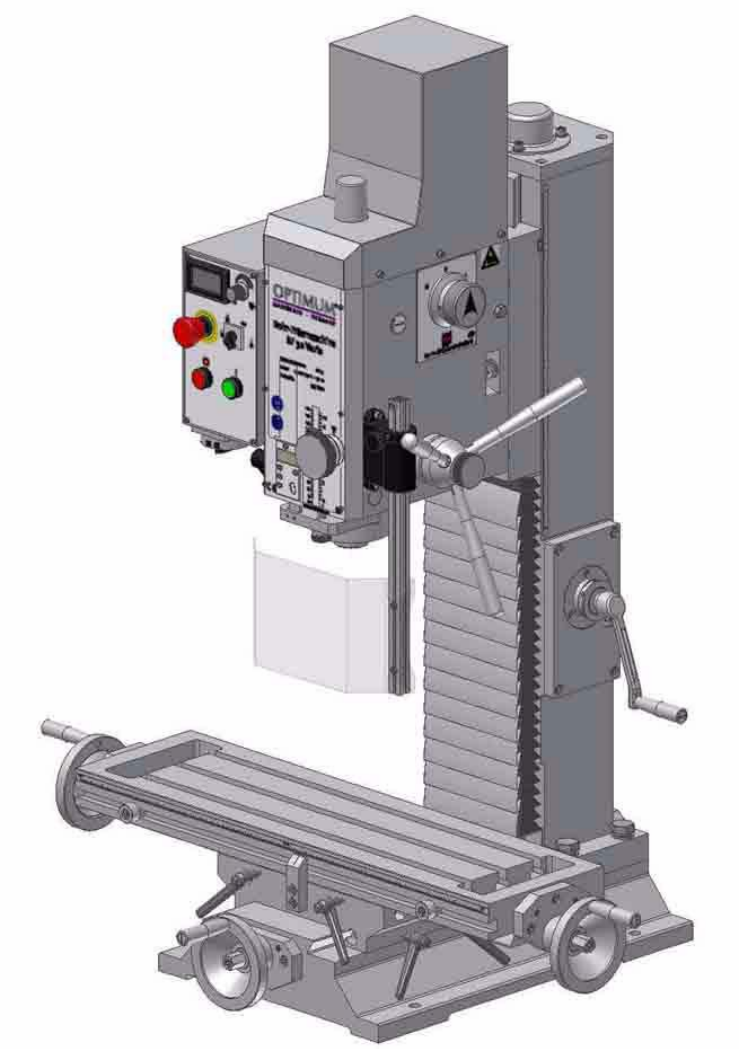
OPTIMUM
MASCHINEN - GERMANY

Operating manual

Version 1.0.3

Drilling-Milling machine

BF 30 Vario



Keep for future reference!

Table of Contents

Preface

We thank you very much that you have decided for the drilling-milling machine BF 30 Vario made by Optimum Maschinen Germany GmbH.

Changes

The illustrations of the drilling-milling machine might in some details deviate from the illustrations of this operating manual but this will have no influence on the operation of the drilling-milling machine.

Any changes in the construction, equipment and accessories are reserved for reasons of enhancement. Therefore, no claims may be derived from the indications and descriptions. Errors excepted!

1 Safety

Glossary of symbols

☞	give additional indications
➔	calls on you to act
❍	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 obeyed.

In addition to this operating manual please observe

- ❍ applicable laws and regulations,
- ❍ legal regulations for accident prevention,
- ❍ the prohibition, warning and mandatory signs as well as the warning notes 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 this manual, please contact us for advice:

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

D- 96103 Hallstadt

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 warnings 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 or death to personnel.
	CAUTION!	Danger of unsafe procedure that might cause injury to personnel or damage to property.
	**ATTENTION!**	Situation that could cause damage to the drilling-milling machine and product and other types of damage. No risk of injury to personnel.
	**INFORMATION**	Application tips and other important or useful information and notes. No dangerous or harmful consequences for personnel or objects.

In the 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 operating 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 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 the company Optimum Maschinen Germany GmbH or operated with different process data, then the drilling-milling machine is being used improperly.

We do not take 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 the company 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 13

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. These could endanger the staff and cause damage to the drilling-milling machine.

1.3 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

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

We have used construction resources and safety techniques to minimise the health risk to the staff 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 by the drilling-milling machine resulting from incorrect operation or unsuitable maintenance.

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

- be duly qualified,
- strictly 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 whenever you detect a failure in the safety devices or when they are not fitted!

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

As the machine operator, this will be your responsibility!

☞ **„Safety devices“ on page 8**

1.4 Qualification of personnel

1.4.1 Target group

This manual is addressed to

- the operator,
- the user,
- the 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 mains. This will prevent it being used by unauthorised staff.

INFORMATION

All personnel involved in assembly, commissioning, operation and maintenance need to

- ❍ be duly qualified,
- ❍ strictly follow this operating manual .

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 property,
- ❍ may affect proper operation of the drilling-milling machine.

1.5 Safety devices

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

Stop the drilling-milling machine immediately if there is a failure in 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 when

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

WARNING!

If you bypass, remove or override a safety device in any other way, you are endangering yourself and other personnel 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 EMERGENY-STOP button,
- ❍ a protective cover at the drill-mill head,
- ❍ a separating protective equipment on the milling spindle.

1.5.1 EMERGENCY-STOP button

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

☞ „Starting the drilling-milling machine“ on page 23

Illustr. 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 emergency stop button is actuated in order to stop the drilling-milling machine generally you might damage tools or workpieces.

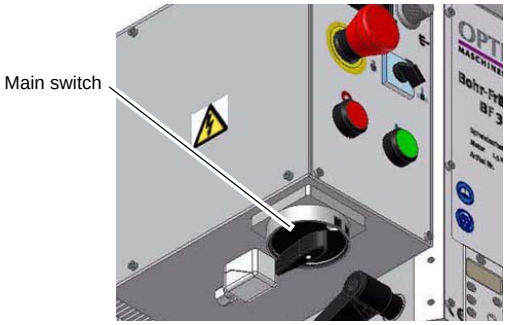
After actuating the button, turn it to the right, in order to restart the machine.

1.5.2 Lockable main switch

In the position " 0 " the lockable main switch can be secured against accidental or non-authorised switching on by means of a padlock.

When the main switch is switched off, the current supply is been interrupted.

Except for the areas marked by the pictogram in the margin.



Illustr. 1-2: Main switch

WARNING!

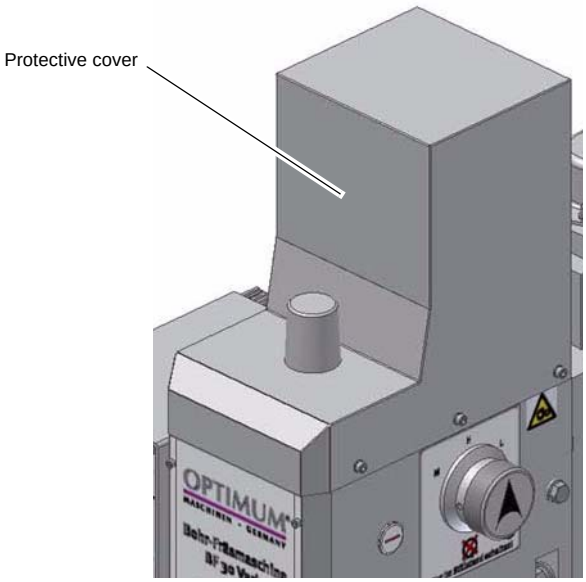
Dangerous voltage even if the main switch is switched off. In the areas marked by the pictogram in the margin, there might be voltage, even if the main switch is switched off.

1.5.3 Protective cover

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

WARNING!

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



Illustr. 1-3: Protective cover

1.5.4 Separating protective equipment

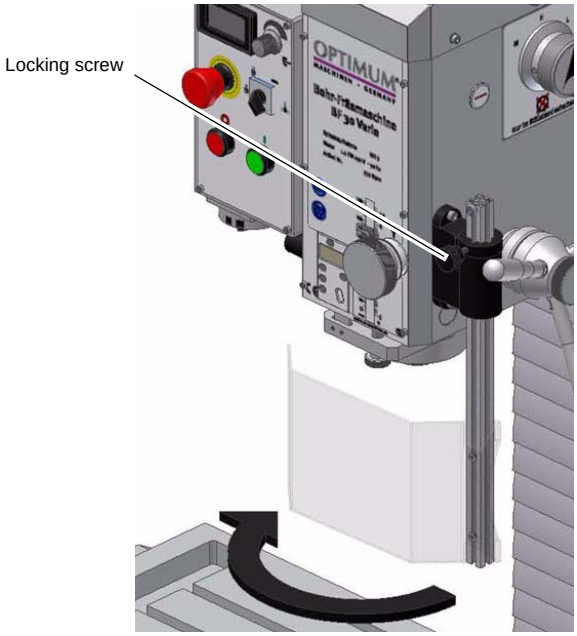
Adjust the protective equipment to the correct height before you start working.

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.



Illustr. 1-4: Separating protective equipment

1.6 Safety check

Check the drilling-milling machine regularly.

Check all safety advices

- ❍ at the beginning of each shift,
- ❍ once a week (with the machine in 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.	

1.7 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 a face guards should be worn.

Use protective gloves when handling pieces with sharp edges.

Use safety shoes when you position, dismantle or transport heavy components.

Use ear protection if the noise level (emission) 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 body protection gear can cause disease. Clean it each time after it has been used and once a week.

1.8 For your own safety during operation

WARNING!

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

Avoid any unsafe working practises:

Make sure your work does not endanger anyone.

- The instructions in this manual need to 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 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 halt.
- Use prescribed protection gear. Make sure to wear a well-fitting work suit, when necessary, a hairnet.
- Do not use protective gloves during drilling or milling work.
- Unplug the shockproof plug from the mains before changing the tool.
- Use suitable devices for removing 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 with and on the drilling-milling machine we highlight the dangers specific to that work.

1.9 Disconnecting the drilling-milling machine and making it safe

Switch off the drilling-milling machine with the main switch before starting any maintenance and repair works.

1.10 Using lifting equipment

WARNING!

