damage.
11. Pull the spindle straight away from the portal.

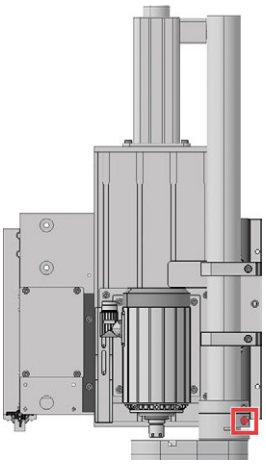


FIG. 30

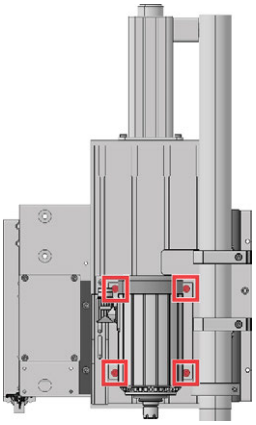


FIG. 31

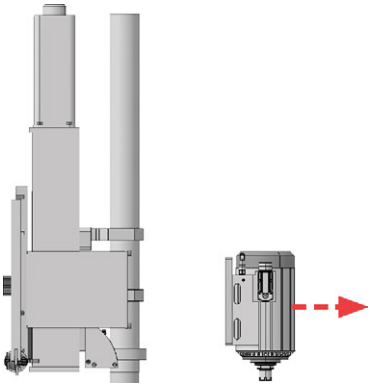


FIG. 32

12. Place the oscillating tangential cutting head straight onto the adapter plate on the machine. Make sure that you correctly align the recesses on the back of the oscillating tangential cutting head with the adapter plate. Hold the oscillating tangential cutting head with one hand.

    ⚠ **CAUTION!** Pay attention to the weight of the tangential cutting head. A falling tangential cutting head can cause injuries and material damage.

13. Secure the oscillating tangential cutting head crosswise with the 4 black screws (marked red).
14. Place the protective cover onto the suction tube and fixate it with the screw (marked red).

    If the machine does not have an enclosure or a laser scanner, the protective cover is monitored electronically. The protective cover must be correctly mounted and the correct mounting must be confirmed on the system cabinet before machining.

    Suction shoe (Page 25)

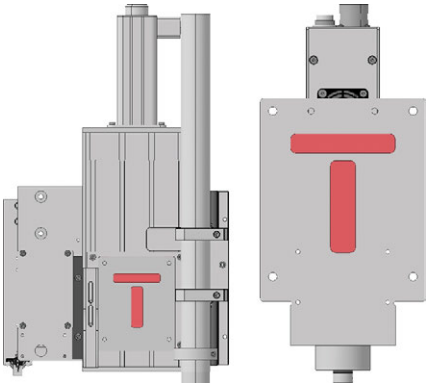


FIG. 33

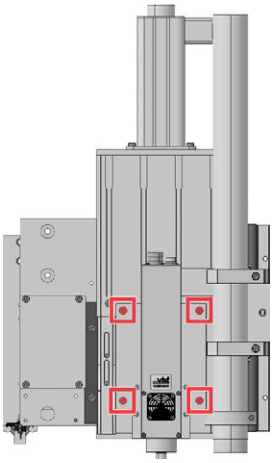


FIG. 34

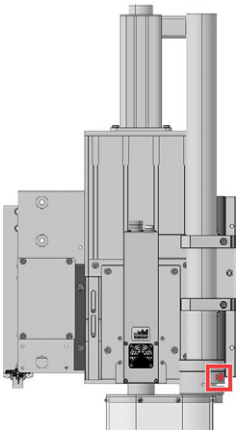


FIG. 35

15. Connect the 2 connection cables (T-axis and oscillation) with the oscillating tangential cutting head.
16. Unlock the emergency stop button.

17. Turn on the machine.

✔ The beep sounds and the controller is ready for operation.

5.7.2 Switching from oscillating tangential cutting head to spindle

1. Start the machine as described here:
   Starting the machine (Page 20)
2. ⚠ **CAUTION!** If available: Remove the tool from the cutting unit. Secure the blade of the tool with a piece of foam.
3. Press the emergency stop button.
4. Change the device file in the manufacturing software.
5. Turn off the machine.
6. Disconnect the 2 connection cables (T-axis and oscillation) from the oscillating tangential cutting head.
7. Loosen the screw (marked red) of the protective cover. Hold the protective cover in place with one hand.
8. Pull the protective cover downwards from the suction tube.
9. Unscrew the 4 black screws (marked red) that secure the oscillating tangential cutting head. Hold the oscillating tangential cutting head with one hand.

   ⚠ **CAUTION!** Pay attention to the weight of the tangential cutting head. A falling tangential cutting head can cause injuries and material damage.
10. Pull the oscillating tangential cutting head straight away from the portal.

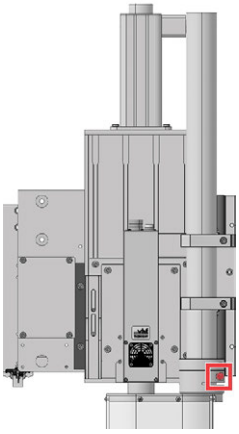


FIG. 36

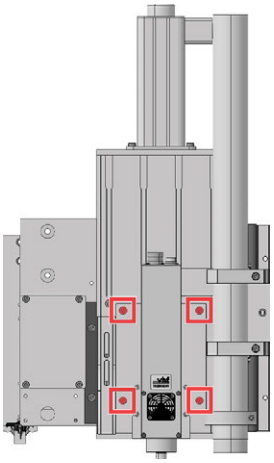


FIG. 37

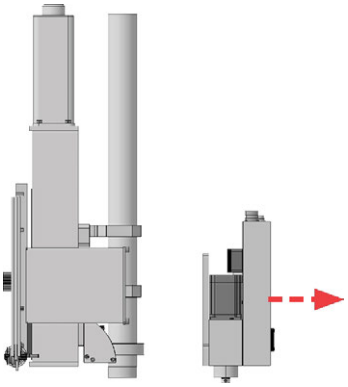


FIG. 38

11. Place the spindle straight onto the adapter plate on the machine. Make sure that you correctly align the recesses on the back of the spindle with the adapter plate. Hold the spindle with one hand.

    ⚠ **CAUTION!** Pay attention to the weight of the spindle. A falling spindle can cause injuries and material damage.
12. Secure the spindle crosswise with the 4 black screws (marked red).
13. Place the suction shoe onto the suction tube and fixate it with the screw (marked blue).

