OPTIMUM
MASCHINEN - GERMANY

Operating instructions

Version 1.3.8

Drilling-Milling machine

OPTImill® BF 16V

GB

Table of contents

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 drilling-milling 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 drilling-milling 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

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1 Safety

Glossary of symbols

☞	gives additional indications
➜	calls on you to get in action
❍	enumerations

This part of the operating manual

- ❍ explains the meaning and use of the warning references contained in the operating manual,
- ❍ explains how to use the drilling-milling machine properly,
- ❍ highlights the dangers that might arise for you and others if these instructions are not followed,
- ❍ tells you how to avoid dangers.

In addition to this operating manual please observe

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

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

INFORMATION

If you are unable to solve a problem using this manual, please contact us for advice:

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Dr. Robert-Pfleger-Str. 26
D- 96103 Hallstadt
E-Mail: info@optimum-maschinen.d

1.1 Safety warnings (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 (pictograms) and warning labels for the specific danger and its (possible) consequences.

Pictogram	Alarm expression	Definition/Consequences
	**DANGER!**	Imminent danger that will cause serious injury or death to personnel.
	WARNING!	Risk: a danger that might cause serious injury of death to personnel.
	CAUTION!	Danger or unsafe procedure that might cause injury to personnel or damage to property.
	**ATTENTION!**	Situation that could cause damage to the drilling-milling machine or products and other types of damage. No risk of injury to personnel.

Pictogram	Alarm expression	Definition/Consequences
	**INFORMATION**	Application tips and other important or useful information and notes. No dangerous or harmful consequences for personnel or objects.

In case of specific dangers, we replace the pictogram by


General danger


with a warning of


injuries to hands,


hazardous electrical voltage

or


rotating parts

1.1.2 Further pictograms


Activation forbidden!


Read the operaing manual before the machine is first used!


Pull the mains plug!


Use protective goggles!


Use protective gloves!


Use protective boots!


Wear a safety suit!


Use ear protection!


Protect the environment!


Contact address

1.2 Proper use

WARNING!

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

- **will endanger personnel,**
- **will endanger the drilling-milling machine and other material property of the operator,**
- **may affect proper operation of the drilling-milling machine.**

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 authorisation of Optimum Maschinen Germany GmbH or operated with different process data, then it is being used improperly.

We do not take any liability for damages caused by improper use.

We would like to stress that any modifications to the construction, or technical or technological modifications that have not been authorised by Optimum Maschinen Germany GmbH will also render the guarantee null and void.

It is also part of proper use that

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

☞ „Technical data“ on page 15

WARNING!

Very serious injury due to improper use.

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

INFORMATION

Thes drilling-milling machine BF16 Variois built according to the standard DIN EN 55011 class B.

WARNING!

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

CAUTION!

If the table drilling 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 misuse

Any other use or any use beyond the use described under "Proper use" is regarded as improper use and is forbidden.

If it is intended to use the device in any other way as described above, it is necessary to consult the manufacturer.

It is only allowed to work metallic, cold and non-flammable material using the milling machine.

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

The operators must be qualified.

1.3.1 Avoiding misuse

➜ Using suitable cutting tools.

➜ Adapting speed settings and feed on the material and on the workpiece.

➜ Clamp the workpiece firmly and vibration-free.

ATTTENTION!

The workpiece must always be fixed in a machine vice, jaw chucks or any other suitable clamping tool such as e.g. clamping claws.

WARNING!

Injuries due to workpieces flying off at high speed

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

➜ Use of cooling and lubricating agents in order to increase the durability of the tool and to improve the surface quality.

➜ Clamp the cutting tools and the workpieces on clean clamping surfaces.

➜ Sufficiently lubricate the machine.

➜ Correctly set the bearing clearance and guidance.

It is recommended to:

➜ Use the drill in a way that it is exactly located between the three clamping jaws of the quick action chuck.

➜ Clamp the end mill by means of the collet chuck and the corresponding clamping collets.

➜ Clamp the end face mill by means of the end mill arbor.

When drilling, please observe that

➜ It is necessary to set the suitable speed depending on the diameter of the drill,

➜ The press-on must only be as intense that the drill can cut on no-load,

➜ If the press-on is too intense, it might result in early tool wear perhaps even tool fracture resp. jamming in the drill hole. If the tool gets jammed, immediately stop the main drive motor by actuating the emergency-stop button,

➜ For hard materials, e.g. steel, it is necessary to use commercial cooling/lubricating agents,

➜ Generally always back out the tool from the workpiece while the shaft is turning.

ATTENTION!

Do not use the quick action chuck as milling tool. Do not clamp the milling tool in the quick action chuck in no case. Use a collet chuck and the corresponding collets for the end mill.

When milling, make sure that

➜ The suitable cutting speed is selected,

➜ For materials with normal mechanical strength, e.g. steel 18-22 m/min,

➜ For materials with higher mechanical strength 10-14 m/min,

➜ The press-on is selected in a way that the cutting speed remains constant,

commercial cooling/lubricating agents are used for hard materials.

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 machine operates with

- high revolutions,
- rotating parts and tools,
- electrical voltage and currents.

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

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

INFORMATION

All personnel involved in assembly, commissioning, operation and maintenance must

- be duly qualified,
- follow this operating manual.

Disconnect the drilling-milling machine whenever cleaning or maintenance work is being carried out.

WARNING!

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

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

All additional installations carried out by the operator must incorporate the prescribed safety devices.

As the machine operator, this will be your responsibility!

☞ **„Safety devices“ on page 11**

1.5 Qualification of personnel

1.5.1 Target group

This manual is addressed to

- operators,
- users,
- maintenance staff.

The warning notes therefore refer to both operation and maintenance of the drilling-milling machine.

Always disconnect the drilling-milling machine plug from the electrical power supply. This will prevent it from being used by unauthorised personnel.

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 expressively 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

All personnel involved in assembly, commissioning, operation and maintenance must

- be duly qualified,
- follow this operating manual.

In the event of improper use

- there may be a risk to personnel,
- there may be a risk to the drilling-milling machine and other material property,
- the proper operation of the drilling-milling machine may be affected.

1.6 User's position

The user must stand 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. Use an appropriate suction unit.

CAUTION!

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

Take additional preventive measures in order to safely avoid health hazards before processing flammable materials (e.g. aluminum, magnesium) or before using flammable additives (e.g. spirit).

1.8 Safety devices

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

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

It is your responsibility!

If a safety device has not been activated or has failed, the drilling-milling machine must only be used when

- the cause of the failure has been removed,
- it has been verified that there is no resulting danger for personnel or objects.

WARNING!

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

- **damage as a result of components or parts of components flying off at high speed,**
- **contact with rotating parts,**
- **fatal electrocution.**

The drilling-milling machine includes the following safety devices:

- an EMERGENCY-STOP button,
- a protective cover on the drill-mill head,
- a separating protective equipment on the milling spindle.

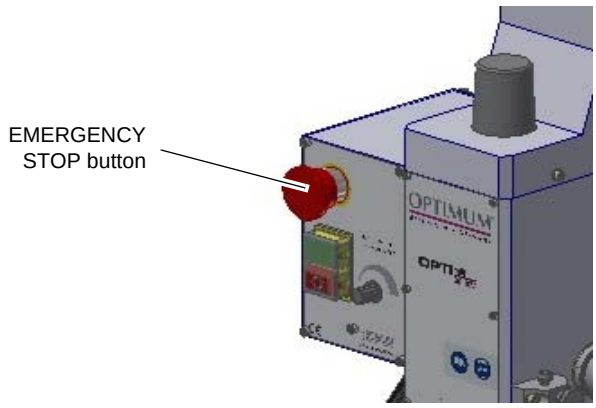
WARNING!

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.

1.8.1 EMERGENCY STOP button

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

☞ „Starting the drilling-milling machine“ on page 24



Img.1-1: EMERGENCY STOP button

ATTENTION!

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

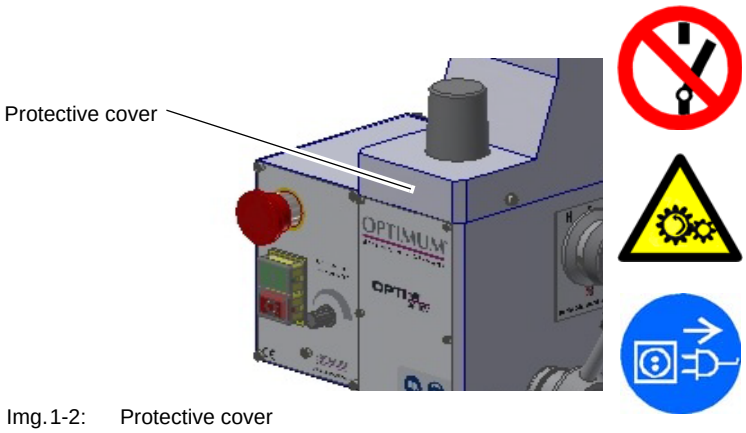
Only press the EMERGENCY-STOP button in case of danger! If the button is actuated in order to stop the drilling-milling machine generally you might damage tools or workpieces.

1.8.2 Protective cover

The drill-mill head is fitted with a protective cover.

WARNING!

Remove the protective cover after the mains plug of the drilling-milling machine has been pulled.



Img.1-2: Protective cover

1.8.3 Separating protective equipment

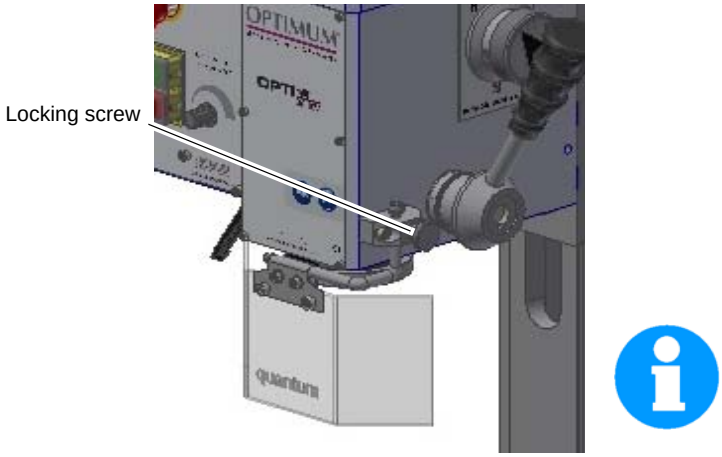
Adjust the protective equipment to the correct height before you start working.

To do so, detach the clamping screw, adjust the required height and retighten 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 DRILL CHUCK PROTECTION IS NOT CLOSED.



Img.1-3: Separating protective equipment

1.9 Safety check

Check the drilling-milling machine regularly.

Check all safety devices

- before starting work,
- once a week (with permanent operation),
- after every maintenance and repair operation.

General check		
Equipment	**Check**	**OK**
Protective covers	Fitted, firmly bolted and not damaged	
Labels, markings	Installed and legible	

Run test		
Equipment	**Check**	**OK**
EMERGENCY-STOP button	When the EMERGENCY-STOP button is activated, the drilling-milling machine should switch off. A restart will not be possible until the EMERGENCY-STOP button has been unlocked and the ON switch has been activated.	
Separating protective equipment around the drilling and milling spindle	Only switch on the drilling-milling machine if the protective equipment is closed.	

1.10 Individual protection gear

For certain work, individual protection gear is required.

Protect your face and eyes: During all work, and specifically work during which your face and eyes are exposed to hazards, a safety helmet with facial protection should be worn.

Use protective gloves when handling pieces with sharp edges.

Wear safety shoes when you position, dismantle 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 individual protection gear is available at the workplace.

CAUTION!

Dirty or contaminated individual protection gear can cause disease.

Clean it after each use and once a week.

1.11 For your own safety during operation

WARNING!

Before activating the drilling-milling machine, double check that it will not endanger other people or cause damage to equipment.

Avoid unsafe working practices:

- The instructions in this manual must be observed during assembly, handling, maintenance and repair.
- Use protective goggles.
- Turn off the drilling-milling machine before measuring the workpiece.
- Do not work on the machine if your concentration is reduced, for example, because you are taking medication.
- Stay on the machine until all rotating parts have come to a halt.
- Use the prescribed protection gear. Make sure to wear a well-fitting work suit and a hainet, if necessary.
- Do not use protective gloves during drilling or milling work.
- Unplug the shockproof plug from the mains before changing the tool.
- Use suitable devices to remove drilling and milling chips.
- Make sure your work does not endanger anyone.