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

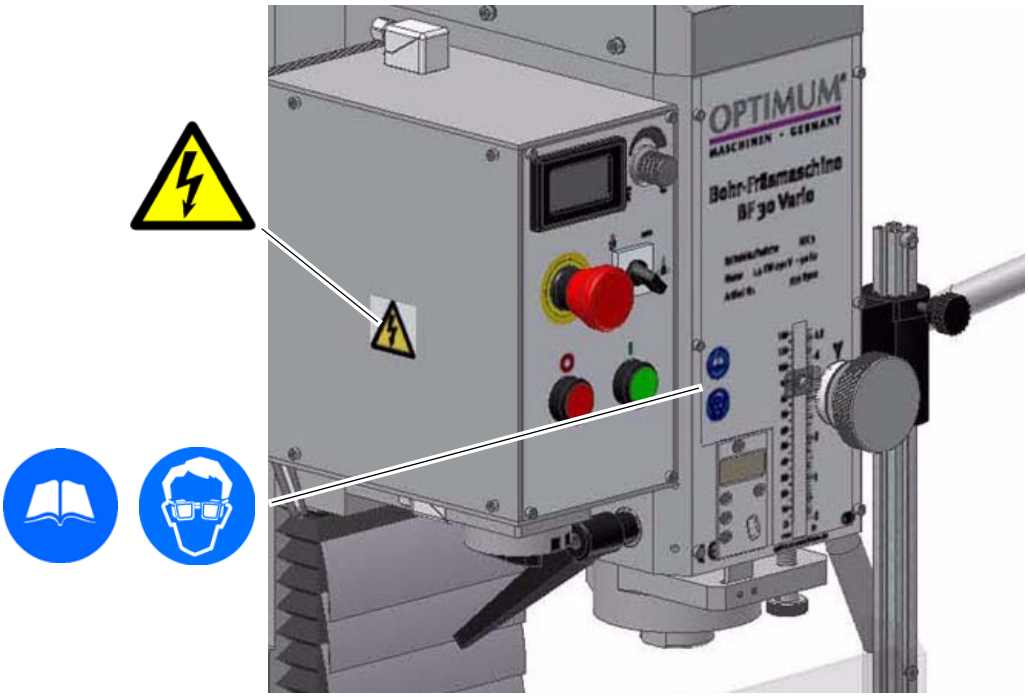
Check that the lifting equipment and load-suspension devices are of sufficient load capacity and are in perfect condition.

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!

Positions of the signs on the drilling-milling machine



Illustr. 1-5: BF 30 Vario

2 Technical data

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

2.1 Power connection		
Motor power consuption	230V ~ 50Hz 1,5 kW	
2.2 Drilling- milling capacity		
Drilling capacity in steel [mm]	max. Ø 30	
Drilling capacity cast iron [mm]	max. Ø 35	
Milling capacity of end-mill cutter [mm]	max. Ø 30	
Milling capacity of inserted tooth cutter [mm]	max. Ø 75	
Working radius [mm]	220	
2.3 Spindle holding fixture		
Spindle holding fixture	MT 3	ISO 30
Extraction rod	M12	
Sleeve travel [mm]	90 mm	
2.4 Drill- mill head		
Swivelling	+ / - 30°	
Gearbox stages	3	
Z-axis travel [mm]	470	
2.5 Cross table		
Table length [mm]	750	
Table width [mm]	210	
Y-axis travel [mm]	200	
X-axis travel [mm]	450	
T - slot size / distance [mm]	12 / 63	
2.6 Work area		
Height [mm]	2100	
Depth [mm]	1900	
Width [mm]	2500	
2.7 Speeds		
Gearbox stage slow [min^{-1}]	65 - 650	
Gearbox stage average [min^{-1}]	150 - 1500	
Gearbox stage fast [min^{-1}]	330 - 3300	

2.8 Environmental conditions	BF 30 Vario
Temperature	5-35 °C
humidity	25 - 80%
2.9 Operating material	**BF 30 Vario**
Gearbox	Oil quantity 1,2 litres Mobilgear 627, ISO VG 100 viscosity 100 cSt at 40° or a corresponding oil
blank steel parts	Mobilgrease OGL 007 or, Mobilux EP 004, acid-free oil, e.g. weapon oil, motor oil

2.10 Emissions

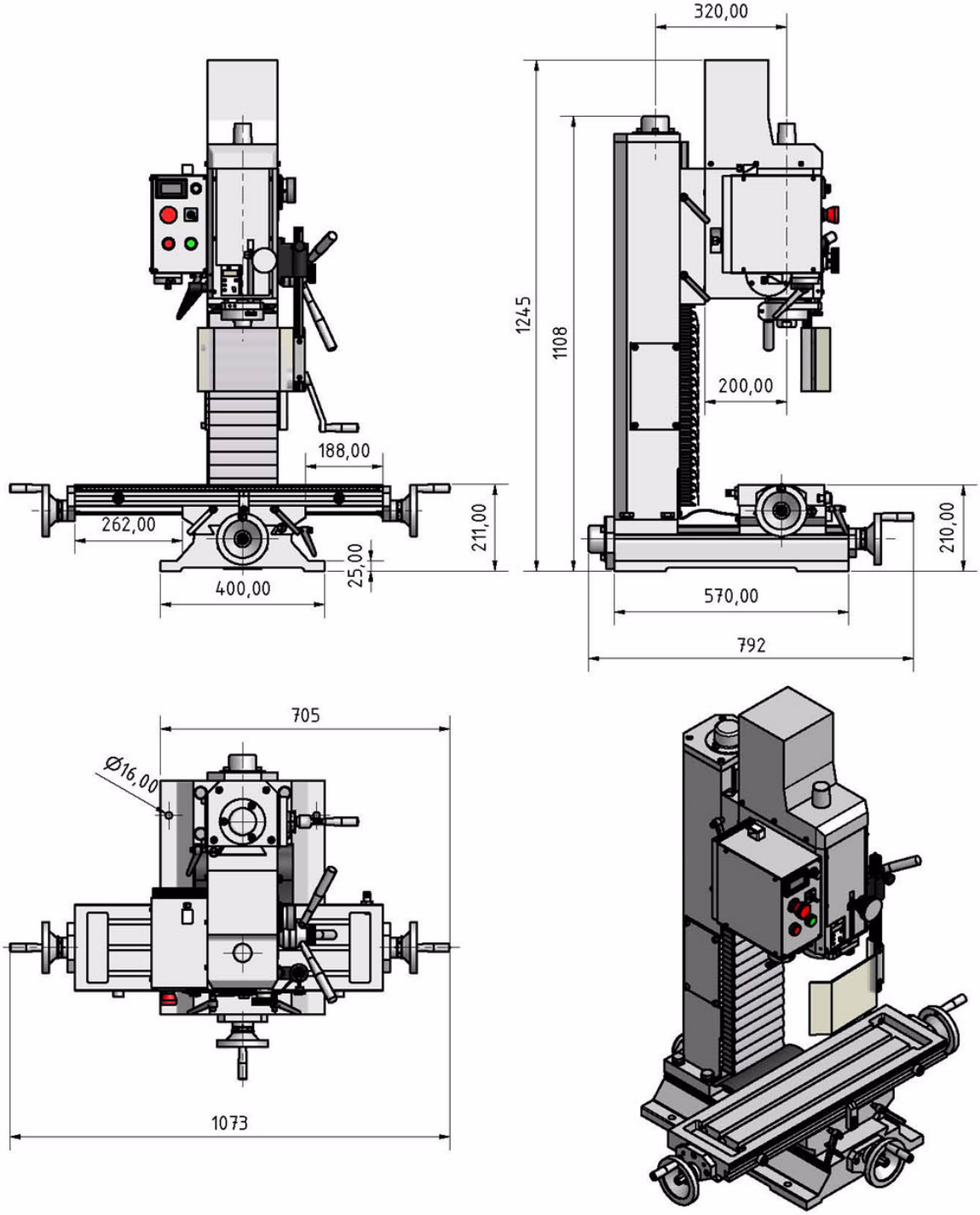
The noise level (emission) of the drilling-milling machine is below 78 dB(A). If the drilling-milling machine is installed in an area where various machines are in operation, the acoustic influence (emission) on the user of the drilling-milling machine may exceed 85 dB(A) at the workplace.

We recommend the use of soundproofing ear protection. Remember that the duration of the noise pollution, the type and characteristics of the working area and operation of other machines influence the noise level in the workplace.

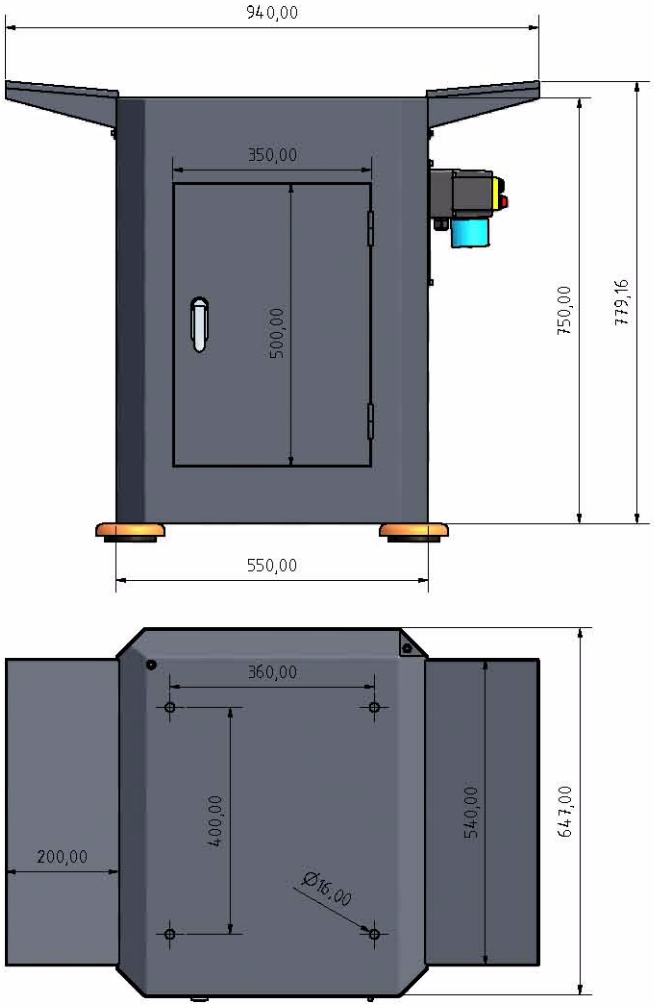
INFORMATION

We recommend to take sound protection and ear protection measures. Please make sure that the period of the noise stress, the type and nature of the working area as well as other machines which are operated simultaneously will influence the noise level at the working place.

2.11 Installation plan BF 30 Vario



2.12 Installation plan of optional substructure



3 Unpacking and connecting

INFORMATION

The drilling-milling machine comes pre-assembled.

3.1 Extent of supply

When the drilling-milling machine is delivered, immediately check that the machine has not been damaged during shipping 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

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:

- **centres of gravity**
- **suspension points**
- **weights**
- **means of transport to be used**
- **prescribed shipping position**

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 and load suspension gear has sufficient load capacity and that it is in perfect condition.

Observe the rules for preventing accidents.

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 intended environmental conditions.

☞ **„Environmental conditions“ on page 14**

Consult the company Optimum Maschinen Germany GmbH if the drilling-milling machine or accessories have to be stored for a period of over three months or under different environmental conditions to those given there.

3.4 Installation and assembly

3.4.1 Requirements of the installation site

The working area for operation, maintenance and repair work must not be hindered.

The mains plug of the drilling-milling machine must 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 the drilling-milling machine.
- ➔ 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 rigidityt. The total weight amounts to 265 kg.

ATTENTION!