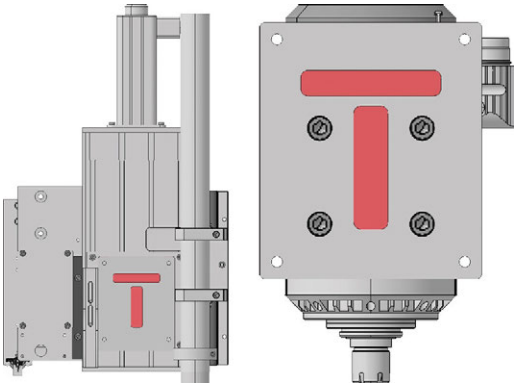


FIG. 39

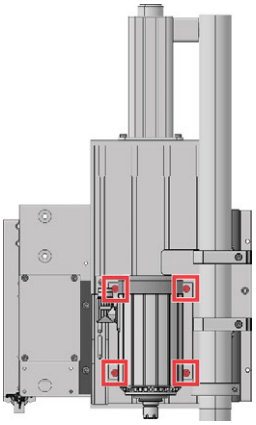


FIG. 40

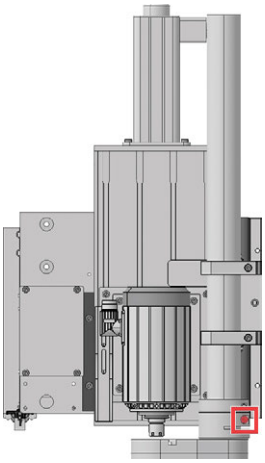


FIG. 41

14. Connect the spindle to all cables, compressed air hoses and cooling liquid hoses (if applicable).
15. Unlock the emergency stop button.
16. Turn on the machine.

✔ The beep sounds and the controller is ready for operation.

17. If the spindle is cooled with cooling liquid, do the following:

a. Start the compressor cooling unit by pressing the **<RES>** button (marked red) on the operating panel of the compressor cooling unit.

> It may be necessary to press the button several times. The compressor cooling unit will stop if there is not enough flow within 3 seconds after the button is pressed. This can be caused by air bubbles in the system.

b. For a few seconds, check if the compressor cooling unit is running without errors and it does not fall below the **Minimum level** mark. Refill with cooling liquid if necessary.

c. Repeat the previous 2 steps until the compressor cooling unit runs without interruption and no error message is displayed.

FIG. 42

FIG. 43

d. Make sure that no cooling liquid is leaking.

5.8 Machining interruptions and cancellation of processing

Machining interruptions and machining aborts are always the result of unforeseen problems that require operator intervention.

Machining interruptions

Machining is *interrupted* in the following cases:

- The laser scanner has detected persons or objects in the safety area.
- The electronically monitored suction shoe is not detected by the sensor.
- Machining was interrupted via the manufacturing software.

» In the event of a machining interruption, ensure the following:

- There are neither persons nor objects in the safety area of the laser scanner. The laser scanner has been reset.
- The electronically monitored suction shoe is correctly attached and detected by the sensor. The suction shoe has been reset.
- Other errors that caused the interruption were fixed.

Machining aborts

Machining is *aborted* in the following cases:

- The machine has a malfunction.
- The power connection of the machine was interrupted.
- The compressed air connection was interrupted.
- The level or flow of the compressor cooling unit is not sufficient.
- The tool change has failed.
- The control unit has detected a malfunction.
- Machining was finished via the manufacturing software.

» In the event of a machining abort, ensure the following:

- The CAM System switch and the main switch are switched off.
- All objects were removed such that the axes can be moved freely.
- The compressed air connection exists and the pressure is at least 6.5 bar.
- The compressor cooling unit is ready for use.
- If the machining has been interrupted during the tool change:
  The tool is correctly seated in the machining unit or has been removed.

5.9 Switching off the machine

1. ⚠ **CAUTION!** Remove the clamped tool from the spindle.
2. Move the axes in the direction of the machine zero point.
3. Switch off the vacuum via the pushbuttons on the system cabinet.
4. Close the manufacturing software.
5. Shut down the production computer.
6. Switch off the machine via the CAM system switch in the system cabinet. If you are not using a system cabinet, switch off the machine via the main switch at the rear of the machine.
7. Remove the workpiece from the machine table.
8. Remove machining residue from the machine table.

6 MAINTENANCE

NOTE **Damage to the spindle when cleaning with compressed air**

Using compressed air to clean the spindle can damage the spindle bearings.

» Clean the spindle exclusively with the service set supplied.

Your machine needs regular maintenance for a long and productive life with minimum downtime. You can carry out the following maintenance yourself.

6.1 Basic maintenance and cleaning

Basic maintenance and basic cleaning includes all maintenance tasks that are necessary to maintain operation. This maintenance must be carried out by you at the prescribed intervals.

6.2 Warranty

The machine and additional equipment are guaranteed for 24 months in single-shift operation. The warranty covers material damage and manufacturing damage, provided that the operating instructions in this document have been observed. In addition, damage to wearing parts is covered, provided that this is not due to function-related wear.

6.3 Definition of wear parts

Wearing parts are parts of the machine which are worn out during normal function before the end of the machine's service life. The maintenance table lists all wearing parts of the machine and their average service life. At the end of the service life, these wearing parts should be replaced in order to maintain smooth operation.

6.4 Maintenance table

6.4.1 Daily maintenance

Task	Brief description
Checking the external power connection for damage	Visual inspection of the external power connection
Checking the external compressed air connection for damage	Visual inspection of the external compressed air connection
Checking the safety devices	Visual inspection and functional test of the safety devices
Checking the suction hose for damage	Visual inspection and functional test of the suction hose
Checking the cooling liquid and cooling liquid level	Visual inspection of the cooling liquid and the cooling liquid level
Daily cleaning of the machine	Daily cleaning of the machine ■ Cleaning the machine table ■ Cleaning the tools ■ Clean the spindle ■ Cleaning the tool magazine ■ Cleaning the camera lens

6.4.2 Weekly maintenance

Task	Brief description
Weekly cleaning of the machine	Weekly cleaning of the machine ■ Cleaning and emptying the vacuum cleaner

6.4.3 Annual maintenance

Task	Brief description
Annual cleaning of the machine	Annual cleaning of the machine ■ Refilling the compressor cooling unit (spindle cooling) ■ Checking the control unit fan