❍ Clamp the workpiece tightly before activating the drilling-milling machine.

In the description of work on the drilling-milling machine we highlight the dangers specific to that work.

1.12 Disconnecting the drilling-milling machine and making it safe

Pull the mains plug before beginning any maintenance or repair work.

1.13 Using lifting equipment

WARNING!

Use of unstable lifting equipment and load-suspension devices that break under load can cause very serious injuries or even death.

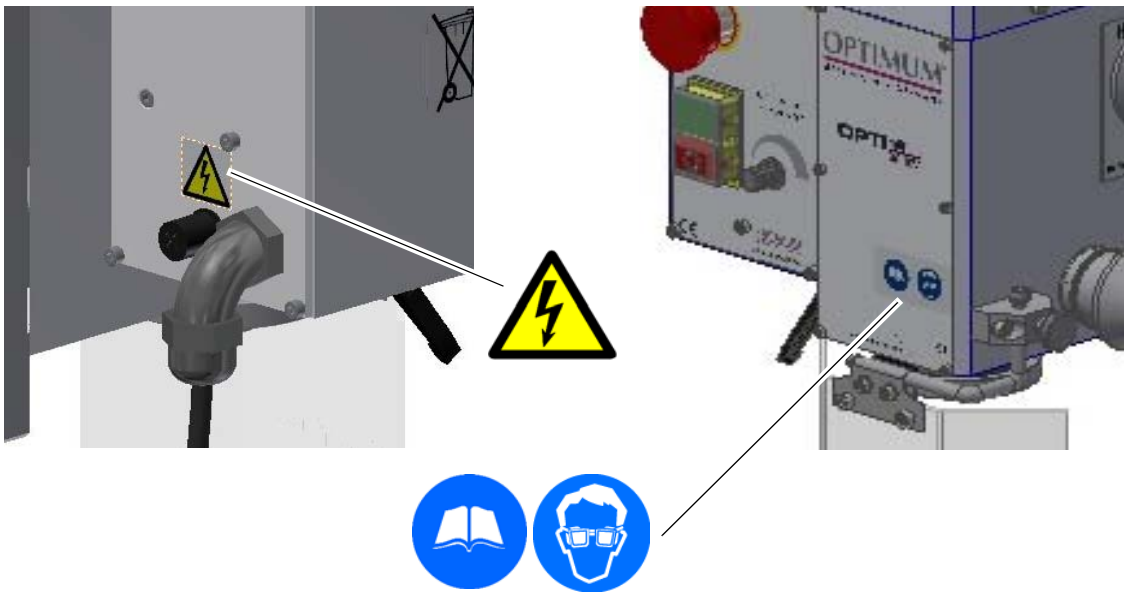
Check that the lifting equipment and load-suspension devices are of sufficient load capacity and in perfect condition.

Observe the rules for preventing accidents issued by your association for the prevention of occupational accidents and safety in the workplace or other inspection authorities.

Tighten loads properly.

Never walk under suspended loads!

1.14 Signs on the drilling-milling machine



Img.1-4: BF16 Vario

2 Technical data

The following information gives the dimensions and weight and is the manufacturer's authorised machine data.

2.1 Electrical connection	
Engine power consumption	240 V / 50Hz / 500 W
2.2 Drilling-Milling capacity	
Drilling capacity in steel [mm]	Ø max. 16
Milling capacity of end-mill cutter [mm]	Ø max. 20
Milling capacity of inserted-tooth cutter [mm]	Ø max. 63mm
Working radius [mm]	175
2.3 Spindle seat	
Spindle seat	MK 3 / M10
Sleeve travel [mm]	50 mm
2.4 Drill-Mill head	
Swivelling	+ / - 90°
Gearbox stages	2
Z-axis travel [mm]	210
2.5 Cross table	
Table length [mm]	400
Table width [mm]	120
Spindle pitch [mm]	2
Y-axis travel [mm]	160
X-axis travel [mm]	220
T-slot size / distance [mm]	10 / 35
2.6 Dimensions	
Height [mm]	795
Depth [mm]	465
Width [mm]	505
Total weight [kg]	60
2.7 Work area	
Height [mm]	2000
Depth [mm]	2200
Width [mm]	1500
2.8 Speeds	
Gearbox stage slow [min^{-1}]	100 - 1500

Gearbox stage fast [min^{-1}]	200 - 3000
2.9 Environmental conditions	
Temperature	5-35 °C
Humidity	25 - 80%
2.10 Operating material	
Gearbox blank steel parts	Mobilgrease OGL 007 or Mobilux EP 004 acid-free oil, e.g. weapon oil or motor oil.

2.11 Emissions

The emission of the drilling-milling machine is below 78 dB(A). If the drilling-milling machine is installed in an area where various machines are in operation, the acoustic influence (immission) on the operator of the drilling-milling machine may exceed 85 dB(A).

INFORMATION

This numeric value had been measured on a new machine under conventional operating conditions. Depending on the age or wear of the machine, the noise behavior of the machine might change.

Furthermore, the extent of the noise emission is also depending on manufacturing influence factors, such as speed, material and clamping conditions.

INFORMATION

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

Unless the degree of noise emission and the degree of noise disturbance are depending on one another it is not possible to use it in order to reliably determine if it is necessary to take further preventive measures or not.

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

- Characteristics of the working chamber, e.g. size or damping behavior,
- Other noise sources, e.g. the number of machines,
- Other processes proceeding nearby and the period during which the operator is exposed to the noise.

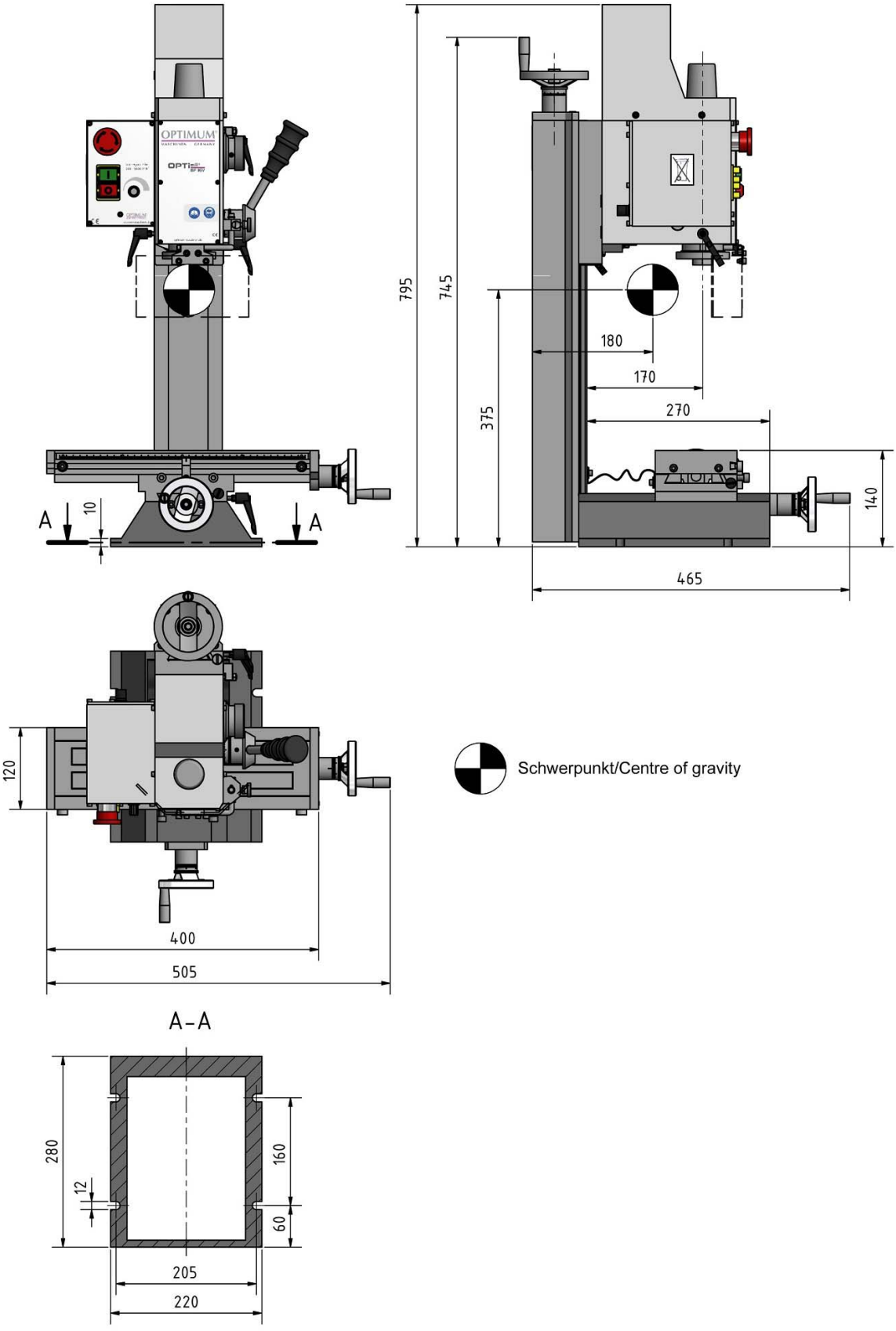
Furthermore, the admissible pollution level may be different from one country to another due to the national regulations.
This information regarding the noise emission should allow the operator of the machine to perform a better evaluation of the endangerments and risks.

CAUTION!

The machine operator has to wear an appropriate ear protection depending on the overall stress caused by noise and on the basic limit values.

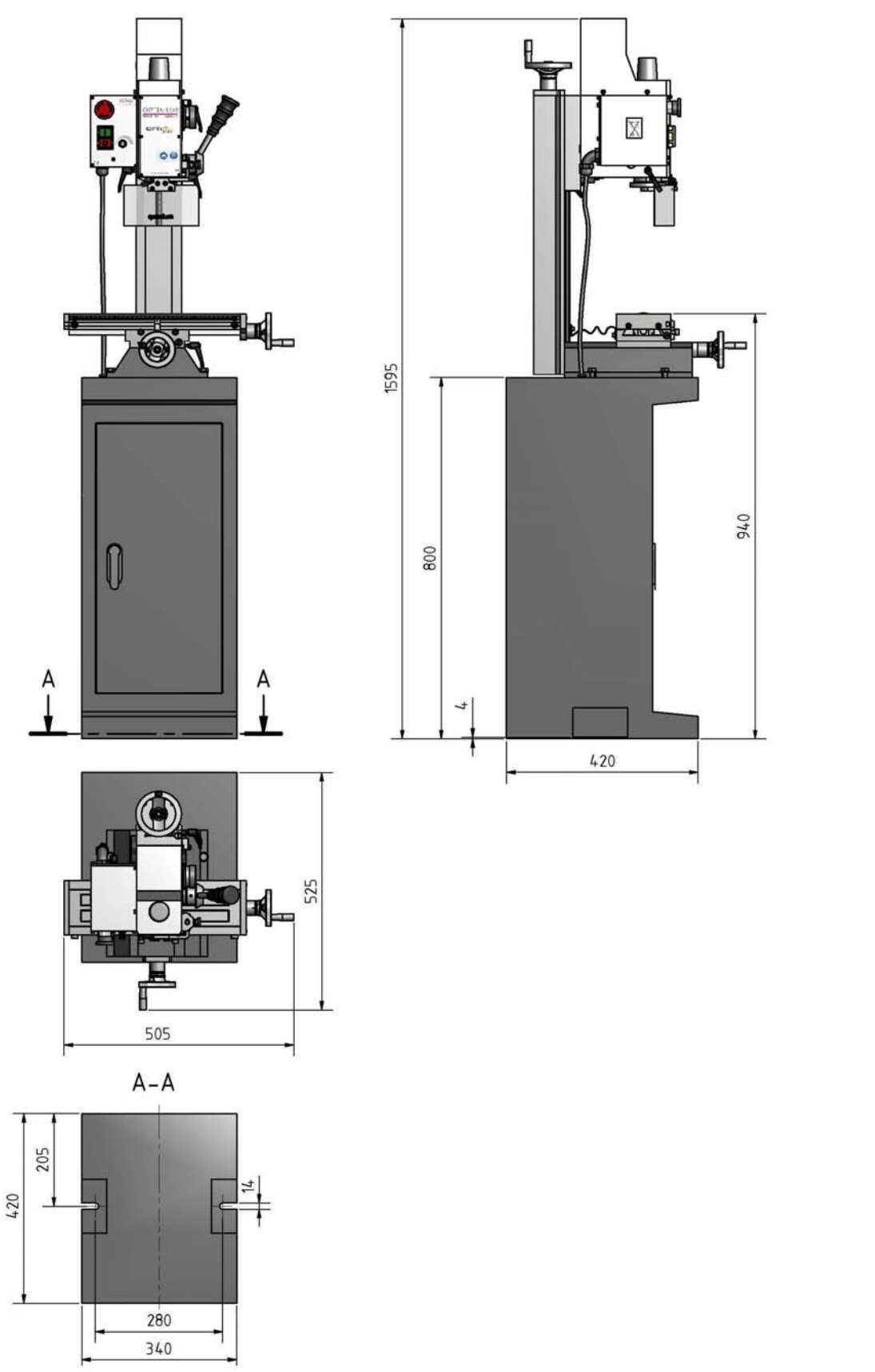
We generally recommend using a sound and ear protection.