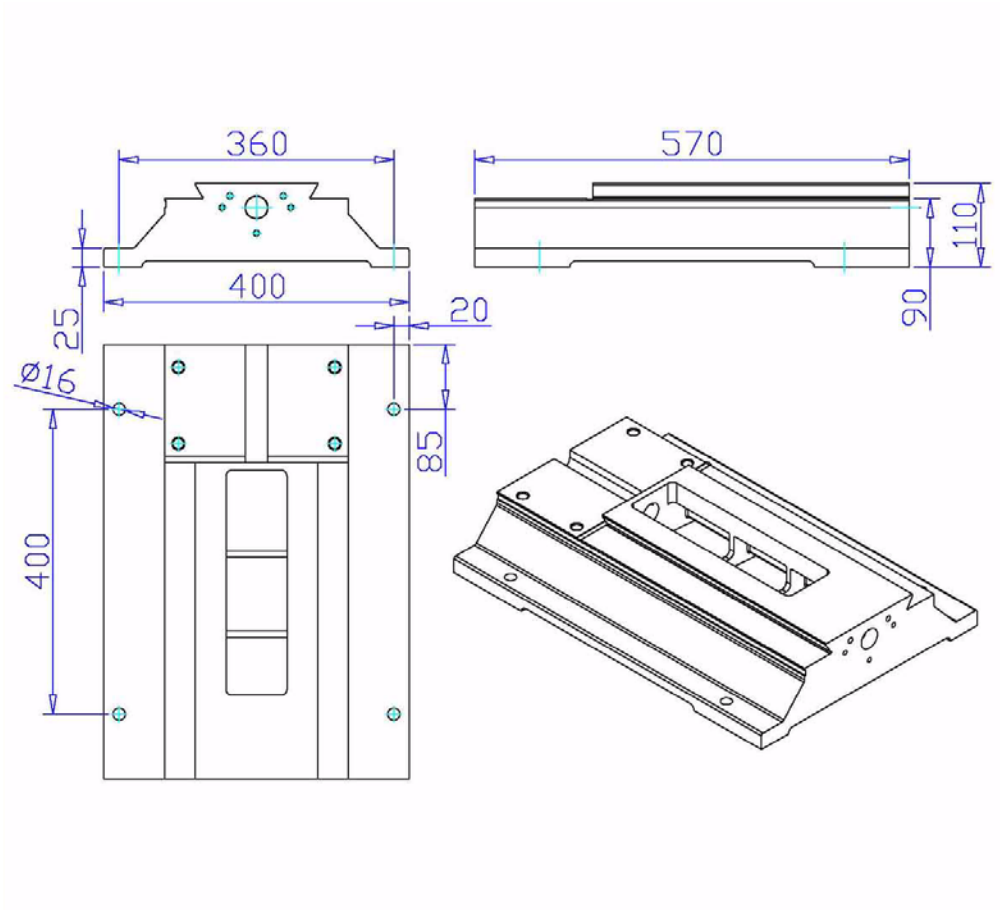
Insufficient rigidity of the foundation leads to the superposition of vibrations between the drilling-milling machine and the foundation (natural frequency of components). Insufficient rigidity of the entire milling machine assembly also rapidly causes the machine to reach critical speeds, with unpleasant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

WARNING!

The quality of the substructure and the kind of fixture of the machine stand to the substructure has to assimilate the loads of the machine. The substructure needs to be even. Please check the horizontal alignment of the substructure of the machine with a spirit level. Fix the machine to the substructure at the provided recesses at the stand. We recommend the use of shear connector cartridges or heavy-duty bolts.

3.4.4 Installation drawing



Illustr. 3-1: Machine base

3.5 First use

3.5.1 Cleaning and lubricating

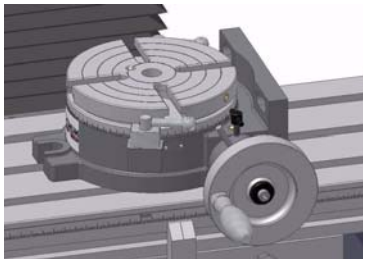
- ➔ Remove the anti-corrosive agent applied to the drilling-milling machine for transport and storage purposes. We recommend the use of stove distillate.
- ➔ Do not use any solvents, thinners or other cleaning agents which could corrode the varnish on the drilling-milling machine. Follow the specifications and indications of the manufacturer of the cleaning agent.
- ➔ Lubricate all bright machine parts with non-corrosive lubricating oil.
- ➔ Grease the drilling-milling machine using the lubrication chart.
  ☞ „Inspection and maintenance“ on page 31
- ➔ Check the smooth running of all spindles. The spindle nuts can be readjusted.
- ➔ Disassemble the taper gibs of the cross table and clean the gibs from the anti-corrosive agent. ☞ „Taper gib“ on page 35

3.5.2 Fill in gear lubricant oil

The drilling-milling machine is delivered without oil filling. Fill in gear lubricant oil.

☞ „Oil change“ on page 32

3.6 Optional accessory

Designation:	Item No	
Machine substructure Dimensions (L x B x H): 650 x 550 x 750	3338430404	
Vice FMS 125	3355127	
Hydraulic vice HMS 125	335 2044	
Kit of parallel spacers 18 pcs	3354000	
Universal coolant equipment 230 V	3352002	
Universal coolant equipment 400 V	3352001	
Levelling- damping element SE1 Levelling- damping element SE2	3381012 3381016	
Milling cutter kit HSS 20 pcs	3386200	
Collet chucks kit direct clamping MT 3	3352014	
Draw-in collet chucks kit MT 3	3352050	
Cutter head for copy and surface milling MT 3	3350213	
Height-adjustable tailstock RST 1	3356155	
Horicontal-vertical circular dividing table RT 150	335 6150	

4 Operation

4.1 Safety

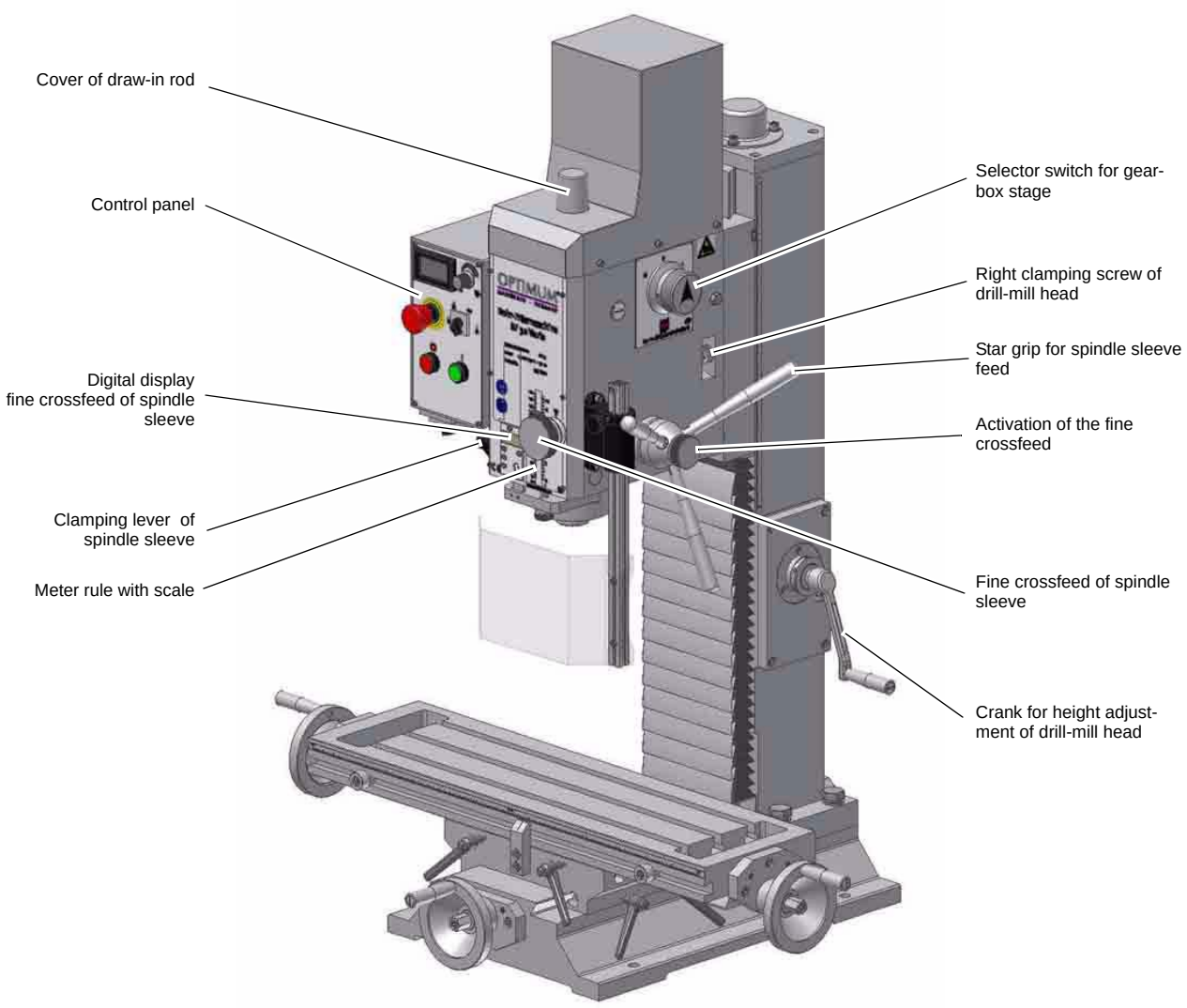
Use the drilling-milling machine only under the following conditions:

- 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 abnormality in operation and make sure it cannot be started-up accidentally or without authorisation.