6.5 Wear and spare parts (self-replacement)

6.5.1 Wear and spare parts (self-replacement)

Task	Brief description
Exchange the spindle	Exchange of the spindle
Exchange the oscillating tangential cutting head	Exchange of the oscillating tangential cutting head
Exchange the control unit	Exchange of the machine control unit
Exchange the frequency converter (SFU)	Exchange of the frequency converter of the spindle
Exchange the controller of the tangential cutting head (TANPWR)	Exchange of the controller of the oscillating tangential cutting head
Exchange the computer	Exchange of the production computer
Exchange the compressor cooling unit	Exchange of the compressor cooling unit
Exchange the cooling and spraying device	Exchange of the cooling and spraying device
Exchange the tool holder	Exchange of the tool holder in the tool magazine
Exchange the vacuum table element	Exchange of the vacuum table element

6.5.2 Wear and spare parts (customer service replacement)

Wear part	Brief description	Interval
Exchange the drive pinion	Exchange of the drive pinion	2,000 operating hours / 1 year / In case of damage
Exchange the track rollers	Exchange of the track roller	2,000 operating hours / 1 year / In case of damage
Exchange the Z-axis motor and clutch	Exchange of the motor and coupling of the Z-axis	2,000 operating hours / 1 year / In case of damage
Exchange the felts	Exchange of the felts	When necessary (heavy pollution)
Exchange the Z-axis limit switch	Exchange of the Z-axis limit switch	In case of damage
Exchange the limit switch X-axis / Y-axis	Exchange of the X- / Y-axis limit switch	In case of damage
Exchange the filter of the vacuum suction unit	Exchange of the vacuum suction unit	When necessary
Exchange the Z adjustment	Exchange of the automatic Z adjustment	When necessary

6.6 Daily maintenance

6.6.1 Checking the external power supply for damage (before switching on the machine)

Check the external power supply cable and the ground cable for kinks and damage. If one of the cables is damaged, the machine must not be started up.

The external power supply cable must be replaced by a qualified electrician, as it is firmly attached to the control unit.

Have the damaged cable replaced immediately by a qualified electrician trained on the machine by vhf. If you cannot replace the cable immediately, switch off the machine at the main switch and secure it with a lock to prevent it from being switched on again.

6.6.2 Checking the external compressed air supply for damage (before switching on the machine)

Check the hose of the external compressed air supply for kinks and damage. If the hose is damaged, the machine must not be started up. An insufficient compressed air supply leads to incorrect tool changes and resulting machine crashes; in addition, tool cooling can be impaired.An insufficient compressed air supply can impair tool cooling. Replace the damaged hose immediately. If you cannot replace the hose immediately, switch off the machine at the main switch and secure it with a lock to prevent it from being switched on again.

6.6.3 Checking the safety devices (before starting work)

Check the safety devices before starting the machining operation. This check includes checking the emergency stop button and the laser scanner. These components are necessary for safe machining. For this reason you should not start machining if one of the 2 safety devices is not fully functional.

1. Turn on the machine.
2. Wait until the status LED of the CNC control unit pulsates blue.

FIG. 44

3. Test the emergency stop button on the system cabinet by pressing it. On the LED display of the CNC control unit, the **Emergency Stop** LED must light up orange as soon as the emergency stop button is pressed.

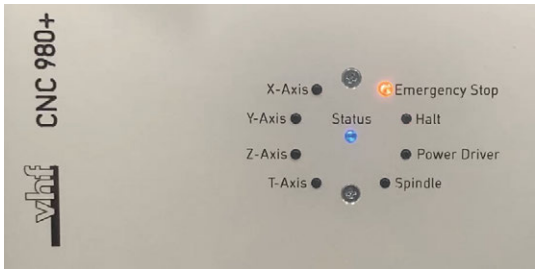


*FIG. 45 ORANGE LED **EMERGENCY STOP***

4. Release the emergency stop button and check if the **Emergency Stop** LED display on the CNC control unit lights up red.

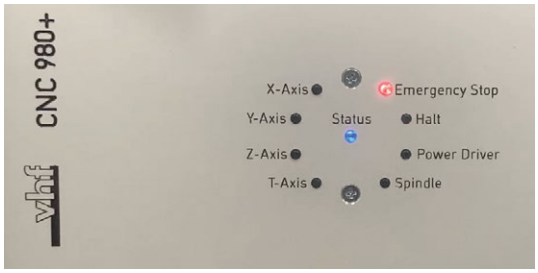


*FIG. 46 RED LED **EMERGENCY STOP***

5. If the emergency stop button does not work properly, do the following:
   a. Turn off the machine.
   b. Turn off the main switch. Secure the main switch with a lock to prevent it from being switched on again.
   c. Contact vhf support.
6. If available: Check if the laser scanner is functioning properly:
   a. Enter the safety area while the axes are moving. If the machine does not stop, the safety area must be set up again.

b. Acknowledge the laser scanner via the system cabinet. To do this, press the pushbutton and the rotary switch labeled **<RESET>** at the same time.

7. If available: Make sure that the electronically monitored suction shoe is mounted correctly.
   Suction shoe (Page 25)

6.6.4 Checking the cooling liquid of the tool cooling system (before starting to machine)

» Check the level and condition of the cooling liquid of the tool cooling system before starting to machine. If necessary, top up with cooling liquid or replace it.
Refilling the cooling liquid (Page 24)

⚠ **CAUTION!** When machining aluminum and aluminum alloys, a functional tool cooling system is absolutely necessary.

6.6.5 Daily cleaning of the machine

The following work is carried out after machining and before switching off the machine:

- Cleaning the machine table
- Cleaning the tools
- Cleaning the protective glass of the camera lens

Cleaning the machine table
Required tools

- Vacuum cleaner
- Moist cloth
- Mild detergent (optional)

1. Remove all objects from the machine table.
2. Turn on the vacuum to fix the vacuum fleece in place.
3. Remove chips with the help of a vacuum cleaner.
4. Clean the sides of the table, the portal, and the portal head with a damp cloth. Remove heavy soiling with the help of a mild detergent.

Cleaning the tools
Required tools

- Brush
- Dry cloth

1. Remove the tool / tool cone.
2. Clean the tool with a brush.
3. Clean the tool cone with a dry cloth.
4. Grease the tool cone slightly.

Cleaning the tool magazine
Required tools

- Vacuum cleaner
- Moist cloth
- Dry cloth

1. Make sure that the tool magazine is free and can be opened.
2. Open the tool magazine.
3. Remove all tools / tool cones.
4. Use a vacuum cleaner to remove chips from the tool magazine.
5. Clean the tool holders with a damp cloth.
6. Reinsert all tool cones.
7. Use a vacuum cleaner to remove chips from the tool length touch probe.
8. Use a vacuum cleaner to remove chips that are stuck to the tool length touch probe.
9. Close the tool magazine.

