



Operating manual

Version 3.1.8

Drilling-milling machine

OPTImill[®]
BF 20V

OPTImill[®]
BF 20L





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Preface

Dear customer,

Thank you very much for purchasing a product made by OPTIMUM.

OPTIMUM metal working machines offer a maximum of quality, technically optimum solutions and convince by an outstanding price performance ratio. Continuous enhancements and product innovations guarantee state-of-the-art products and safety at any time.

Before commissioning the machine please thoroughly read these operating instructions and get familiar with the machine. Please also make sure that all persons operating the machine have read and understood the operating instructions beforehand.

Keep these operating instructions in a safe place nearby the machine.

Information

The operating instructions include indications for safety-relevant and proper installation, operation and maintenance of the machine. The continuous observance of all notes included in this manual guarantee the safety of persons and of the machine.

The manual determines the intended use of the machine and includes all necessary information for its economic operation as well as its long service life.

In the paragraph "Maintenance" all maintenance works and functional tests are described which the operator must perform in regular intervals.

The illustration and information included in the present manual can possibly deviate from the current state of construction of your machine. Being the manufacturer we are continuously seeking for improvements and renewal of the products. Therefore, changes might be performed without prior notice. The illustrations of the machine may be different from the illustrations in these instructions with regard to a few details. However, this does not have any influence on the operability of the machine.

Therefore, no claims may be derived from the indications and descriptions. Changes and errors are reserved!

Your suggestion with regard to these operating instructions are an important contribution to optimising our work which we offer to our customers. For any questions or suggestions for improvement, please do not hesitate to contact our service department.

If you have any further questions after reading these operating instructions and you are not able to solve your problem with a help of these operating instructions, please contact your specialised dealer or directly the company OPTIMUM.

Optimum Maschinen Germany GmbH

Dr.- Robert - Pflieger - Str. 26

D-96103 Hallstadt




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1 Safety

Glossary of symbols

	gives further advice
	calls on you to act
	enumerations

This part of the operating instructions

- explains the meaning and use of the warning notices included in these operating instructions,
- defines the intended use of the drilling-milling machine,
- points out the dangers that might arise for you or others if these instructions are not observed,
- informs you about how to avoid dangers.

In addition to these operation instructions, please observe

- the applicable laws and regulations,
- the legal regulations for accident prevention,
- the prohibition, warning and mandatory signs as well as the warning labels on the drilling-milling machine.

Always keep this documentation close to the drilling-milling machine.

INFORMATION

If you are unable to solve a problem using these operating instructions, please contact us for advice:



Optimum Maschinen Germany GmbH

Dr. Robert-Pfleger-Str. 26



D- 96103 Hallstadt

email: info@optimum-maschinen.de

1.1 Safety instructions (warning notes)

1.1.1 Classification of hazards

We classify the safety warnings into various levels. The table below gives an overview of the classification of symbols (ideogram) and the warning signs for each specific danger and its (possible) consequences.

Ideogram	Warning alert	Definition / consequence
	DANGER!	Threatening danger that will cause serious injury or death to people.
	WARNING!	A danger that might cause severe injury to the staff or can lead to death.
	CAUTION!	Danger or unsafe procedure that might cause injury to people or damage to property.
	ATTENTION!	Situation that could cause damage to the drilling-milling machine and products and other types of damage. No risk of injury to people.



Ideogram	Warning alert	Definition / consequence
	INFORMATION	Application tips and other important or useful information and notes. No dangerous or harmful consequences for people or objects.

In case of specific dangers, we replace the pictogram by



1.1.2 Other pictograms

Activation forbidden!	Warning of flammable substances!	Warning of suspended loads!	Warning risk of stumbling!
Warning tilting danger!	Warning of automatic startup!	Warning of biological hazard!	Read the operating instruction!
Pull the main plug!	Use safety glasses! protection	Use face shield!	Use protective boots!
Use protective suit!	Use ear protection!	Protect the environment!	Contact address



1.2 Intended use

WARNING!

In the event of improper use, the drilling-milling machine

- there may be a risk to the staff,
- the drilling-milling machine and other material property of the operating company will be endangered,
- the correct function of the drilling-milling machine may be affected.



The drilling-milling machine is designed and manufactured to be used for milling and drilling cold metals or other non-flammable materials or materials that do not constitute a health hazard by using commercial milling and drilling tools.

The drilling-milling machine must only be installed and operated in a dry and well-ventilated place. If the drilling-milling machine is used in any way other than described above, modified without the approval of the company Optimum Maschinen Germany GmbH then the drilling-milling machine is being used improperly.

We will not be held liable for any damages resulting from any operation which is not in accordance with the intended use.

We would like to stress that any modifications to the construction or technical or technological modifications that have not been authorised by the company Optimum Maschinen Germany GmbH will also render the guarantee null and void. It is also part of intended use that

- the maximum values for the drilling-milling machine are complied with,
- the operating manual is observed,
- the inspection and maintenance instructions are observed.

 "Technical data" on page 15

WARNING!

Heaviest injuries through improper use.

It is forbidden to make any modifications or alterations to the operating values of the drilling-milling machine. These could endanger the staff and cause damage to the drilling-milling machine.



INFORMATION

The drilling-milling machine is built according to the standard DIN EN 55011 class B.

The class B (machine tools) is intended to be used in residential facilities, where the power is supplied via a public low voltage supply system.



ATTENTION!

If the drilling-milling machine is not used as intended or if the safety directives or the operating instructions are ignored the liability of the manufacturer for any damages to persons or objects resulting hereof is excluded and the claim under guarantee is becoming null and void!



1.3 Reasonably foreseeable misuses

Any other use as the one determined under the "Intended use" or any use beyond the described use shall be deemed as not in conformity and is forbidden.

Any other use has to be discussed with the manufacturer.

It is only allowed to process metal, cold and non-inflammable materials with the milling-machine.

In order to avoid misuses it is necessary to read and understand the operating instructions before the first commissioning.

The operators must be qualified.



1.3.1 Avoiding misuses

- Use of suitable cutting tools.
- Adapting the speed adjustment and feed to the material and workpiece.
- Clamp workpieces firmly and vibration-free.

For the drilling-milling machine there are conversion kits.

The attachments are provided as a kit to computer-controlled milling (CNC Computerized numerical control). However, the control of the step motors can also be done manually via a special controller (control, potentiometer). A step motor control is required in each case.

The drilling-milling machine must only be installed and operated in a dry and well-ventilated place.

The machine BF20V and BF20L covered by the standard DIN EN 13128 (milling machines, including drilling machines). Therein, the manually controlled machines are divided into two classes with different protection levels, depending on the travel speed of a single power-driven axis. In addition, the requirements for automatically controlled machines listed (highest level of protection).

The one who changed the manually controlled BF20V and BF20L on CNC control is legally the manufacturer of a new machine due to the significant change in the machine and is therefore responsible for compliance with the requirements of the Machinery Directive and the DIN EN 13128.

The tool follows a path of movement which is normally not predictable by the operator. Because of the additional hazards caused by flying parts the standard defines protective devices. It does not matter what speeds are available on the axes.

We expressly point out that the guarantee will expire due to any constructive technical or procedural changes which had not been performed by the company Optimum Maschinen Germany GmbH.

With the conversion of the machine BF20V and BF20L an cabinet is required.

A suitable cabinet for these machines you can order:

- Cabinet SHC 1 for BF20V, item no. 353 9091
- Cabinet SHC 2 for BF20L, item no. 353 9092

ATTENTION!

The workpiece is always to be fixed by a machine vice, jaw chuck or by another appropriate clamping tool such as for the clamping claws.



WARNING!

Risk of injury caused by workpieces flying off.

Clamp the workpiece in the machine vice. Make sure that the workpiece is firmly clamped in the machine vice resp. that the machine vice is firmly clamped on the machine table.

- Use cooling and lubricating agents to increase the durability of the tool and to improve the surface quality.
- Clamp the cutting tools and workpieces on clean clamping surfaces.
- Sufficiently lubricate the machine.
- Correctly adjust the bearing clearance and the guidings.

It is recommended:

- Insert the drill in a way that it is exactly positioned between the three clamping jaws of the quick action chuck.
- Clamp and mills by means of the collet chuck and the corresponding collets.
- Clamp end face mills by means of shell end mill arbors.

When drilling make sure that





- the suitable speed is set depending on the diameter of the drill,
- the pressure must only be such that the drill can cut without load
- in case of too strong pressure the drill will get worn early or even might break resp. get jammed in the hole. If the drill gets jammed immediately stop the main motor by pressing the emergency stop button,
- for hard materials, e.g. steel, use commercial cooling / lubricating agents,
- generally always drive the turning spindle out of the workpiece.

ATTENTION!

Do not use the quick action drill chuck for milling tools. Never clamp a milling cutter into the quick action drill chuck. Use a collet chuck and the corresponding collets for the end mill.



When milling make sure that

- the corresponding cutting speed is selected,
 - for workpieces with normal strength values, e.g. steel 18-22 m/min,
 - for workpieces with high strength values 10-14 m/min,
 - the pressure is selected in a way that the cutting speed remains constant,
- for hard materials commercial cooling / lubricating agents are used.

1.4 Possible dangers caused by the drilling-milling machine

The drilling-milling machine was built using the latest technological advances.

Nonetheless there remains a residual risk, since the drilling-milling machine operates with

- at high speeds,
- with rotating parts and tools,
- with electrical voltages and currents.

We have used construction resources and safety techniques to minimize the health risk to persons resulting from these hazards.

If the drilling-milling machine is used and maintained by the staff who are not duly qualified, there may be a risk by the drilling milling machine resulting from incorrect operation or unsuitable maintenance.

INFORMATION

Everyone involved in the assembly, commissioning, operation and maintenance must

- be duly qualified,
- strictly follow these operating instructions.

Always disconnect the drilling-milling machine from the electrical power supply when performing cleaning or maintenance works.

WARNING!

The drilling-milling machine may only be used with functional safety devices.

Disconnect the drilling-milling machine immediately, whenever you detect a failure in the safety devices or when they are not fitted!

All additional devices installed by the operator have to be equipped with the prescribed safety devices.

This is your responsibility being the operating company!

👉 "Safety devices" on page 11





1.5 Qualification of personnel

1.5.1 Target group

This manual is addressed to

- the operating companies,
- the users,
- the staff for maintenance works.

Therefore, the warning notes refer to both, operation and maintenance staff of the drilling-milling machine.

Disconnect the drilling-milling machine always from the electrical power supply. This will prevent it from being used by unauthorized staff.

The qualifications of the staff for the different tasks are mentioned below:



Operator

The operator is instructed by the operating company about the assigned tasks and possible risks in case of improper behaviour. Any tasks which need to be performed beyond the operation in the standard mode must only be performed by the operator if it is indicated in these instructions and if the operating company expressly commissioned the operator.

Electrical specialist

Due to his professional training, knowledge and experience as well as his knowledge of respective standards and regulations the electrical specialist is able to perform works on the electrical system and to recognise and avoid any possible dangers himself.

The electrical specialist is specially trained for the working environment in which he is working and knows the relevant standards and regulations.

Specialist staff

Due to his professional training, knowledge and experience as well as his knowledge of relevant regulations the specialist staff is able to perform the assigned tasks and to recognise and avoid any possible dangers himself.

Instructed persons

Instructed persons were instructed by the operating company about the assigned tasks and any possible risks in case of improper behaviour.

INFORMATION

Everyone involved in the assembly, commissioning, operation and maintenance must

- be duly qualified,
- strictly follow these operating instructions.

In the event of improper use

- there may be a risk to the staff,
- there may be a risk to the drilling milling machine and other material values,
- the correct function of the drilling-milling machine may be affected.



1.6 Operator positions

The operator's position is in front of the drilling-milling machine.

1.7 Safety measures during operation

CAUTION!

Risk due to inhaling of health hazardous dusts and mist.





Dependent on the material which need to be processed and the used auxiliaries dusts and mist may be caused which might impair you health.

Make sure that the generated health hazardous dusts and mist are safely sucked off at the point of origin and is dissipated or filtered from the working area. To do so, use a suitable extraction unit.

CAUTION!

Risk of fire and explosion by using flammable materials or cooling lubricants.

Before processing inflammable materials (e.g. aluminium, magnesium) or using inflammable auxiliary materials (e.g. spirit) it is necessary to take additional preventive measures in order to safely avoid health risks.



1.8 Safety devices

Use the drilling-milling machine only with properly functioning safety devices.

Stop the drilling-milling machine immediately if there is a failure on the safety device or if it is not functioning for any reason.

It is your responsibility!

If a safety device has been activated or has failed, the drilling-milling machine must only be used if you

- have removed the cause of the failure,
- have verified that there is no danger resulting for the staff or objects.

WARNING!

If you bypass, remove or deactivate a safety device in any other way, you are endangering yourself and other staff working with the drilling-milling machine. The possible consequences are

- injuries may occur due to workpiece or parts of workpieces flying off,
- contact with rotating parts,
- fatal electrocution.

The drilling-milling machine includes the following safety devices:

- an EMERGENCY STOP push button,
- a protective cover on the drilling / milling head.
- a separating protective device on the milling spindle,

WARNING!

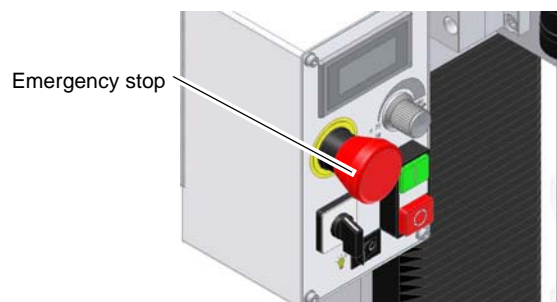
The separating protective equipment which is made available and delivered together with the machine is designed to reduce the risk of workpieces or fractions of them which being expelled, but not to remove them completely. Always work carefully and observe the limit values of your chipping process.



1.8.1 EMERGENCY-STOP push button

The EMERGENCY STOP push button switches off the drilling-milling machine.

☞ "Switching on the drilling-milling machine" on page 27



Img.1-1: EMERGENCY-STOP push button



ATTENTION!

The emergency stop push button stops the drilling-milling machine the moment it is activated.

Press the **EMERGENCY STOP** push button only if there is a risk! If this push button is actuated in order to switch off the drilling-milling machine in the standard operation the tool or workpiece might get damaged.

After having actuated the EMERGENCY STOP, turn the knob of the particular push button to the right in order to restart the machine.

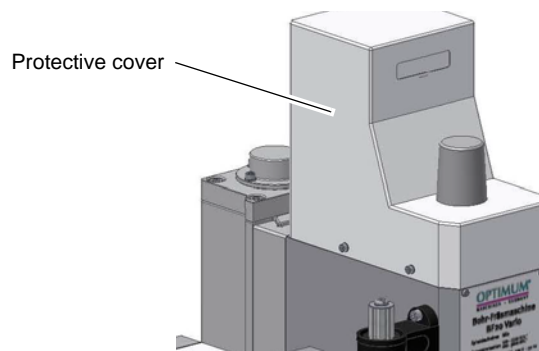


1.8.2 Protective cover

The drilling / milling head is equipped with a protective cover.

WARNING!

Only remove the protective cover when the mains plug of the drilling-milling machine is disconnected.



Img. 1-2: Protective cover

1.8.3 Separating protective equipment

Adjust the protective equipment to the correct height before you start working. To do so, detach the clamping screw, adjust the required height and re-tighten the clamping screw.

A switch is integrated in the fixture of the spindle protection which monitors that the cover is closed.

INFORMATION

You cannot start the machine if the spindle protection is not closed.



Img. 1-3: Separating protective equipment



1.9 Safety check

Check the drilling-milling machine in regular intervals.

Check all safety devices

- before each operation,
- once a week (with the machine in operation),
- after every maintenance and repair work.

General check		
Equipment	Check	OK
Protective covers	Mounted, firmly bolted and not damaged	
Signs, Markings	Installed and legible	

Functional check		
Equipment	Check	OK
EMERGENCY-STOP push button	When the EMERGENCY-STOP button is activated, the drilling-milling machine should switch off. Make sure that it is only possible to restart the machine if the EMERGENCY STOP push button is unlocked and the ON switch was activated.	
Separating protective equipment around the drilling milling spindle	The drilling-milling machine may switch on only when the safety device is closed.	

1.10 Personnel protective equipment

For certain work personal protective equipment is required.

Protect your face and your eyes: Wear a safety helmet with facial protection when performing works where your face and eyes are exposed to hazards.



Use protective gloves when handling pieces with sharp edges.



Use safety shoes when you assemble, disassemble or transport heavy components.



Use ear protection if the noise level (inmission) in the workplace exceeds 80 dB (A).

Before starting work make sure that the prescribed personnel protective equipment is available at the working place.



CAUTION!

Dirty or contaminated personnel protective equipment can cause diseases. Clean it each time after use and once a week.





1.11 For your own safety during operation

WARNING!

Before activating the drilling-milling machine assure yourself that this will neither endanger other persons nor cause damage to equipment.



Avoid any unsafe working practices:

- The instructions mentioned in these operating instructions have to be strictly observed during assembly, operation, maintenance and repair.
- Wear safety goggles.
- Switch off the drilling-milling machine before measuring the workpiece.
- Do not work on the drilling-milling machine, if your concentration is reduced, for example, because you are taking medication.
- Stay on the drilling-milling machine until the working spindle has come to a complete standstill.
- Use the prescribed personnel protective equipment. Make sure to wear a well-fitting work suit and, if necessary, a hairnet.
- Do not use protective gloves when drilling or milling.
- Disconnect the shock-proof plug from the outlet before replacing the tool.
- Use appropriate auxiliary materials to remove drilling and milling chips.
- Make sure that nobody is endangered by your work.
- Safely and firmly clamp the workpiece before switching on the drilling-milling machine.

We specially point out the specific dangers when working with and on the drilling-milling machine.

1.12 Switching-off and securing the drilling-milling machine

Unplug the main switch before starting any maintenance or repair work.



1.13 Using lifting equipment

WARNING!

The use of unstable lifting and load suspension gear that might break under load can cause severe injuries or even death.

Check that the lifting equipment and load-suspension gears are of sufficient load capacity and are in perfect condition.

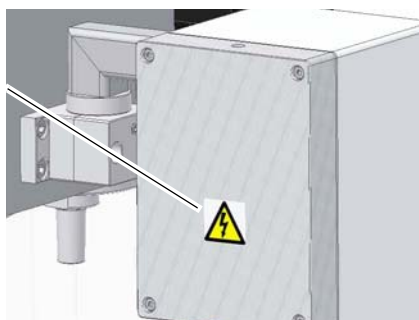
Observe the accident prevention regulations issued by your Employers Liability Insurance Association or other competent supervisory authority, responsible for your company.

Fasten the loads properly.

Never walk under suspended loads!



1.14 Signs on the drilling-milling machine



Img. 1-4: Drilling-milling machine





2 Technical data

The following information are the dimensions and indications of weight and the manufacturer's approved machine data.

2.1	Electrical connection	BF20V	BF20L
	Motor	240 V / 50Hz / 850 W	
2.2	Drilling-milling capacity	BF20V	BF20L
	Drilling capacity [mm]	max. Ø 16	
	Milling capacity of end-mill cutter [mm]	max. Ø 20	
	Milling capacity of inserted tooth cutter [mm]	max. Ø63	
	Throat [mm]	185	
2.3	Spindle seat	BF20V	BF20L
	Spindle seat	MT 3 / M10	
	Spindle sleeve stroke [mm]	50 mm	
2.4	Drilling and milling head	BF20V	BF20L
	Swivelling	+ / - 90°	
	Reduction stages	2	
	Z axis travel [mm]	280	
2.5	Cross table	BF20V	BF20L
	Table length [mm]	500	700
	Table width [mm]	180	
	X-axis travel [mm]	280	480
	Y-axis travel [mm]	175	
	T - slot size / distance [mm]	12 / 63	
	Max. load [kg]	50	40
2.6	Dimensions	BF20V	BF20L
	Height [mm]	935	
	Depth [mm]	565	565
	Width [mm]	745	950
	Total weight [kg]	103	115
2.7	Working area	BF20V	BF20L
	Height [mm]	2000	
	Depth [mm]	2200	
	Width [mm]	1500	
2.8	Speeds	BF20V	BF20L
	Gear stage slow [min ⁻¹]	90 - 1480	



Gear stage rapid [min ⁻¹]	150 - 3000	
2.9 Environmental conditions	BF20V	BF20L
Temperature	5 - 35 °C	
Humidity	25 - 80%	
Operating material	BF20V	BF20L
Gear Bare steel parts	Mobilgrease OGL 007 or, Mobilux EP 004, or Mobil XHP acid-free oil, for example Gun oil, engine oil	

2.10 Emissions

The emission of the drilling-milling machine is below 80 dB(A).

If the drilling-milling machine is installed in an area where various machines are in operation, the noise exposure (immission) on the operator of the drilling-milling machine at the working place may exceed 80dB(A).

INFORMATION

This numerical value was measured on a new machine under proper operating conditions. Depending on the age respectively on the wear of the machine it is possible that the noise behaviour of the machine changes.