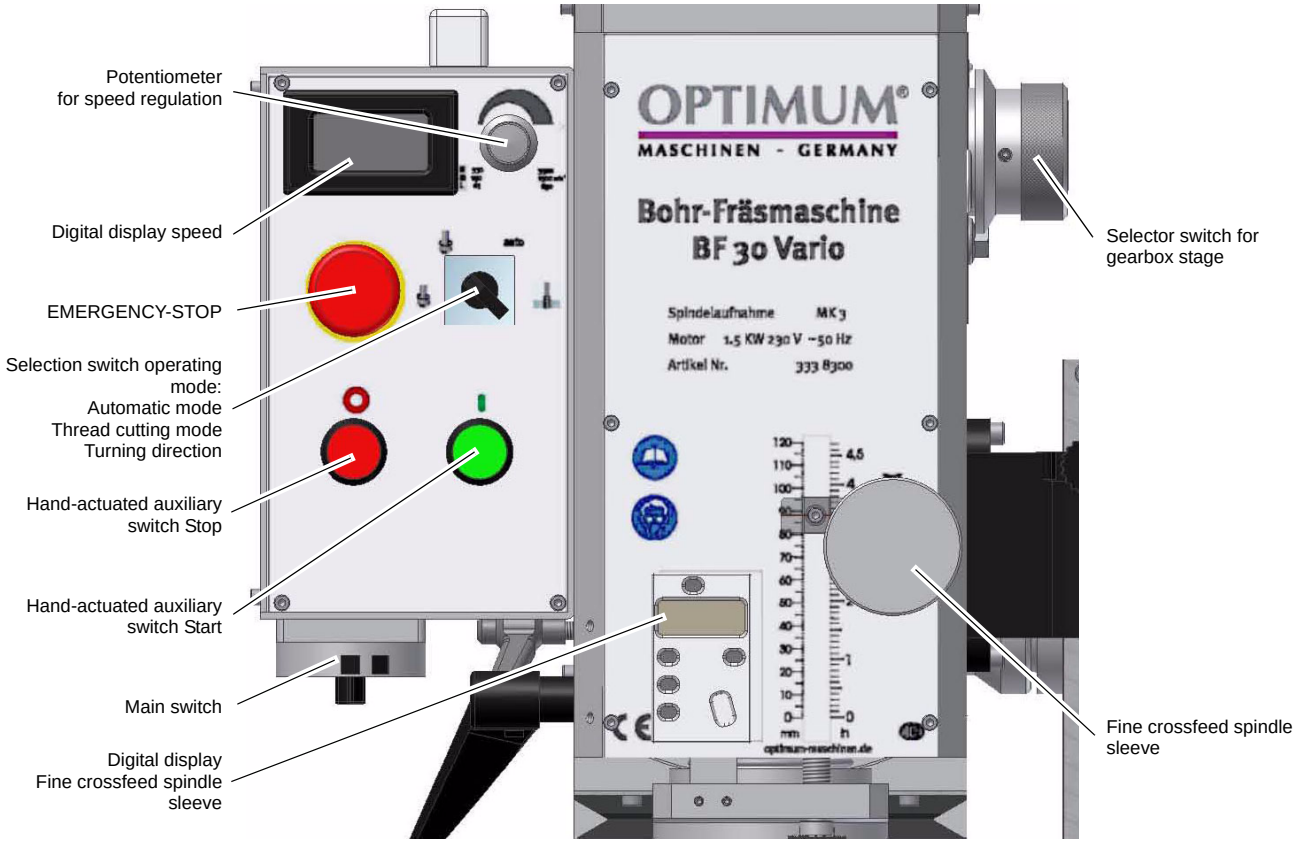
☞ „For your own safety during operation“ on page 11

4.2 Control and indicating elements



Illustr. 4-1: BF 30 Vario

4.2.1 Control panel



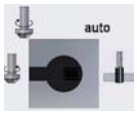
Illustr. 4-2: Control panel

Selector switch operating mode

With the selector switch the operating mode „Auto, threading or right-hand respectively left-hand run“ is being selected.

Operating mode „Auto“

In the automatic mode the engine starts up according to a predefined path over the drilling depth stop of the shaft automatically and will stop at the final position. This way for, the push button Start and Stop does not have to be actuated for repetitve drilling tasks.



Operating mode threading

In the threading mode the engine automatically starts up according to a predefined path over the drilling depth stop and changes automatically the drilling direction as soon as the predefined depth is being achieved. The screw tap exits the workpiece.

Switch for the turning direction

Standard operation, selection right-handed or left-handed rotation.

Potentiometer

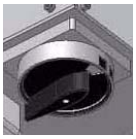
Speed setting "VARIO"

Push button ON

The „push button ON“ will start up the rotation of the drilling spindle.

Push button OFF

The „push button OFF“ switches off the rotation of the drilling spindle.



Main switch

Interrupts or connects the power supply.

4.3 Starting the drilling-milling machine

- ➔ Switch on the main switch.
- ➔ Close the protective equipment.
- ➔ Select the operating mode.
- ➔ Select the gear level.
- ➔ Set the potentiometer to the lowest speed.
- ➔ Actuate the hand-actuated auxiliary switch Start.
- ➔ Set the required speed on the potentiometer.

ATTENTION!

Wait until the drilling-milling machine has come to a complete halt before inverting the turning direction using the change-over switch.

4.4 Switching-off the drilling-milling machine

- ➔ Press the hand-actuated auxiliary switch Stop. For long-term standstill switch the drilling-milling machine off with the main switch.

4.5 Inserting a tool

4.5.1 Installation

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 may be caused by parts flying off.

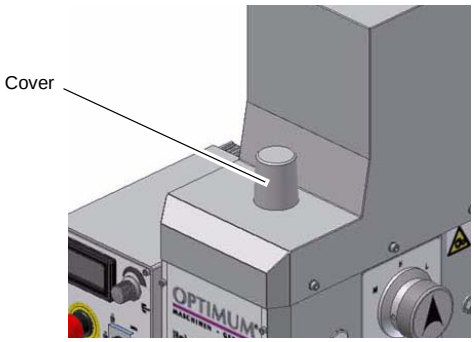
The mill head is equipped with a draw-in rod M12.

➔ Remove the cover.

➔ Clean the seat in the milling spindle / spindle sleeve.

➔ Clean the taper of your tool.

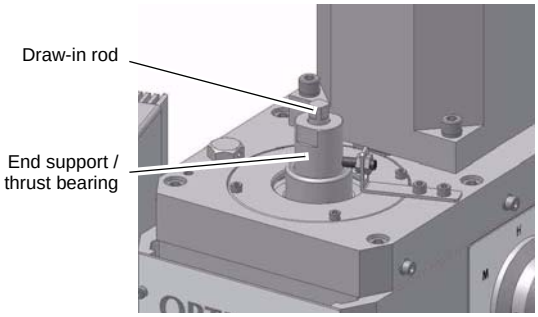
➔ Insert the tool into the holding fixture / spindle sleeve.



Illustr. 4-3: Drill-Mill head

➔ Screw the draw-in rod into the tool.

➔ Tighten the tool with the draw-in rod and hold the spindle onto the end support with a key.



Illustr. 4-4: Drill-Mill head without hood

4.5.2 Disassembly

➔ Hold the spindle thrust bearing with a wrench and loosen the draw-in rod. Turn the draw-in rod further, so that the tool is squeezed out from the cone admission.

ATTENTION!

When using an MT 3 spindle.

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 20

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.

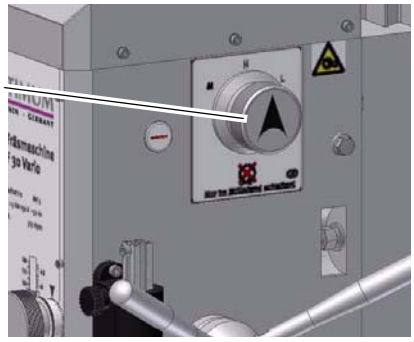
4.7 Changing the speed range

ATTENTION!

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

➔ Select gear level.
H = rapid
M = middle
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.



Illustr. 4-5: Drill-Mill head

4.8 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.

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 (meters per minute)

d = tool diameter in m (meters)

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	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 depending on 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**
	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**
	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		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 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 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 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

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 lubricant ensures better working results and a longer edge life of the cutting tool.

INFORMATION

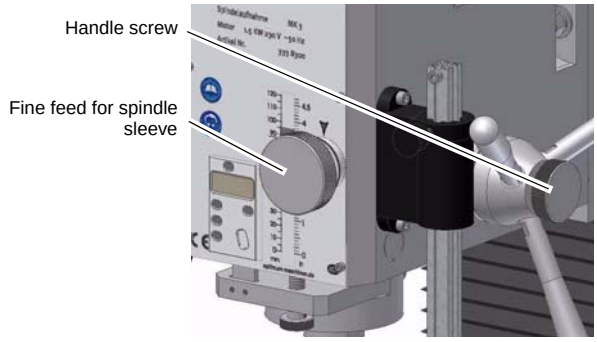
Use a water-soluble and non-pollutant emulsion as a cooling agent. This can be acquired from authorised distributors.

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

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.



Illustr. 4-6: Handle screw

4.10 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.

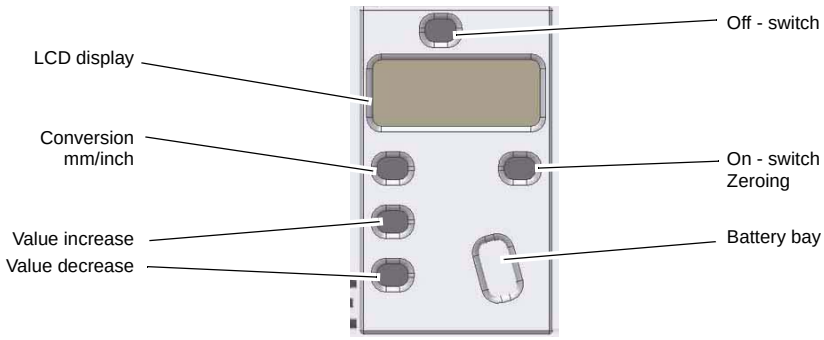
Loosen the handle screw (☞ Illustr. 4-6: „Handle screw“ on page 27) .
The spindle sleeve lever moves away from the drill-mill head and disengages the clutch of the fine feed.

4.11 Digital display for spindle sleeve travel

4.11.1 Technical data

Measuring range	mm	0 - 999,99
	inch	0 - 39,371“
Reading precision	mm	0,01
	inch	0,0004“
Power supply		round cell 1,55V 145mAh (SR44) 11,6 x 5,4mm

4.11.2 Design



Illustr. 4-7: Digital display

- ON / O,
  switches the display on and resets the reading of the display to "0".
- mm/in,
  converts the measuring unit from *millimetres* to *inches* and vice versa.
- OFF,
  switches the display off.
- ↑,
  performs a value increase.
- ↓,
  performs a value decrease.

INFORMATION

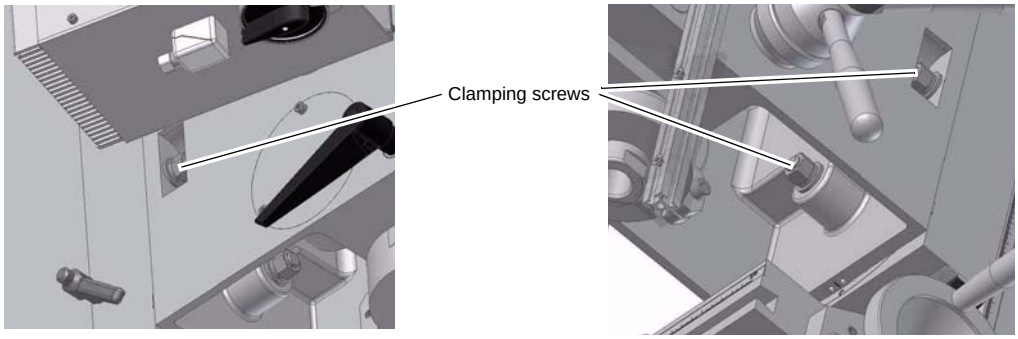
Before inserting the new battery, wait about 30 seconds. Please make sure, that the contacts are metallically bright and free from coverings which result from bleeding or gassing batteries. Grip the new batteries only with plastic forceps, if possible not with the hand due to the formation of oxide and 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.

4.12 Trouble shooting

Problem	Possible cause	Solution
Flash the display	• Voltage too low	• Change battery
Screen doesn't refresh	• Disturbance in the circuit	• Remove the battery, wait 30 seconds and re-insert the battery.
No data visible	• No power supply • Battery voltage less than 1,55V	• Clean battery contacts • Replace battery

4.13 Swivelling the drill-mill head

The drill-mill head may be swivelled 30° to the right and to the left. Three screwings need to be loosened.