2.12 Installation plan BF16 Vario



Img. 2-1: Installation plan BF16 Vario

2.13 Installation plan of optional substructure



Img.2-2: Substructure 3353003

3 Assembly and connection

INFORMATION

The drilling-milling machine comes pre-assembled.

3.1 Extent of supply

When the drilling-milling machine is delivered, check immediately that the machine has not been damaged during transport and that all components are included. Also check that no fastening screws have come loose.

Compare the parts supplied with the information on the packaging list.

3.2 Transport

- Center of gravity

- Attachment positions (marking the positions for the attachment position gear)

- Prescribed transport position (marking the top side)

- Means of transportation to be used
- Weights

WARNING!

Machine parts falling off forklift trucks or other transport vehicles could cause very serious or even fatal injuries. Follow the instructions and information on the transport case.

WARNING!

Use of unstable lifting equipment and load-suspension devices that break under load can cause very serious injury or even death.

Check that the lifting and load-suspension gear has sufficient load capacity and that it is in perfect condition. Observe the rules for preventing accidents issued by your association for the prevention of occupational accidents and safety in the workplace or other inspection authorities.

Hold the loads properly. Never walk under suspended loads!

3.3 Storage

ATTENTION!

Improper storage may cause important parts to be damaged or destroyed.
Store packed or unpacked parts only under the following ambient conditions.
Please follow the instructions and indications on the transportation box.

❍ Fragile goods (goods require careful handling)

❍ Protect against humidity and humid environments

☞ „Environmental conditions“ on page 16.

❍ Prescribed position of the packaging box (marking the top side – arrows pointing upward)

❍ Maximum stacking height

Example: non-stackable – do not pile any further packaging boxes on top of the first packaging box

Consult Optimum Maschinen Germany GmbH if the drilling-milling machine and accessories have to be stored for a period of over three months or under different external conditions than those given here ☞ „Information“ on page 5.

3.4 Installation and assembly

3.4.1 Site requirements

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

INFORMATION

In order to provide for good functionality and high machining accuracy as well as long durability of the machine the site should fulfill certain criteria.

Observe the following items:

- The device must only be installed and operated in dry ventilated places.
- Avoid places nearby machines generating chips or dust.
- The site has to be vibration-free, i.e. at a distance from presses, planing machines, etc.
- The substructure has to be appropriate for drilling-milling machine. Also make sure that the load bearing capacity and the evenness of the floor are appropriate.
- The substructure has to be prepared in a way that possibly used coolant cannot penetrate into the ground.
- Protruding parts such as stops, handles, etc. need to be secured by measures provided by the customer if necessary in order to avoid dangers for persons.
- Provide sufficient space for assembly and operating staff as well as for material transport.
- Also allow for accessibility for setting and maintenance works.
- Make sure that the mains plug of the turning machine is freely accessible.
- Provide for sufficient illumination (minimum value: 500 lux, measured at the tool tip). In case of little intensity of illumination provide for additional illumination i.e. by a separate workplace illuminator.

INFORMATION

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

3.4.2 Load suspension point

WARNING!

Danger of crushing and overturning. Proceed with extreme caution when lifting, installing and assembling the machine.

➜ Secure the load-suspension device around the drill-mill head. Use a lifting sling for this purpose.

➜ Clamp all the clamping levers at the drilling-milling machine before lifting it.

➜ Make sure that no add-on pieces or varnished parts are damaged due to the load suspension.

3.4.3 Installation

➜ Check the horizontal orientation of the base of the drilling-milling machine with a spirit level.

➜ Check that the foundation has sufficient floor-load capacity and rigidity.
☞ „Total weight [kg]“ on page 15

ATTENTION!

Insufficient rigidity of the foundation leads to the superposition of vibrations between the drilling-milling machine and the foundation (natural frequency of components). Insufficient rigidity of the entire milling machine assembly also rapidly causes the machine to reach critical speeds, with unpleasant vibrations, leading to bad milling results.

➜ Position the drilling-milling machine on the intended foundation.

➜ Attach the drilling-milling machine using the provided recesses in the machine base.

☞ „Installation plan BF16 Vario“ on page 17.

3.5 First use

ATTENTION

Before you begin with the commissioning on the machines check that all screws, fasteners and fuses are tight. If necessary they must be tightened.

WARNING!

Risk by using improper workpiece clamping materials or by operating the machine with inadmissible speed.

Only use the clamping materials which had been delivered together with the machine or as optional equipment offered by OPTIMUM.

Use the working clamping materials only in the provided admissible speed range.

Workpiece clamping materials must only be modified according to the recommendations of OPTIMUM or of the clamping material manufacturer.

WARNING!

Staff and equipment may be endanged if the drilling-milling machine is first used by unexpert staff.

We do not take responsibility for damage caused by incorrect commissioning.

☞ „Qualification of personnel“ on page 9.

3.5.1 Power supply

➜ Connect the electrical feeder.

➜ Check the fuse protection (fuse) of your electrical supply according to the technical specifications for the total connected load of the drilling-milling machine.

3.5.2 Cleaning and lubricating

➜ Remove the anticorrosive agent applied on the drilling-milling machine for transport and storage purposes. We recommend the use of kerosene.

➜ Do not use any solvents, thinners or other cleaning agents which could corrode the varnish on the drilling-milling machine. Follow the specifications of the manufacturer of the cleaning agent.

➜ Lubricate all bright machine parts with non-corrosive lubricating oil.

Cleaning the machine

➜ Grease the drilling-milling machine according to the lubrication chart.
☞ „Inspection and maintenance“ on page 32

➜ Check smooth running of all spindles.

➜ Connect the electrical power cable (shockproof plug).

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.

4 Operation

4.1 Safety

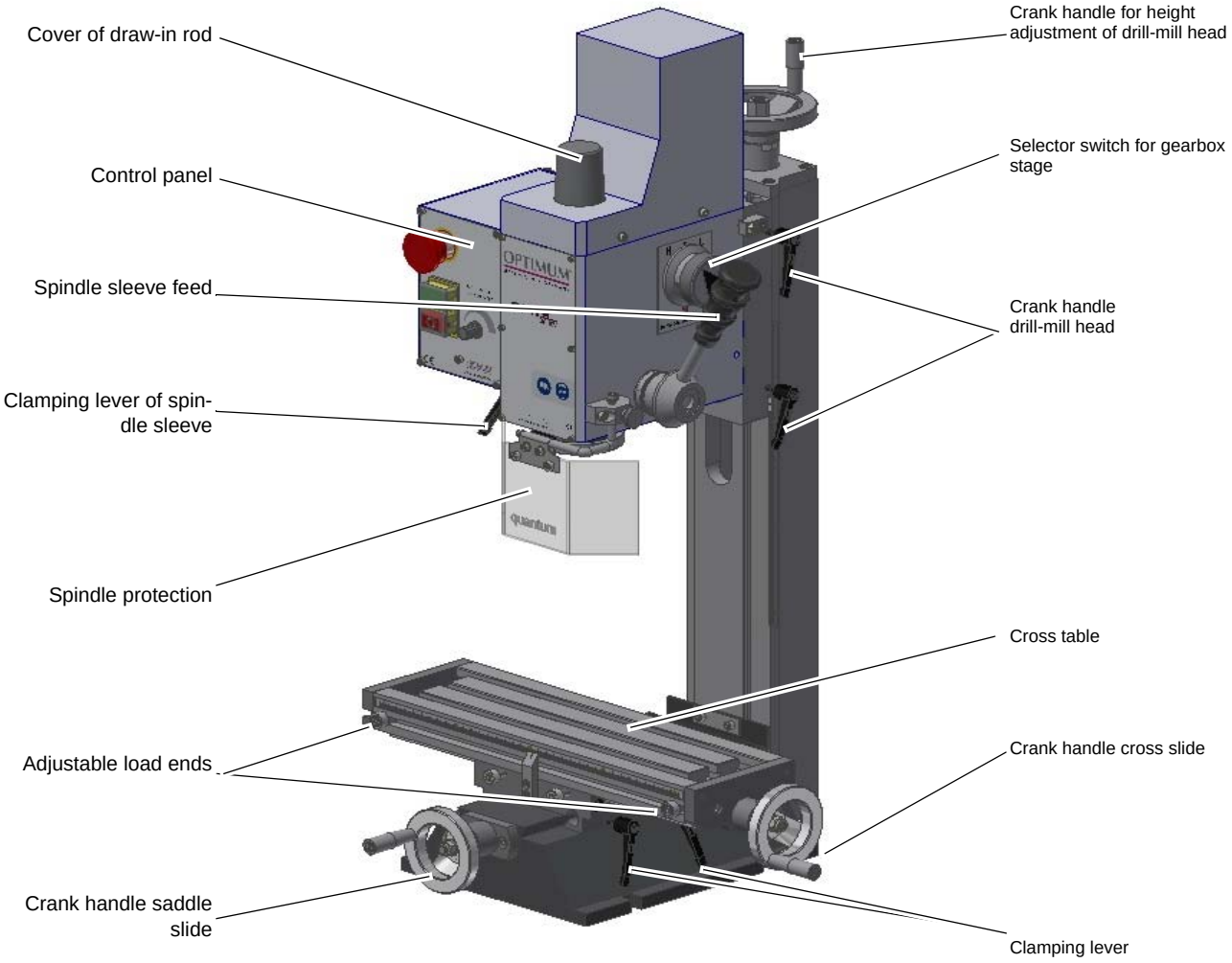
Use the drilling-milling machine only under the following conditions:

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

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

☞ „For your own safety during operation“ on page 13.

4.2 Control and indicating elements

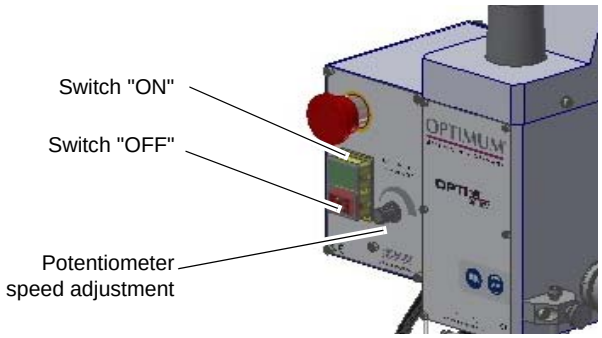


Img. 4-1: BF16 Vario

4.3 Starting the drilling-milling machine

By pressing the green button, the machine is switched on.

By pressing the red button, the machine is switched off.



Img.4-2: Control panel

The electrical system controls slowly the speed with a ramp to the set value. Wait a little while before you continue with the feed when milling or drilling.

4.4 Inserting tool

The mill head is equipped with an MK 2 seat and a draw-in rod M10.

CAUTION!