Furthermore, the factor of the noise emission is also depending on manufacturing influencing factors, e.g. speed, material and clamping conditions.



INFORMATION

The mentioned numerical value is the emission level and not necessarily a safe working level.

Though there is a dependency between the degree of the noise emission and the degree of the noise disturbance it is not possible to use it reliably to determine if further precaution measures are required or not.

The following factors influence the actual degree of the noise exposure of the operator:

- Characteristics of the working area, e.g. size or damping behaviour,
- Other noise sources, e.g. the number of machines,
- Other processes taking place in the proximity and the period of time during which the operator is exposed to the noise.

Furthermore, it is possible that the admissible exposure level might be different from country to country due to national regulations.

This information about the noise emission shall allow the operator of the machine to more easily evaluate the endangering and risks.

CAUTION!

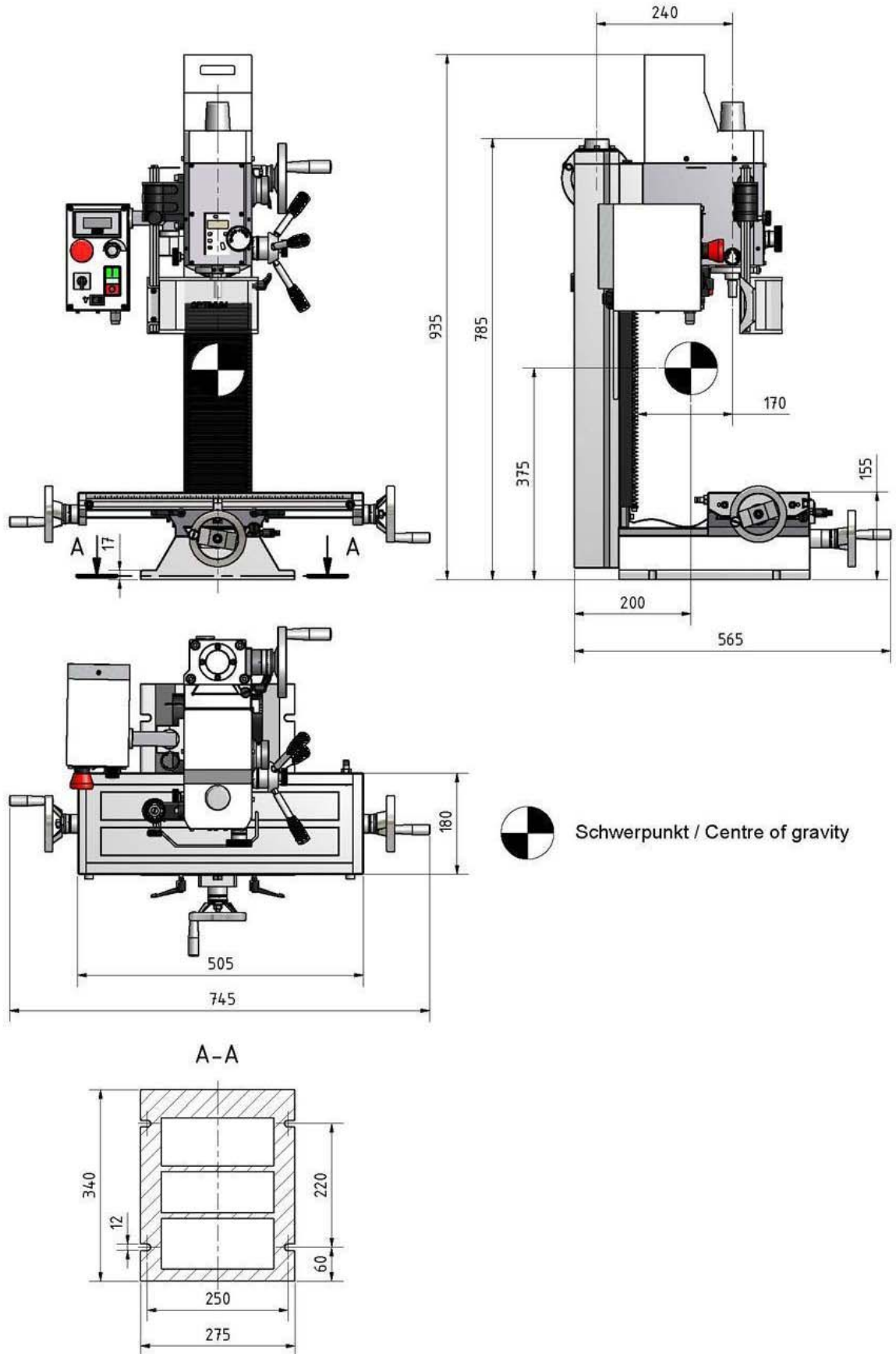
Depending on the overall noise exposure and the basic limit values the machine operators must wear an appropriate hearing protection.

We generally recommend to use a noise protection and a hearing protection.





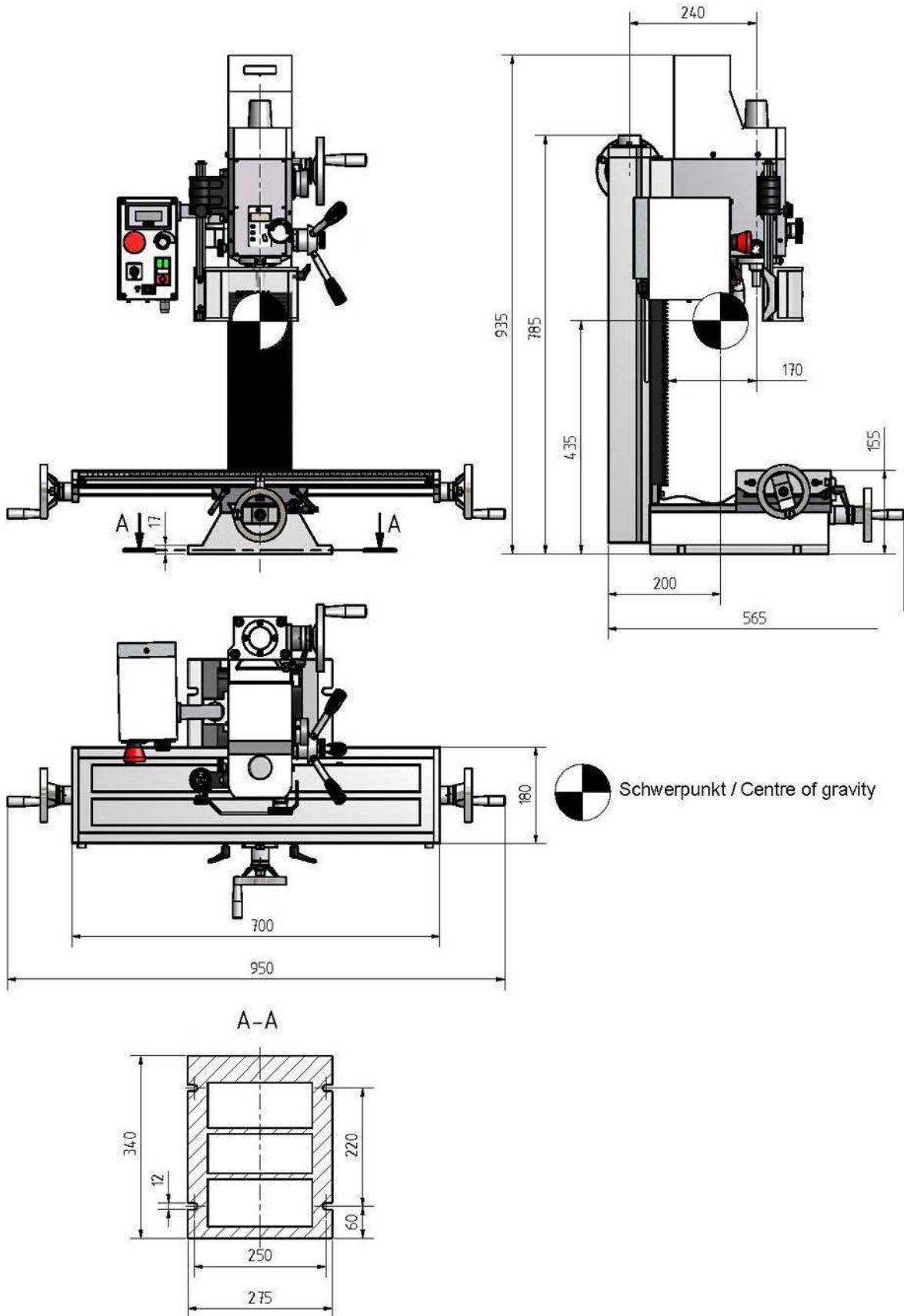
2.11 Dimensions, installation plan BF20V



Img.2-1: installation plan BF20V



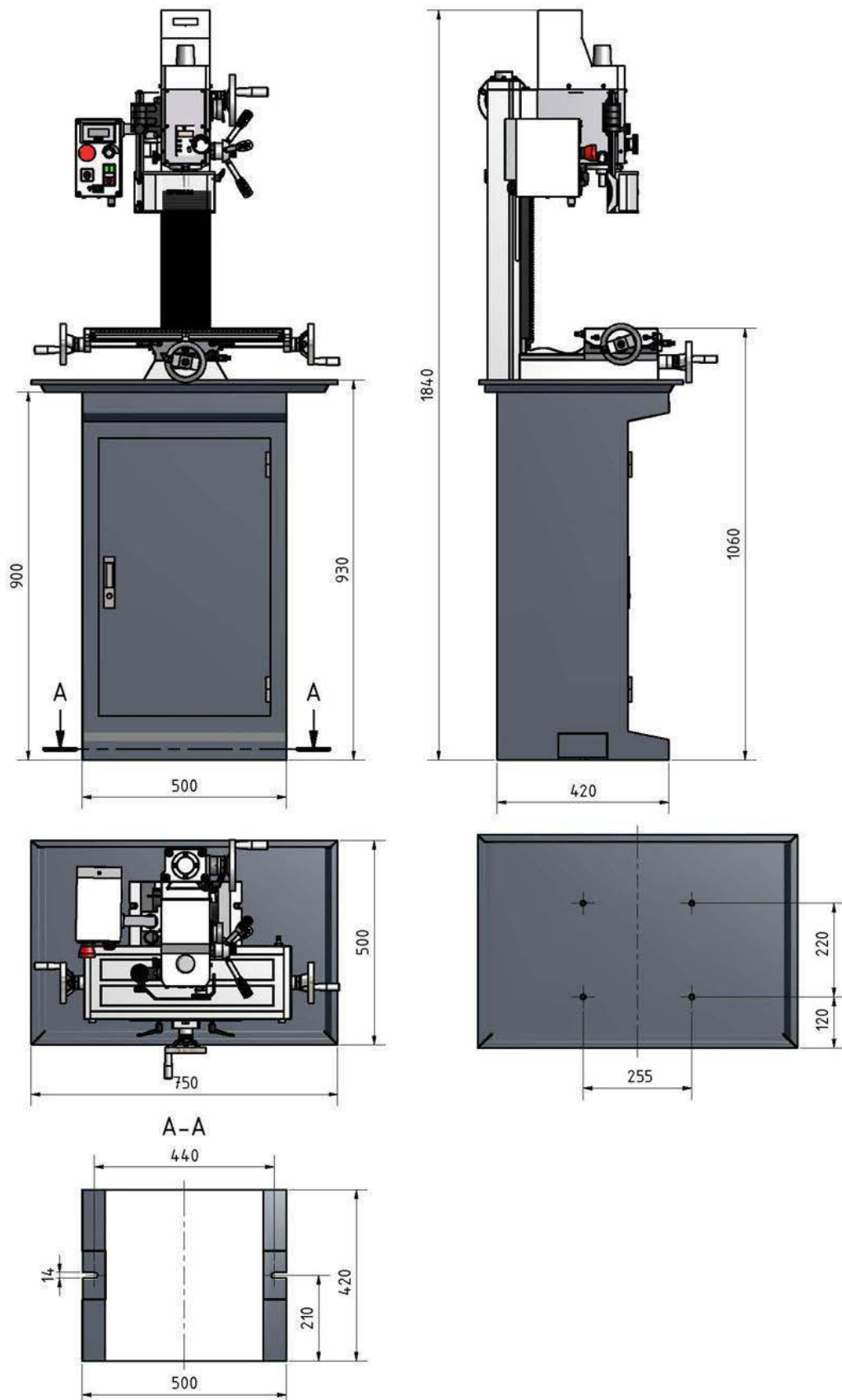
2.12 Dimensions, installation plan BF20L



Img.2-2: installation plan BF20L



2.13 Installation plan of optional substructure



Img.2-3: installation plan substructure 3353003



3 Unpacking and connecting

INFORMATION

The drilling-milling machine is pre assembled.



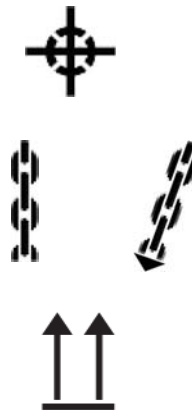
3.1 Scope of delivery

Check immediately upon delivery of the drilling-milling machine if there are any transport damages or loosened fastening screws.

Compare the scope of delivery with the packing list.

3.2 Transport

- Centres of gravity
- Load suspension point
(Marking of the positions for the load suspension gear)
- Prescribed transportation position
(Marking of the top surface)
- Means of transport to be used
- Weights



WARNING!

Severe or fatal injuries may occur if parts of the machine tumble or fall down from the forklift truck or from the transport vehicle. Follow the instructions and information on the transport case.



WARNING!

The use of unstable lifting and load suspension gear that might break under load can cause severe injuries or even death. Check that the lifting and load suspension gear has sufficient load capacity and that it is in perfect condition.



Observe the accident prevention regulations issued by your Employers Liability Insurance Association or other competent supervisory authority, responsible for your company.

Fasten the loads properly.

Never walk under suspended loads!



3.3 Storage

ATTENTION!

In case of wrong and improper storage electrical and mechanical machine components might get damaged and destroyed.

Store packed and unpacked parts only under the intended environmental conditions.

Follow the instructions and information on the transport case.



- Fragile goods
(Goods require careful handling)
- Protect against moisture and humid environment
☞ "Environmental conditions" on page 16
- Prescribed position of the packing case
(Marking of the top surface - arrows pointing to the top)
- Maximum stacking height

Example: not stackable - do not stack a second packing case on top of the first one.



Consult Optimum Maschinen Germany GmbH if the machine and accessories are stored for more than three months or are stored under different environmental conditions than those given here.

3.4 Installation and assembly

3.4.1 Requirements regarding the installation site

Organize the working area around the drilling-milling machine according to the local safety regulations.

INFORMATION

In order to attain good functionality and a high processing accuracy as well as a long durability of the machine the installation site should fulfil certain criteria.

Please observe the following points:

- The device must only be installed and operated in a dry and well-ventilated place.
- Avoid places nearby machines generating chips or dust.
- The installation site must be free from vibrations also at a distance of presses, planing machines, etc.
- The substructure must be suitable for the drilling-milling machine. Also make sure that the floor has sufficient load bearing capacity and is level.





- The substructure must be prepared in a way that possibly used coolant cannot penetrate into the floor.
- Any parts sticking out such as stops, handles, etc. have to be secured by measures taken by the customer if necessary in order to avoid endangerment of persons.
- Provide sufficient space for the staff preparing and operating the machine and transporting the material.
- Also consider that the machine is accessible for setting and maintenance works.
- Provide for sufficient illumination (Minimum value: 500 lux, measured at the tool tip). At little intensity of illumination an additional illumination has to be ensured e.g. by means of a separate workplace lamp.

INFORMATION

The mains plug of the drilling-milling machine must be freely accessible.



3.4.2 Load suspension point

WARNING!

Danger of crushing and tilting. Proceed carefully when lifting, installing and assembling the machine.



- Fix the load lifting gear around the drilling-milling head. Use a lifting sling for this purpose. lifting sling.
- Firmly clamp all clamping levers on the drilling-milling machine before lifting the drilling-milling machine.
- Make sure that the load attachment does not cause damage to components or paint.

3.4.3 Assembly

- Check if the underground of the drilling-milling machine is level using a spirit level.
- Check if the underground is sufficiently stable and rigid. The total weight 103 -115 kg.

ATTENTION!

Insufficient rigidity of the foundation leads to the superposition of the vibrations of the drilling-milling machine and of the underground (natural frequency of components). Critical speeds and moves in the axis with displeasing vibrations are rapidly achieved in case of insufficient rigidity of the whole system and will lead to bad milling results.



- Place the drilling-milling machine on the provided underground.
- Fix the drilling-milling machine in the provided through-holes on the machine foot.

WARNING!

The condition of the underground and the fixing type of the machine foot to the underground must be in a way that it can bear the loads of the drilling-milling machine. The underground must be level. Check if the underground of the drilling-milling machine is level using a spirit level.



Fix the foot of the drilling-milling machine to the substructure with the provided through-holes. When using an optionally available machine substructure, it also needs to be anchored safely and firmly. We recommend you to use shear connector cartridges resp. heavy-duty anchors.

- 📖 "Dimensions, installation plan BF20V" on page 17,
- 📖 "Dimensions, installation plan BF20L" on page 18,
- 📖 "Installation plan of optional substructure" on page 19.



3.5 First commissioning

ATTENTION!

Before commissioning the machine check all screws, fixtures resp. safety devices and tighten up the screws if necessary!



WARNING!

Risk by using improper tool holders or operating them at inadmissible speeds.

Only use the tool holders (e.g. drill chuck) which were delivered with the machine or which are offered as optional equipment by OPTIMUM.

Only use tool holders in the intended admissible speed range.

It is only allowed to modify tool holding fixtures in compliance with the recommendations of OPTIMUM or the manufacturer of the clamping device.



WARNING!

When first commissioning the drilling-milling machine by inexperienced staff you endanger people and the machine.

We do not take any liability for damages caused by incorrectly performed commissioning.

☞ "Qualification of personnel" on page 10



3.5.1 Power supply

- Connect the electrical supply cable.
- Check the fusing (fuse) of your electrical supply according to the technical instructions regarding the total connected power of the drilling-milling machine.

3.5.2 Cleaning and lubricating

- Remove the anti-corrosive agents on the drilling-milling machine which had been applied for transportation and storage. Therefore, we recommend you to use paraffin.
- Do not use any solvents, cellulose thinner or any other cleaning agents which might affect the coating of the drilling-milling machine when cleaning the machine. Observe the indications and notes of the manufacturer for cleaning agents.
- Oil all blank machine parts using an acid-free lubricating oil.
- Lubricate the drilling-milling machine according to the lubricating plan.
 - ☞ "Inspection and maintenance" on page 39
- Check if all spindles are running smoothly. The spindle nuts are re-adjustable.
- Disassemble the V-ledges of the cross table and clean the ledges from the anti-corrosive agent. ☞ "V-ledges" on page 40

3.5.3 Warming up the machine

ATTENTION!

If the drilling-milling machine and in particular the milling spindle is immediately operated at maximum load when it is cold it may result in damages.

If the machine is cold such as e.g. directly after having transported the machine it should be warmed up at a spindle speed of only 500 1/min for the first 30 minutes.





3.6 Optional accessory

Designation	Item No	
machine base	335 3002	
machine base	335 3003	
Collet chucks kit 5-pcs MT2 / M10 directly clamping	335 1980	
Collet chuck holder MT2 / M10 (ER25)	335 2044	
Set of collet chucks, 1-16mm 15 pieces (ER25)	344 1109	
Collet chuck holder MT2 / M10 (ER32)	335 2045	
Collet chucks kit 3-20mm 18-pcs (ER32)	344 1122	
Quick-action drill chuck (0-13mm) B16	305 0623	
Morse taper taper mandrel MT2 / M10 / B16	305 0670	
Mill cutter holding cone MT2 / M10 id=16mm	335 2102	
Machine vice FMSN 100	335 4110	
Three-axis vice DAS 75 slewable, turnable, tiltable	335 4175	
Two-axis vice ZAS 50 slewable, turnable	335 4170	
Chucking tool kit SPW 10	335 2016	
Milling cutter kit 12-pcs (4-5-6-10-12), each two- and four-edged, TIN-coated	335 2113	
Add-on adapter to the machine bed lathe TU2506 / TU2807	335 6572	
Adapter for high speed motor (without high speed motor)	335 6571	
round cell 1,55V 145mAh (SR44) 11.6 x 5.4mm	338 5480	



4 Operation

4.1 Safety

Commission the drilling-milling machine only under the following conditions:

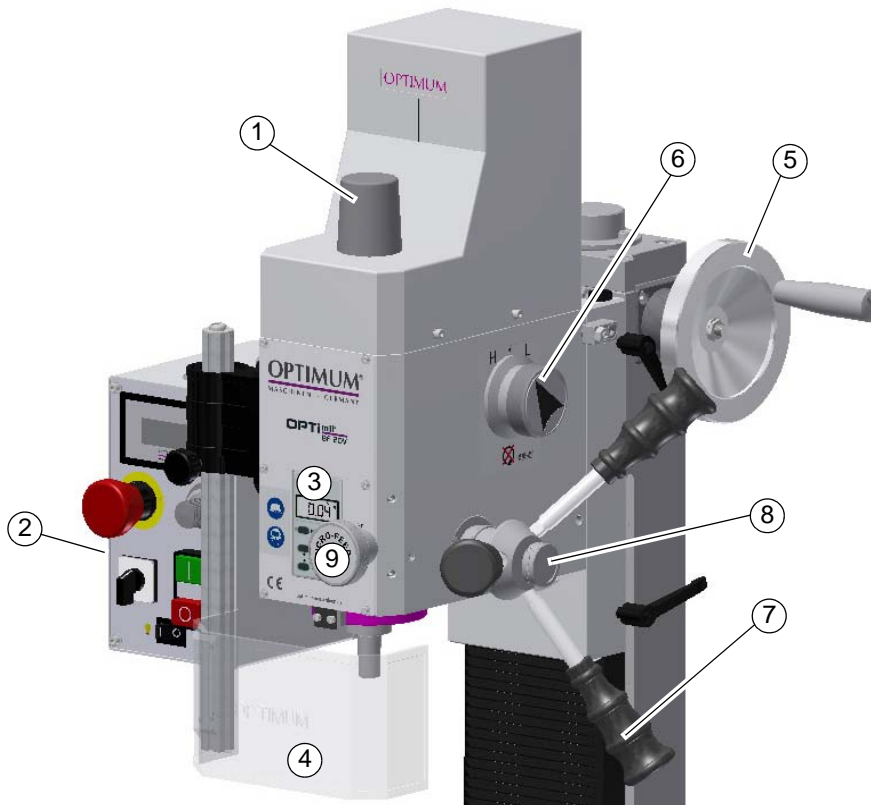
- The drilling-milling machine is in proper working order.
- The drilling-milling machine is used as intended.
- The operating manual is followed.
- All safety devices are installed and activated.