Illustr. 4-8: Clamping screws

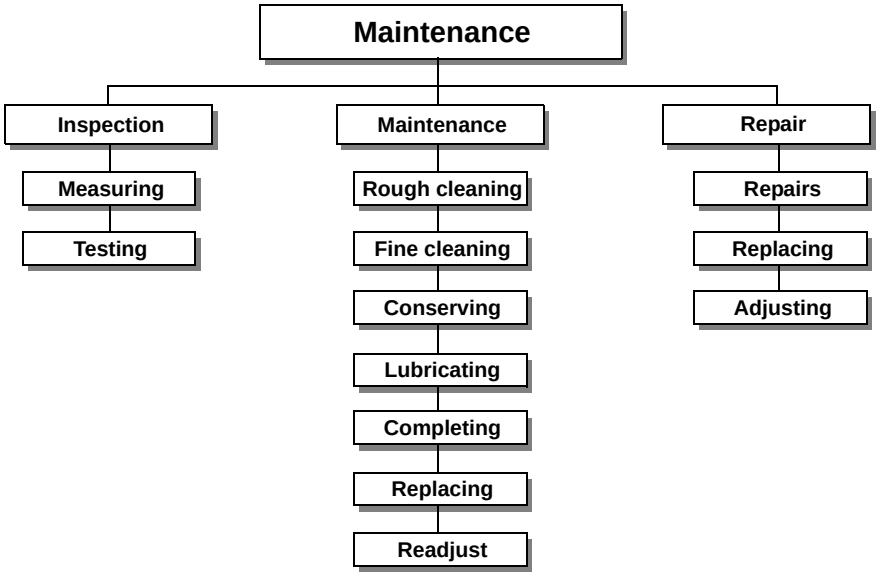
5 Maintenance

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.



Illustr. 5-1: Maintenance – definition according to DIN 31051

ATTENTION !

Properly performed regular maintenance is an essential prerequisite for

- **safe operation,**
- **fault-free operation,**
- **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.

☞ „Disconnecting the drilling-milling machine and making it safe“ on page 12

Position a warning sign.

5.1.2 Restarting

Before restarting run a safety check.

☞ „Safety check“ on page 10

WARNING!

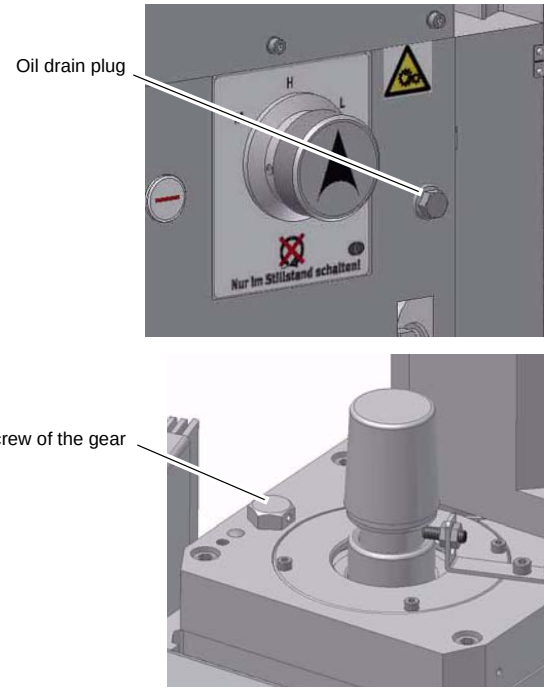
Before starting the drilling-milling machine you must check that there is no danger for the staff and the drilling-milling machine is undamaged.

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.

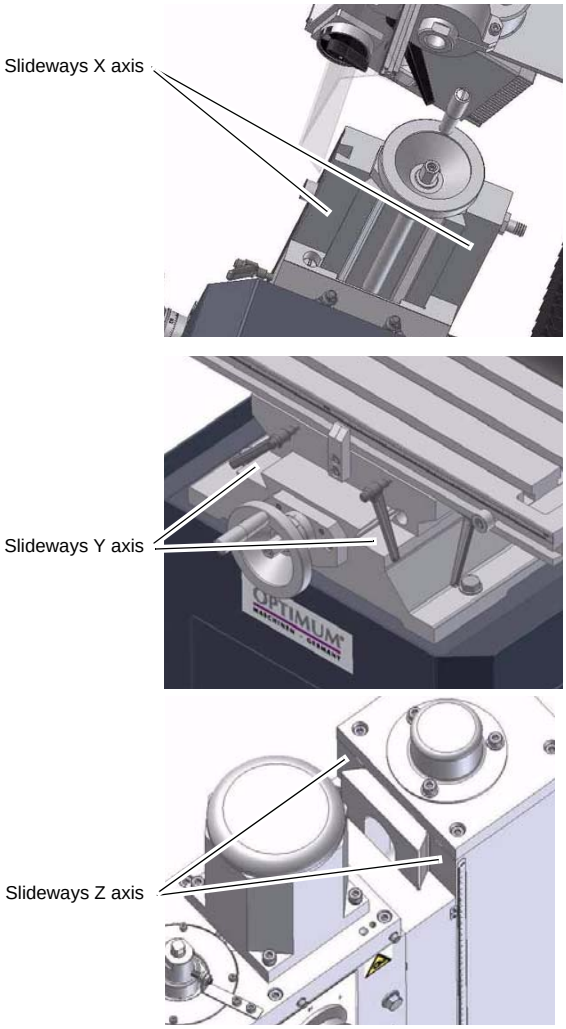
Interval	Where?	What?	How?
Start of work, after each maintenance or repair operation	Drilling-Milling machine	→ ☞ „Safety check“ on page 10	
Start of work, after each maintenance or repair operation	Dovetail slideways	Lubricate	→ Lubricate all slideways.
Weekly	Cross table	Lubricate	→ Lubricate all blank steel parts. Use acid-free oil, for example weapon oil or engine oil.
Weekly	Gearbox milling head	Oil level	→ Check the oil level of the gear. The oil level must be in the middle of the view glass.  Illustr. 5-2: Oil view glass speed gear

Interval	Where?	What?	How?
first after 200 operating hours, then every 2000 operating hours	Gearbox milling head	Oil change	➔ For the oil change use an appropriate collecting basin with appropriate capacity. ➔ Have the drilling-milling machine run for a few minutes, the oil will heat up and will slightly penetrate from the opening. ➔ Remove the ventilation screw from the gear. ➔ Remove the oil drain plug. ➔ Refill the oil over the removed ventilation screw. Quantity and type of oil ☞ „Operating material“ on page 14

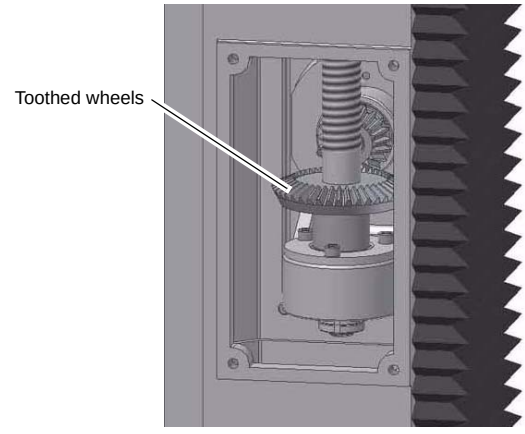


Illustr. 5-3: Mill head

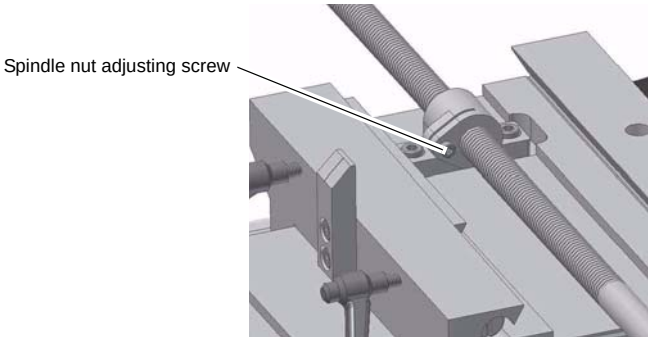
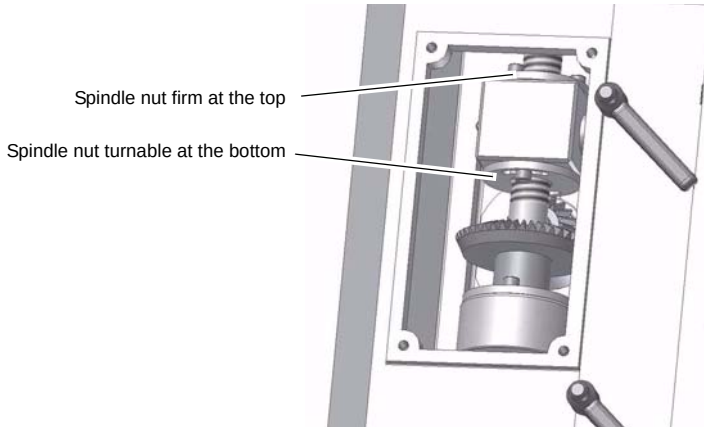
Interval	Where?	What?	How?
Weekly	Drilling-Milling machine	Lubricate	➔ Oil all slideways.
every six month	Adjustment Z axis	Grease	➔ Clamp the milling head. ➔ Remove the maintenance lid on the column. ➔ Lubricate the toothed wheels.

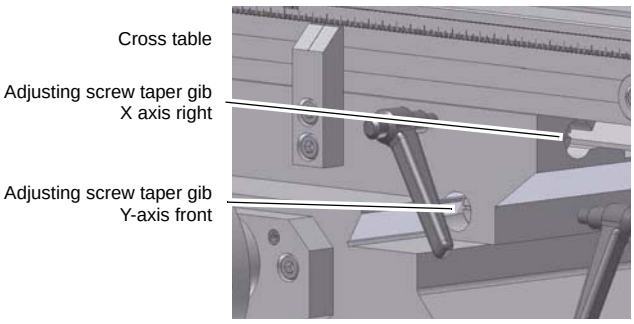
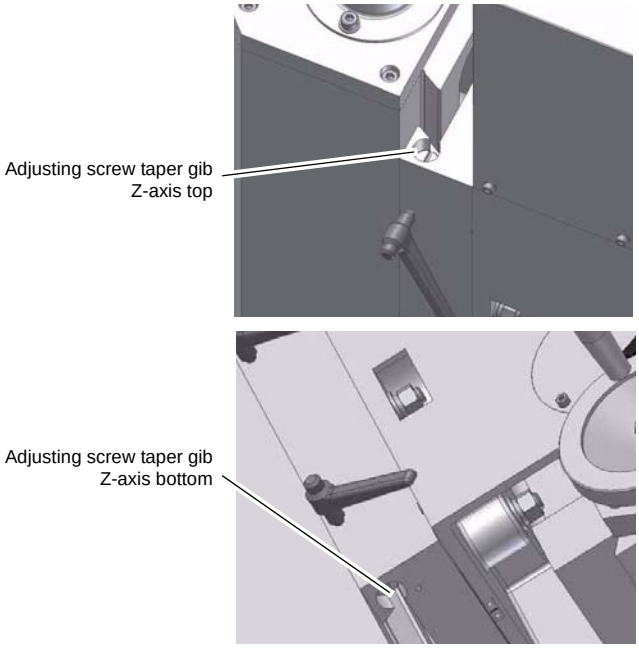


Illustr. 5-4: Slideways



Illustr. 5-5: Adjustment Z axis

Interval	Where?	What?	How?
as required	Spindle nuts cross table	Readjust	An increased clearance in the spindles of the cross table can be reduced by readjusting the spindle nuts.  Illustr. 5-6: Spindle nut X - axis (milling table faded out) The spindle nuts are readjusted by reducing the flank of screw thread of the spindle nut with an adjusting screw. By readjusting a smooth running move over the whole toolpath is to be assured, otherwise the wear by friction between spindle nut / spindle would increase considerably. The readjustment screw of the Y axis can be attained from the backside, the readjustment screw of the spindle nut of the X axis can be attained from the right or left side of the milling table.
as required	Spindle nut Z- axis	Readjust	An enlarged clearance in the spindle of the Z-axis can be performed by reciprocal turning of the spindle nut.  Illustr. 5-7: Spindle nuts Z-axis By readjusting a smooth running move over the whole toolath is to be assured, otherwise the wear by friction between spindle nut / spindle would increase considerably. ➔ Turn the crank of the drilling-milling head as low as possible. ➔ Firmly clamp the clamping lever left and right. ➔ Remove the maintenance lid on the column.