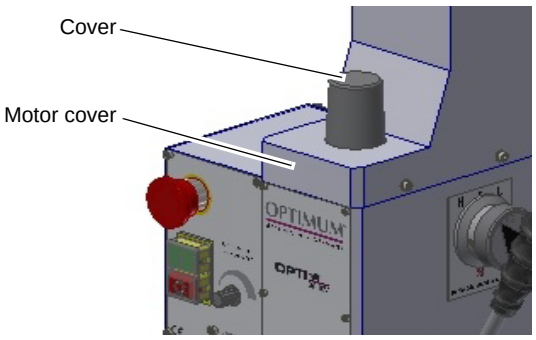
When milling operations are performed the cone seat must always be fixed to the draw-in rod. All cone connections with the taper bore of the work spindle without using the draw-in rod is not allowed for milling operations. The cone connection should be released by the lateral pressure. Injuries by parts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

In the work spindle you may only use tool holding fixtures and clamping tools with morse taper MK2 and internal screw thread M10 for an interlocking fixture. Reducing bushes is not allowed.

➜ Remove the cover. There is no need to disassemble the motor cover completely.

➜ Clean the conical seat in the mill head.

➜ Clean the taper mandrel of your tool.



Img.4-3: Drill-mill head

➜ Press the taper mandrel with some push into the seat. If the taper mandrel does not hold by itself, either the taper mandrel or the taper bore of the work spindle are not clean or free of grease.

➜ Use the draw-in tool supplied with the machine.
- Hexagon socket spanner for draw-in rod.
- Hexagon socked spanner for draw-in nut.

➜ Screw the draw-in rod approx. 15 turns into the taper of your tool.

➜ Tighten the draw-in nut.

➜ Follow the same steps in reverse order to extract the tool from the machine.

4.4.1 Use of collet chucks

When using collet chucks for the reception of milling tools, a higher operation tolerance is possible. The exchange of the collet chucks for a smaller or larger end mill cutter is performed simply and rapidly and the disassembly of the complete tool is not required. The work spindle is

equipped with a surface for the hold-up with a fork wrench to unfasten the swivel nut of the collet chuck retainer. The collet chuck is pressed into the ring of the swivel nut and must hold there by itself. By fastening the swivel nut on the tool the milling cutter is clamped.

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.

☞ „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.“ on page 22

4.4.2 Direct clamping into the work spindle

Tools or collet chucks with a taper shank MK 2 may be clamped directly into the work spindle. For mounting these tools, proceed as described under ☞ „Inserting tool“ on page 24. Make sure that the tool is clamped with the draw-in rod.

☞ „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.“ on page 22

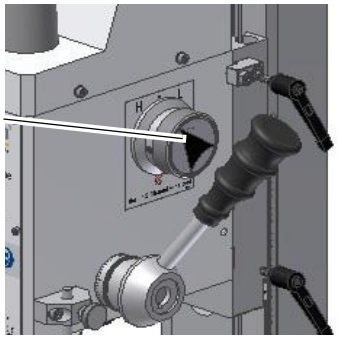
4.5 Changing the speed range

ATTENTION!

Wait until the drilling-milling machine has come to a complete halt before changing the speed using the gear switch.

➜ Turn the gear switch in the position "H" for a speed range of 200 - 3000 min^{-1} .

➜ Turn the gear switch into the position "L" for a speed range of 100 - 1500 min^{-1} .



Img.4-4: Drill-mill head

➜ Adjust the speed with the potentionmeter.

4.5.1 Selecting the speed

For milling operations, the essential factor is the selection of the correct speed. The speed determines the cutting speed of the cutting edges which 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.

For 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 (meters per minute)

p = 3,14

d = tool diameter m (meters)

4.5.2 Standard values for cutting speeds

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

Tool	Steel	Grey cast iron	Age-hardened Al alloy
Peripheral 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	Age-hardened Al alloy 150 - 350 m/min
	Spindle 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	Age-hardened Al alloy 150 - 250 m/min
	Spindle 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

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

Material		Cutter 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 subse-quently 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 subse-quently drawn, up to 1200 N/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 advanta-geous 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 since 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

Friction during the cutting process causes high temperatures at the cutting edge of the tool. The tool should be cooled during the milling process. Cooling the tool with a suitable cooling lubri-cant ensures better working results and a longer edge life of the cutting tool.

INFORMATION

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

Make sure that the cooling agent is properly retrieved. Respect the environment when dispos-ing of any lubricants and cooling agents. Follow the manufacturer's disposal instructions.

4.6 Clamping the workpieces

CAUTION!

Injury by flying off parts.

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.

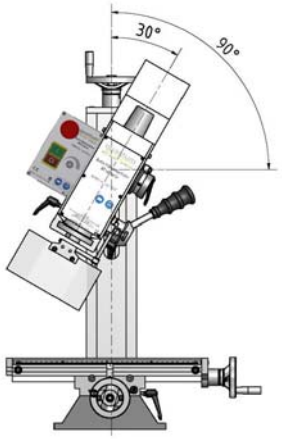
☞ „If the machine is cold such as e.g. directly after having transported the machine it should be warmed up at a spindle speed of only 500 1/min for the first 30 minutes.“ on page 22

4.7 Swivelling the drill-mill head

The drill-mill head may be swiveled 90° to the right and to the left.

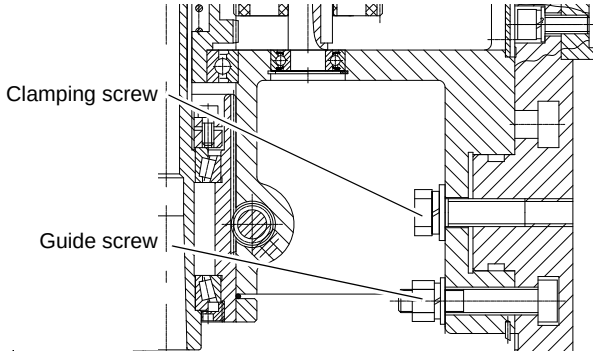
CAUTION!

The drill head may tilt to the right or to the left on its own after loosening a screw. Proceed with extreme caution when loosening the clamping joints.



Img.4-5: Swivelling the drill-mill head

- ➜ Loosen or unscrew the nut of the guide screw.
- ➜ Hold the drill-mill head. Loosen the clamping screw. Swivel the drill-mill head into the desired position.
- ➜ Retighten the guide and clamping screw.

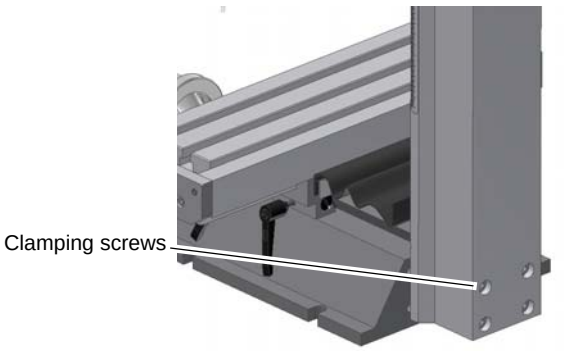


Img.4-6: Clamping screw, guide screw

4.8 Offset the drill-mill head

The upright of the drill-mill head may be offset to the right or to the left.

Use the offsetting possibility if the drill-mill head is swivelled to the left or to the right for machining purposes.



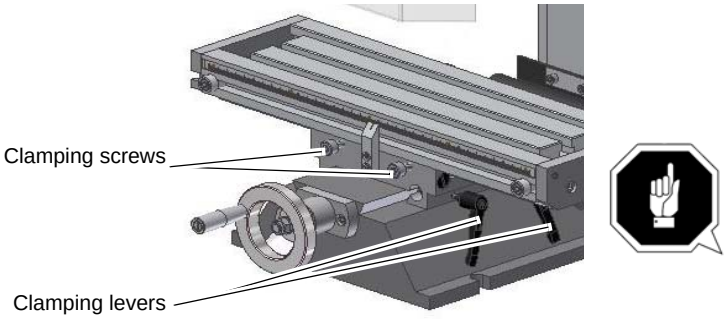
Img.4-7: BF 16 Vario

4.9 Clamping levers

The drilling-milling machine is equipped with clamping levers and clamping screws for the respective movement axes.

ATTENTION!

Use the clamping levers for locking the position of the axes during drilling or milling operation.

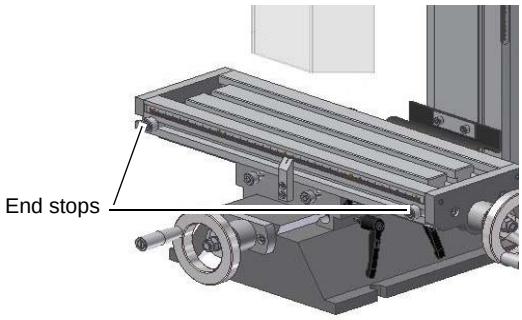


Img.4-8: Clamping spots of the cross table

4.10 End stops

The cross table is fitted with two adjustable end stops.

Use the end stops for limiting the travel in order to guarantee the exact repeatability when manufacturing various identical components.



Img.4-9: End stops X-axis

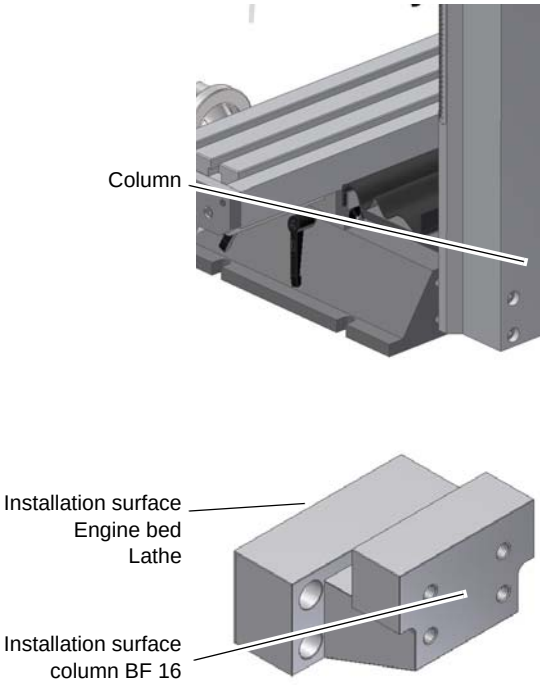
4.11 Installation on a lathe

The mill head with column can be mounted on the lathe D240 and D280. For fastening, an adapter is required. The adapter needs to be fixed to the engine bed. It is not possible to fix it to the lathe slide. The adapter is dimensioned in a way that the middle of the lathe chuck should be reached with the center of the milling spindle (alignment headstock - lathe chuck).

☞ „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.“ on page 22

Due to the manufacturing tolerances of castings and the manufacturing tolerances of two different machines it is, however, not possible to reach the exact center. The adapter may be too short or too long.

If required, the adapter is to be milled off or equipped with dummy sheets. When using sheets the complete surface is to be filled.



Img.4-10: Adapter

In order to reduce the support expenditure of the column with milling head during the orientation we recommend you to disassemble the milling head off the column. Unscrew the locking screw (safety screw) position 266. Disassemble the milling head off the column by completely loosening the clamping screw and the leading screw and stripping off the milling head. (☞ “Clamping screw, guide screw“ on page 28)

Control the orientation (90° angle horizontal and vertical) of the column with the reference planes on the engine bed of the lathe.

INFORMATION

In order to prevent you from having to reorient the milling head when altering later on, we recommend you to provide the column and the adapter as well as the adapter and the engine bed with alignment pins. If required, pin the column together with the cross table before disassembling the column. It would be best if you use hardened straight pins according to DIN 6325 in 8mm or 10mm and a fitting tolerance zone m6. (z.B. DIN 6325-8 m6 x 30). These alignment pins have a round cap on one side which facilitates pinning together the parts. When assembled the boring holes must necessarily be pilot-drilled about 0,2mm smaller and then be rubbed with a reamer also when already assembled. Therefore use a new twist drill with a diameter of 7,8mm for alignment pins of 8mm.