Cleaning the camera lens
Required tools

- Moist cloth
- Dry cloth

1. Clean the camera lens *carefully* with a damp cloth. Then dry the camera lens *carefully* with a dry cloth.
   Make sure *not to move* the camera when cleaning it. Otherwise, the camera may be misaligned and recalibration may be necessary.

6.7 Weekly maintenance

6.7.1 Cleaning and emptying the vacuum cleaner

1. Open the vacuum cleaner.
2. Empty the contents of the vacuum cleaner.
3. Clean the filter of the vacuum cleaner.
4. Close the vacuum cleaner.
5. Switch on the dust extraction system and check that the vacuum cleaner is working properly.
6. If the dust suction is inadequate: check the hose.
   - If the hose is clogged: Clean the hose.
   - If the hose is damaged: Replace the hose.
7. If the hose is not the cause of the problem: Connect another vacuum cleaner and test the dust extraction system.

- If the suction is still inadequate, do not start up the machine.

6.8 Annual maintenance

6.8.1 Refilling the compressor cooling unit (spindle cooling)

This maintenance is only necessary for machines whose spindle is cooled with cooling liquid.

Cooling liquid

The compressor cooling unit requires a cooling liquid that meets the following requirements:

- Distilled water mixed with cooling liquid
- No added chlorine
- No carbonated water
- No drinking water

Recommended cooling liquid:

Antifrogen® N

Mixing ratio 1:5, 1:3

⚠ **CAUTION!** Handle the cooling liquid carefully and wash your hands thoroughly afterwards. Have the cooling liquid and contaminated items disposed of properly. Observe the safety data sheet of the cooling liquid.

Procedure

1. Turn off the machine.
2. Remove the yellow cap on the front of the compressor cooling unit.
3. Insert the funnel into the opening on the front of the compressor cooling unit.
4. ⚠ **CAUTION!** Fill the compressor cooling unit up to the mark **Maximum level** of the level hose. Only use the cooling liquid specified above in the correct mixing ratio.

FIG. 47

5. ⚠ **CAUTION!** Check for any leaking liquid on the back of the compressor cooling unit. If cooling liquid leaks, proceed as follows:
   a. Remove any leaked cooling liquid immediately with a cloth.
   b. Make sure that the hoses are connected correctly.
   c. If the hoses cannot be connected tightly, drain the cooling liquid and collect it in a container. Contact the vhf support.
   d. If the hoses are tightly connected, fill the compressor cooling unit up to the mark **Maximum level**.
6. Remove the funnel from the opening on the front of the compressor cooling unit.
7. Seal the opening with the yellow cap.
8. Turn on the machine.
9. Start the compressor cooling unit by pressing the **<RES>** button (marked red) on the operating panel of the compressor cooling unit.

   It may be necessary to press the button several times. The compressor cooling unit will stop if there is not enough flow within 3 seconds after the button is pressed. This can be caused by air bubbles in the system.

10. For a few seconds, check if the compressor cooling unit is running without errors and it does not fall below the **Minimum level** mark. Refill with cooling liquid if necessary.
11. Repeat the previous 2 steps until the compressor cooling unit runs without interruption and no error message is displayed.

FIG. 48

FIG. 49

6.9 Wear and spare parts (self-replacement)

6.9.1 Replacing the spindle / Replacing the oscillating tangential cutting head

You can replace the spindle and the oscillating tangential cutting head yourself.

» To replace, follow the steps in the description for changing the machining units. When doing so, mount the new machining unit of the same type and do not change the device file in the manufacturing software.

Changing the machining unit (Page 28)

6.9.2 Replacing the control unit (CNC)

1. Turn off the machine.
2. Turn off the main switch. Secure the main switch with a lock to prevent it from being switched on again.
3. Switch off the control unit at the switch on the rear panel.
4. Disconnect the power plug.
5. Disconnect the 5 axis cables (**X Axis**, **Y Axis**, **Z Axis**, **T Axis** and **U Axis**).
6. Disconnect the screw connector of the output connector **Output.**
7. Disconnect the screw connector of the input connector **Input.**
8. Disconnect the screw connector of the output connector **Extension Output**.
9. Disconnect the screw connector of the spindle communication **Spindle**.
10. Disconnect the screw connector of the control panel **HBOX**.
11. Disconnect the screw connector **RS 232**.
12. Disconnect the USB cable to the production computer.
13. Unscrew the 4 screws that fasten the control unit to the front of the system cabinet.
14. Pull the control unit out of the system cabinet towards the front.
15. Insert the new control unit into the system cabinet.
16. Screw in the 4 screws that fasten the control unit to the front of the system cabinet.
17. Connect the USB cable to the production computer.
18. Connect the screw connector of the spindle communication **Spindle**.
19. Connect the screw connector **RS 232**.
20. Connect the screw connector of the control panel **HBOX**.
21. Connect the screw connector of the input connector **Input**.
22. Connect the screw connector of the output connector **Output.**
23. Connect the 2 screw connectors of the output connector **Extension Output**.
24. Connect the 5 axis cables (**X Axis**, **Y Axis**, **Z Axis**, **T Axis** and **U Axis**).
25. Connect the power plug.
26. Turn on the control unit at the switch on the back of the control box.
27. Check the safety devices.

Checking the safety devices (before starting work) (Page 36)

6.9.3 Replacing the spindle frequency converter (SFU)

1. Turn off the machine.
2. Switch off the toggle switch for the CAM system on the base of the machine.
3. Turn off the main switch. Secure the main switch with a lock to prevent it from being switched on again.
4. Disconnect the screw connector of the power plug.
5. Disconnect the screw connector of the spindle sensor **Spindle Sensor**.
6. Disconnect the screw connectors of the spindle cable **Spindle**.
7. Disconnect the screw connector of the cable to the control unit **Control.**
8. Disconnect the grounding cable.

9. Unscrew the 4 screws that fasten the frequency converter to the front of the system cabinet.
10. Pull the frequency converter out of the system cabinet towards the front.
11. Insert the new frequency inverter into the system cabinet.
12. Screw in the 4 screws that fasten the frequency converter to the front of the system cabinet.
13. Connect the grounding cable.
14. Connect the screw connectors of the spindle cable **Spindle**.
15. Connect the screw connector of the spindle sensor **Spindle Sensor**.
16. Connect the screw connector of the power plug.