All failures should be eliminated immediately. Stop the drilling-milling machine immediately in the event of any abnormality in operation and make sure it cannot be started up accidentally or without authorisation.



☞ "For your own safety during operation" on page 14

4.2 Control and indicating elements



Img.4-1: Drilling-milling machine

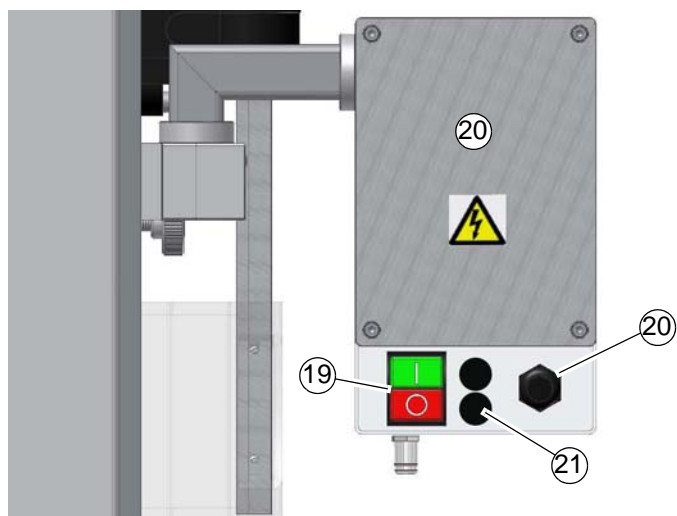
Pos.	Designation	Pos.	Designation
1	Cover of draw-in rod	2	Control panel
3	Digital display fine crossfeed of spindle sleeve	4	Spindle protection
5	Crank for height adjustment of the drill-mill head	6	Selector switch for reduction stage
7	Star grip for spindle sleeve feed	8	Activation of the fine adjustment
9	Fine adjustment of spindle sleeve		



4.2.1 Control panel



Img.4-2: control panel, front view



Img.4-3: Control panel, back

Pos.	Designation	Pos.	Designation
10	Clamping screw of spindle sleeve	11	Digital display speed
12	EMERGENCY-STOP	13	Speed control
14	Push button Start	15	Change-over switch
16	Machine lighting	17	Push button Stop
18	Digital display fine crossfeed of spindle sleeve	19	Main switch
20	Control	21	230V voltage supply
22	Fuse		



Main switch

Switches the voltage supply on.
The main switch is at the back of the control panel.



Hand-actuated auxiliary switch Start / Stop

Switches the machine on or off.



Turning direction

Selection left-handed, right-handed rotating or switch-off position. At the left-handed rotation the speed is about 35% less than at the right-handed rotation. First select the turning direction before switching on the machine with the push button.



Speed

Potentiometer to set the required speed. Adjust the speed with the potentiometer. The speed and thus the cutting speed depends on the material of the workpiece, the milling cutter diameter and the cutter type.



The electronics controls the speed slowly to the target value with a ramp. Therefore, please wait a while before you continue milling or drilling with the feed.

Gear stage

Selection rotary-type switch to select the reduction stage.



ATTENTION!

Wait until the drilling-milling machine has come to a complete halt, before performing any changes on the gear switch.



- Turn the gear switch to the position "H" for a speed range from approx. 150 - 3000min⁻¹.
- Turn the gear switch to the position "L" for a speed range 90 - 1480 min⁻¹

4.3 Switching on the drilling-milling machine

- Switch on the main switch.
- Select the gear level.
- Choose rotational direction.
- Set the potentiometer to the lowest speed.
- Close spindle protection system.
- Actuate push button "Start".
- Set the required speed on the potentiometer.

4.4 Switching off the drilling-milling machine

- Press the hand-actuated auxiliary switch Stop. During long-term standstill switch the turning direction switch to the zero position.



4.5 Inserting a tool

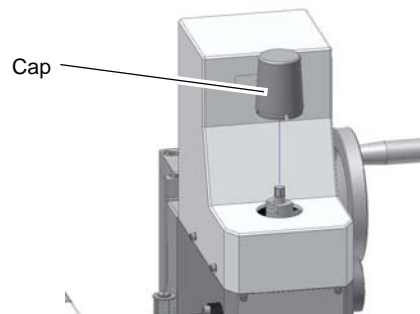
4.5.1 Installation

WARNING!

When milling operations are performed the cone seat must always be fixed to the draw-in rod. For milling operations it is not allowed to perform any cone connections with the taper bore of the work spindle without using the drawing rod. The cone connection should be released by the lateral pressure. Injuries may be caused by parts flying off.

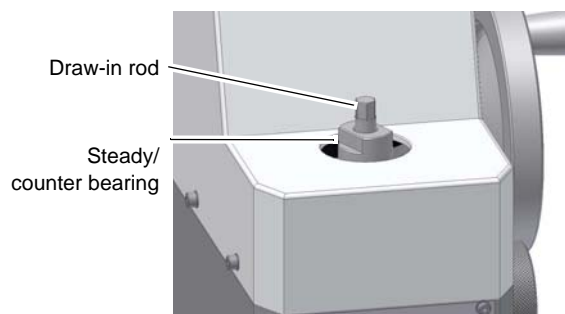
The milling head is equipped with a draw-in rod M10.

- Remove the cap.
- Clean the seat in the spindle / quill.
- Clean the taper of your tool.
- Insert the tool in the spindle / quill.



Img. 4-4: Drilling and milling head

- Screw the draw-in bar in the tool.
- Tighten the tool with the draw-in rod and hold the spindle on the counter bearing by means of a wrench.



Img. 4-5: Drilling and milling head

4.5.2 Disassembly


- Hold the spindle counter bearing with a wrench and loosen the draw-in rod. Continue turning the draw-in rod, so that the tool is squeezed out from the conical collet.

ATTENTION!

When installing a cold morse taper into a heated-up machine those MT seats tend to shrink on the morse taper contrary to the quick-releaser tapers.



4.5.3 Use of collet chucks

When using collet chucks for the reception of milling tools, a higher operation tolerance can be achieved. The exchange of the collet chucks for a smaller or larger end mill cutter is performed simply and rapidly and it is not necessary to disassemble the complete tool. The collet chuck is pressed into the ring of the swivel nut and must rest there by itself. The milling cutter is clamped by fastening the swivel nut on the tool. Make sure that the correct collet chuck is used for each milling cutter diameter, so that the milling cutter may be fastened securely and firmly.  "Optional accessory" on page 24



4.6 Clamping the workpieces

CAUTION!

Risk of injury caused by workpieces flying off.

The workpiece is always to be fixed by a machine vice, jaw chuck or by another appropriate clamping tool such as for the clamping claws.



4.7 Changing the speed range

ATTENTION!

Wait until the drilling-milling machine has come to a complete halt, before performing any changes on the gear switch.

- Select gear level
 - H = rapid
 - L = low
- Adjust the speed with the potentiometer. The speed and thus the cutting speed depends on the material of the workpiece, the milling cutter diameter and the cutter type.



Selector switch gear stage
H = rapid
L = low



Img. 4-6: Drilling and milling head

4.8 Selecting the speed

The correct speed is an important factor for milling. The speed determines the cutting speed by which the cutting edges cut the material. By selecting the correct cutting speed, the service life of the tool is increased and the working result is optimized.

The optimum cutting speed mainly depends on the material and on the material of the tool. With tools (milling cutters) made of hard metal or ceramic insert it is possible to work with higher speeds than with tools made of high-alloy high speed steel (HSS). You will achieve the correct cutting speed by selecting the correct speed.

In order to determine the correct cutting speed for your tool and for the material to be cut you may refer to the following standard values or a table reference book (e.g. Tabellenbuch Metall, Europa Lehrmittel, ISBN 3808517220).

The required speed is calculated as follows:

$$n = \frac{V}{\pi \times d}$$

n = speed in min^{-1} (revolutions per minute)

V = cutting speed in m/min (meter per minute)

d = tool diameter in m (Meter)



4.8.1 Standard values for cutting speeds

[m/min] with high-speed steel and hard metal in conventional milling.

Tool	Steel	Grey cast iron	Al alloy age-hardened
Plain mill and side milling cutters [m/min]	10 - 25	10 - 22	150 - 350
Relieved form cutters [m/min]	15 - 24	10 - 20	150 - 250
Inserted -tooth cutter with SS [m/min]	15 - 30	12 - 25	200 - 300
Inserted-tooth cutter with HM [m/min]	100 - 200	30 - 100	300 - 400

The results are the following standard values for speeds in dependence of the milling cutter diameter, cutter type and material.

Tool diameter [mm] Peripheral and side milling cutters	Steel 10 - 25 m/min	Grey cast iron 10 - 22 m/min	Al alloy cured 150 - 350 m/min
	Speed [min ⁻¹]		
35	91 - 227	91 - 200	1365 - 3185
40	80 - 199	80 - 175	1195 - 2790
45	71 - 177	71 - 156	1062 - 2470
50	64 - 159	64 - 140	955 - 2230
55	58 - 145	58 - 127	870 - 2027
60	53 - 133	53 - 117	795 - 1860
65	49 - 122	49 - 108	735 - 1715

Tool diameter [mm] form cutters	Steel 15 - 24 m/min	Grey cast iron 10 - 20 m/min	Al alloy cured 150 - 250 m/min
	Speed [min ⁻¹]		
4	1194 - 1911	796 - 1592	11900 - 19000
5	955 - 1529	637 - 1274	9550 - 15900
6	796 - 1274	531 - 1062	7900 - 13200
8	597 - 955	398 - 796	5900 - 9900
10	478 - 764	318 - 637	4700 - 7900
12	398 - 637	265 - 531	3900 - 6600
14	341 - 546	227 - 455	3400 - 5600
16	299 - 478	199 - 398	2900 - 4900



4.8.2 Standard values for speeds with HSS – Eco – twist drilling

Material	Drill diameter										Cooling ³⁾
		2	3	4	5	6	7	8	9	10	
Steel, unalloyed, up to 600 N/mm ²	n ¹⁾	5600	3550	2800	2240	2000	1600	1400	1250	1120	E
	f ²⁾	0.04	0.063	0.08	0.10	0.125	0.125	0.16	0.16	0.20	
Structural steel, alloyed, quenched and subsequently drawn, up to 900N/mm ²	n	3150	2000	1600	1250	1000	900	800	710	630	E/oil
	f	0.032	0.05	0.063	0.08	0.10	0.10	0.125	0.125	0.16	
Structural steel, alloyed, quenched and subsequently drawn, up to 1200N/mm ²	n	2500	1600	1250	1000	800	710	630	560	500	Oil
	f	0.032	0.04	0.05	0.063	0.08	0.10	0.10	0.125	0.125	
Stainless steels up to 900 N/ mm ² e.g. X5CrNi18 10	n	2000	1250	1000	800	630	500	500	400	400	Oil
	f	0.032	0.05	0.063	0.08	0.10	0.10	0.125	0.125	0.16	

¹⁾: Speed [n] in r/min
²⁾: Feed [f] in mm/r
³⁾: Cooling: E = Emulsion; oil = cutting oil

- The above mentioned indications are standard values. In some cases it may be advantageous to increase or decrease these values.
- When drilling a cooling or lubricating agent should be used.
- For stainless materials (e.g. VA – or NIRO steel sheets) do not center as the material would compact and the drill bit will become rapidly blunt.
- The workpieces need to be tensed in flexibly and stably (vice, screw clamp).

INFORMATION

High temperatures are generated at the tip of the tool by the occurring friction heat. The tool should be cooled during the milling process. By cooling with an appropriate coolant lubricant you will achieve a better working result and longer durability of the tool.



INFORMATION

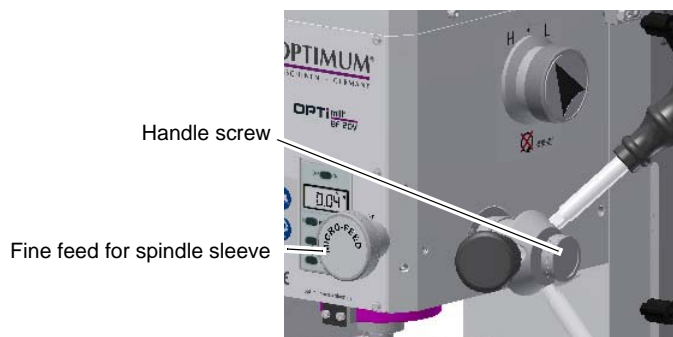
Use a water-soluble and non-pollutant emulsion as a cooling agent. This can be acquired from authorised distributors.

Make sure that the cooling agent is properly retrieved. Respect the environment when disposing of any lubricants and coolants. Follow the manufacturer's disposal instructions.



4.9 Manual spindle sleeve feed with the fine feed

- ➔ Turn the handle screw.
The spindle sleeve lever will move towards the drill-mill head and will activate the clutch of the fine feed.
- ➔ Turn the spindle sleeve fine feed in order to move the spindle sleeve.

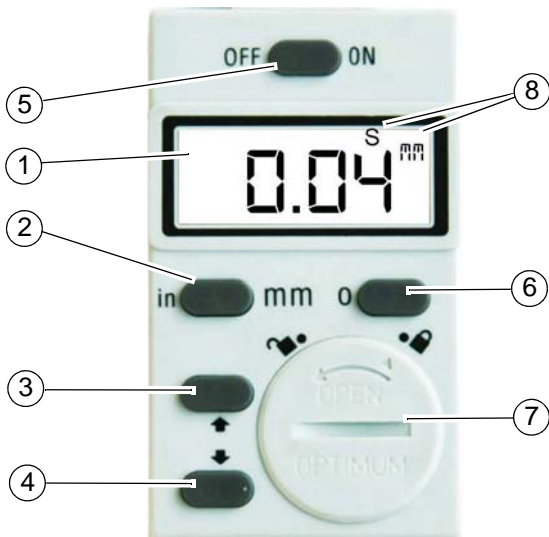


Img.4-7: Fine feed



4.10 Digital display for spindle sleeve travel

Measuring range	0 - 999.99mm
	0 - 39.371"inch
Reading precision	0.01mm
	0.0004"inch
Power supply	round cell CR2032 , 3 V 20 x 3,2mm



Pos.	Designation
1	LCD display
2	Shifting mm/inch
3	Performs a value increase in operating mode "S" (Setting)
4	Performs a value decrease in operating mode "S" (Setting)
5	ON/OFF switch
6	Zero position and activation of operation mode "S"
7	Battery bay
8	Display of operation mode "S" and selected unit "mm / inch"

Operation mode "S"

The operation mode "S" is used to enter and to compensate the mechanical play (backlash) of quill mechanism.

- (1) Display which shows the operating modes "S", "inch" or "mm"
- (2) converts the measuring unit from *millimetres* to *inches* and vice versa.
- (3) ▲ , Value increase in operation mode "S"
- (4) ▼ , Value decrease in operation mode "S"
- (5) Switches the display ON or OFF.
- Resets the display to the set compensation value "S".

Enter the offset value of the quill mechanism

- ➔ Press the button (6) for about 2-3 seconds. The operation mode (8) "S" is activated and displayed.



- Enter the offset value of a quill mechanism, based on your experience with the keys (3) or (4).
- Stop the operation mode "S" by pressing the button (6) again.

INFORMATION



Before inserting the new battery, wait about 30 seconds. Please make sure, that the contacts are metallicly bright and free from coverings which result from bleeding or gassing batteries. Grip the new batteries only with plastic forceps, if possible not with the hand due to the formation of oxide and never with metal forceps in order to avoid a short circuit. In most cases the round cell will be inserted into the digital display with the marking upside. After inserting the round cell, the battery compartment has to be closed again.

4.10.1 Malfunctions

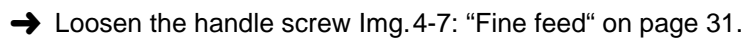
Malfunction	Cause / possible effects	Solution
Flashing of the display	<ul style="list-style-type: none"> • Voltage too low 	<ul style="list-style-type: none"> • Change battery
Screen doesn't refresh	<ul style="list-style-type: none"> • Operation mode "S" is active • Disturbance in the circuit 	<ul style="list-style-type: none"> • Disable the operation mode "S". • Remove the battery, wait 30 seconds and reinsert the battery.
No data visible	<ul style="list-style-type: none"> • No power supply • Battery voltage less than 3V 	<ul style="list-style-type: none"> • Clean battery contacts • Replace battery

4.11 Manual spindle sleeve feed with the spindle sleeve lever

ATTENTION!

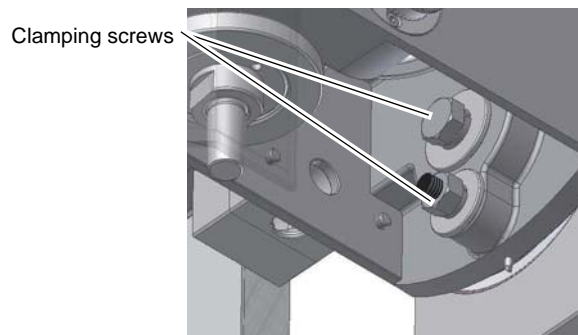


The clutch of the fine feed has to be disengaged before the spindle sleeve lever can be used. Activating the spindle sleeve lever when the fine feed is engaged may damage the clutch.

- Loosen the handle screw  on page 31.
The spindle sleeve lever moves away from the drill-mill head and disengages the clutch of the fine feed.

4.12 Swivelling the drill-mill head

The milling head may be swivelled to the right and to the left. Two screwings need to be loosened.



Img.4-8: Clamping screws

CAUTION!

If the screws are completely unfastened, the drilling-milling head might fall down. When slewing the working head, only unfasten the screws as far as necessary to be able to perform the settings. After having set the slewing angle, retighten the fixing screws.





4.12.1 Shifting the drill-mill head

The column of the drill-mill head can be shifted each to the left or to the right.

Use the option of shifting if you need to swivel the drill-mill head to the left or to the right for working.

4.13 Assembly of the optional adapter for a high speed motor

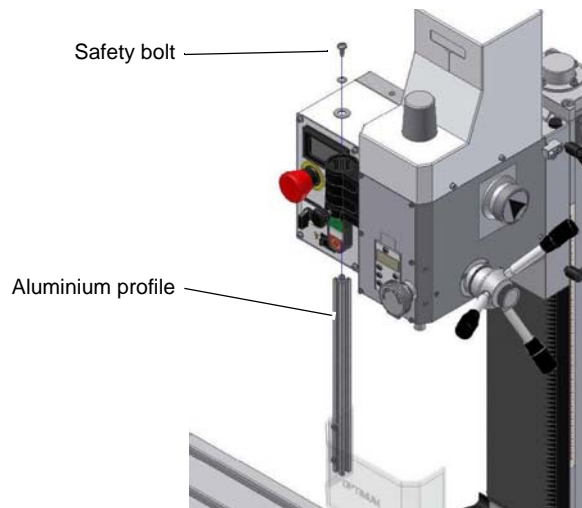
The machine BF20V and BF20L covered by the standard DIN EN 13128 (milling machines, including drilling machines). The one who changed the BF20V and BF20L is legally the manufacturer of a new machine due to the significant change in the machine and is therefore responsible for compliance with the requirements of the Machinery Directive and the DIN EN 13128.

CAUTION!