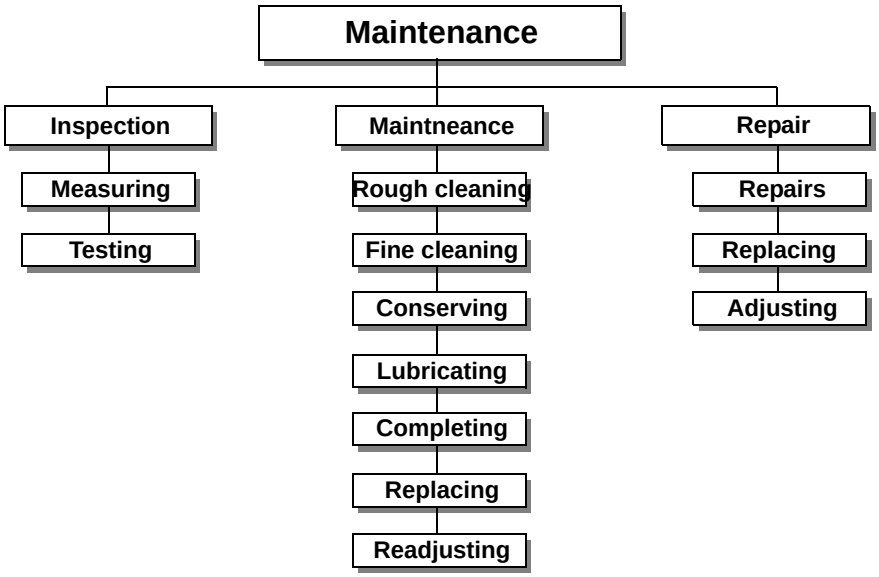
5 Maintenance

In this chapter you will find important information about

- inspection
- maintenance
- repair

of the drilling-milling machine.

The diagram below shows which of these headings each task falls under.



Img.5-1: Maintenance - Definition according to DIN 31051

ATTENTION!

Properly performed regular maintenance is an essential prerequisite for

- **safe operation,**
- **faulty-free operation,**
- **a long service life of the drilling-milling machine and**
- **the quality of the products you manufacture.**

Installations and equipment from other manufacturers must also be in optimum 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 personnel 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 unplugged from the mains power supply.

Pull the plug.

5.1.2 Restarting

Before restarting run a safety check.

☞ „Safety devices“ on page 11

WARNING!

Before connecting the drilling-milling machine you must check that there is no danger for personnel and the drilling-milling machine is undamaged.

5.2 Inspection and maintenance

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

Interval	Where?	What?	How?
Start of work, after each maintenance or repair operation	**Drilling-Milling machine**	☞ „Individual protection gear“ on page 13	
Start of work, after each maintenance or repair operation	**Dovetail slideways**	Lubricate	➜ Lubricate all slideways.
weekly	**cross table**	Lubricate	➜ Lubricate all blank steelparts. Use acid-free oil, for example weapon oil or engine oil.
as required	**spindle nuts**	Re-adjust	An increased clearance in the spindles of the cross table can be reduced by re-adjusting the spindle nuts. See spindle nuts on position 66 and 71 ☞ „Ersatzteile - Spare parts BF16 Vario“ on page 34 The spindle nuts are re-adjusted by reducing the flank of screw thread of teh spindle nut with an adjusting screw. By re-adjusting a smooth running move over the whole toolpath is to be assured, otherwise the wear by friction between spindle nut / spindle would increase considerably.
every six months	**Geared drill-mill head**	Grease	➜ Swivel the drill-mill head completely to the right (90°) as described under ☞ „Swivelling the drill-mill head“ on page 28. ➜ Detach the cover plate on the rear side. ➜ Lubricate the gearwheels. ☞ „Operating material“ on page 16

INFORMATION!

The spindle bearing arrangement is permanently lubricated. No new lubrication is necessary.

5.3 Repair

Any maintenance work may only be carried out by a specialized company or by duly trained personnel. Any maintenance work on electrical equipment may only be carried out by specialized electrical staff.

For any repair work, get assistance from an employee of Optimum Maschinen Germany GmbH's technicial service or send us the drilling-milling machine.

Optimum Maschinen Germany GmbH does not take any responsibility nor does it guarantee against damage and operating anomalies resulting from failure to observe this operating manual.

For repairs, only use

- faulty-free and suitable tools,
- original spare parts or serial parts expressly authorised by Optimum Maschinen Germany GmbH.