6.9.4 Replacing the oscillation control unit (TANPWR)

1. Turn off the machine.
2. Switch off the main switch. Secure the main switch with a lock to prevent it from being switched on again.
3. Switch off the control unit by using the switch on the rear panel.
4. Disconnect the power plug.
5. Disconnect the screw connector of the output cable **TANPWR Out 24V**.
6. Disconnect the screw connector of the input cable **TANPWR In 24V**.
7. Unscrew the 4 screws that fasten the control unit box to the front of the system cabinet.
8. Pull the control unit box unit out of the system cabinet towards the back.
9. Insert the new control unit box into the system cabinet.
10. Screw in the 4 screws that fasten the control unit box to the front of the system cabinet.
11. Connect the screw connector of the input cable connector **TANPWR In 24V**.
12. Connect the screw connector of the output cable **TANPWR Out 24V**.
13. Connect the power plug.
14. Switch on the control unit at the switch on the rear panel.

6.9.5 Replacing the distribution box of the multi unit

1. Turn off the machine.
2. Switch off the main switch. Secure the main switch with a lock to prevent it from being switched on again.
3. Disconnect the cables from the **multi unit**, **universal head** and **tangential knife** sockets on the distribution box of the multi unit.
4. Disconnect the screw connector of the input cable **TANPWR In 24V** from the oscillation control unit (TANPWR).
5. Disconnect the following cables from the control unit (CNC):
   - **T-axis**
   - The cable with the wires **Extension out 4** and **Extension out 5** (with ground wire)
   - The cable with the **OUT 3** wire (with ground wire)
6. Loosen the 2 wing nuts on the distribution box and remove the distribution box from the system cabinet.
7. Using the 2 wing nuts, fasten the new distribution box in the system cabinet.
8. Connect the following cables to the control unit (CNC):
   - **T-axis**
   - The cable with the wires **Extension out 4** and **Extension out 5** (with ground wire)
   - The cable with the **OUT 3** wire (with ground wire)
9. Connect the screw connector of the input cable **TANPWR In 24V** to the oscillation control unit (TANPWR).
10. Connect the corresponding cables to the **multi unit**, **universal head** and **tangential knife** sockets on the distribution box of the multi unit.

6.9.6 Replacing the manufacturing computer

1. Turn off the machine.
2. Turn off the main switch. Secure the main switch with a lock to prevent it from being switched on again.
3. Disconnect the power plug.
4. Disconnect the Ethernet cable.
5. Disconnect the screen cable.
6. Disconnect the USB cables.

7. Unscrew the screws that secure the mount of the production computer.
8. Pull the production computer out of the system cabinet towards the back.
9. Insert the new production computer into the system cabinet.
10. Screw in the screws that secure the mount of the production computer.
11. Connect the USB cables.
12. Connect the screen cable.
13. Connect the Ethernet cable.
14. Connect the power plug.

6.9.7 Replacing the compressor cooling unit (spindle cooling)

This maintenance is only necessary for machines whose spindle is cooled with cooling liquid.

⚠ **CAUTION!** Handle the cooling liquid carefully and wash your hands thoroughly afterwards. Have the cooling liquid and contaminated items disposed of properly. Observe the safety data sheet of the cooling liquid.

1. Turn off the machine.
2. Switch off the main switch. Secure the main switch with a lock to prevent it from being switched on again.
3. Disconnect the power plug and the **Sensor B** cable at the back of the compressor cooling unit.
4. Drain the cooling liquid from the front of the compressor cooling unit:
    a. Have a flat drip tray ready.
    b. Pull up the hose lock on the upper connection of the level hose.
    c. Pull the hose out of the upper connection and turn the hose to the side and into the drip tray. The free end of the hose must be lower than the compressor cooling unit.
    d. Wait until the cooling liquid has completely drained.
5. Disconnect the cooling liquid hoses at the rear of the compressor cooling unit. If possible, seal the hoses with a plug. Collect leaking cooling liquid with a cloth.
6. Unscrew the 4 screws that fasten the compressor cooling unit to the front of the system cabinet.
7. Pull the compressor cooling unit out of the system cabinet towards the front.
8. Insert the new compressor cooling unit into the system cabinet.
9. Screw in the 4 screws that fasten the compressor cooling unit to the front of the system cabinet.
10. Connect the power plug and the cable **Sensor B** at the back of the compressor cooling unit.
11. Connect the cooling liquid hoses at the back of the compressor cooling unit.
12. Fill up the compressor cooling unit.
    Refilling the compressor cooling unit (spindle cooling) (Page 38)

6.9.8 Replacing the nozzles of the mold cooling

1. Turn off the machine.
2. If the machine uses minimum quantity lubrication (gray nozzle hoses), do the following:
    a. Open the black swivel nut on the pipe above the nozzle hoses.
    b. Unscrew the screw that secures the pipe to the machine.
    c. Remove the nozzles from the machine.
    d. Position the new nozzles onto the machine and screw the black swivel nut onto the tube of the new nozzles.
    e. Using the screw, screw the tube of the new nozzles onto the machine.
3. If the machine uses a cooling and spraying device (blue nozzle hose), do the following:
    a. Unscrew the screw that secures the supply line to the nozzle hose. If you replace the nozzle together with the shut-off valve, also unscrew the supply line at the shut-off valve and mark the supply lines.
    b. Unscrew the end switch from the machine. If you replace the nozzle together with the shut-off valve, unscrew the valve and remove it with the nozzle.
    c. Screw the new nozzle hose to the machine. If applicable, screw the new shut-off valve together with nozzle hose to the machine.
    d. Screw the supply line to the nozzle hose. If applicable, also screw the supply line tightly to the shut-off valve.
4. Align the new nozzles.
    Aligning the spray nozzles (Page 25)

6.9.9 Replacing the tool holders in the tool magazine

1. Open the tool magazine.
2. Remove the grub screw on the tool holder that you want to exchange.
3. Pull the tool holder upwards and out of the tool magazine.
4. Insert the new tool holder into the tool magazine.
5. Tighten the grub screw of the tool holder.
6. Retract the tool magazine.

7 DECOMMISSIONING AND DISPOSAL

7.1 Decommissioning

To prevent damage due to prolonged storage (more than 1 month), perform the following work:

Component	Task
Linear guide rails, toothed racks	Grease the linear guide rails and toothed racks.
Spindle	Clean the cone.
Minimum quantity lubrication	Depressurize the minimum quantity lubrication and drain it.
Machine in general	Switch off the machine at the main switch and secure it against being switched on again with a lock.
External compressed air connection	Disconnect the external compressed air connection.
Spindle cooling	Drain the system.
Power connection	Disconnect the power supply.
Ethernet network cable	Disconnect the Ethernet network cable.