Two persons are needed to disassemble the milling head since the milling head needs to be held in its position when disassembling the screws.

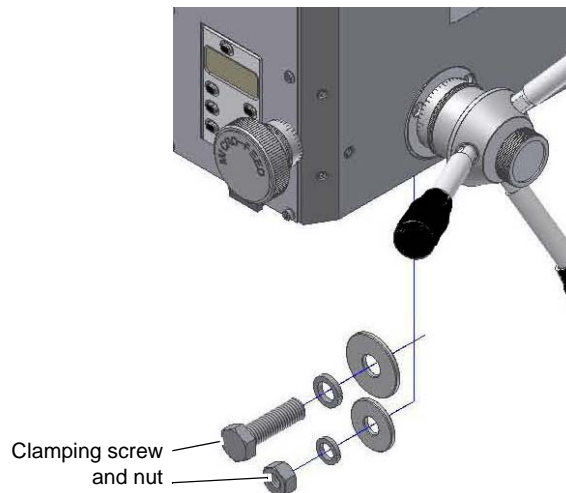


- Remove spindle protection.
Remove the screw and pull the aluminium profile with blinds from the guiding.



Img. 4-9: Spindle protection

- Disassemble clamping screw and nut.

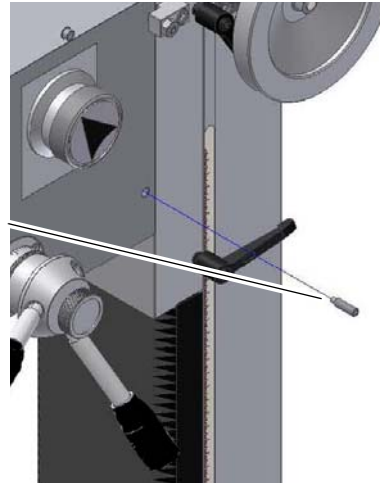


Img. 4-10: Fastening screws



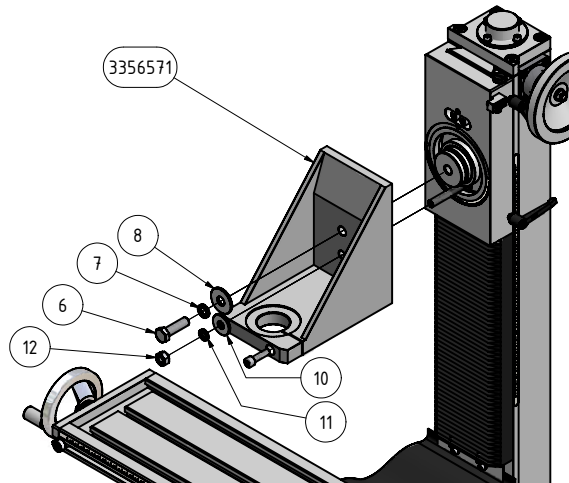
- Loosen or completely unscrew the screw.
- Remove the mill head to the front.

Screw position 266



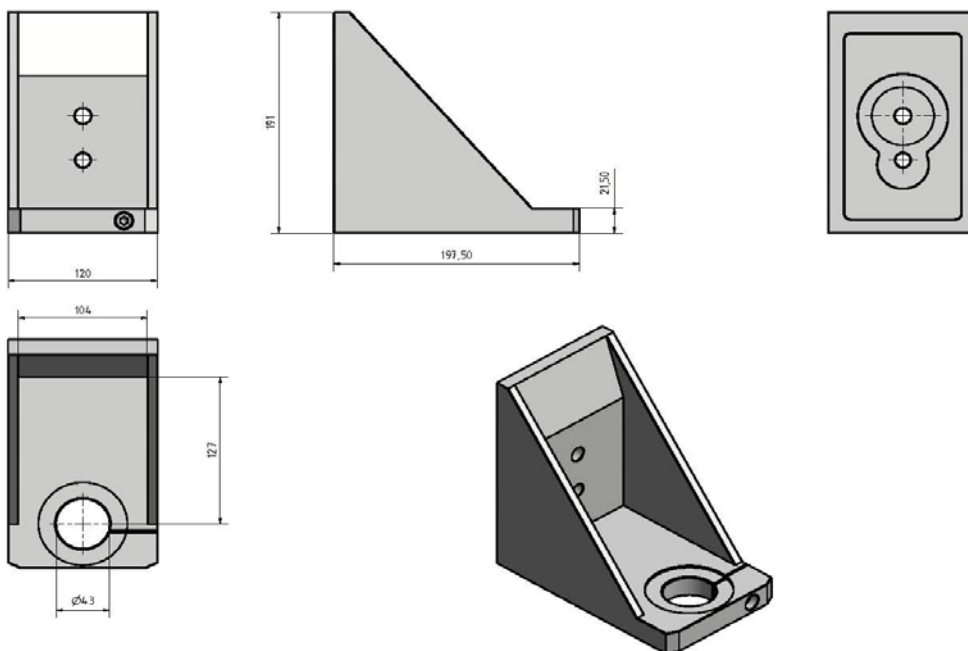
Img.4-11: Safety bolt

- The high speed adapter will be aligned and fixed with the same fixing screws as the mill head on the turning bearingblock.



Img.4-12: high speed adapter

4.13.1 Drawing adapter for a high speed motor



Img.4-13: high speed adapter 3356571



4.14 Assembly of the column on the lathe

The machine BF20V and BF20L covered by the standard DIN EN 13128 (milling machines, including drilling machines). The one who changed the BF20V and BF20L is legally the manufacturer of a new machine due to the significant change in the machine and is therefore responsible for compliance with the requirements of the Machinery Directive and the DIN EN 13128.

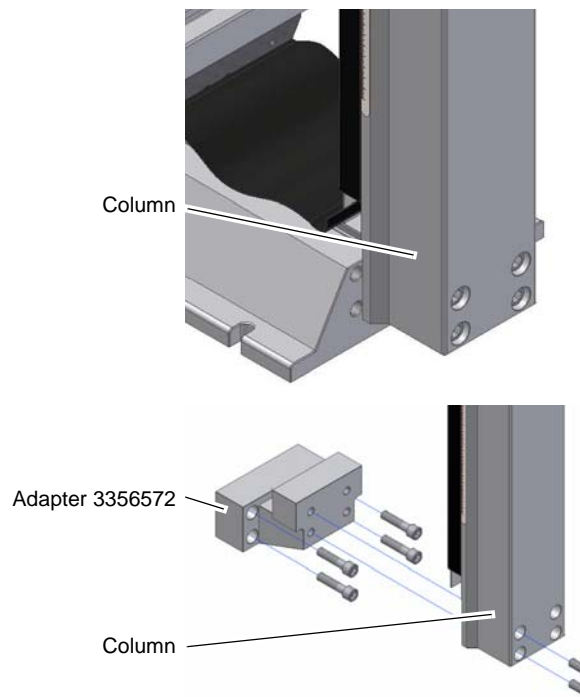
The mill head with column can be mounted on the lathe bed of the TU2506 and TU2807. An adapter is required to fix it. It is not possible to fix it on the lathe saddle.

The adapter is dimensioned in a way that the center of the lathe chuck can be reached with the centre of the milling spindle (line tailstock - lathe chuck).

☞ "Optional accessory" on page 24

Due to the manufacturing tolerances of cast parts and the manufacturing tolerances of two different machines, it is however not possible to exactly reach the centre. The adapter might be too short or too long.

If required, the adapter has to be milled or provided with dummy sheets. When using dummy sheets, the complete surface needs to be filled.



Img.4-14: Adapter

When aligning the column with the mill head mounted onto it, we recommend to disassemble the mill head from the column in order to reduce the holding force of the column. Unscrew the stud screw (screw) position 266. Disassemble the mill head from the column by completely loosening the clamping screw and the guide screw and pull off the mill head.

Check the alignment (right angle horizontal and vertical) of the column regarding the reference level at the lathe bed.

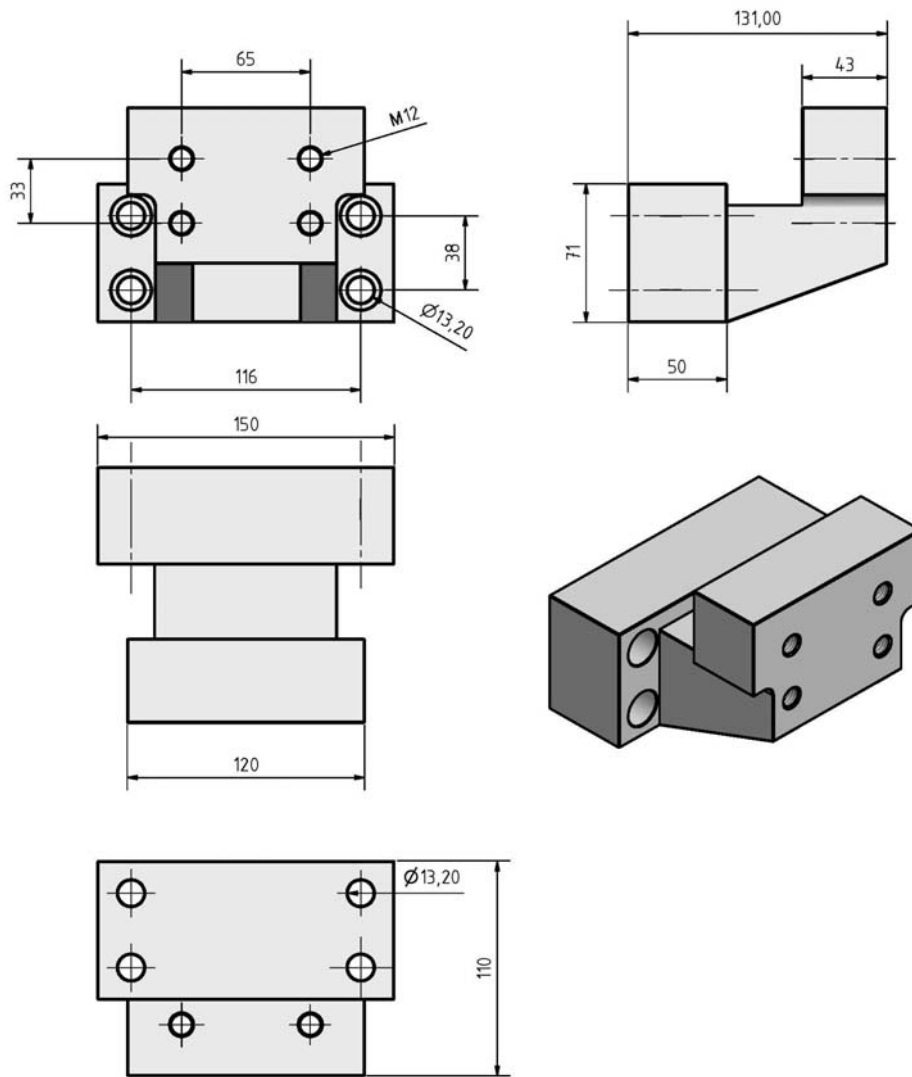
INFORMATION

In order to avoid the efforts of alignment when retrofitting it at a later time, we recommend you to provide the column and the adapter as well as the adapter and the lathe bed with aligning pins. If required, also pin the column to the cross table before disassembling the column. It is most suitable to use hardened straight pins of 8mm or 10mm according to DIN 6325 and an adjustment tolerance field m6 (e.g. DIN 6325-8 m6 x 30). These straight pins have a round cap on one side which simplifies to stick the parts together. The holes have to be predrilled imperatively about 0,2mm smaller in the assembled status and have to be grinded with a reamer also in the assembled status. Therefore, make sure to use a new spiral drill with a diameter of 7.8mm for the straight pins of 8mm.





4.14.1 Drawing adapter



Img.4-15: Adapter 3356572



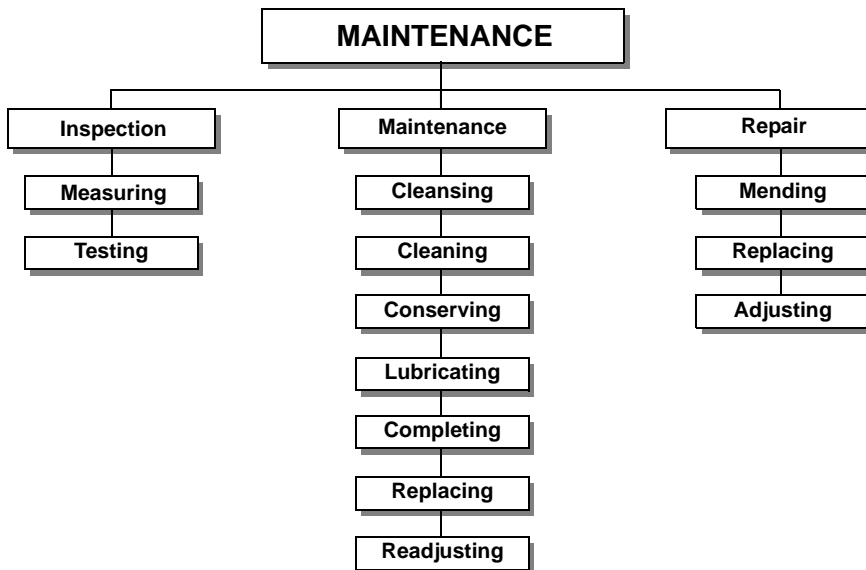
5 Maintenance

In this chapter you will find important information about

- Inspection
- Maintenance
- Repair

of the drilling-milling machine.

The diagram below shows you which tasks belongs to which term.



Img.5-1: Maintenance – Definition according to DIN 31 051

ATTENTION !

Properly performed regular maintenance is an essential prerequisite for

- operational safety,
- failure-free operation,
- long service life of the drilling-milling machine and
- the quality of the products which you manufacture.

Installations and equipment from other manufacturers must also be in good order and condition.



5.1 Safety

WARNING!

The consequences of incorrect maintenance and repair work may include:

- very serious injury to personnel working on the drilling-milling machine,
- damage to the drilling-milling machine.

Only qualified staff should carry out maintenance and repair work on the drilling-milling machine.



5.1.1 Preparation

WARNING!

Only carry out work on the drilling-milling machine if it has been disconnected from the mains power supply.

☞ "Switching-off and securing the drilling-milling machine" on page 14

Attach a warning sign.





5.1.2 Restarting

Before restarting run a safety check.

☞ "Safety check" on page 13

WARNING!

Before starting the drilling-milling machine, you must check that there is no danger for persons and that the drilling-milling machine is not damaged.

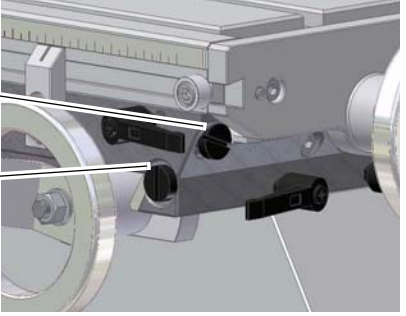
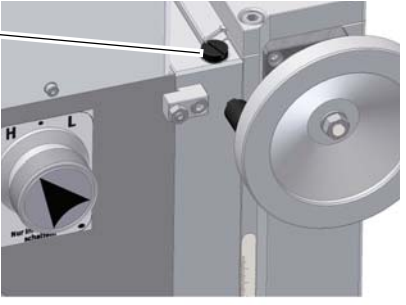


5.2 Inspection and maintenance

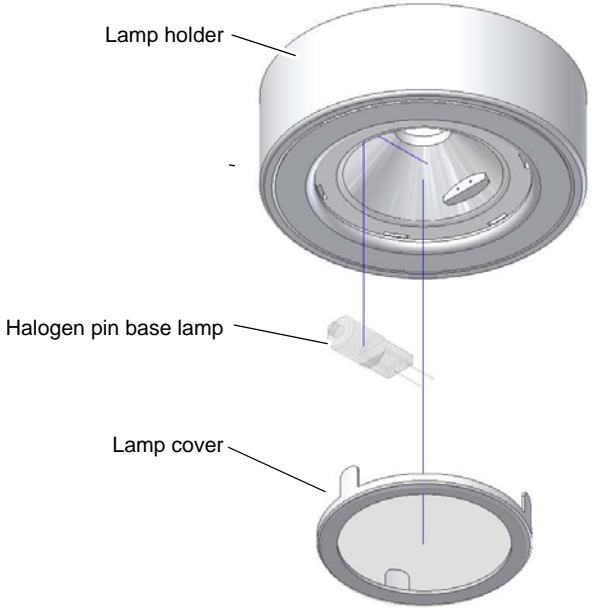
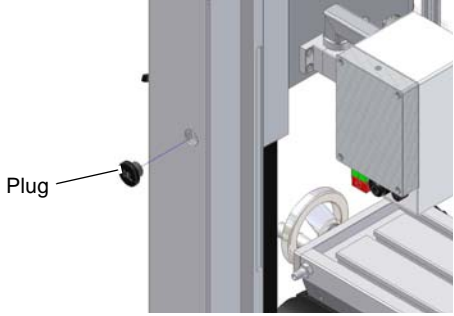
The type and level of wear depends to a large extent on the individual usage and operating conditions. For this reason, all the intervals are only valid for the authorised conditions.

Interval	Where?	What?	How?
Start of work, after every maintenance or repair work	Drilling-milling machine	→ ☞ "Safety check" on page 13	
Start of work, after every maintenance or repair work	Dovetail guides	Oiling	→ Lubricate all slideways.
Every week	Cross table	Oiling	→ Oil all bare steel surfaces. Use an acid-free oil, e.g. weapon oil or motor oil.
As required	Spindle nuts	Readjusting	An extended clearance in the spindles of the cross table can be reduced by readjusting the spindle nuts. Refer to spindle nuts position 66 and 71 The spindle nuts are readjusted by reducing the thread flanks of the spindle nut by means of a regulating screw. Due to the readjustment it is necessary to check if a smooth movement over the whole travel is still given, otherwise the wear is considerably increased due to the friction between the spindle nut and the spindle.



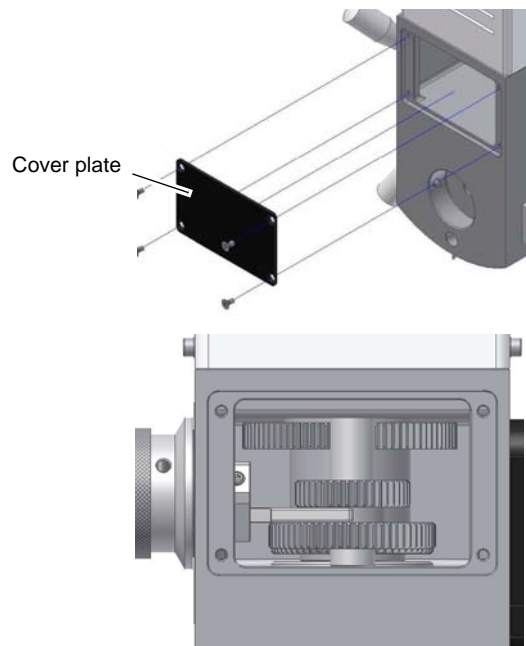
Interval	Where?	What?	How?
As required	V-ledges	Readjusting X and Y axis	<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 45%;"> <p>Cross table</p> <p>Take-up screw taper gib X axis</p> <p>Take-up screw taper gib Y axis</p> </div> <div style="width: 45%;">  </div> </div> <p style="text-align: center;">Img.5-2: Cross table</p> <ul style="list-style-type: none"> ➔ Turn the take-up screw of the corresponding V-ledge clockwise. The taper gib is continued to push in and reduced by it the gap in the guide way. ➔ Check the settings. The corresponding guideway must be more easily moveable but ensure a stable guiding.
As required	V-ledges	Readjusting Z axis	<div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 45%;"> <p>Take-up screw taper gib Z axis</p> </div> <div style="width: 45%;">  </div> </div> <p style="text-align: center;">Img.5-3: Milling head</p> <ul style="list-style-type: none"> ➔ Proceed as described under "Readjusting X and Y axis".



Interval	Where?	What?	How?
As required	Machine illumination	Replacing the halogen lamp	 <p>Img.5-4: Replacing the halogen lamp</p> <ul style="list-style-type: none"> ➔ Tilt the mill head a little to the right. This way you can easily remove the lamp cover in order to allow replacing of the halogen lamp. ➔ Plug a small screw driver into the recess between the lamp holder and the lamp cover. ➔ By slightly turning the screw driver you can remove the lamp cover. ➔ Pull the halogen pin base lamp with a cloth and replace the halogen lamp. Type: Halogen pin base lamp, Osram 12V - 10W, base G4
every six months	Spindle and spindle nut Z axis	Lubricating	<ul style="list-style-type: none"> ➔ Open the plug. ➔ Crank the milling head into the suitable height. ➔ Oil or grease the spindle nut and spindle.  <p>Img.5-5: Column</p>



Interval	Where?	What?	How?
every six months	Gear drill-mill head	Lubricating	<p>→ Turn the drill-mill head as described under "Swivelling the drill-mill head" on page 33 completely by 90° to the right.</p> <p>→ Check if the clamping screws are firmly tightened as described under "Swivelling the drill-mill head" on page 33 and that the drill-mill head can not independently tilt.</p> <p>→ Disassemble the cover plate at the rear.</p> <p>→ Lubricate the gearwheels. "Operating material" on page 16</p>



Img.5-6: Rear

INFORMATION

The spindle bearing is lifetime-lubricated. It is not necessary to lubricate it again.