6 Ersatzteile - Spare parts BF16 Vario

6.1 Ersatzteilzeichnung Fräskopf - Explosion drawing milling head

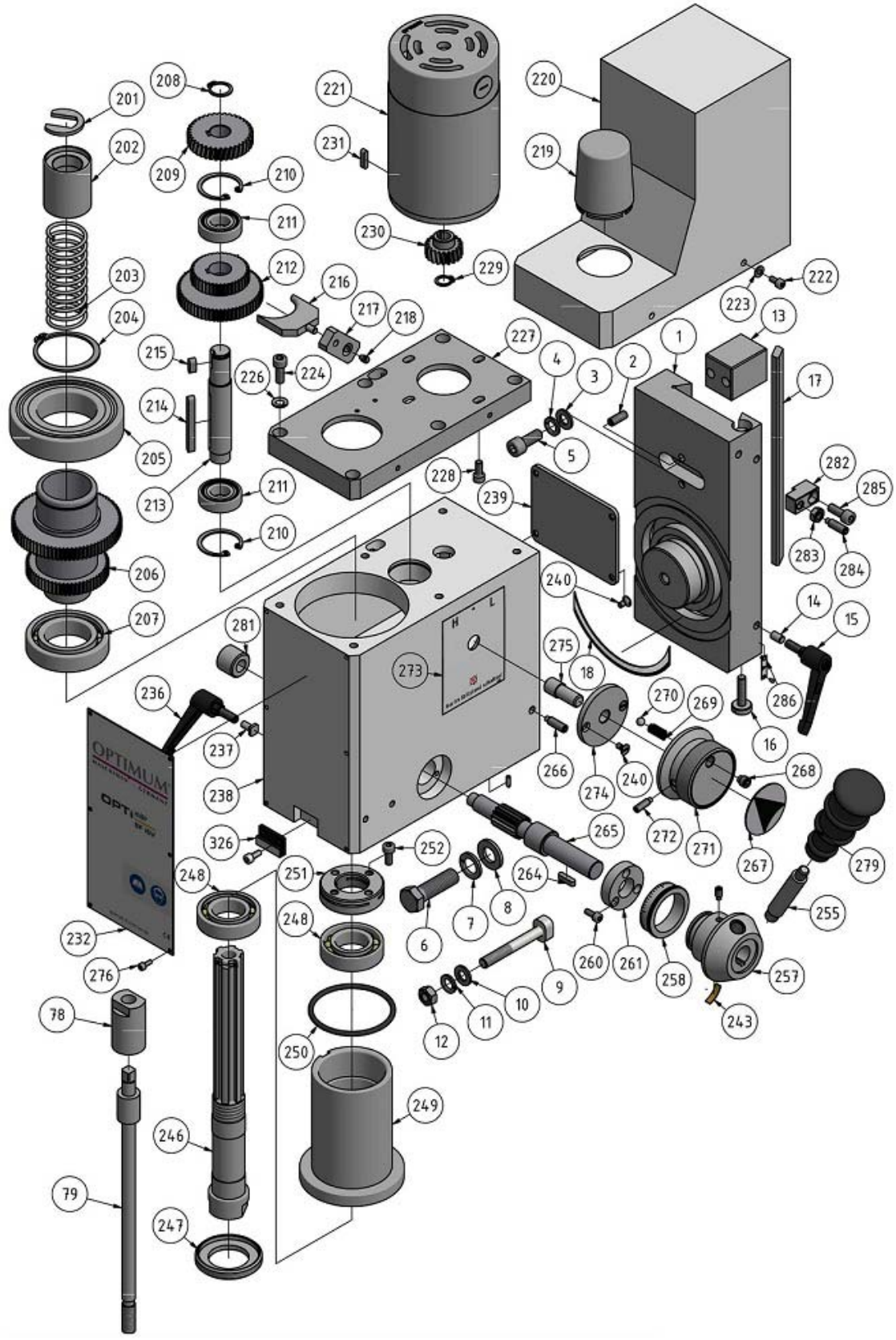


Abb.6-1: Fräskopf - Milling head

6.2 Ersatzteilzeichnung Säule - Explosion drawing column

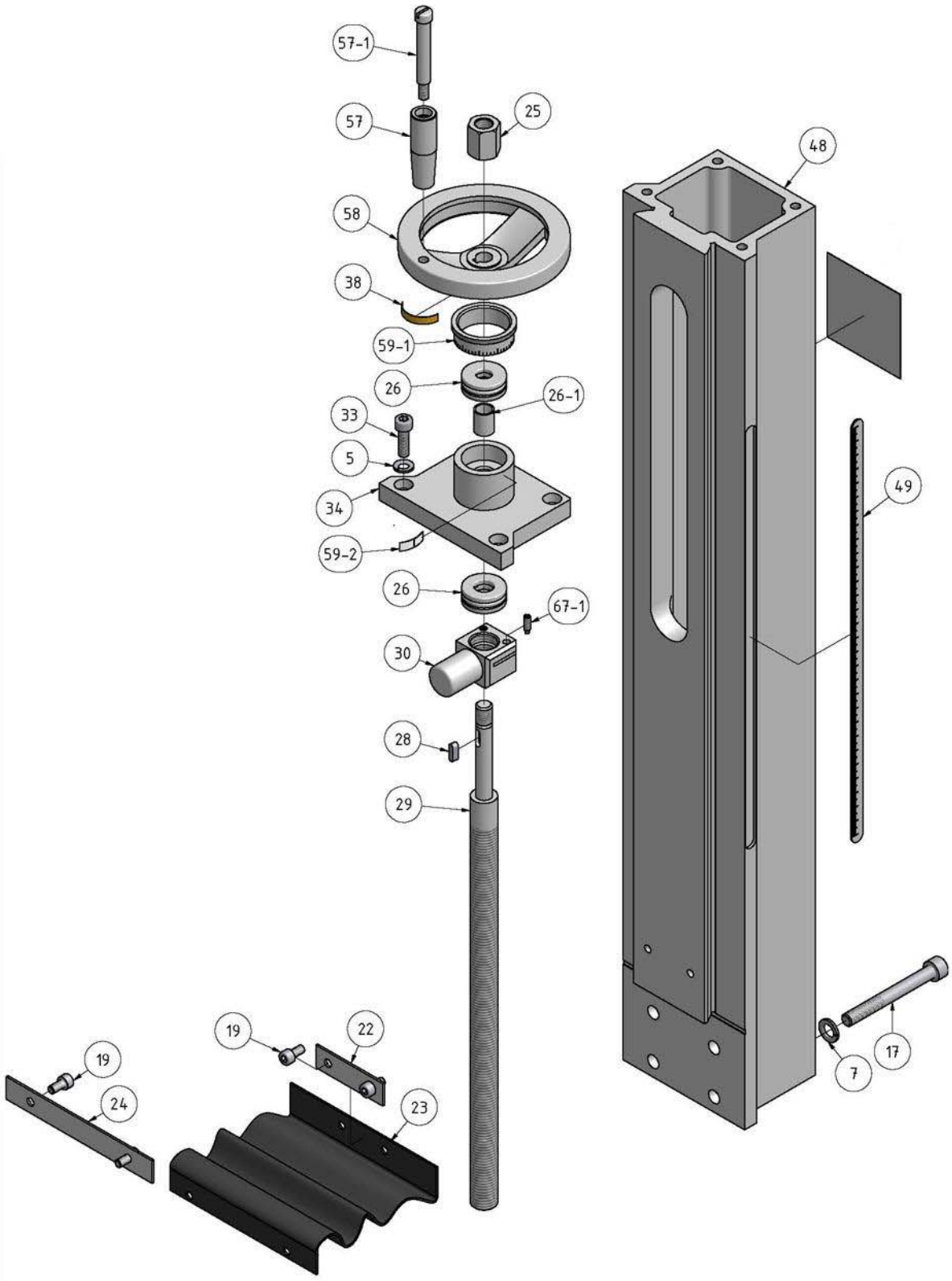


Abb. 6-2: Säule - Column

6.3 Ersatzteilzeichnung Kreuztisch - Explosion drawing cross table

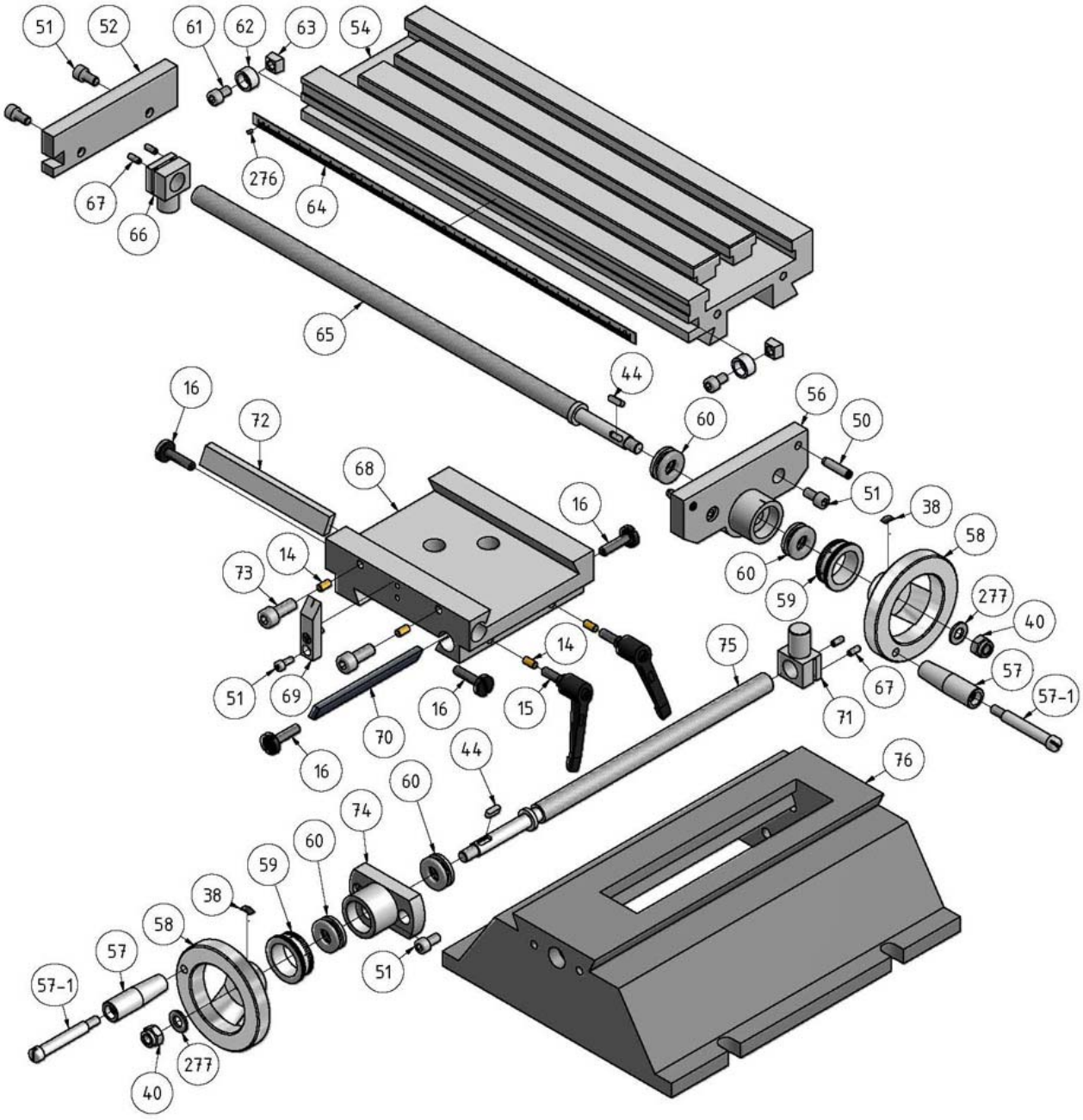


Abb.6-3: Kreuztisch - Cross table

6.4 Ersatzteilzeichnung Fräsfutterschutz - Explosion drawing milling chuck protection

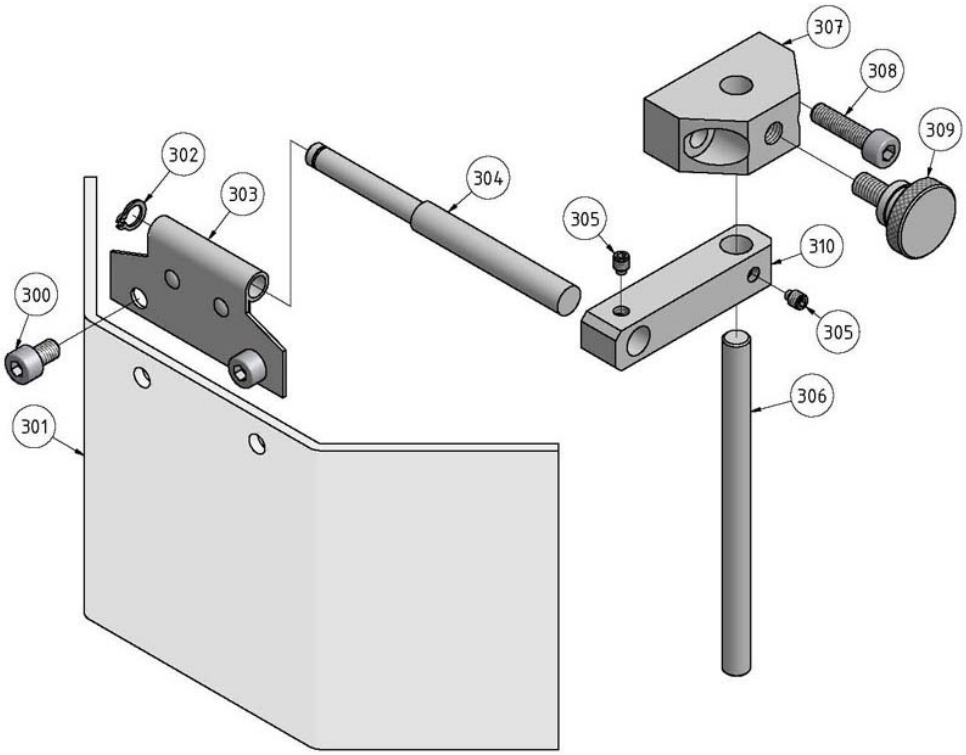


Abb. 6-4: Fräsfutterschutz - Milling chuck protection

6.5 Ersatzteilzeichnung Schaltkasten - Explosion drawing switch box

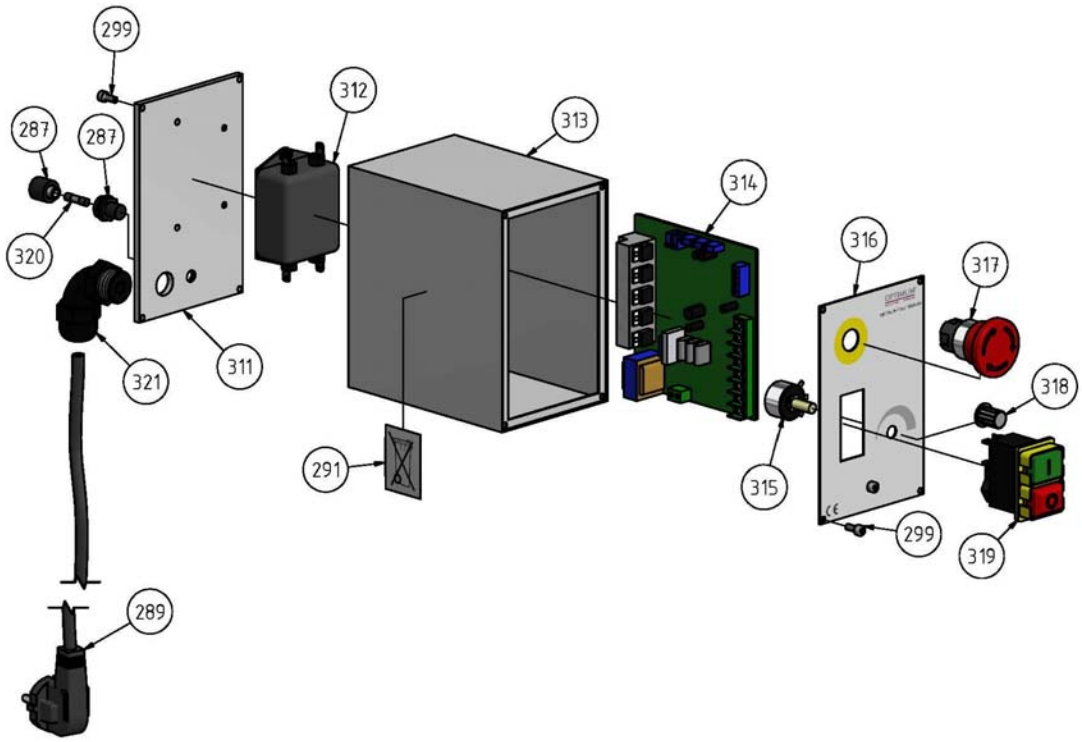


Abb. 6-5: Schaltkasten - Switch box

6.6 Ersatzteilzeichnung Fräsfutterschutz, Baujahr ab 2011 - Explosion drawing milling chuck protection, year of manufacture 2011