7.2 Dispose of the cooling liquid and machining residue

When disposing of the cooling liquid/machining residue, obey the following regulations:

- Avoid entry of hazardous machining residue into the soil, water and sewer system.
- Keep a sample of the product to be disposed of for at least 6 months.
- Observe the national and local laws of the disposal site.
- If required, have the products disposed of by an approved disposal company.

7.3 Disposal of the machine

The machine must not be disposed of together with residual waste. This is indicated by the symbol with the crossed-out garbage can. In the European Union (EU), this falls under Directive 2012/19/EU.

We will dispose of the machine at no cost. The owner will bear the costs for disassembly, packaging and transport.

» Before you send the machine in for disposal, contact your reseller's customer service or recycling@vhf.de.

» Delete all personal data under your own responsibility from all data carriers of the internal and/or external devices.

» If you dispose of the machine yourself, observe the national and local laws of the disposal location.

» If necessary, have the machine disposed of by an approved waste disposal company.

8 MACHINING PARAMETERS

DANGER **Flammable and/or explosive materials**

Working with flammable and/or explosive materials such as aluminum without appropriate safety measures can lead to death or serious injury.

- **Before** machining, make sure that the dust extraction system is suitable for flammable/explosive materials and functions properly.
- **Before** machining, make sure that the tool cooling system is filled with a suitable cooling lubricant and is functioning properly.
- Only use cooling lubricants recommended by vhf.
- **During** machining, check continuously that the tool is cooled. Stop machining immediately if cooling is insufficient.

Depending on the material to be machined, the speed and feed rate should be adjusted.

The following parameters are only reference values for the most common tools, depending on the experience that vhf collected.

For parameters of other tools from the vhf product range, please contact vhf customer service.

8.1 Thermoplastics

Almost all solid plastics without fiber reinforcement.

For spindles with a speed of up to 30,000 rpm

- Single-tooth cutter with polished flute (ES-PS-...)

Cutting edge diameter [mm]	3	4	6	8
Speed range [rpm]	25,000 – 30,000	25,000 – 30,000	20,000 – 25,000	15,000 – 20,000
Feed X / Y direction [mm/s]	35 – 45	40 – 50	55 – 65	60 – 75
Feed Z direction [mm/s]	3 – 5	3 – 5	5 – 8	8 – 10
Material removal [mm]	3 – 4.5	4 – 6	6 – 12	8 – 16

- Double-tooth cutter with polished flute (ZS-PS-...)

Cutting edge diameter [mm]	3	4	6
Speed range [rpm]	20,000 – 25,000	20,000 – 25,000	20,000 – 25,000
Feed X / Y direction [mm/s]	30 – 40	50 – 60	60 – 75
Feed Z direction [mm/s]	3 – 5	3 – 5	5 – 8
Material removal [mm]	3 – 4.5	4 – 8	6 – 12

- Engraving tools (GS -...)

Point angle [°]	15	36	60	90
Speed range [rpm]	19,000 – 24,000	19,000 – 24,000	17,000 – 22,000	15,000 – 20,000
Feed X / Y direction [mm/s]	8 – 14	8 – 16	10 – 16	10 – 16
Feed Z direction [mm/s]	2 – 3	2 – 3	2 – 3	2 – 3
Material removal [mm]	0.2 – 0.3	0.2 – 0.4	0.3 – 0.6	0.9 – 1.5

- Engraving cutter for acrylic glass (GF-...K-...)

Point angle [°]	30	60	90
Speed range [rpm]	11,000 – 16,000	10,000 – 15,000	10,000 – 15,000
Feed X / Y direction [mm/s]	14 – 20	13 – 20	15 – 20
Feed Z direction [mm/s]	2 – 3	2 – 3	2 – 3
Material removal [mm]	0.5 – 0.7	0.6 – 1	0.9 – 1.5

For spindles with a speed of up to 60,000 rpm

- Single-tooth cutter with polished flute (ES-PS-...)

Cutting edge diameter [mm]	Speed range [rpm]	Feed X / Y direction [mm/s]	Feed Z direction [mm/s]	Material removal [mm]
3	30,000 – 35,000	40 – 50	3 – 5	3 – 4.5
4	27,000 – 32,000	45 – 55	3 – 5	4 – 6
6	20,000 – 25,000	55 – 65	5 – 8	6 – 9
8	15,000 – 20,000	60 – 75	8 – 10	8 – 16

- Double-tooth cutter with polished flute (ZS-PS-...)

Cutting edge diameter [mm]	Speed range [rpm]	Feed X / Y direction [mm/s]	Feed Z direction [mm/s]	Material removal [mm]
3	20,000 – 25,000	30 – 40	3 – 5	3 – 4.5
4	20,000 – 25,000	50 – 60	3 – 5	4 – 8
6	20,000 – 25,000	60 – 75	5 – 8	6 – 12

- Engraving tools (GS -...)

Point angle [°]	Speed range [rpm]	Feed X / Y direction [mm/s]	Feed Z direction [mm/s]	Material removal [mm]
15	19,000 – 24,000	8 – 14	2 – 3	0.2 – 0.3
36	19,000 – 24,000	8 – 16	2 – 3	0.2 – 0.4
60	17,000 – 22,000	10 – 16	2 – 3	0.3 – 0.6
90	15,000 – 20,000	10 – 16	2 – 3	0.4 – 0.8

- Engraving cutter for acrylic glass (GF-...K-...)

Point angle [°]	Speed range [rpm]	Feed X / Y direction [mm/s]	Feed Z direction [mm/s]	Material removal [mm]
30	11,000 – 16,000	14 – 20	2 – 3	0.5 – 0.7
60	10,000 – 15,000	13 – 20	2 – 3	0.6 – 1
90	10,000 – 15,000	15 – 20	2 – 3	0.9 – 1.5

8.2 Aluminum composite panels (Dibond®)

Panels with a polyethylene core and aluminum face sheets.

For spindles with a speed of up to 30,000 rpm

- Single-tooth cutter Varius® (ES-SC-...)

Cutting edge diameter [mm]	3	4	6
Speed range [rpm]	25,000 – 30,000	25,000 – 30,000	23,000 – 28,000
Feed X / Y direction [mm/s]	35 – 45	50 – 60	65 – 75
Feed Z direction [mm/s]	3 – 5	3 – 5	5 – 8
Material removal [mm]	All at once	All at once	All at once

- V-groove cutter for aluminum composites (ES-AV-... and RB-AV-...)