5.3 Repair

Request for a service technician of the company Optimum Maschinen Germany GmbH for all repairs.

If the repairs are carried out by qualified technical staff, they must follow the indications given in these operating instructions.

The company Optimum Maschinen Germany GmbH does not take responsibility nor does it guarantee for damages and failures resulting of non-observance of this operating manual.

For repairs only use

- faultless and suitable tools
- only original parts or parts from series expressly authorised by Optimum Maschinen Germany GmbH.



5.4 Setting instructions control

Please find below a description to set the operating parameters, if required after replacement of the control and of the motor.

Vmax

This is the potentiometer to set the maximum possible speed of the motor.

The speed of 3000 min^{-1} must not be exceeded since the spindle bearings and your tools might get damaged.

Vmin

This is the potentiometer to set the minimum possible speed of the motor. Make sure that the speed does not fall below 50 min^{-1} .

With reduced speed also the torque (power of the motor) and the cooling will reduce!

Torque

This is the potentiometer to set the torque when readjusting the motor. Depending on the application set the value by which the the control will readjust. If you require less readjustment, turn the potentiometer one to two turns in direction "minus". For a larger readjustment, turn the potentiometer in direction "plus". For thread cutting we recommend little torque.

Slope

This is the potentiometer to set the acceleration time of the motor at the moment when it starts turning. If you require a smoother ramp, turn the potentiometer in direction "plus". In order to achieve a steeper ramp, turn the potentiometer in direction "minus".

CL

This is the potentiometer to set the current limiting as an overload protection for the motor. The current limiting is set by the manufacturer and must not be changed in any way.

General information

The control is charged with high constant-voltage currencies. Please make imperatively sure that the housing will only be opened up in the idle status. Furthermore, make sure that any settings are only being performed when the housing is closed.

The spindle trimmers of the potentiometer are designed with 12 gears. This means in order to achieve the corresponding minimum or maximum value, the spindle trimmer needs to be turned 12 times. Due to this high number of gears of the spindle trimmer it is possible to perform a very sensitive setting over the corresponding potentiometer.

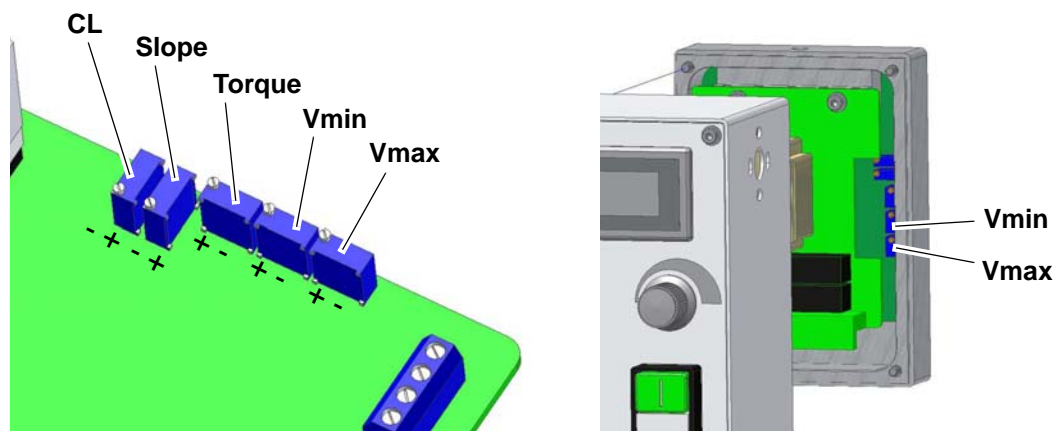
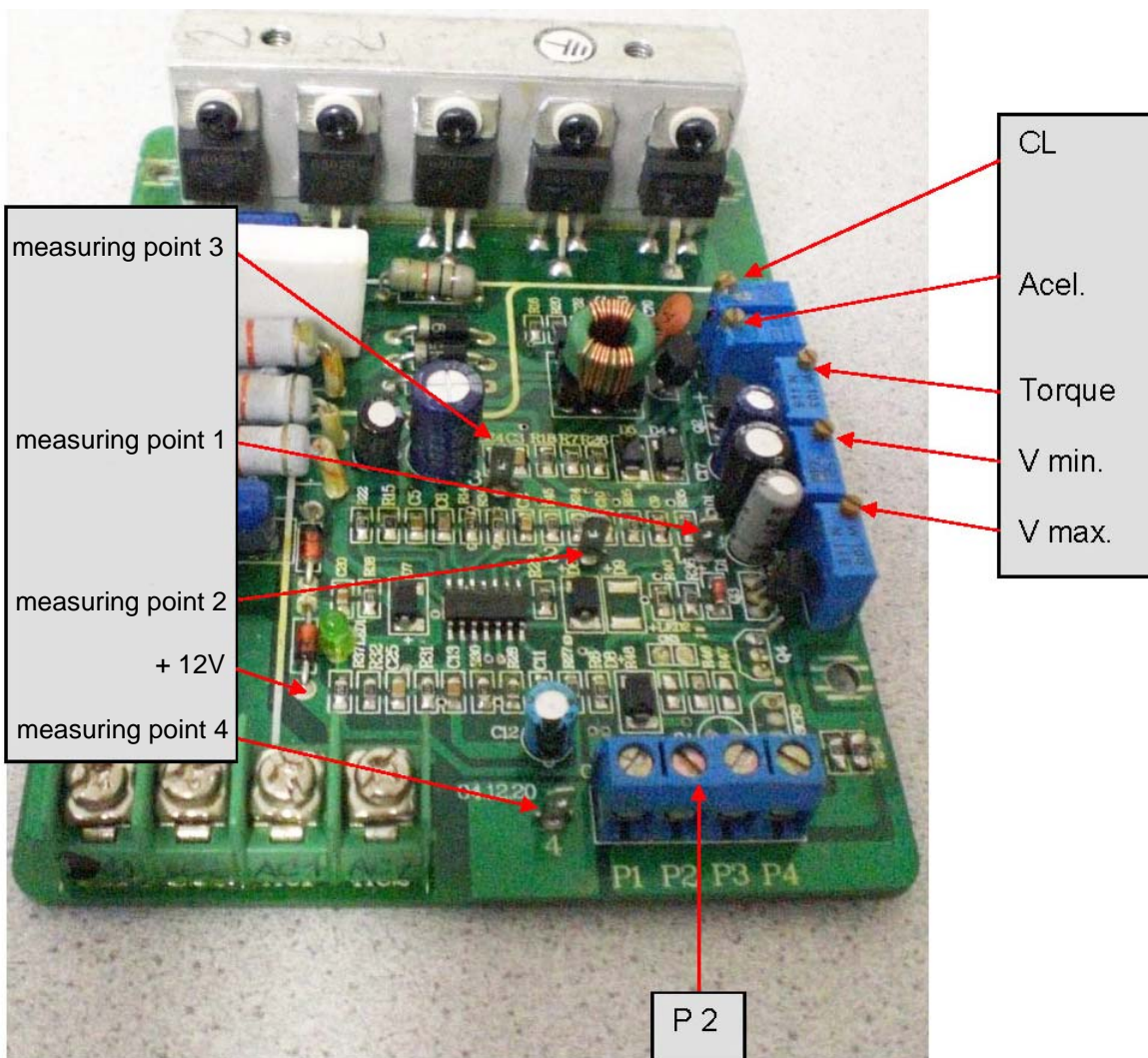


Fig.5-7: Control board

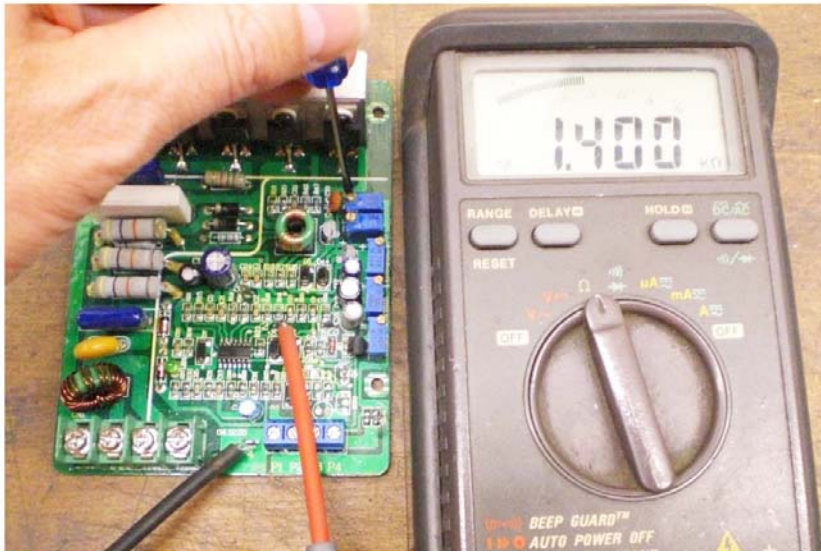


Potentiometer	Measuring points	Setting value	
CL	4 -> 2	-> 1,40 K Ohm	
Torque	4 -> 3	-> 1,94 K Ohm	
Acel	1 -> P2	-> 40,0 K Ohm	Measuring range min. 1 M Ohm
V max.	+12V -> P4	-> 0,555 K Ohm	
V min.	4 -> P3	-> 0,757 K Ohm	} Only approximate value, perform setting via speed control.