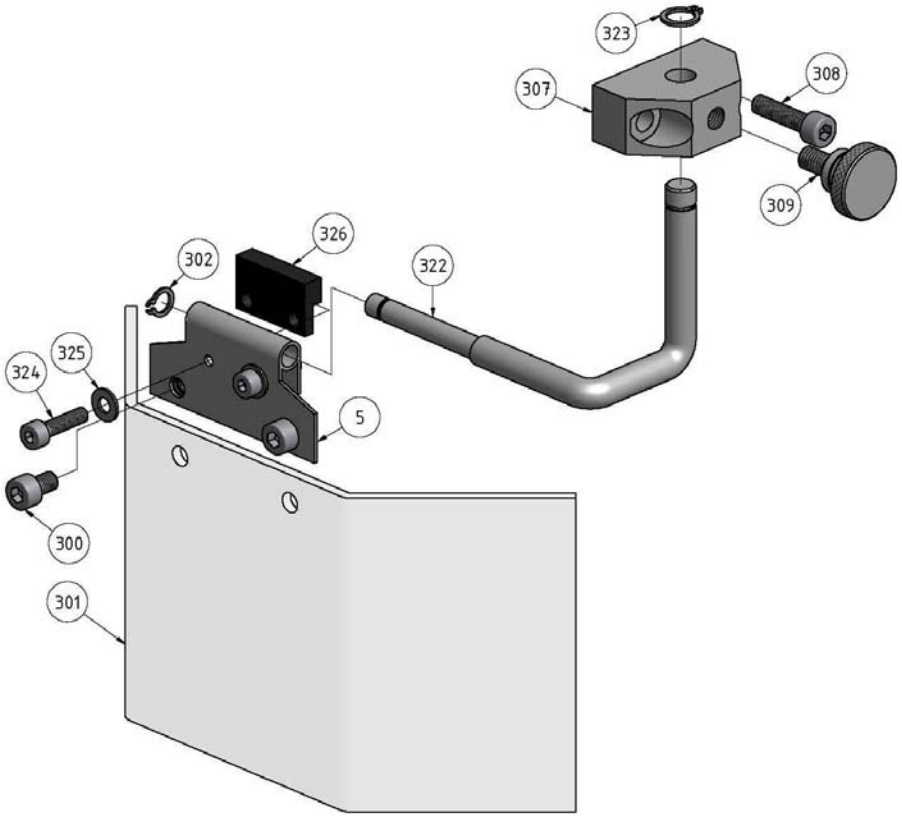


Abb. 6-6: Fräsfutterschutz - Milling chuck protection

6.7 Maschinenschilder - Machine labels

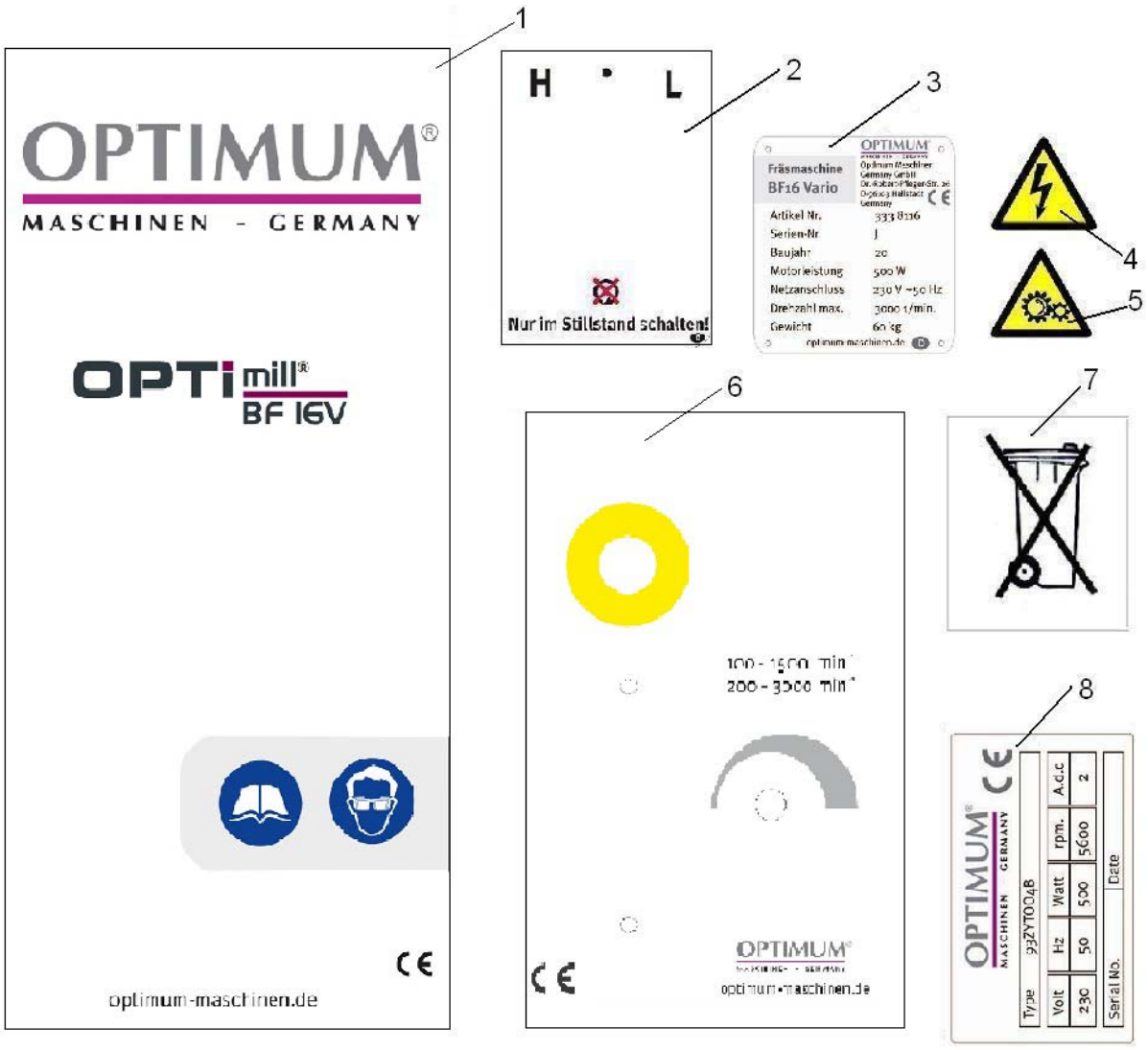


Abb.6-7: Maschinenschilder - Machine labels

6.7.1 Maschinenschilder - Machine labels

Pos.	Bezeichnung	Designation	Menge Quan-tity	Grösse Size	Artikelnummer Article no.
1	Frontschild	Front label	1		03338116L01
2	Getriebeschild	Gear box label	1		03338116L02
3	Maschinenschild	Machine label	1		03338116L03
4	Sicherheitsschild	Safety label	1		03338116L04
5	Sicherheitsschild	Safety label	1		03338116L05
6	Schild Schaltkasten	Switch box label	1		03338116L06
7	Hinweisschild	Instruction label	1		03338116L07
8	Motorschild	Motor lable	1		03338116L08

6.7.2 Ersatzteilliste- Spare parts list

Pos.	Bezeichnung	Designation	Menge	Grösse	Artikelnummer
			Qty.	Size	Item no.
1	Drehlagerbock	Connect board	1		0333811601
2	Stiftschraube	Locking screw	2	M6x16	
3	Unterlegscheibe	Washer	2		0333811603
4	Federscheibe	Spring washer	6	8	
5	Innensechskantschraube	Hexagon socket screw	2	M8x25	
6	Schraube	Screw	1	M12x40	
7	Federscheibe	Spring washer	5	12	
8	Unterlegscheibe	Washer	1	12	
9	Schraube	Screw	1		0333811609
10	Unterlegscheibe	Washer	1	10	
11	Federscheibe	Spring washer	1	10	
12	Mutter	Nut	1	M10	
13	Führungsstück	Guide piece	1		0333811613
14	Messingstift	Brass pin	5		0333811614
15	Klemmhebel	Clamping lever	3	DM6x16	0333811615
16	Schlitzkopfschraube	Slotted haed screw	1		0333811616
17	Leiste	Gib	1		0333811617
18	Winkelskala	Angle scale	1		0333811618
19	Innensechskantschraube	Hexagon socket screw	12	M5x10	
20	Faltenbalg	Bellows	1		0333811620
21	Mutter	Nut	2	M5	
22	Halterung Faltenbalg	Fixing of bellows	1		0333811622
23	Gummi - Späneabdeckung	Rubber chip cover	1		0333811623
24	Leiste	Gib	1		0333811624
25	Mutter	Nut	2	M16x1.5	
26	Lager	Bearing	2	51200	04051200
26-1	Buchse	Bushing	1		03338116261
27	Kegelzahnrad	Tapered toothed wheel	1		0333811627
28	Passfeder	Feather key	2	4x16	0333811628
29	Spindel Z-Achse	Spindle Z-axis	1		0333811629
30	Spindelmutter Z-Achse	Spindle nut Z-axis	1		0333811630
31	Unterlegscheibe	Washer	4	5	
32	Abdeckkappe	Cover cap	1		0333811632
33	Innensechskantschraube	Hexagon socket screw	4	M8x20	
34	Abdeckplatte Säule	Cover plate column	1		0333811634
35	Lagerabdeckung	Bearing cover	1		0333811635
36	Innensechskantschraube	Hexagon socket screw	7	M5x12	
37	Skalenring	Scale ring	1		0333811637
38	Federstück	Spring piece	4		0333811638
39	Handrad	Handwheel	1		0333811639
40	Kontermutter	Counternut	4		0333811640
44	Passfeder	Key	2	4x12	0333811644
48	Säule	Column	1		0333811645
49	Skala Z-Achse	Scale Z-axis	1		0333811649
50	Kegelstift	Tapered pin	1	A5x25	0333811650
51	Innensechskantschraube	Hexagon socket screw	12	M6x16	
52	Lagerbock X-Achse	Bearing block x-axis	1		0333811652
53	Dichtung	Seal	2		0333811653
54	Frästisch	Milling table	1		0333811654
56	Lagerbock X-Achse	Bearing block x-axis	1		0333811656
57	Griff	Handle	3	M8x63	0333811657
57-1	Schraube	Screw	1		03338116571
58	Handrad	Handwheel	3		0333811658
59	Skalenring	Scale ring	3		0333811659
59-1	Skalenring	Scale ring	1		03338116591
59-2	Skala	Scale	1		03338116592
60	Lager	Bearing	5	51100	04051100
61	Innensechskantschraube	Hexagon socket screw	2	M6x10	
62	Hülse	Bushing	2		0333811662
63	Nutenstein	Sliding block	1		0333811663
64	Skala X-Achse	Scale X-axis	1		0333811664
65	Spindel X-Achse	Spindle X-axis	1		0333811665
66	Spindelmutter X-Achse	Spindle nut X-axis	1		0333811666
67	Innensechskantschraube	Hexagon socket screw	4	M4x20	
67-1	Gewindestift	Grub screw	2	ISO 4028/M4x12	
68	Kreuztischführung	Guide cross table	1		0333811668
69	Anschlag Endlage X-Achse	Limit stop x-axis	1		0333811669

Pos.	Bezeichnung	Designation	Menge Qty.	Grösse Size	Artikelnummer Item no.
70	Leiste	Gib	1		0333811670
71	Spindelmutter Y-Achse	Spindle nut Y-axis	1		0333811671
72	Leiste	Gib	1		0333811672
73	Innensechskantschraube	Hexagon socket screw	2	M6x25	
74	Lagerbock	Bearing block	1		0333811674
75	Spindel Y-Achse	Spindle Y-axis	1		0333811675
76	Maschinenfuss	Machine base	1		0333811676
77	Innensechskantschraube	Hexagon socket screw	4	M12x90	
78	Buchse	Bushing	1		0333811678
79	Anzugsstange	Screw rod	1		0333811679
201	Positionsscheibe	Position disc	1		03338116201
202	Buchse	Bushing	1		03338116202
203	Zugfeder	Tension spring	1	2.5x28x110-3	03338116203
204	Sicherungsgring	Circlip	1	45	03338116204
205	Kugellager	Ball bearing	1	6209-2RZ	0406209.2R
206	Zahnrad	Gear	1	Z60/Z80	03338116206
207	Kugellager	Ball bearing	1	7007AC	0407007.2R
208	Sicherungsgring	Circlip	1	15	03338116208
209	Zahnrad	Gear	1	(Z46)	03338116209
210	Sicherungsgring	Circlip	2	32	03338116210
211	Kugellager	Ball bearing	2	6002-2RZ	0406002.2R
212	Zahnrad	Gear	1	(Z42/Z62)	03338116212
213	Antriebswelle	Shaft	1		03338116213
214	Passfeder	Key	1	5x50	03338116214
215	Passfeder	Key	1	C5x12	03338116215
216	Schaltgabel	Gearshift fork	1		03338116216
217	Arm Schaltgabel	Arm gearshift fork	1		03338116217
218	Schraube	Screw	1	M5x8	
219	Abdeckkappe	Cap cover	1		03338116219
220	Motorhaube	Motor cover	1		03338116220
221	Motor	Motor	1		03338116221
222	Innensechskantschraube	Hexagon socket screw	6	M4x8	
223	Unterlegscheibe	Washer	6	4	
224	Innensechskantschraube	Hexagon socket screw	6	M6x14	
226	Unterlegscheibe	Washer	6	6	
227	Fräskopf Gehäusedeckel	Milling head casing cover	1		03338116227
228	Innensechskantschraube	Hexagon socket screw	6	M5x12	
229	C-Sicherungsgring	C-Circlip	1	10	03338116229
230	Zahnrad	Gear	1	(Z25)	03338116230
231	Passfeder	Key	1	C4x16	03338116231
236	Klemmhebel	Clamping lever	1	DM8x20	03338116236
237	Messingstift	Brass pin	1		03338116237
238	Gehäuse Fräskopf	Housing milling head	1		03338116238
239	Abdeckung	Cover	1		03338116239
240	Senkkopfschraube	countersunk head screw	6	M4x8	
243	Federstück	Spring piece	2		03338116243
246	Spindel	Spindle	1		03338116246
247	Spindelmutter	Spindle nut	1		03338116247
248	Kugellager	Ball bearing	2	7005AC/P5	0407005.2R
249	Pinole	Pinole	1		03338116249
250	O-ring	O-ring	1	58x2.65	03338116250
251	Klemmmutter	Clamping nut	1		03338116251
252	Innensechskantschraube	Hexagon socket screw	1	DIN 4762/M5x12	
255	Griffhebel	Handle lever	1		03338116255
257	Nabe	Hub	1		03338116257
258	Skalenring	Scale ring	1		03338116258
260	Innensechskantschraube	Hexagon socket screw	3	M4x10	
261	Abdeckscheibe	Cover pane	1		03338116261
264	Passfeder	Key	1	4x12	03338116264
265	Schaftritzel	Pinion shaft	1		03338116265
266	Stiftschraube	Locking screw	1	M6x20	
267	Indikator	Indicator	1		03338116267
268	Stiftschraube	Locking screw	1	M8x8	
269	Feder	Spring	1	0.8x5x25-3	03338116269
270	Stahlkugel	Steel bal	1	6.5	03338116270
271	Wahldrehschalter	Rotary selector	1	12x50	03338116271
272	Stiftschraube	Locking screw	1	M5x16	
274	Aufnahmescheibe	Retainer disc	1		03338116274
275	Schaltwelle	Shaft	1		03338116275
276	Niet	Rivet	4		