Point angle [°]	90 (ES-AV-... max. 4 mm material removal)	90 (RB_AV-... max. 6 mm material removal)	135 (RB_AV-... max. 4 mm material removal)
Speed range [rpm]	25,000 – 30,000	15,000 – 20,000	15,000 – 20,000
Feed X / Y direction [mm/s]	65 – 75	30 – 40	30 – 40
Feed Z direction [mm/s]	5 – 8	5 – 8	5 – 8
Minimum remaining material [mm]	0.6 – 0.8	0.6 – 0.8	0.6 – 0.8

For spindles with a speed of up to 60,000 rpm

- Single-tooth cutter Varius® (ES-SC-...)

Cutting edge diameter [mm]	Speed range [rpm]	Feed X / Y direction [mm/s]	Feed Z direction [mm/s]	Material removal [mm]
3	30,000 – 35,000	40 – 50	3 – 5	All at once
4	25,000 – 30,000	50 – 60	3 – 5	All at once
6	23,000 – 28,000	65 – 75	5 – 8	All at once

- V-groove cutter for aluminum composites (ES-AV-... and RB-AV-...)

Point angle [°]	Speed range [rpm]	Feed X / Y direction [mm/s]	Feed Z direction [mm/s]	Minimum remaining material [mm]
90 (ES-AV-... max. 4 mm material removal)	25,000 – 30,000	65 – 75	5 – 8	0.6 – 0.8
90 (RB_AV-... max. 6 mm material removal)	15,000 – 20,000	30 – 40	5 – 8	0.6 – 0.8
135 (RB_AV-... max. 4 mm material removal)	15,000 – 20,000	30 – 40	5 – 8	0.6 – 0.8

8.3 Aluminum

Soft aluminum alloys like AlMg3, AlMg1, AlMg4.5Mn, etc.

For spindles with a speed of up to 30,000 rpm

- Single tooth cutter with hawk beak (ES-HB-...)

Cutting edge diameter [mm]	3	4	6	8
Speed range [rpm]	25,000 – 30,000	25,000 – 30,000	25,000 – 30,000	20,000 – 25,000
Feed X / Y direction [mm/s]	25 – 35	35 – 45	45 – 55	50 – 60
Feed Z direction [mm/s]	2 – 4	2 – 4	4 – 6	4 – 6
Material removal [mm]	0.8 – 1.3	1 – 1.6	1.2 – 1.8	1.5 – 2

- Double-tooth cutter Varius® (ZS-SC -...)

Cutting edge diameter [mm]	3	4	6	8
Speed range [rpm]	25,000 – 30,000	25,000 – 30,000	18,000 – 23,000	15,000 – 20,000
Feed X / Y direction [mm/s]	25 – 35	35 – 45	45 – 55	50 – 60
Feed Z direction [mm/s]	2 – 4	2 – 4	4 – 6	4 – 6
Material removal [mm]	0.9 – 1.5	1.2 – 2	1.8 – 3	2 – 4

- Engraving tools (GS -...)

Point angle [°]	15	36	60	90
Speed range [rpm]	23,000 – 28,000	23,000 – 28,000	21,000 – 26,000	19,000 – 24,000
Feed X / Y direction [mm/s]	8 – 14	8 – 14	9 – 15	9 – 15
Feed Z direction [mm/s]	2 – 3	2 – 3	2 – 3	2 – 3
Material removal [mm]	0.2 – 0.3	0.2 – 0.4	0.3 – 0.6	0.4 – 0.8

For spindles with a speed of up to 60,000 rpm

- Single-tooth cutter with hawk beak (ES-HB-...)

Cutting edge diameter [mm]	Speed range	Feed X / Y direction [mm/s]	Feed Z direction [mm/s]	Material removal [mm]
3	35,000 – 40,000	35 – 45	2 – 4	0.8 – 1.3
4	33,000 – 38,000	40 – 50	2 – 4	1 – 1.6
6	25,000 – 30,000	45 – 55	4 – 6	1.2 – 1.8
8	20,000 – 25,000	50 – 60	4 – 6	1.5 – 2

- Double-tooth cutter Varius® (ZS-SC -...)

Cutting edge diameter [mm]	Speed range	Feed X / Y direction [mm/s]	Feed Z direction [mm/s]	Material removal [mm]
3	30,000 – 35,000	35 – 45	2 – 4	0.9 – 1.5
4	27,000 – 32,000	40 – 50	2 – 4	1.2 – 2
6	18,000 – 23,000	45 – 55	4 – 6	1.8 – 3
8	15,000 – 20,000	50 – 60	4 – 6	2 – 4

- Engraving tools (GS -...)

Point angle [°]	Speed range	Feed X / Y direction [mm/s]	Feed Z direction [mm/s]	Material removal [mm]
15	23,000 – 28,000	8 – 14	2 – 3	0.2 – 0.3
36	23,000 – 28,000	8 – 14	2 – 3	0.2 – 0.4
60	21,000 – 26,000	9 – 15	2 – 3	0.3 – 0.6
90	19,000 – 24,000	9 – 15	2 – 3	0.4 – 0.8

8.4 Foams

Mainly PU or PE foams for case inserts.

For all spindles

- Triple-tooth cutter for foams (DS-FO-...)

Cutting edge diameter [mm]	Speed range	Feed X / Y direction [mm/s]	Feed Z direction [mm/s]	Material removal [mm]
3	25,000 – 30,000	25 – 35	5 – 10	Max. total cutting length
4	21,000 – 26,000	30 – 40	5 – 10	Max. total cutting length
6	15,000 – 20,000	40 – 50	5 – 10	Max. total cutting length
8	12,000 – 17,000	45 – 55	5 – 10	Max. total cutting length
10	10,000 – 15,000	40 – 60	5 – 10	Max. total cutting length

8.5 Wood-based materials

Wood-based materials such as solid wood, MDF, plywood, chipboard, etc.

For spindles with a speed of up to 30,000 rpm

- Single-tooth cutter Varius® (ES-SC-...)

Cutting edge diameter [mm]	3	4	6	8
Speed range [rpm]	25,000 – 30,000	25,000 – 30,000	20,000 – 25,000	18,000 – 23,000
Feed X / Y direction [mm/s]	25 – 35	35 – 45	55 – 65	60 – 80
Feed Z direction [mm/s]	3 – 5	3 – 5	5 – 8	5 – 8
Material removal [mm]	1.5 – 2.25	2 – 3	3 – 4.5	4 – 6

- Double-tooth cutter for wood-based materials (ZS-WO -...)