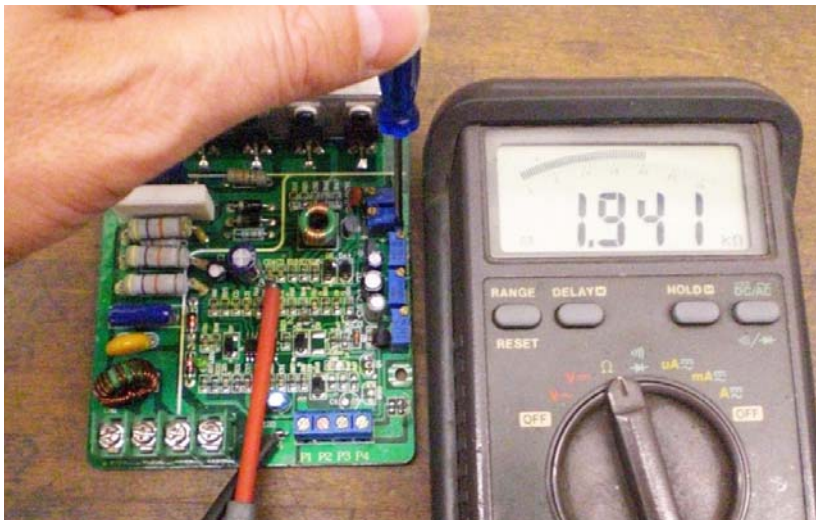




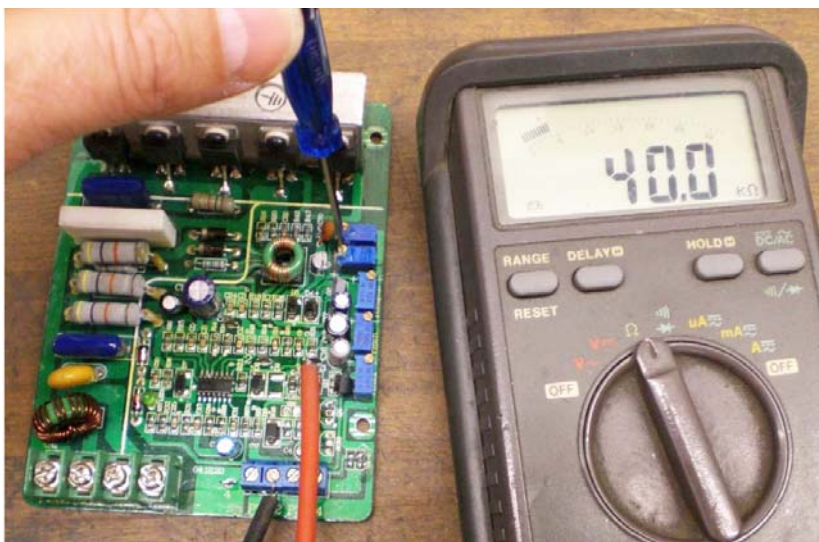
Setting CL



Setting Torque



Setting Acel







6 Ersatzteile - Spare parts BF20 Vario

6.1 Kreuztisch - Cross table

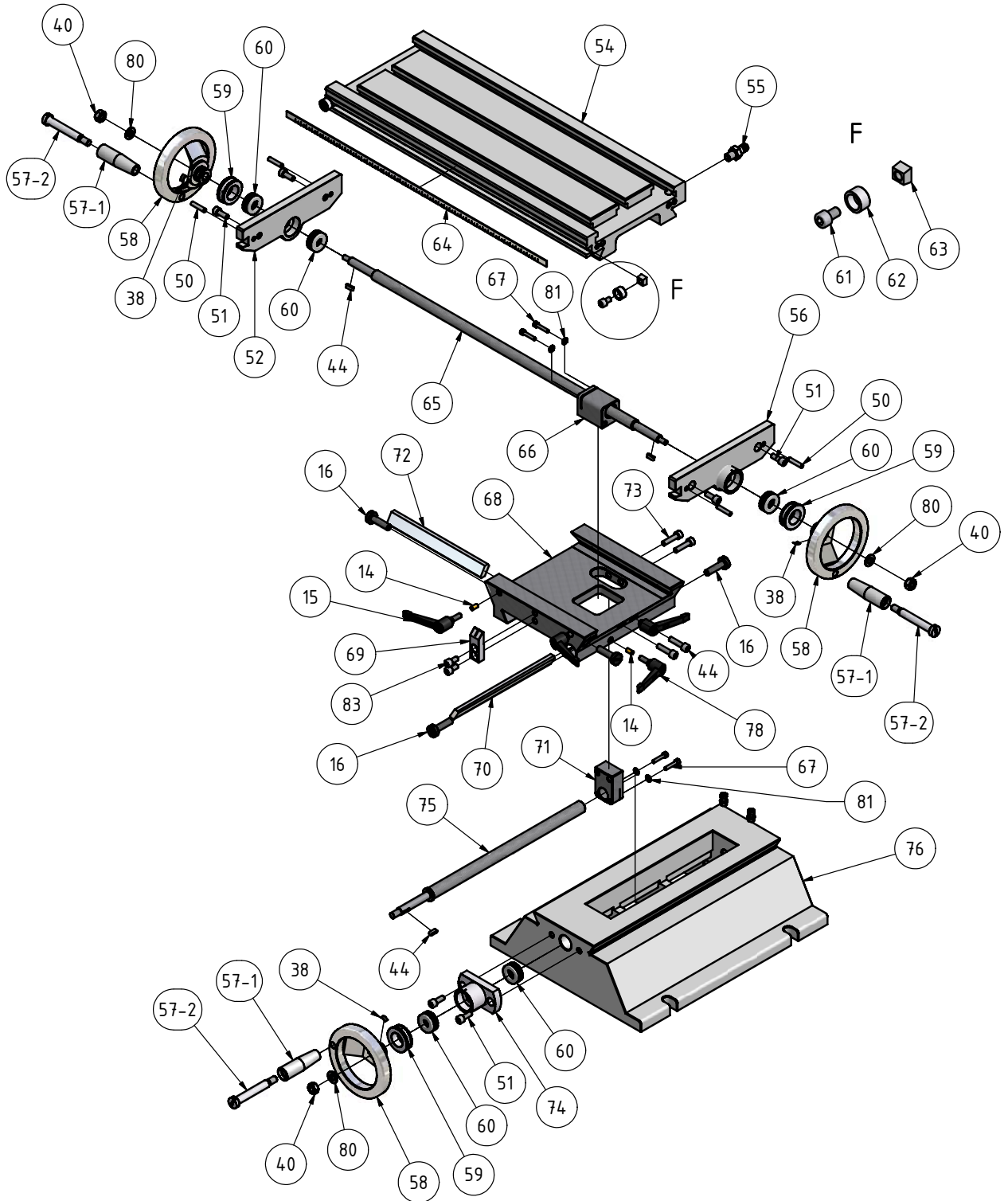


Abb.6-1: Kreuztisch - Cross table

6.2 Kreuztisch ab Baujahr 2007 - Cross table starting from year of construction 2007

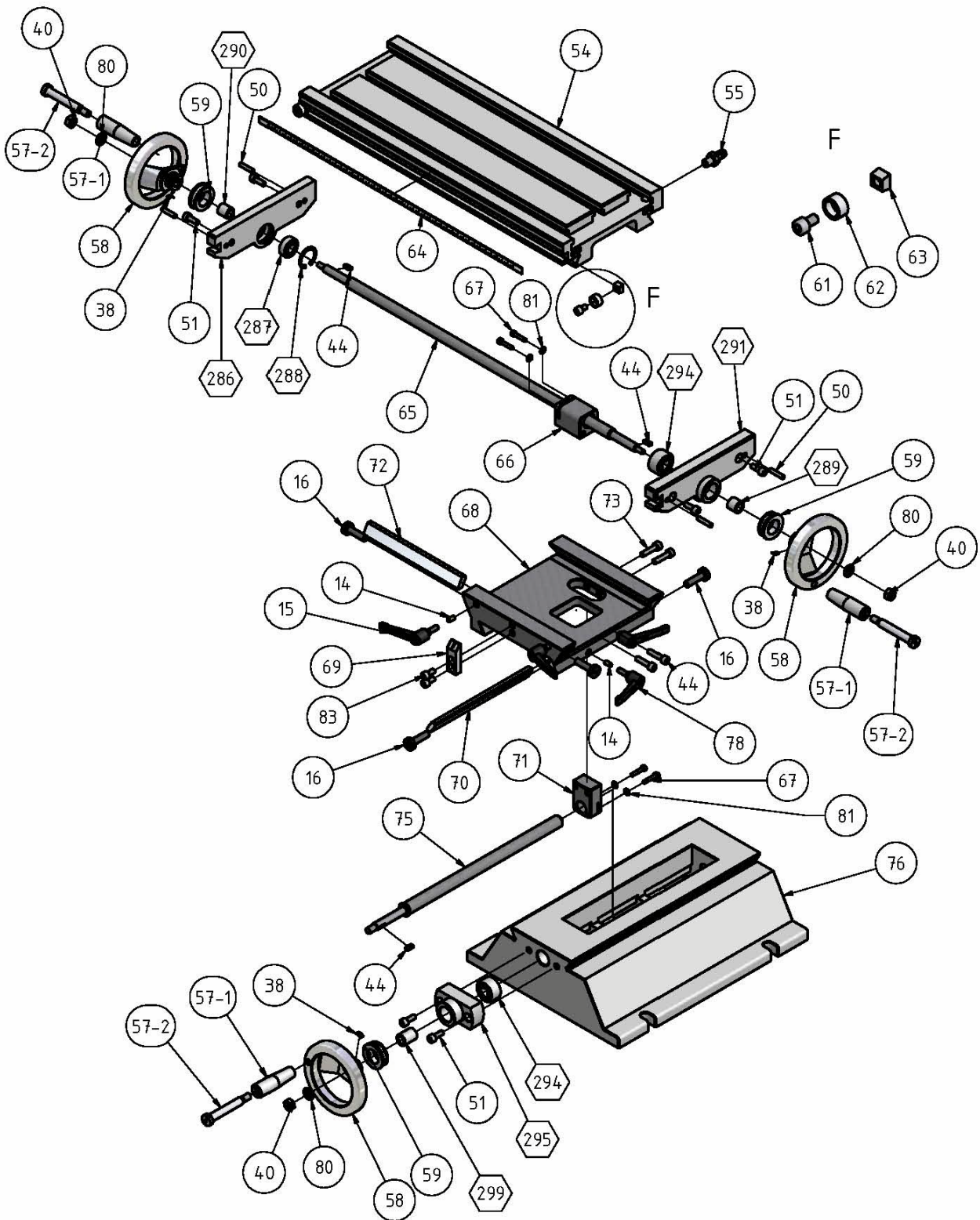


Abb.6-2: Kreuztisch - Cross table



6.3 Säule 1 von 2 - Column 1 of 2

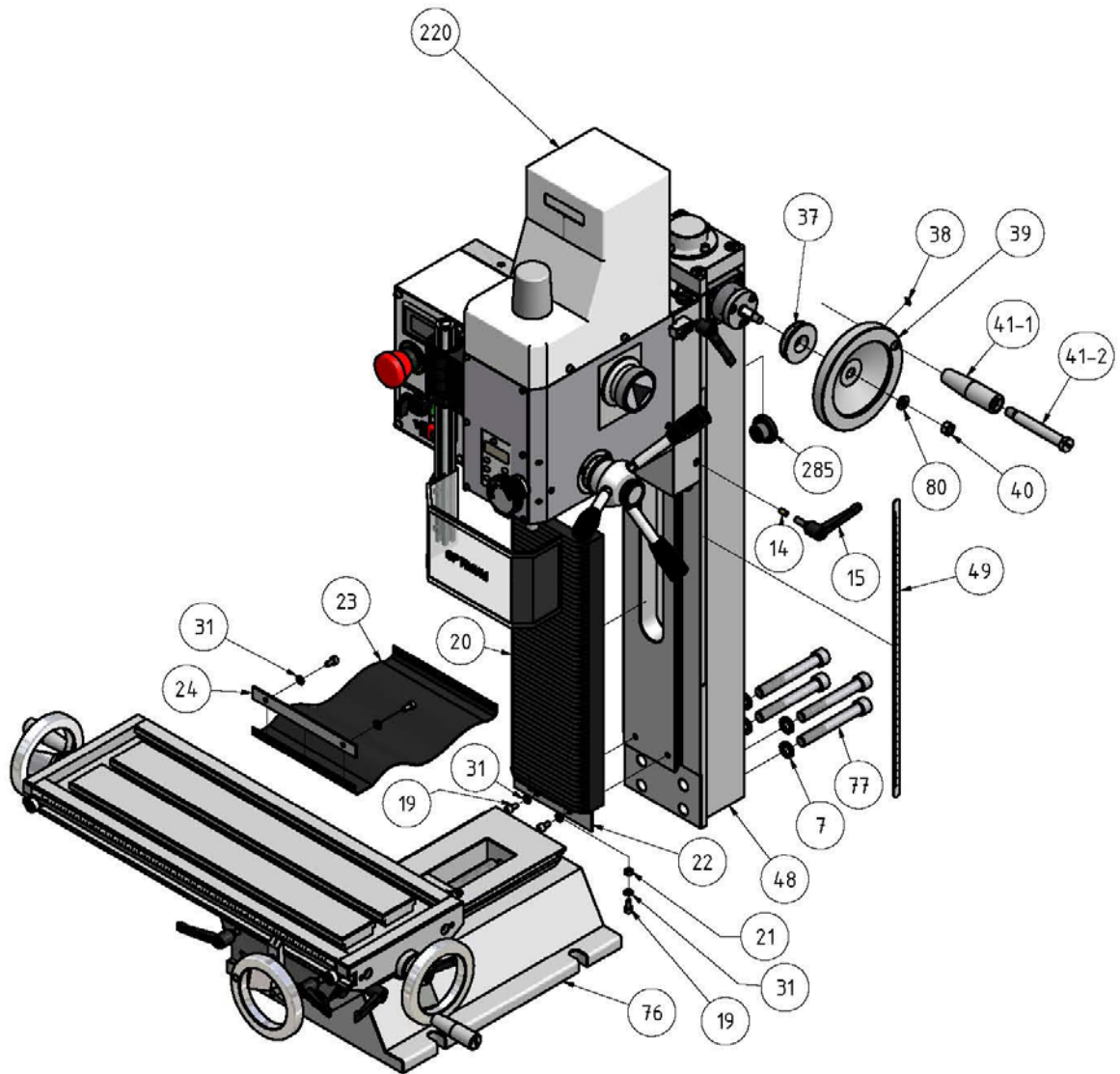


Abb. 6-3: Säule 1 von 2 - Column 1 of 2

6.4 Säule 2 von 2 - Column 2 of 2

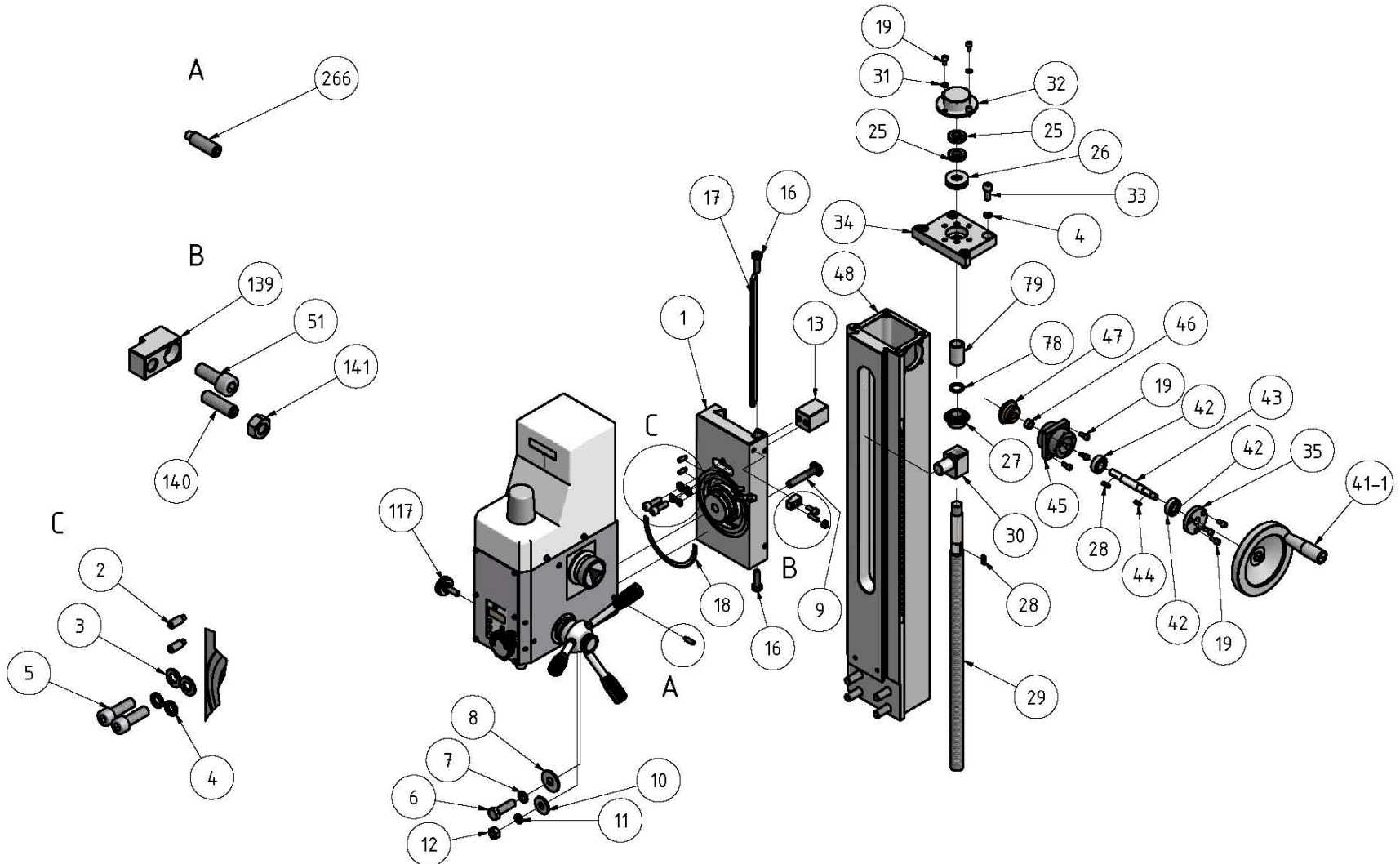


Abb.6-4: Säule 2 von 2 - Column 2 of 2





6.5 Säule 2 von 2 ab Baujahr 2007 - Column 2 of 2 starting from year of construction 2007

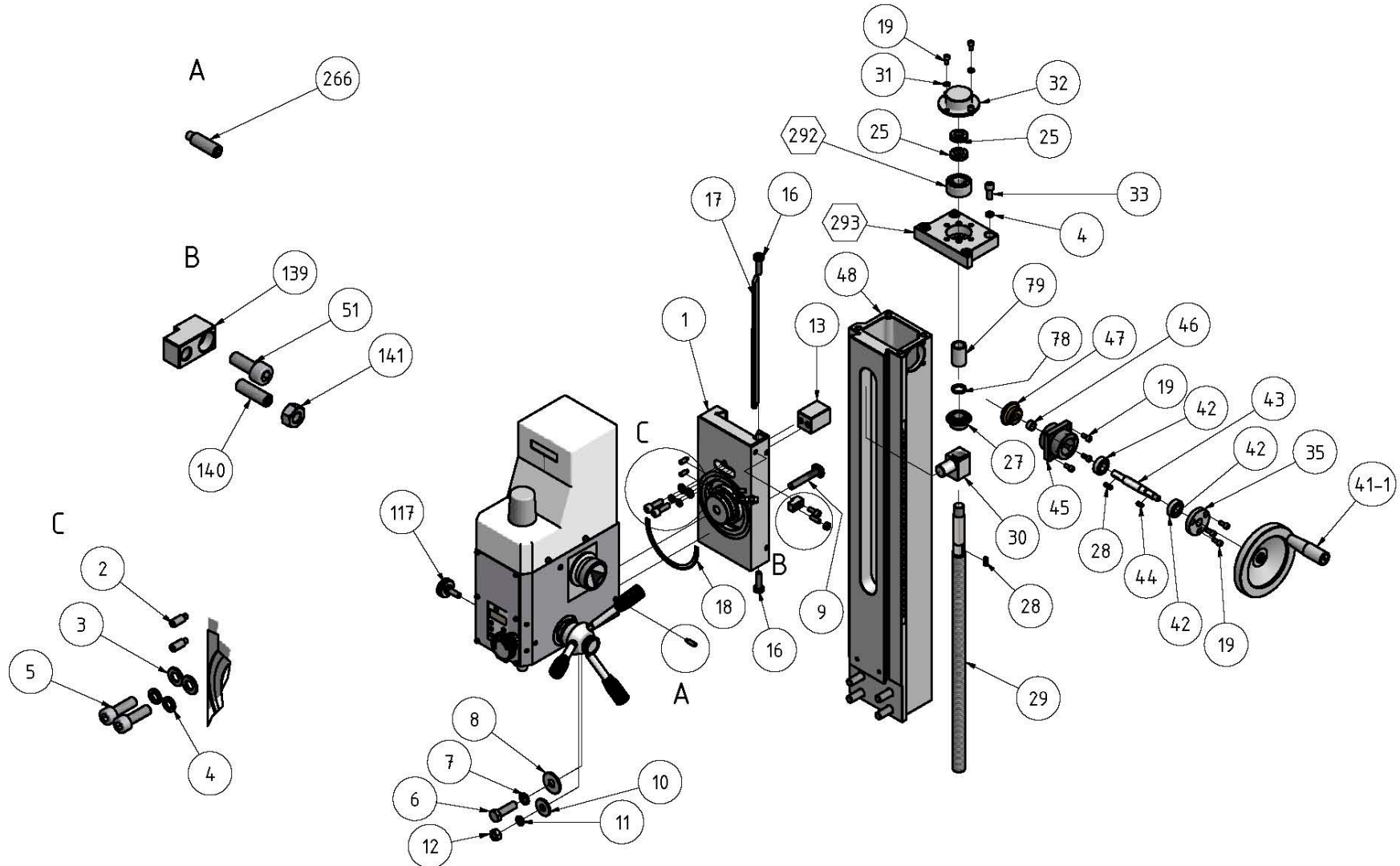


Abb.6-5: Säule 2 von 2 - Column 2 of 2



6.6 Fräskopf 1 von 2 - Milling head 1 of 2

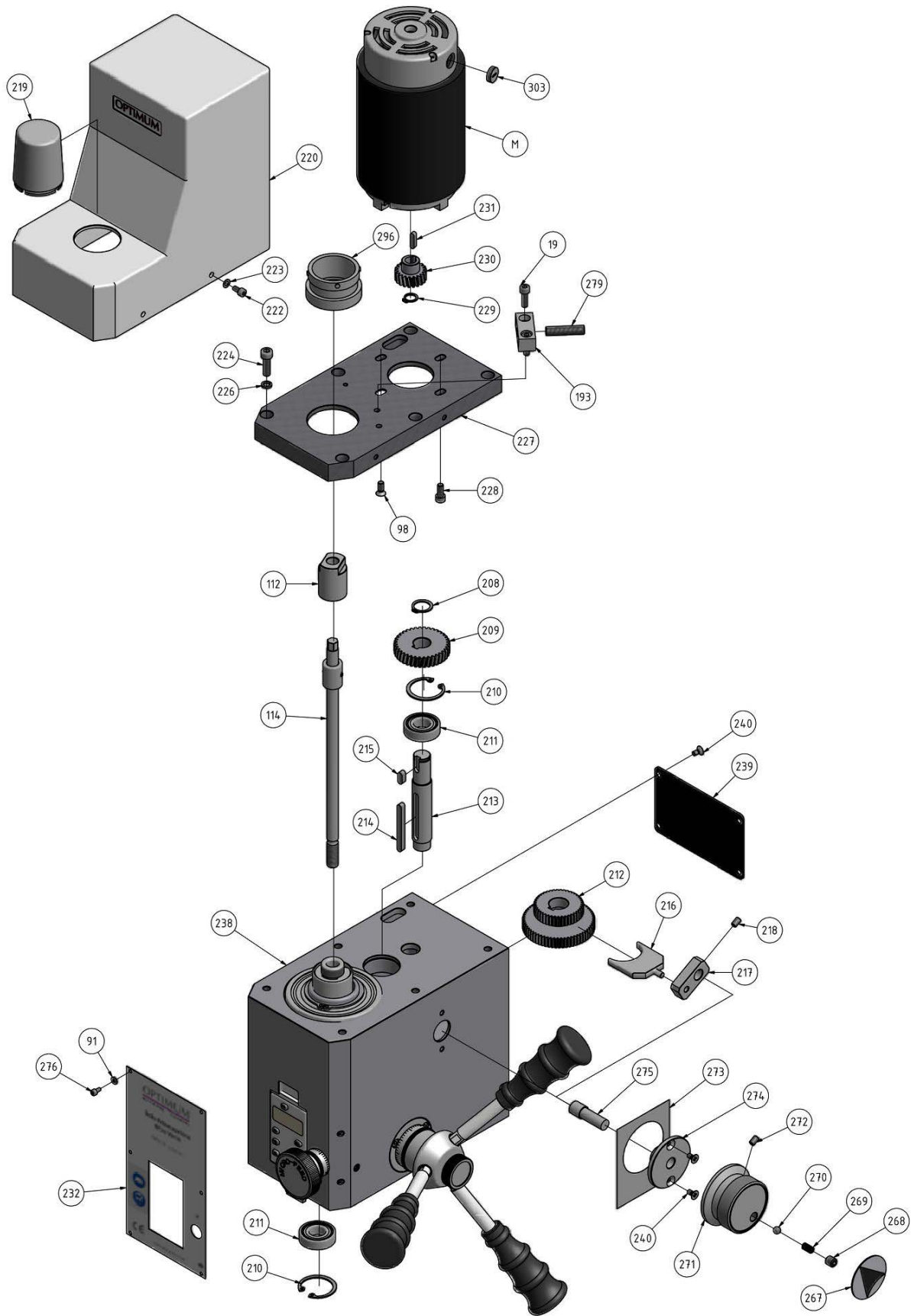


Abb.6-6: Fräskopf 1 von 2 - Milling head 1 of 2



6.7 Fräskopf 2 von 2 - Milling head 2 of 2

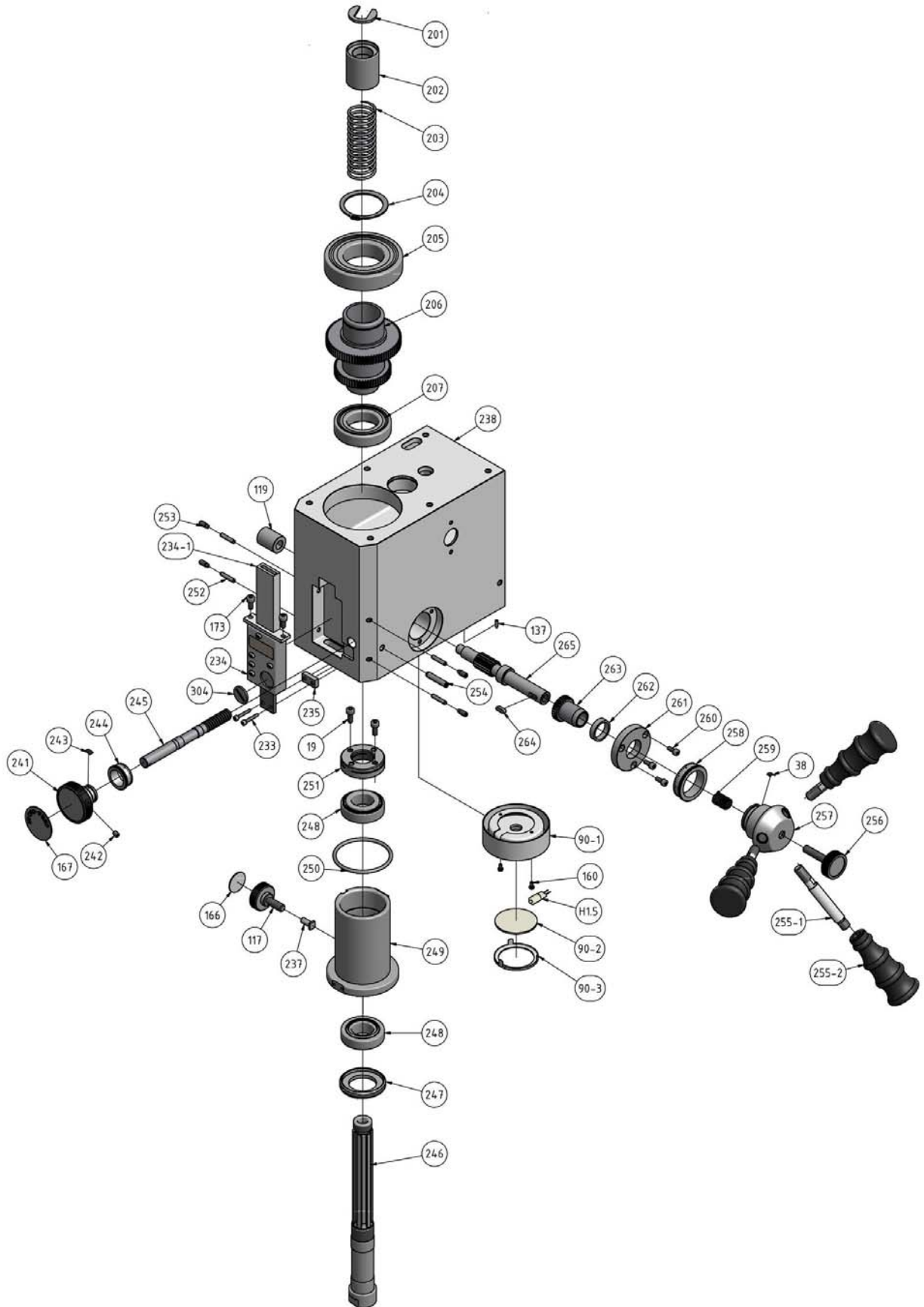


Abb.6-7: Fräskopf 2 von 2 - Milling head 2 of 2



6.8 Bedienkonsole und Schutzeinrichtung - Operation panel and protection device

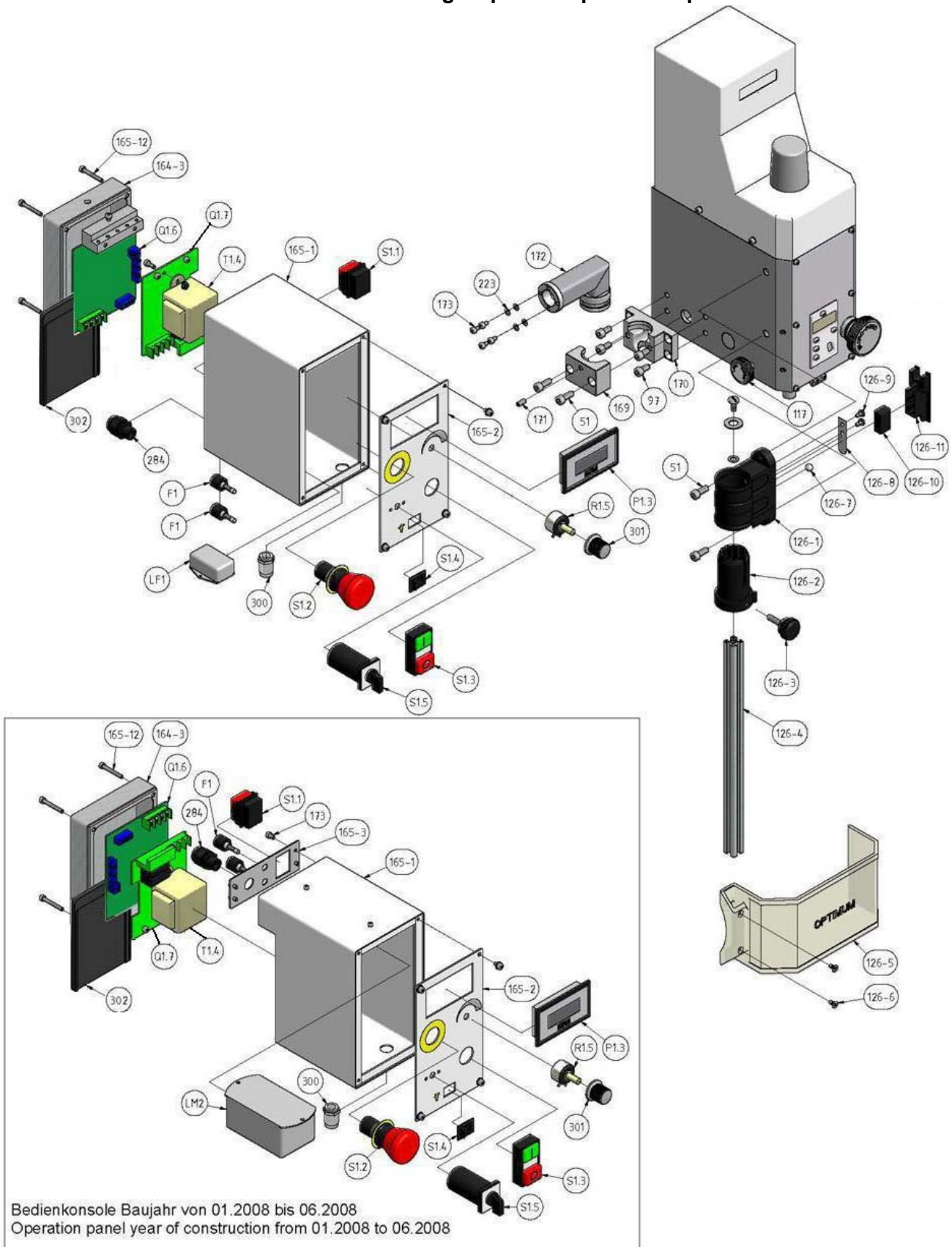


Abb.6-8: Panel und Schutzeinrichtung - Operation panel and protection device



6.9 Optionaler Unterbau - Optional sub structure

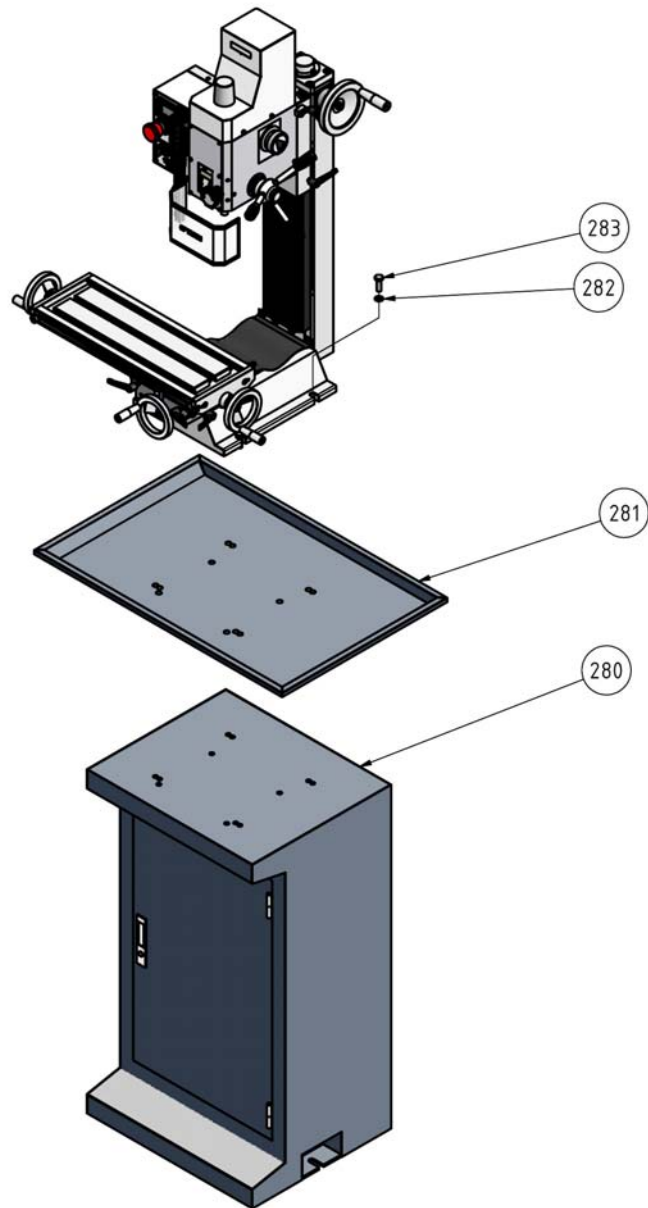


Abb.6-9: Unterbau - Sub structure



6.10 Schaltplan - Wiring diagram

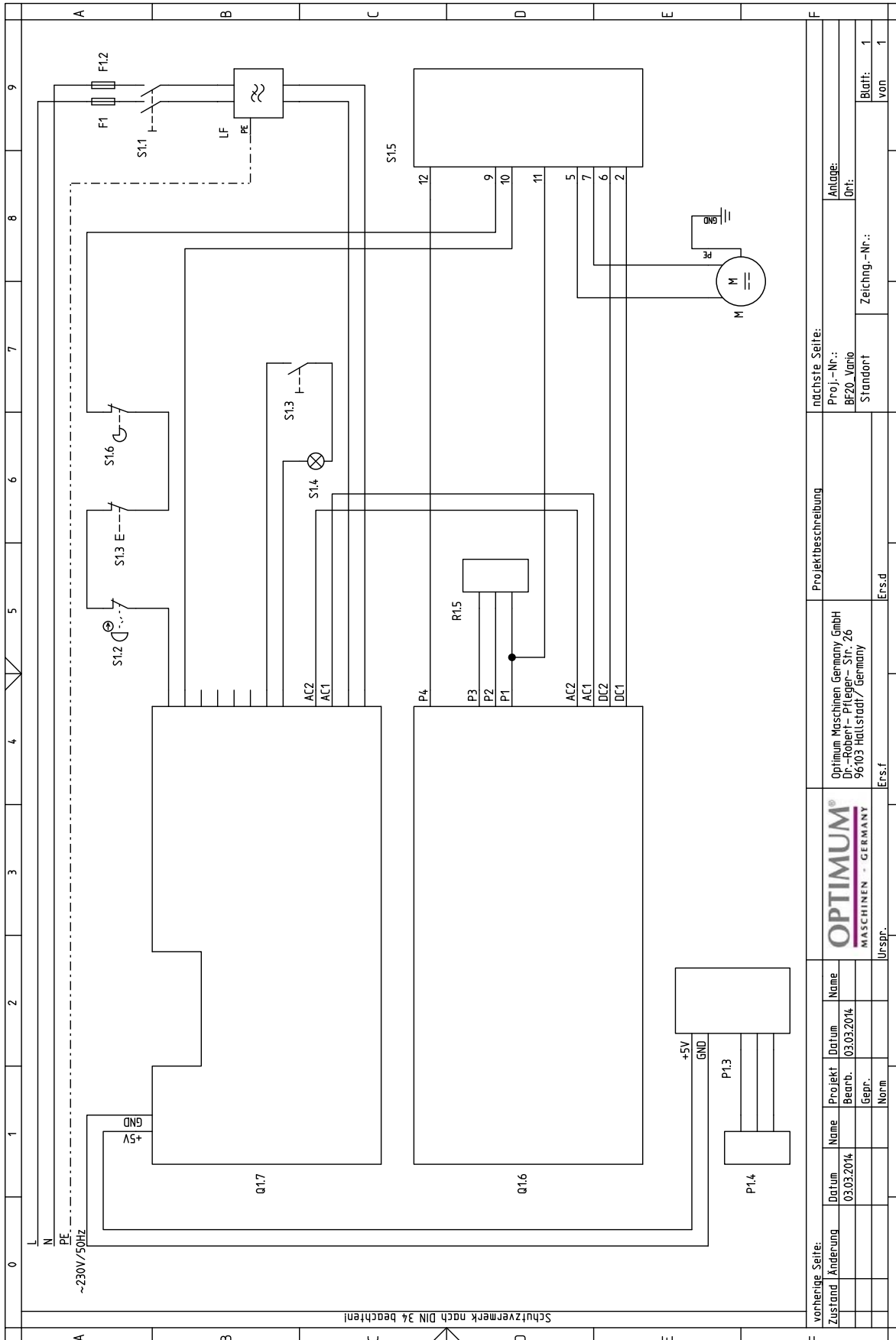


Abb.6-10: Schaltplan-Wiring diagram



6.10.1 Ersatzteilliste - Spare part list

Pos.	Bezeichnung	Designation	Menge	Zeichnungsnummer	Grösse	Artikelnummer
			Qty.	Drawing no.	Size	Item no.
1	Drehlagerbock Fräskopf	Connect board	1	DM14-01-14		0333812001
2	Gewindestift	Socket head set screw	2	GB 79-85	M6 x 16	
4	Federring	Spring washer	6	GB 93-87	M8	
5	Innensechskantschraube	Hexagon head cap screw	2	ISO 4762	M8 x 25	
6	Sechskantschraube	Hexagon head screw	1	GB 5783-86	M12 x 40	
7	Federring	Spring washer	5	GB 93-87	M12	
8	Unterlegscheibe	Washer	1	DM14-01-39		0333812008
9	Schraube	Screw	1			0333812009
10	Unterlegscheibe	Washer	1	DM14-01-40		0333812010
11	Federring	Spring washer	1	GB 93-87	M10	
12	Sechskantmutter	Hexagon nut	1	GB 6170-86	M10	
13	Führungsstück	Connect collar	1	DM14-01-13		0333812013
14	Messingstift	Brass pin	6	DM14-00-05		0333812014
15	Klemmhebel	Adjust locating handle	4	JBT 7270.12-1994	DM6 x 16	0333812015
16	Schraube Keilleiste	Gib screw	6	DM14-02-20		0333812016
17	Keilleiste Z-Achse	Taper gib z axis	1	DM14-00-01		0333812017
18	Winkelskala	Angle plate	1	DM14-00-03		0333812018
19	Innensechskantschraube	Hexagon head cap screw	20	GB 70-85	M5 x 10	
20	Faltenbalg	Bellows	1	DM14-00-06		0333812020
21	Mutter	Hexagon nut	2	DIN EN 24 032	M5	
22	Halterung Faltenbalg	Bellows bracket	1	DM14-00-06		0333812022
23	Gummi - Späneabdeckung	Rubber splash guard	1	DM14-00-08		0333812023
24	Leiste	Plate	1	DM14-00-09		0333812024
25	Nutmutter	Groove nut	2	GB 810-88	M16x1.5	0333812025
26	Axiallager	Axially grooved ball bearing	1	51203	51203	04051203
27	Kegelzahnrad	Taper gear	1	DM14-03-06	26 Z ; m 1,5	0333812027
28	Paßfeder	Key	3	DIN 6885	A 4 x 4 x 16	0333812028
29	Spindel Z-Achse	Lift lead screw	1	DM14-03-04		0333812029
30	Spindelmutter Z-Achse	Lift lead screw nut	1	DM14-03-05		0333812030
31	Scheibe	Washer	8	GB 97.1-85	5	
32	Abdeckkappe	Nut collar	1	DM14-03-01		0333812032
33	Innensechskantschraube	Hexagon head cap screw	4	GB 70-85	M8 x 20	
34	Abdeckplatte Säule	Column cover	1	DM14-03-02	alt / old	0320218
35	Lagerabdeckung	Bearing cover	1	DM14-03-10		0333812035
37	Skalenring Z-Achse	Lift dial z axis	1	DM14-03-11		0333812037
38	Federstück	Spring piece	4			0333812038
39	Handrad Z Achse	Handwheel z axis	1	DM14-03-13		0333812039
40	Sechskantmutter	Hexagon nut	4	ISO 4033	M8	
41	Griff komplett	Handle complete	1			0333812041
41-1	Griffhülse	Handle sleeve	1	JB7270.5-1994-80	80	0333812041-1
41-2	Schraube	Screw	1	JB7270.5-1994-M10	M10 x 80	0333812041-2
42	Rillenkugellager einreihig	Grooved ball bearing single-row	2	6001-2RZ		0406001.2R
43	Welle Handrad Z Achse	Lift shaft z axis	1	DM14-03-12		0333812043
44	Paßfeder	Key	5	DIN 6885	A 4 x 4 x 12	0333812044
45	Lagerbock	Lift bearing base	1	DM14-03-09		0333812045
46	Buchse	Collar	1	DM14-03-08		0333812046
47	Kegelzahnrad	Taper gear	1	DM14-03-07		0333812047
48	Säule	Column	1	DM14-03-03		0333812048
49	Skala Z-Achse	Lift plate	1	DM14-00-04		0333812049
50	Zylinderstift	Cylindrical pin	4	GB 119-86	A 5 x 24	
51	Innensechskantschraube	Hexagon head cap screw	11	GB 70-85	M6 x 16	
52	Lagerbock Kreuztisch links X-Achse	Table dial support x axis left	1	DM14-02-02	alt / old	0320232
54	Frästisch	Cross table	1	DM14-02-03	BF20	0333812054
54	Frästisch	Cross table	1	DM14-02-03L	BF20 L	0333812254
55	Eienschraubverschraubung Schlauchanschluss	Screwing in screw connection hose connector	1	DM14-02-18	M10 x 1	0333812055
56	Lagerbock Kreuztisch rechts X-Achse	Table dial support x axis	1	DM14-02-06	alt / old	0320235