Interval	Where?	What?	How?
as required	Taper gib	Readjust X- and Y axis	 Illustr. 5-8: Cross table ➔ Turn the adjusting screw of the respective taper gib front and rear, or left and right in the clockwise direction. The taper gib is continued to push in and reduced by it the gap in the guide way. ➔ Control your attitude. The respective guide way must be still easily mobile from the adjustment, result in however a stable guidance.
as required	Taper gib	Readjust Z-axis	 Illustr. 5-9: Column and mill head ➔ As described under "readjust X- and Y-axis".

INFORMATION!

The spindle bearing arrangement is continuously lubricated. It is not required to relubricate it.

5.3 Repair

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

If the repairs are carried out by qualified technical staff, they must follow the indications given in this manual.

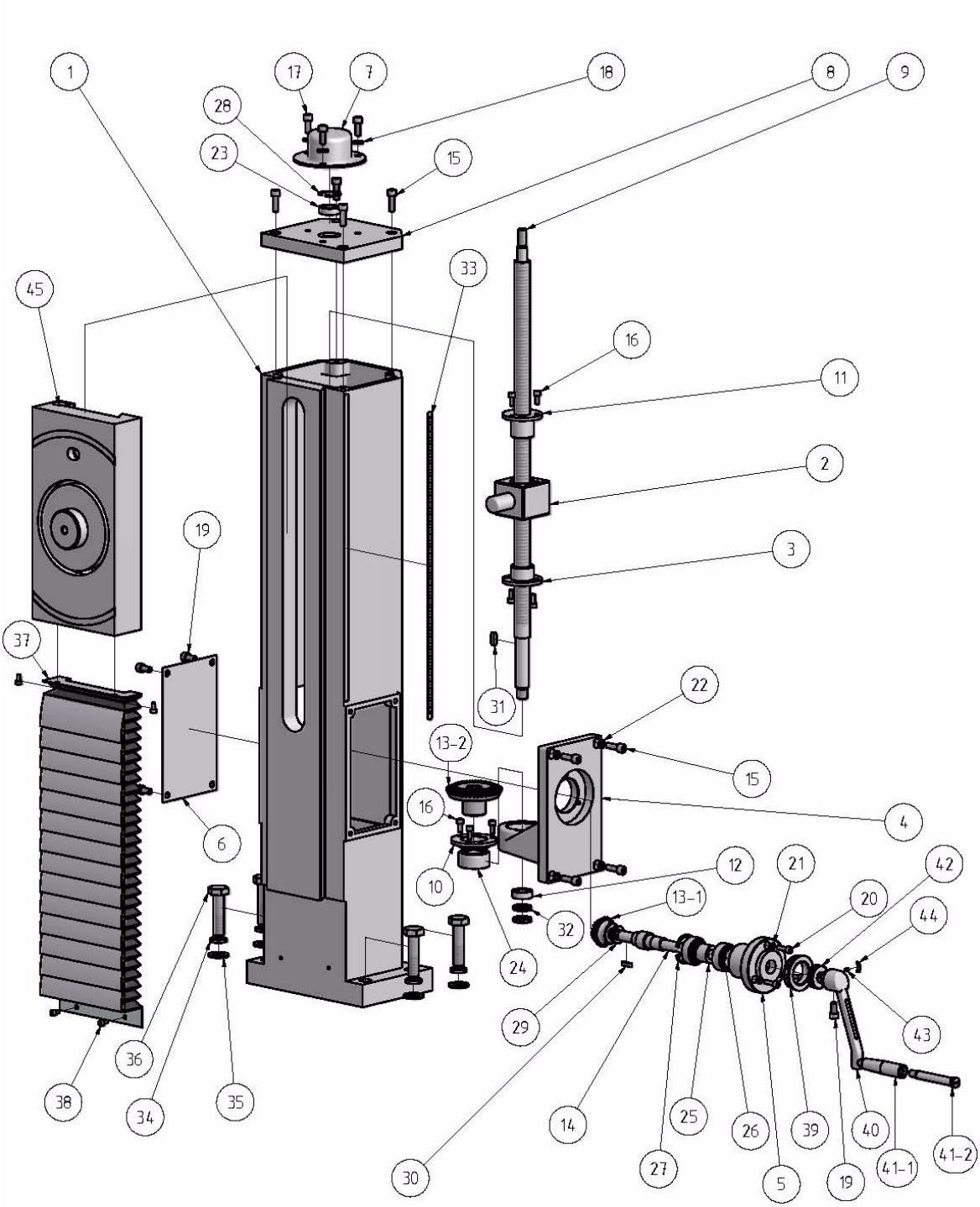
The company Optimum Maschinen Germany GmbH does not take responsibility nor does it guarantee against damage and operating anomalies resulting from failure to observe this operating manual.

For repairs only use

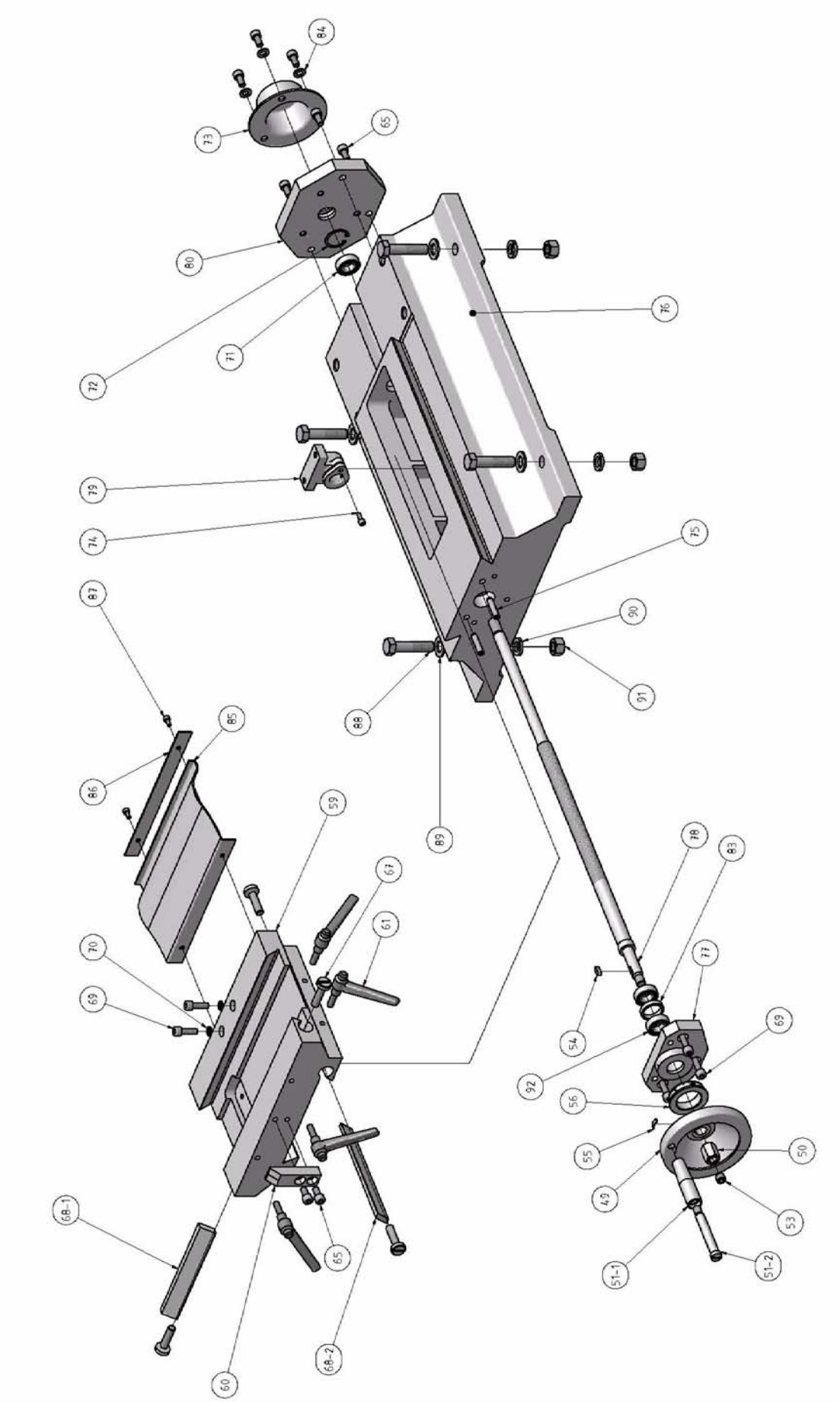
- only faultless and suitable tools,
- only original spare parts or serial parts expressly authorised by the company Optimum Maschinen Germany GmbH.