Pos.	Bezeichnung	Designation	Menge Qty.	Grösse Size	Artikelnummer Item no.
277	Scheibe	Washer	2	DIN 125/8	
279	Schaltknopf	Knob	1		03338116278
280	Gewindestift	Grub screw	2	DIN4028/M5x10	
281	Buchse	Bushing	1		03338116281
282	Führungsstück	Guide piece	1		03338116282
283	Sechskantmutter	Hexagon nut	2	ISO 4032/ M6	
284	Gewindestift	Grub screw	2	ISO 4028/M6x20	
285	Innensechskantschraube	Hexagon socket screw	2	DIN 4762/M6x16	
286	Skala	Scale	1		03338116286
287	Gehäuse Sicherung kpl.	Housing fuse cpl.	2		03338116287
288	Sicherung	Fuse	2		03338120F1
289	Anschlusskabel	Conesting cable	1		03338116289
290	Abdeckung	Cover	1		03338116290
292	Gehäuse Schaltkasten	Housing switch cabinet	1		03338116292
293	Steuerkarte	Control board	1		03338120Q1.6
294	Netzfilter	Line filter	1		03338116294
295	Potentiometer	Potentiometer	1		03338120R1.5
296	Label Schaltkasten	label switch cabinet	1		03338116296
297	Drehknopf	Knob	1		03338420301
298	Ein-Aus-Schalter mit NOT-AUS Funktion	On-Off switch with EMERGENCY STOP function	1		0320299
299	Innensechskantschraube	Hexagon socket screw	12	DIN 4762/M4x10	
300	Innensechskantschraube	Hexagon socket screw	2	DIN 4762/M5x8	
301	Fräsfutterschutz	Milling chuck protection	1		03338116301
302	Sicherungsring	Retaining ring	1	DIN 471/6	
303	Bügel	Bracket	1		03338116303
304	Welle	Shaft	1		03338116304
305	Gewindestift	Grub screw	2	ISO 4028/M4x5	
306	Stange	Rod	1		03338116306
307	Halter	Holder	1		03338116307
308	Innensechskantschraube	Hexagon socket screw	2	DIN 4762/M5x20	
309	Stellschraube	Locking screw	1		03338116309
310	Führungsstück	Guide piece	1		03338116310
	Fräsfutterschutz kpl.	Milling chuck protection cpl.	1		03338116301cpl
	Zubehör kplt.	Accessory box cplt.	1		0333811600
Ersatzteilliste Fräsfutterschutz, Schaltkasten Baujahr ab 2011- Spare parts list milling chuck protection, switch box year of construction 2011					
311	Platte	Plate	1		03338116311
312	Netzfilter	Line filter	1		03338116312
313	Gehäuse	Housing	1		03338116313
314	Steuerplatine	Control board	1		03338116314
315	Potentiometer	Potentiometer	1	4K7	03338120R1.5
317	Not-Aus-Schalter	Emergency stop button	1		03338120S1.2
318	Knopf	Knob	1		03338120301
319	Ein-Aus-Schalter	On-Off switch	1	KJD-17B	0342025108
320	Feinsicherung	Fuse	1	10A	03338116320
321	Zugentlastung	Cord grip	1		03338116321
322	Bügel	Bracket	1		03338116322
323	Sicherungsring	Retaining ring	1		03338116323
324	Innensechskantschraube	Hexagon socket screw	2		03338116324
325	Scheibe	Wacher	2		03338116325
326	Reedkontakt Kpl.	Reedkontakt cpl.	1		0302024192

6.8 Schaltplan - Wiring diagram

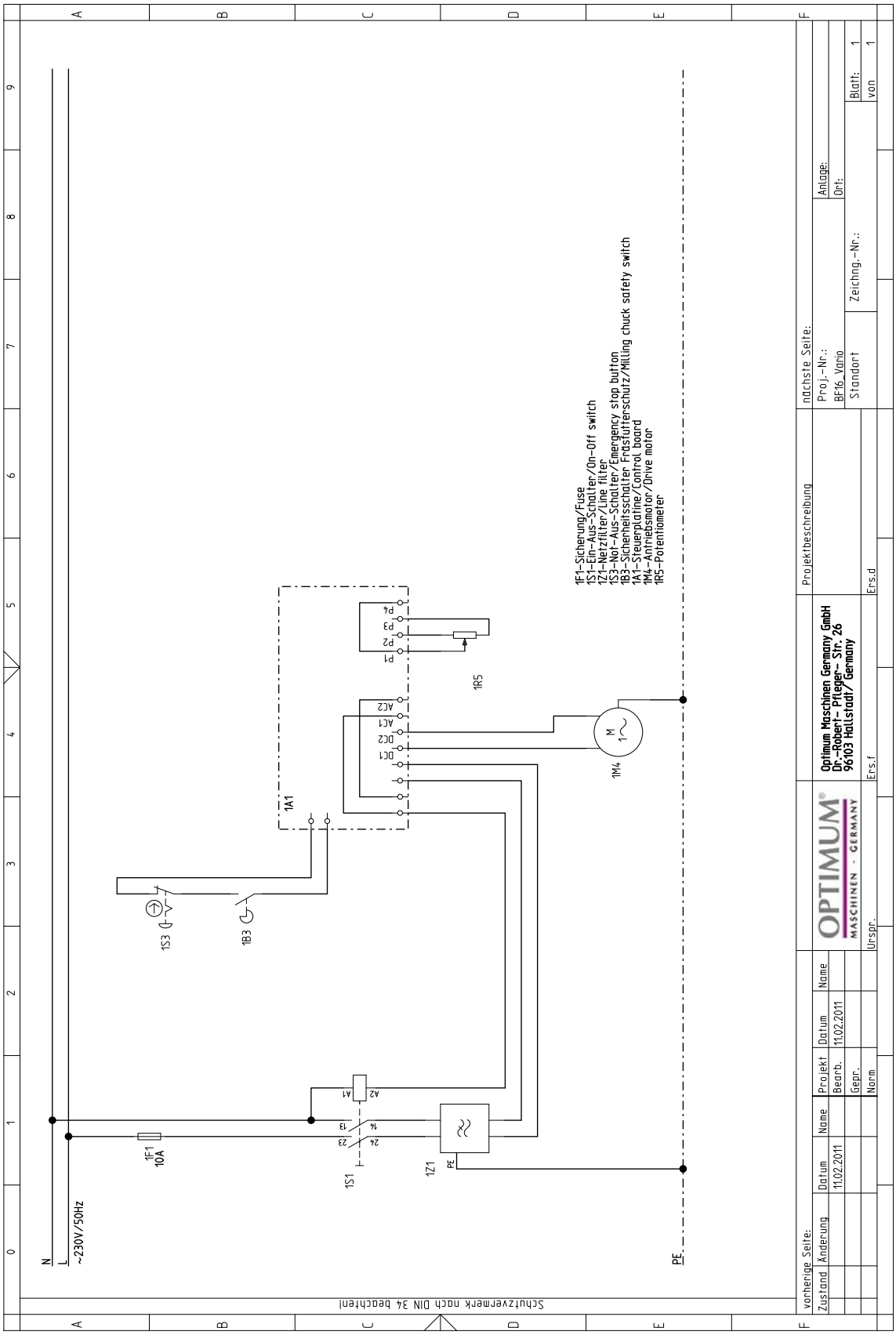


Abb. 6-8: Schaltplan - Wiring diagram

7 Anomalies

7.1 Anomalies in the drilling-milling machine

Anomaly	Cause/ possible effects	Solution
The drilling-milling machine does not start.	• Defective fuse.	• Have it checked by authorised personnel.
Tool „burnt“.	• Incorrect speed. • The chips have not been removed from the hole. • Tool blunt. • Operating without cooling.	• Select different speed, feed too high. • Retract tool more often. • Sharpen and replace tool. • Use cooling agent.
Impossible to insert holding taper into the spindle sleeve.	• Remove dirt, grease or oil from the internal conical surface of the spindle sleeve or the holding taper. • Morse taper does not correspond MK 2 / M10.	• Clean surfaces well. Keep surfaces free of grease. • Use Morse taper MK 2 / M10
Motor does not start.	• Defective fuse.	• Have it checked by authorised personnel.
Working spindle rattling on rough workpiece surface.	• Climb milling machining not possible under the current operating conditions. • Clamping levers of the movement axes not tightened. • Loose collet chuck, loose drill chuck, loose draw-in rod. • Tool blunt. • Workpiece loose. • Excessive slack in bearing. • Spindle shaft worn or worn out. • Working spindle goes up and down.	• Perform conventional milling machining. • Tighten clamping levers. • Check, re-tighten. • Sharpen or replace tool. • Secure the workpiece properly. • Re-adjust bearing clearance or replace bearing. • Replace pos. 246 and 251 of spare parts list 2. • Re-adjust bearing clearance or replace bearing pos. 248 spare parts list 2.

8 Appendix

8.1 Copyright

8.2 Terminology/ Glossary

Term	Explanation
Cross table	Bearing surface, clamping surface for the workpiece with X and Y axis travel.
Taper mandrel	Taper of the tool seat, taper of the bit or the drill chuck.
Workpiece	Piece to be milled, drilled or machined.
Draw-in rod	Threaded bar for fastening the taper mandrel in the spindle sleeve.
Drill chuck	Device for holding the bit.
Collet chuck	Holding fixture for end mill cutters.
Drill-mill head	Upper part of the milling-drilling machine.
Spindle sleeve	Hollow shaft in which the milling spindle turns.
Milling spindle	Shaft activated by the motor.
Drilling table	Bearing surface, clamping surface.
Taper mandrel	Cone of the bit or drill chuck.
Spindle sleeve lever	Manual control for activating the bit.
Quick-action drill chuck	Manually tightenable bit holding fixture.
Workpiece	Piece to be turned or machined.
Tool	Milling cutter, drill bit, counterstick, etc..

8.3 Change information manual

Chapter	Short note	new version no.
Spare parts	new electrical box	1.3.8
CE declaration	Changed standard to DIN EN 12100:2010	1.3.8

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 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

Used devices need to be decommissioned in a professional way in order to avoid later misuses and endangerment of the environment or persons

- Pull off the mains plug.
- Disconnect 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

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 handles as common household waist, but that is 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,
- repeated failures.

Optimum Maschinen Germany GmbH
Dr.-Robert-Pfleger-Str. 26

D-96103 Hallstadt

Fax +49 (0) 951 - 96 555 - 888
E-Mail: info@optimum-maschinen.de

8.9 EC - Declaration of Conformity BF16 Vario

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

hereby declares that the following product,

Type of machine:	BF16 Vario
Designation of the machine:	Drilling-Milling machine
Serial number:	J __ __ __ __
Year of manufacture:	20__

all relevant provisions of the **Machinery Directive (2006/42/EC)** corresponds.

The machnine continues to comply with all provisions of the **Directives Electrical equipment (2006/95/EC)** and **electromagnetic compatibility (2004/108/EC)**.

The following harmonized standards were applied:

DIN EN ISO 12100:2010	Safety of machines - General design principles - Risk evaluation and risk reduction
DIN EN 60204-1	Safety of machinery - Electrical equipment of machines - General requirements
DIN EN 55011 class B: 2003-08	Industrial, scientific radio-frequency equipment

The following technical standards were applied:

EN 13128: 2001	Safety of machine tools: Milling and drilling machines

Responsible for documentation: Kilian Stürmer, Tel.: +49 (0) 951 96 555-800

Address:	Dr.-Robert-Pfleger-Str. 26 D - 96103 Hallstadt

Kilian Stürmer
(Manager)

Hallstadt, 10.09.2012

9 Index