57	Griff komplett	Handle complete	3			0333812057
57-1	Griffhülse	Handle sleeve	3	JB7270.5-1994-63	63	0333812057-1
57-2	Schraube	Screw	3	JB7270.5-1994-M8	M8 x 63	0333812057-2
58	Handrad Kreuztisch	Handwheel cross table	3	DM14-02-01		0333812058
59	Skalenring	Dial	3	DM14-02-19		0333812059
60	Axiallager	Axially grooved ball bearing	5	51200	alt / old	04051200
61	Innensechskantschraube	Hexagon head cap screw	2	GB 70-85	M6 x 10	
62	Hülse Endlagenanschlag X-Achse	Stopper x axis	2	DM14-02-04		0333812062
63	Rechteckmutter (Nutenstein)	Wedgy nut	2	DM14-02-05		0333812063



Pos.	Bezeichnung	Designation	Menge	Zeichnungsnummer	Grösse	Artikelnummer
			Qty.	Drawing no.	Size	Item no.
64	Skala X-Achse BF20	Table plate x axisBF20	1	DM14-00-02	BF20	0333812064
64	Skala X-Achse BF20 L	Table plate x axisBF20 L	1	DM14-00-02L	BF20 L	0333812264
65	Spindel X-Achse BF20	Table lead screw x axis BF20	1	DM14-02-11	BF20	0333812065
65	Spindel X-Achse BF20 L	Table lead screw x axis BF20 L	1	DM14-02-11L	BF20 L	0333812265
66	Spindelmutter X-Achse	Table lead screw nut x axis	1	DM14-02-09		0333812066
67	Innensechskantschraube	Hexagon head cap screw	4	GB 70-85	M4 x 20	
68	Kreuztischführung	Saddle	1	DM14-02-08	BF20	0333812068
69	Anschlag Endlage X-Achse	Limit plate x axis	1	DM14-02-07		0333812069
70	Keilleiste Y-Achse	Taper gib y axis	1	DM14-02-10		0333812070
71	Spindelmutter Y-Achse	Lead screw nut y axis	1	DM14-02-16		0333812071
72	Keilleiste X-Achse	Taper gib x axis	1	DM14-02-17	BF20	0333812072
73	Innensechskantschraube	Hexagon head cap screw	2	GB 70-85	M6 x 25	
74	Lagerbock	Saddle dial support	1	DM14-02-13		0320249
75	Spindel Y-Achse	Lead screw y axis	1	DM14-02-14		0333812075
76	Maschinenfuss	Base	1	DM14-02-15	BF20	0333812076
77	Innensechskantschraube	Hexagon head cap screw	4	GB 70-85	M12 x 90	
78	Klemmhebel	Clamping lever	4	JBT7270.12-1994	DM6x16	0333812078
78	Distanzring für Spindel Z-Achse	Spacer ring for spindle z axis	1	DM14-03-15		0333812078
79	Hülse für Z-Achse	Case for z axis	1	DM14-03-14		0333812079
80	Scheibe	Washer	6	GB 97.1-85	8	
81	Scheibe	Washer	2	GB 97.1-85	4	
83	Innensechskantschraube	Hexagon head cap screw	6	GB 70-85	M6 x 12	
90	Maschinenleuchte komplett	Machine lightning complete	1			0333812090
90-1	Gehäuse Maschinenleuchte	Housing machine lightning	1			0333812090-1
90-2	Schutzglas	Protection glas	1			0333812090-2
90-3	Deckel Maschinenleuchte	Cover machine lightning	1			0333812090-3
H 1.5	Halogen-Stiftsockellampe 12V , 10 W, Sockel G4	Halogen lamp 12V , 10 W, Sockel G4	1			03338120H15
91	Scheibe		6	GB 97.1-85	3	
98	Senkschraube mit Kreuzschlitz	Countersunk screw	1	BS 4183	M5 x 12	
112	Gegenhalter Anzugsstange	Holder screw rod	1	DM14-01-42		03338120112
114	Anzugsstange	Screw rod	1	DM14-20-02		03338120114
117	Klemmschraube Pinole	Clamping screw collar	1	DM14-01-43		03338120117
119	Verschlussstück	Endplate	1	DM14-01-25		03338120119
126	Schutzeinrichtung komplett	Protection device complete	1	BF20-XHZMX		03338120126
126-1	Gehäuse	Housing	1	BF20-XHZMX		03338120126-1
126-2	Aluminium Profilaufnahme	Aluminium profile admission	1	BF20-XHZMX		03338120126-2
126-3	Klemmschraube	Clamping scew	1	BF20-XHZMX		03338120126-3
126-4	Aluminiumprofil	Aluminium profile	1	B15-04-02	L=290mm	03338120126-4
126-5	Schutz	Protection	1	BF20-XHZMX		03338120126-5
126-6	Schraube	Screw	2	BF20-XHZMX		03338120126-6
126-7	Stahlkugel	Steel ball	1	BF20-XHZMX		03338120126-7
126-8	Federblech	Spring plate	1	BF20-XHZMX		03338120126-8
126-9	Schraube	Screw	2	BF20-XHZMX		03338120126-9
126-10	Mikroschalter Spindelschutz	Micro switch spindle protection	1	BF20-XHZMX		03338120126-10
126-11	Deckel	Cover	1	BF20-XHZMX		03338120126-11
127	Innensechskant-Gewindestift mit Spitze	Hexagon head cap thread pin screw with point	1	GB 78-85	M5 x 6	03338120127
137	Zeiger Winkelskala	Scale-pin	1			03338120137
139	Anschlagstück	Stopper	1	DM14-00-10		03338120139
140	Innensechskant-Gewindestift mit flachem Ende	Hexagon head cap thread pin screw with flat end	1	GB 77-85	M6 x 20	
141	Sechskantmutter	Hexagon nut	1	GB 6170-86	M6	
160	Flachkopfschraube mit Kreuzschlitz	Cheese head screw	2	ISO 7045	M3 x 6 - 4.8 - H	
164-3	Gehäuse Steuerung	Housing control boards	1	DM14-10-04		03338120164-3
165-1	Panel Gehäuse	Panel housing	1	DM14-10-02A		03338120165-1
165-2	Blende	Cover	1	DM14-10-01A		03338120165-2
165-3	Blende	Cover	1			03338120165-3
165-12	Innensechskantschraube	Innensechskantschraube	4	GB 70-85	M4 x 30	
166	Label lösen / spannen	Label loose / tighten	1			03338120166
167	Label Feinvorschub	Label Micro feed	1			03338120167
168	Morsekonus MK2 - B16	Morse taper MK2 - B16	1	DM14-MS2W-B16		03338120168
169	Halierung Panel	Mounting plate panel	1	DM14-10-07		03338120169
170	Halierung Panel	Mounting plate panel	1	DM14-10-08		03338120170
171	Innensechskant-Gewindestift mit Ringschneide	Innensechskant-Gewindestift with cup point	1	GB 80-85	M5 x 12	03338120171
172	Haltearm Panel	Holding arm panel	1	DM14-10-06		03338120172
173	Innensechskantschraube	Hexagon head cap screw	4	GB 70-85	M4 x 6	
201	Positionsscheibe	Position washer	1	DM14-01-08		03338120201