6 Ersatzteile - Spare parts - BF30 Vario

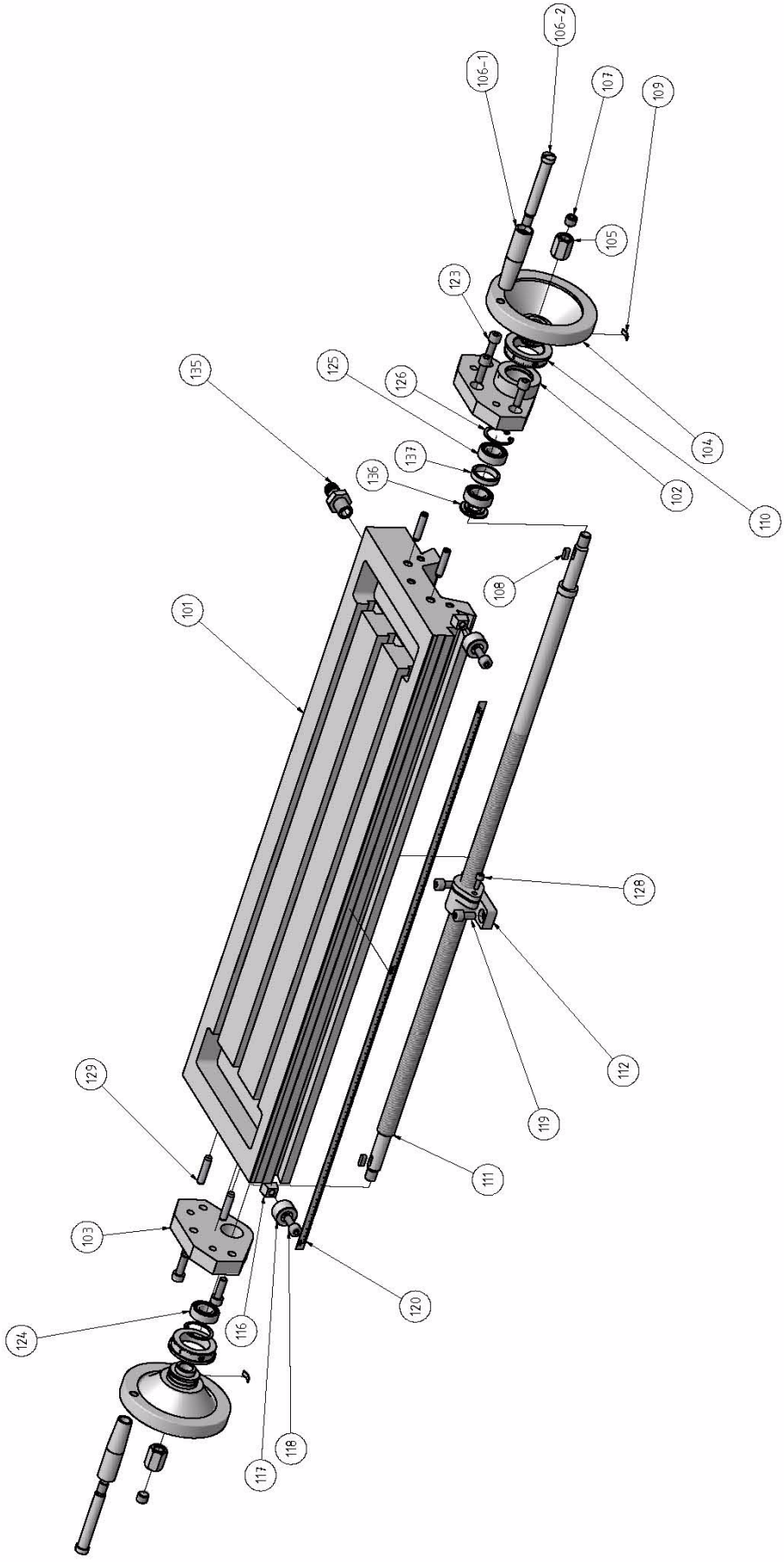
6.1 Säule - Column



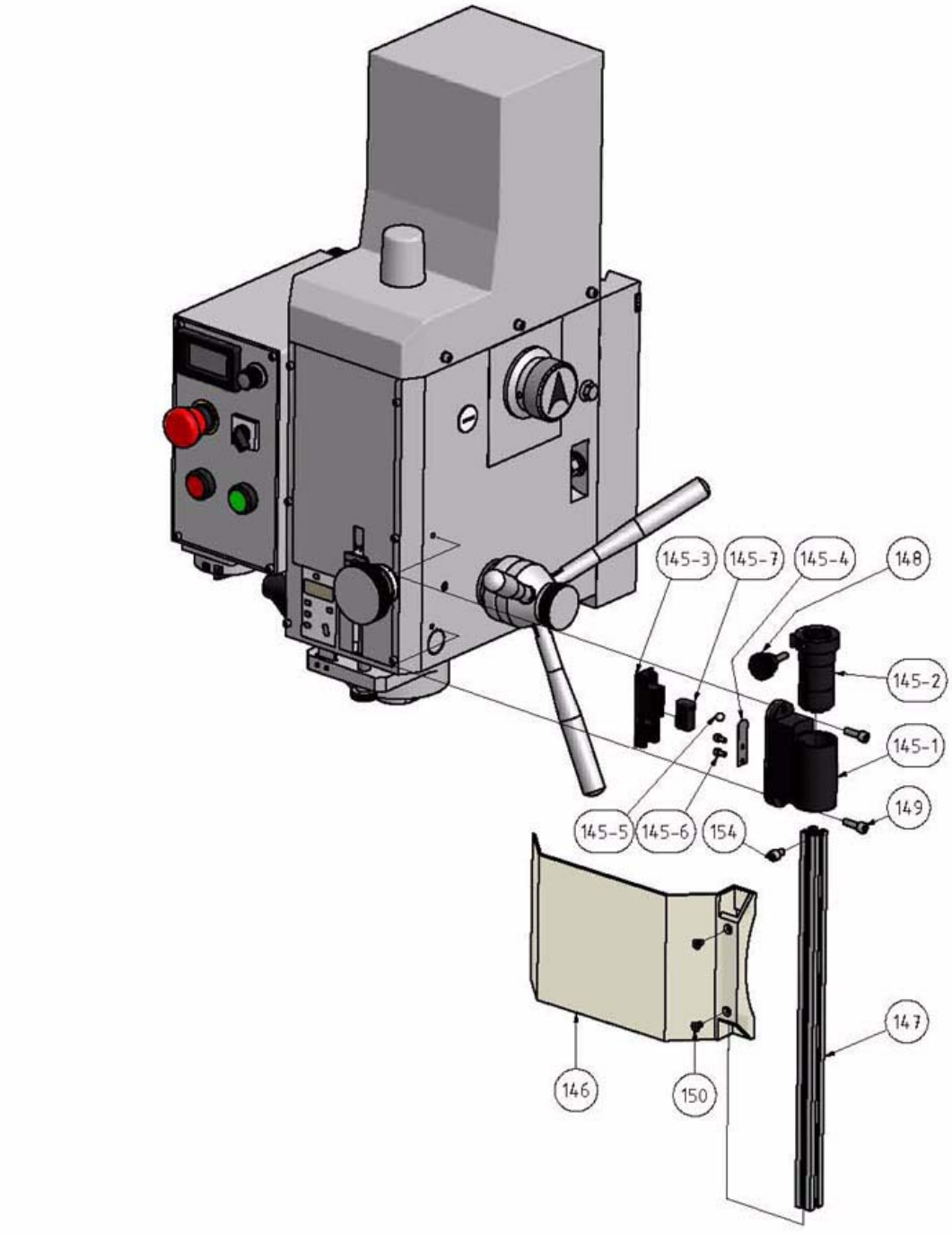
6.2 Kreuztisch - Cross table 1 - 2



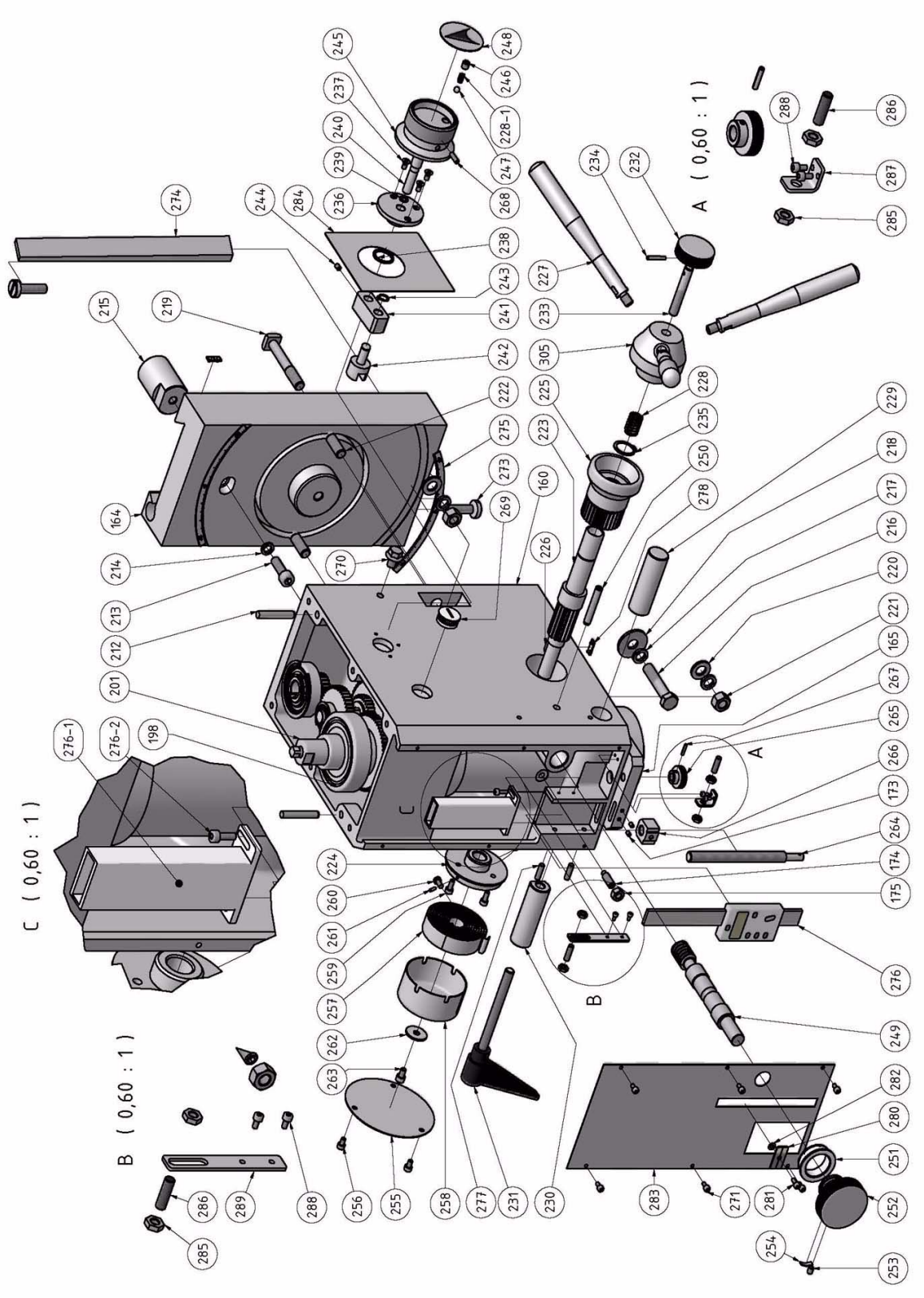
6.3 Kreuztisch - Cross table 2 - 2