Cutting edge diameter [mm]	3	4	6	8
Speed range [rpm]	25,000 – 30,000	25,000 – 30,000	19,000 – 24,000	15,000 – 20,000
Feed X / Y direction [mm/s]	25 – 30	30 – 40	40 – 50	45 – 60
Feed Z direction [mm/s]	3 – 5	3 – 5	5 – 8	5 – 8
Material removal [mm]	2.25 – 3	3 – 4	4.5 – 6	6 – 8

For spindles with a speed of up to 60,000 rpm

- Single-tooth cutter Varius® (ES-SC-...)

Cutting edge diameter [mm]	Speed range	Feed X / Y direction [mm/s]	Feed Z direction [mm/s]	Material removal [mm]
3	35,000 – 40,000	35 – 45	3 – 5	1.5 – 2.25
4	25,000 – 30,000	35 – 45	3 – 5	2 – 3
6	20,000 – 25,000	50 – 65	5 – 8	3 – 4.5
8	18,000 – 23,000	60 – 80	5 – 8	4 – 6

- Double-tooth cutter for wood-based materials (ZS-WO -...)

Cutting edge diameter [mm]	Speed range	Feed X / Y direction [mm/s]	Feed Z direction [mm/s]	Material removal [mm]
3	31,000 – 36,000	30 – 35	3 – 5	2.25 – 3
4	25,000 – 30,000	30 – 40	3 – 5	3 – 4
6	19,000 – 24,000	40 – 50	5 – 8	4.5 – 6
8	15,000 – 20,000	45 – 60	5 – 8	6 – 8

8.6 Thread milling tools

Threading tools with which you can mill threads in thermoplastics, aluminum, base metals, aluminum composite panels and steels. The following parameters were tested for thermoplastics and aluminum.

A core hole must be pre-drilled for threads whose diameter is larger than the cutting head of the circular thread cutter.

8.6.1 Thread whirler

Thread size	Head diameter [mm]	Pitch [mm]	Core hole [mm]	Speed range	Feed X / Y direction [mm/s]
M2	1.55	0.40	1.60	25,000 – 30,000	10 – 20
M3	2.44	0.50	2.50	15,000 – 20,000	15 – 25
M4	3.20	0.70	3.30	11,000 – 16,000	15 – 25
M5	4.00	0.80	4.20	10,000 – 15,000	20 – 30
M6	4.85	1.00	5.00	10,000 – 15,000	20 – 30

Thread size	Head diameter [mm]	Pitch [mm]	Core hole [mm]	Speed range	Feed X / Y direction [mm/s]
M8	6.50	1.25	6.80	9,000 – 13,000	20 – 30
M10	7.90	1.50	8.50	8,000 – 12,000	20 – 30

8.6.2 Circular drill thread milling cutter

Thread size	Head diameter [mm]	Pitch [mm]	Additional immersion depth of drill bit [mm]	Core hole [mm]	Speed range
M2	1.55	0.40	1.30	1.60	28,000 – 30,000
M2.5 – M3	2.00	0.45 – 0.50	1.30	2.05 – 2.50	21,000 – 26,000
M4 – M5	3.15	0.70 – 0.80	1.30	3.30 – 4.20	16,000 – 21,000
M6	4.80	1.00	1.30	5.00	11,000 – 16,000
M8 – M10	5.90	1.25 – 1.50	2.30	6.80 – 8.50	10,000 – 15,000
M12 – M16	5.90	1.75 – 2.00	2.30	10.20 – 14.00	10,000 – 15,000
BGF-MKV	5.90	1.50	2.30	According to the size of the cable gland	10,000 – 15,000

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Original EC Declaration of Conformity

according to EC Directive for Machines 2006/42/EC Annex II A

We hereby

vhf camfacture AG
Lettenstraße 10
72119 Ammerbuch
Germany

expressly declare that the product

Machine:	**CNC portal milling machine**
Type:	**Active Pro**
Design:	**CAM ... Active Pro / CAM ... Active Pure**
Serial number:	**from AP01116...**

fulfills all the relevant provisions of the following directives:

– **2006/42/EC** Machinery Directive
– **2014/30/EC** EMC directive

References of the applied harmonized standards according to Article 7 (2):

– **EN 614-1:2006 + A1:2009**
– **EN ISO 12100:2010**
– **EN ISO 16090-1:2018**
– **EN ISO 13849-1:2015**
– **EN ISO 13849-2:2012**
– **EN 60204-1:2018**
– **EN IEC 61000-3-2:2019**
– **EN 61000-3-3:2013 + A1:2019 + A2:2021 + A2:2021/AC:2022**
– **EN 61326-1:2013**
– **EN 61326-2-1:2013**

The manufacturer undertakes to electronically transmit relevant information on the machinery in response to a reasoned request by the national authorities. Person established within the Community who is authorized to compile the technical file:

Dipl.-Ing. (FH) Frank Benzinger
Vorstandsvorsitzender / Chief Executive Officer (CEO)
vhf camfacture AG
Lettenstraße 10
D-72119 Ammerbuch

Ammerbuch, 2023-07-17

(Frank Benzinger, CEO)

Original Declaration of Conformity

according to Supply of Machinery (Safety) Regulations 2008

We hereby

vhf camfacture AG
Lettenstraße 10
72119 Ammerbuch
Germany

expressly declare that the product

Machine:	**CNC portal milling machine**
Type:	**Active Pro**
Design:	**CAM ... Active Pro / CAM ... Active Pure**
Serial number:	**from AP01116...**

fulfills all the relevant provisions of the following directives:

– Supply of Machinery (Safety) Regulations 2008
– Electromagnetic Compatibility Regulations 2016

References of the applied harmonized standards:

– BS EN 614-1: 2006 + A1: 2009
– BS EN ISO 12100: 2010
– BS EN ISO 16090-1:2018
– BS EN ISO 13849-1:2015
– BS EN ISO 13849-2: 2012
– BS EN 60204-1:2018
– BS EN IEC 61000-3-2:2019
– BS EN 61000-3-3:2013 + A2:2021
– BS EN 61326-1: 2013
– BS EN 61326-2-1: 2013

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Dipl.-Ing. (FH) Frank Benzinger
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Ammerbuch, 2023-07-17

(Frank Benzinger, CEO)

Made
in
Germany

vhf camfacture AG