Pos.	Bezeichnung	Designation	Menge	Zeichnungsnummer	Grösse	Artikelnummer
			Qty.	Drawing no.	Size	Item no.
202	Buchse	Spring sleeve	1	DM14-01-07		03338120202
203	Druckfeder	Spring	1	GB2089-94	2.5x28x110-3	03338120203
204	Sicherungsring	Retainer ring	1	GB 894.1 - 45		03338120204
205	Rillenkugellager	Grooved ball bearing	1	6209-2Z	6209-2Z	0406209.2R
206	Zahnradkombination	Gear combination	1	DM14-01-06	Z 60 / Z 80, m 1	03338120206
207	Rillenkugellager	Grooved ball bearing	1	6007-2Z	6007-2Z	0406007.2R
208	Sicherungsring	Retainer ring	1	DIN 471	15 x 1	03338120208
209	Zahnrad schrägverzahnt	Gear diagonally-toothed	1	DM14-01-10	Z 37, m 1,25, 9°	03338120209
210	Sicherungsring	Retainer ring	2	DIN 472	32 x 1.2	03338120210
211	Rillenkugellager	Grooved ball bearing	2	6002-2Z	6002-2Z	0406002.2R
212	Zahnradkombination	Gear combination	1	DM14-01-05	Z 62 / Z 42, m 1	03338120212
213	Zwischenwelle	Intermediate shaft	1	DM14-01-04		03338120213
214	Paßfeder	Key	1	DIN 6885	A 5 x 5 x 50	03338120214
215	Paßfeder	Key	1	DIN 6885	A 5 x 5 x 12	03338120215
216	Schaltgabel	Fork	1	DM14-01-17		03338120216
217	Arm Schaltgabel	Fork arm	1	DM14-01-16		03338120217
219	Abdeckkappe Anzugsstange	Cover	1	DM14-01-09		03338120219
220	Motorhaube	Motor cover	1	DM14-01-35A		03338120220
222	Innensechskantschraube	Hexagon head cap screw	4	GB 70-85	M4 x 8	
223	Scheibe	Washer	8	GB 848-85	4	
224	Innensechskantschraube	Hexagon head cap screw	6	GB 70-85	M6 x 20	
226	Federring	Spring washer	6	GB 93-87	M6	
227	Fräskopf Gehäusedeckel	Fixed cover	1	DM14-01-20		03338120227
229	Sicherungsring	Retainer ring	1	GB 894.1	10	
230	Zahnrad schrägverzahnt	Gear diagonally-toothed	1	DM14-01-11	Z 20, m 1,25, 9°	03338120230
233	Innensechskantschraube	Hexagon head cap screw	2	GB 70-85	M3 x 20	
234	Digitalanzeige	Digital slide guage	1	DQ1		03338120234
234-1	Schutzabdeckung	Protective cover	1			03338120235
235	Linealbefestigung Digitalanzeige	Base for ruler digital display	1	DM14-01-31		03338120237
237	Klemm- und Führungsstift	Clamping and guide pin	1	DM14-01-34		03338120238
238	Gehäuse Fräskopf	Housing milling head	1	DM14-01-19		03338120239
239	Abdeckung	Cover	1	DM14-01-12		
240	Senkschraube mit Kreuzschlitz	Countersunk screw	6	GB 819-85	M4x8	
241	Drehknopf Feinzustellung	Micro feed knob	1	DM14-01-30		03338120241
242	Innensechskant-Gewindestift mit Spitze	Hexagon head cap thread pin screw with point	1	GB 78-85	M5 x 6	
243	Federstück	Spring piece	1			03338120243
244	Skalenring Feinzustellung	Micro feed dial	1	DM14-01-28		03338120244
245	Schneckenwelle	Worm shaft	1	DM14-01-27		03338120245
246	Spindel	Spindle	1	DM14-01-03		03338120246
247	Spindelmutter	Nut	1	DM14-01-01		03338120247
248	Kegelrollenlager einreihig	Taper roller bearing single-row	2	32005 X/Q		04032005
249	Pinole	Collar	1	DM14-01-02		03338120249
250	O-Ring	O-ring	1	GB 3452-1	58x2.65	03338120250
251	Klemmmutter	Clamp nut	1	DM14-01-41		03338120251
252	Zylinderstift	Cylindrical pin	4	GB 119-86	B4x20	
253	Gewindestift geschlitzt mit langem Zapfen	Thread pin slit with long tap	4	GB 79-85	M5 x 12	
254	Zylinderstift	Cylindrical pin	1	GB 120-86-A	6x30	
255	Griffhebel komplett	Handle complete	3			03338120255
255-1	Gewindestange	Threaded rod	3	JB_T7271.6-1994	BM10x80	03338120255-1
255-2	Griff	Handle	3	JBT7271.5-1994		03338120255-2
256	Griffschraube	Locking knob	1	DM14-01-21		03338120256
257	Nabe Sterngriff Pinolenvorschub	Feed handle disc	1	DM14-01-22		03338120257
258	Skalenring Sterngriff	Feed dial	1	DM14-01-36		03338120258
259	Feder	Compression spring	1	GB2089-94	1.2x12x25-3	03338120259
260	Innensechskantschraube	Hexagon head cap screw	3	GB 70-85	M4 x 10	
261	Abdeckscheibe	Cover	1	DM14-01-26		03338120261
262	Klemmring	Adjust collar	1	DM14-01-37		03338120262
263	Kupplung mit Verzahnung	Clutch with gear	1	DM14-01-23		03338120263
264	Passfeder	Key	1	DIN 6885 A	4 x 4 x 12	03338120264
265	Verzahnnte Welle	Toothed shaft	1	DM14-01-24		03338120265
266	Gewindestift geschlitzt mit langem Zapfen	Thread pin slit with long tap	1	GB 79-85	M6 x 20	
267	Indikator	Plate	1	DM14-BP-03		03338120267



Pos.	Bezeichnung	Designation	Menge	Zeichnungsnummer	Grösse	Artikelnummer
			Qty.	Drawing no.	Size	Item no.
268	Innensechskant-Gewindestift mit flachem Ende	Hexagon head cap thread pin screw with flat end	1	GB 77-85	M8 x 8	
269	Feder	Compression Spring	1	GBT2089-94	0.8x5x25-3	03338120269
270	Stahlkugel	Steel ball	1	GBT308-1994	6,5	03338120270
271	WahldrehschalterGetriebe	Locating knob	1	DM14-01-33		03338120271
272	Innensechskant-Gewindestift mit Spitze	Hexagon head cap thread pin screw with point	2	GB 78-85	M5 x 8	
273	Drehzahllabel	Shifting plate	1	DM14		03338120273
274	Aufnahmescheibe	Locating base	1	DM14-01-38		03338120274
275	Schaltwelle	Shifting shaft	1	DM14-01-15		03338120275
276	Innensechskantschraube	Hexagon head cap screw	6	GB 70-85	M3 x 6	
277	Winkel Messfühler	Angle sensor	1			03338120277
278	Innensechskantschraube	Hexagon head cap screw	2	GB 70-85	M5 x 8	
279	Drehzahlsensor	Sensor, number of revolutions	1			03338120279
280	Optionaler Unterbau	Optional sub structure	1			03338120280
281	Optionale Wanne Unterbau	Optional pan sub structure	1			03338120281
282	Scheibe	Washer	4	GB 848-85	10	
283	Sechskantschraube	Hexagon head screw	4	GB 5783-86	M10 x 30	
284	Zugentlastung Anschlusskabel	Strain relief connection cable	1			03338120284
285	Schmierverschluss	Lubrication catch	1			03338120285
286	Lagerbock Kreuztisch links X-Achse	Table dial support x axis left	2	DM14-02-02-A		03338120286
287	Rillenkugellager, einreihig	Grooved ball bearing, single-row	1	6000		0406000.2R
288	Sicherungsring	Snap ring	1	DIN 472	28 x 1,2	03338120288
289	Distanzhülse	Distance case	1			03338120289
290	Distanzhülse	Distance case	1			03338120290
291	Lagerbock Kreuztisch rechts X-Achse	Table dial support x axis	1	DM14-02-06-A		03338120291
292	Schräggugellager, zweireihig	Skew-angle roller bearing, double-row	1	3203		0403203
293	Abdeckplatte Säule	Column cover	1	DM14-03-02-A		03338120293
294	Schräggugellager, zweireihig	Skew-angle roller bearing, double-row	2	3200		0403200
295	Lagerbock	Saddle dial support	1	DM14-02-13-A		03338120295
296	Sensorring	Sensor ring	1			03338120296
299	Distanzhülse	Distance case	1			03338120299
300	Start- Stop Verbindung für CNC Controller	Start- Stop connection for CNC controller	1			03338120300
301	Drehknopf	Knob	1			03338120301
302	Kunststoffplatte	Plastic plate	1			03338120302
303	Verschluss	Plug	2			03338120303
304	Verschluss	Plug	1			03338120304
S1.1	Hauptschalter	Main switch	1			03338120S1.1
S1.2	NOT-AUS-Schlagschalter	Emergency push button	1			03338120S1.2
S1.3	Ein - Aus Drucktaster	On- Off push button	1			03338120S1.3
S1.4	Ein - Aus Schalter Halogenlampe	On- Off switch halogen lamp	1			03338120S1.4
S1.5	Drehrichtungsschalter ZH-A	Change over switch ZH-A	1			03338120S1.5
S1.6	Mikroschalter Spindelschutz	Micro switch spindle protection	1			03338120S1.6
R1.5	Potentiometer 4,7 K Ω	Potentiometer 4,7 K Ω	1			0320298
T1.4	Transformator 230V / 12V	Transformer 230V / 12V	1			03338120T1.4
P1.3	Digitale Drehzahlanzeige	Digital speed indicator	1			03338120P1.3
Q 1.6	Steuerkarte	Control board	1			0320297
Q1.7	Relaiskarte	Relay board	1			03338120Q1.7
T1.4	Transformator 230V / 12V , alter Typ	Transformer 230V / 12V , old type	1			0340292
H 1.5	Halogen-Stiftsockellampe 12V , 10 W, Sockel G4	Halogen lamp 12V , 10 W, Sockel G4	1			03338120H1.5
M	Motor	Motor	1			03338120M
M - 1	Motorkohle / carbon brush motor	Carbon brush motor	2			03338120M-1
X1	Schutzkontaktstecker	Cable	1			03338120X1
F1/ F1.2	Sicherung	Fuse	2		10A	03338120F1
LF1	Netzfilter	Line filter	1			03338120LF1
LF2	Netzfilter	Line filter	1			03338120LF2



6.11 Maschinenschilder - Machine labels

6.11.1 Maschinenschilder - Machine labels

Pos.	Bezeichnung	Designation	Menge	Grösse	Artikelnummer
			Quantity	Size	Article no.
1	Frontschild	Front label	1	BF20 Vario	03338120L01
				BF20L Vario	03338122L01
2	Infoschild	Info label	1	BF20 Vario	03338120L02
3	Maschinenschild	Machine label	1	BF20 Vario	03338120L03
				BF20L Vario	03338122L03
4	Sicherheitsschild	Safety label	1	BF20 Vario	03338120L04
5	Sicherheitsschild	Safety label	1	BF20 Vario	03338120L05
6	Getriebeschild	Gear box label	1	BF20 Vario	03338120L06
7	Sicherheitsschild	Safety label	1	BF20 Vario	03338120L07



7 Malfunctions

7.1 Malfunctions on the drilling-milling machine

Malfunction	Cause / possible effects	Solution
The drilling-milling machine does not start	<ul style="list-style-type: none"> Power-on sequence ignored. 	<ul style="list-style-type: none"> "Switching on the drilling-milling machine" on page 27 Have it checked by authorised personnel.
Tool "burnt".	<ul style="list-style-type: none"> Incorrect speed. The filings have not been removed from the bore hole. Tool blunt. Operating without cooling agent. 	<ul style="list-style-type: none"> Select another rate, feed too high. Pull out tool more often. Sharpen or replace tool. Use cooling agent.
Impossible to insert grip cone into the spindle sleeve.	<ul style="list-style-type: none"> Remove any dirt, grease or oil from the internal conical surface of the spindle sleeve or the grip cone. 	<ul style="list-style-type: none"> Clean surfaces well Keep surfaces free of grease.
It is not possible to push-out the taper.	<ul style="list-style-type: none"> Optional MT3 taper is shrunk on the Morse taper. 	<ul style="list-style-type: none"> Let the machine run at highest speed for two minutes in order to warm it up and then retry to disassemble the taper.
Motor does not start	<ul style="list-style-type: none"> Drill chuck protection not closed Defective electrical / electronic 	<ul style="list-style-type: none"> Check whether chuck protection is closed and possibly close. Have it checked by authorised personnel.
Working spindle rattling on rough piece surfaces	<ul style="list-style-type: none"> Climb milling machining not possible under the current operating conditions. Clamping lever of the movement axes not tightened. Loose collet chuck, loose drill chuck, loose draw-in rod. Tool blunt. The workpiece is not fastened. Excessive slack in bearing. Working spindle goes up and down. 	<ul style="list-style-type: none"> Perform conventional milling. Tighten clamping lever Check, re-tighten. Sharpen or replace tool Clamp the workpiece firmly. Readjust bearing slack or replace bearing Readjust bearing slack or replace bearing
Fine feed of the spindle sleeve does not work	<ul style="list-style-type: none"> Fine feed is not correctly activated. Coupling of the fine feed does not cam-in, is soiled, blurred, worn, defective 	<ul style="list-style-type: none"> "Manual spindle sleeve feed with the fine feed" on page 31 Clean, replace.



8 Appendix

8.1 Copyright

This document is copyright. All derived rights are also reserved, especially those of translation, re-printing, use of figures, broadcast, reproduction by photo-mechanical or similar means and recording in data processing systems, neither partial nor total.

Subject to technical changes without notice.

8.2 Terminology/Glossary

Term	Explanation
Cross table	Bearing surface, clamping surface for the workpiece with X- and Y-axis travel
Taper mandrel	Cone of the drill or of the drill chuck
Workpiece	Piece to be milled, drilled or machined.
Draw-in rod	Threaded rod to fix the taper mandrel in the spindle sleeve.
Drill chuck	Device for holding the bit
Collet chuck	Holder for end mill
Drilling and milling head	Upper part of the drilling-milling machine
Spindle sleeve	Hollow shaft in which the milling spindle turns.
Milling spindle	Shaft activated by the motor
Drilling table	Supporting surface, clamping surface
Taper mandrel	Cone of the drill or of the drill chuck
Spindle sleeve lever	Manual operation for the drill feed
Quick action - drill chuck	Drill chuck can be fixed by hand.
Workpiece	Piece to be drilled or machined.
Tool	Milling cutter, drill bit, etc.

8.3 Change information manual

Chapter	short information	new version number
1.3.1	Avoiding misuses	3.1.7
EC declaration	changed standard	3.1.7
5.4	Setup Instructions motor control board	3.1.7
4.10	New digital display for spindle sleeve travel	3.1.8



8.4 Liability claims for defects / warranty

Beside the legal liability claims for defects of the customer towards the seller the manufacturer of the product, OPTIMUM GmbH, Robert-Pfleger-Straße 26, D-96103 Hallstadt, does not grant any further warranties unless they are listed below or had been promised in the frame of a single contractual agreement.

- The processing of the liability claims or of the warranty is performed as chosen by OPTIMUM GmbH either directly or through one of its dealers.
Any defective products or components of such products will either be repaired or replaced by components which are free from defects. The property of replaced products or components passes on to OPTIMUM Maschinen Germany GmbH.
- The automatically generated original proof of purchase which shows the date of purchase, the type of machine and the serial number, if applicable, is the precondition in order to assert liability or warranty claims. If the original proof of purchase is not presented, we are not able to perform any services.
- Defects resulting of the following circumstances are excluded from liability and warranty claims:
 - Using the product beyond the technical options and proper use, in particular due to overstraining of the machine.
 - Any defects arising by one's own fault due to faulty operations or if the operating manual is disregarded.
 - Inattentive or incorrect handling and use of improper equipment.
 - Non-authorized modifications and repairs.
 - Insufficient installation and safeguarding of the machine
 - Disregarding the installation requirements and conditions of use.
 - Atmospheric discharges, overvoltage and lightning strokes as well as chemical influences.
- The following items are as well not subject to the liability or warranty claims:
 - Wearing parts and components which are subject to a standard wear as intended such as e.g. V-belts, ball bearings, illuminants, filters, sealings, etc.
 - Non reproducible software errors
- Any services which OPTIMUM GmbH or one of its agents performs in order to fulfill in the frame of an additional guarantee are neither an acceptance of the defects nor an acceptance of its obligation to compensate. Such services do neither delay nor interrupt the warranty period.
- Place of jurisdiction among traders is Bamberg.
- If one of the above mentioned agreements is totally or partially inefficient and/or null, it is considered as agreed what is closest to the will of the warrantor and which remains in the framework of the limits of liability and warranty which are predefined by this contract.

8.5 Note regarding disposal / options to reuse:

Please dispose of your device environmentally friendly by disposing of scrap in a professional way.

Please neither throw away the packaging nor the used machine later on, but dispose of them according to the guidelines established by your city council/municipality or by the corresponding waste management enterprise.

8.5.1 Decommissioning

CAUTION!

Immediately decommission used machines in order to avoid later misuse and endangering of the environment or of persons.

- **Disconnect the machine from the mains.**
- **Cut the connection cable.**
- **Remove all environmentally hazardous operating fluids from the used device.**





- If applicable remove batteries and accumulators.
- Disassemble the machine if required into easy-to-handle and reusable assemblies and component parts.
- Supply the machine components and operating fluids to the provided disposal routes.

8.5.2 Disposal of the packaging of new devices

All used packaging materials and packaging aids of the machine are recyclable and generally need to be supplied to the material reuse.

The packaging wood can be supplied to the disposal or the reuse.

Any packaging components made of cardboard box can be chopped up and supplied to the waste paper collection.

The films are made of polyethylene (PE) and the cushion parts are made of polystyrene (PS). These materials can be reused after reconditioning if they are forwarded to a collection station or to the appropriate waste management enterprise.

Only forward the packaging materials correctly sorted to allow a direct reuse.

8.5.3 Disposing of the old device

INFORMATION

Please make sure in your own interest and in the interest of the environment that all component parts of the machine will be disposed of in the provided and admitted ways.

Please note that the electrical devices include lots of reusable materials as well as environmentally hazardous components. Account for separate and professional disposal of the component parts. In case of doubt, please contact your municipal waste management. If appropriate, call on the help of a specialist waste disposal company for the treatment of the material.



8.5.4 Disposal of electrical and electronic components

Please make sure that electrical components are disposed of in a professional way according to the legal requirements.

The device includes electric and electronic components and must not be disposed of with the rubbish. According to the European directive 2002/96/EG regarding electrical and electronic used devices and the execution of national rights used electrical tools and electrical machines need to be collected separately and be supplied to an environmentally compatible reuse.

Being the machine operator you should obtain information regarding the authorized collection or disposal system which applies for your company.

Please make sure that the batteries and/or accumulators are disposed of in a professional way according to the legal regulations. Please only throw discharged batteries in the collection boxes in shops or at municipal waste management companies.

8.5.5 Disposal of lubricants and coolants

ATTENTION!

Please imperatively make sure to dispose of the used coolant and lubricants in an environmentally compatible way. Observe the disposal notes of your municipal waste management companies.



INFORMATION

Used coolant emulsions and oils should not be mixed up since it is only possible to reuse used oils which had not been mixed up without pre-treatment.





The disposal notes for the used lubricants are made available by the manufacturer of the lubricants. If necessary, request the product-specific data sheets.

8.6 Disposal via municipal collection

Disposal of used electric and electronic machines

(Applicable in the countries of the European Union and other European countries with a separate collecting system for those devices).

The sign on the product or on its packing indicates that the product must not be handled as common household waste, but that it needs to be delivered to a central collection point for recycling. Your contribution to the correct disposal of this product will protect the environment and the health of your fellow men. The environment and the health are endangered by incorrect disposal. Recycling of material will help to reduce the consumption of raw materials. Your District Office, the municipal waste collection station or the shop where you have bought the product will inform you about the recycling of this product.



8.7 RoHS , 2002/95/CE

The sign on the product or on its packing indicates that this product complies with the European guideline 2002/95/EC .



8.8 Product follow-up

We are required to perform a follow-up service for our products which extends beyond shipment.

We would be grateful if you could send us the following information:

- Modified settings
- Experiences with the drilling-milling machine, which could be important to other users
- Recurring failures



EC - Declaration of Conformity



Machinery Directive 2006/42/EC Annex II 1.A

**The manufacturer /
retailer:** Optimum Maschinen Germany GmbH
Dr.-Robert-Pfleger-Str. 26
D - 96103 Hallstadt

hereby declares that the following product,

Product designation: Drilling- milling machine

Type designation: BF20V
BF20L

Serial number: _ _ _ _ _

Year of construction: 20__

Manual milling machine for private user, as well as craft and industrial plants which meets all the relevant provisions of the above mentioned Directive 2006/42/EC as well as the other directives applied (below) including their amendments in force at the time of declaration.

The following other EU Directives have been applied: EMC Directive 2004/108/EC, Low Voltage Directive 2006/95/EC

The safety objective meet the requirement of EC Directive 2006/95/EC

The following harmonized standards were applied:

EN 13128:2001+A2:2009/AC:2010
Safety of machine tools - Milling machines (including boring machines)

EN 50370-1:2005
Electromagnetic compatibility (EMC) - Product family standard for machine tools - Part 1: Emission

EN 50370-2:2003
Electromagnetic compatibility (EMC) - Product family standard for machine tools - Part 2: Immunity

EN 60204-1:2006/A1:2009
Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:2005/A1:2008)

EN ISO 12100:2010
Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)

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Kilian Stürmer
(CEO / Managing director)
Hallstadt, 2011-12-28



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