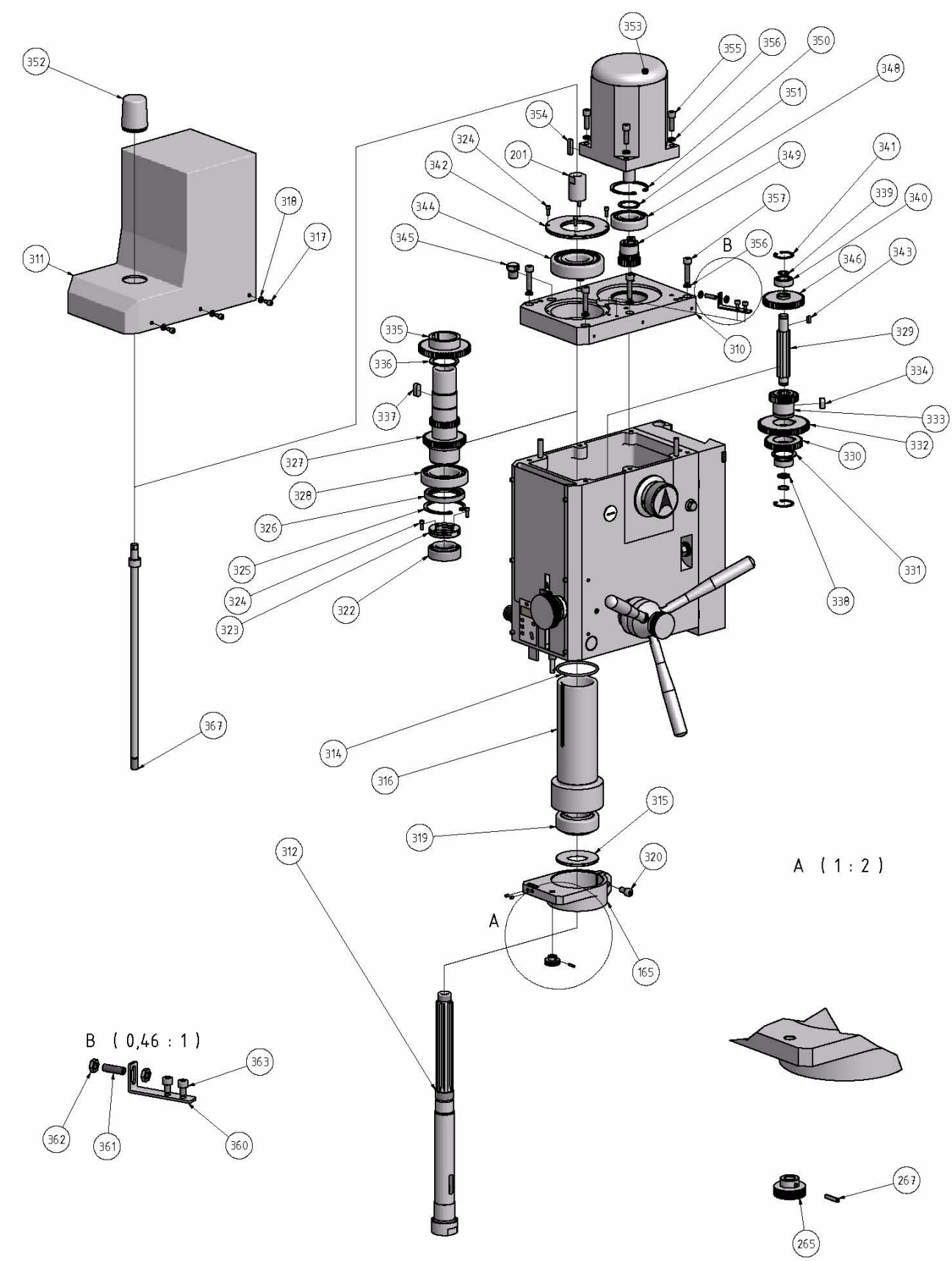
6.4 Schutzeinrichtung - Protection device



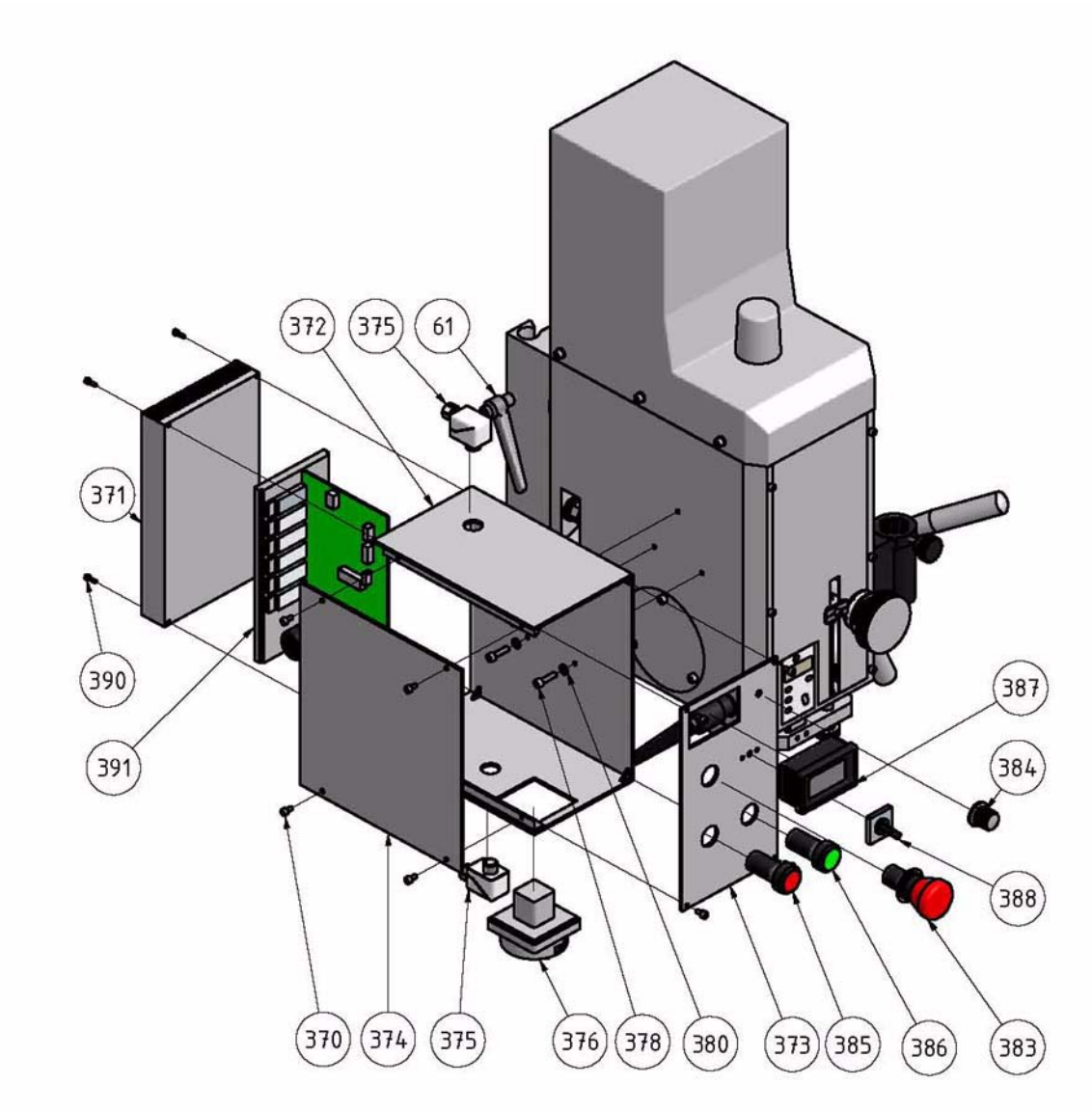
6.5 Fräskopf - Milling head 1 - 3



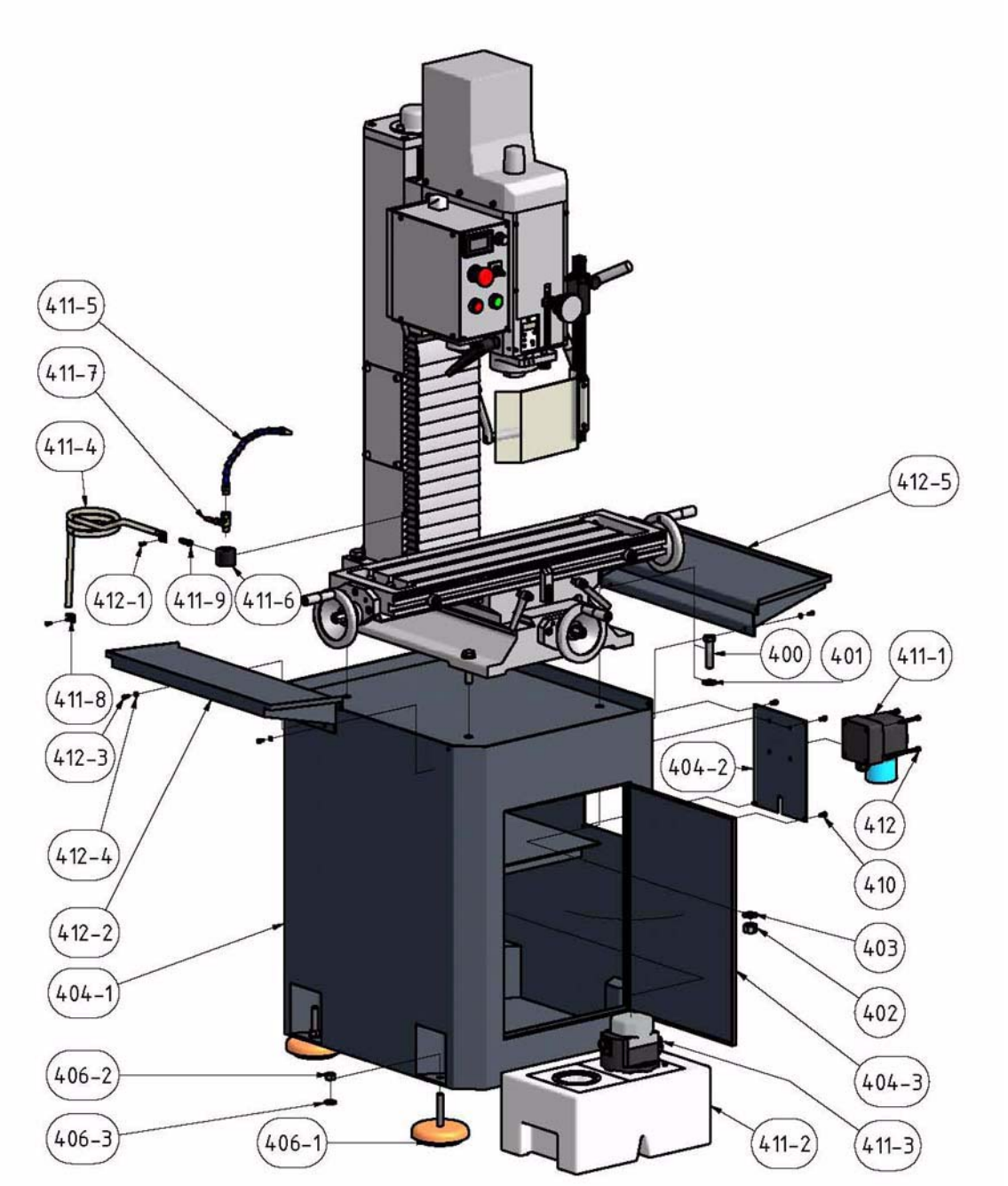
6.6 Fräskopf - Milling head 2 - 3



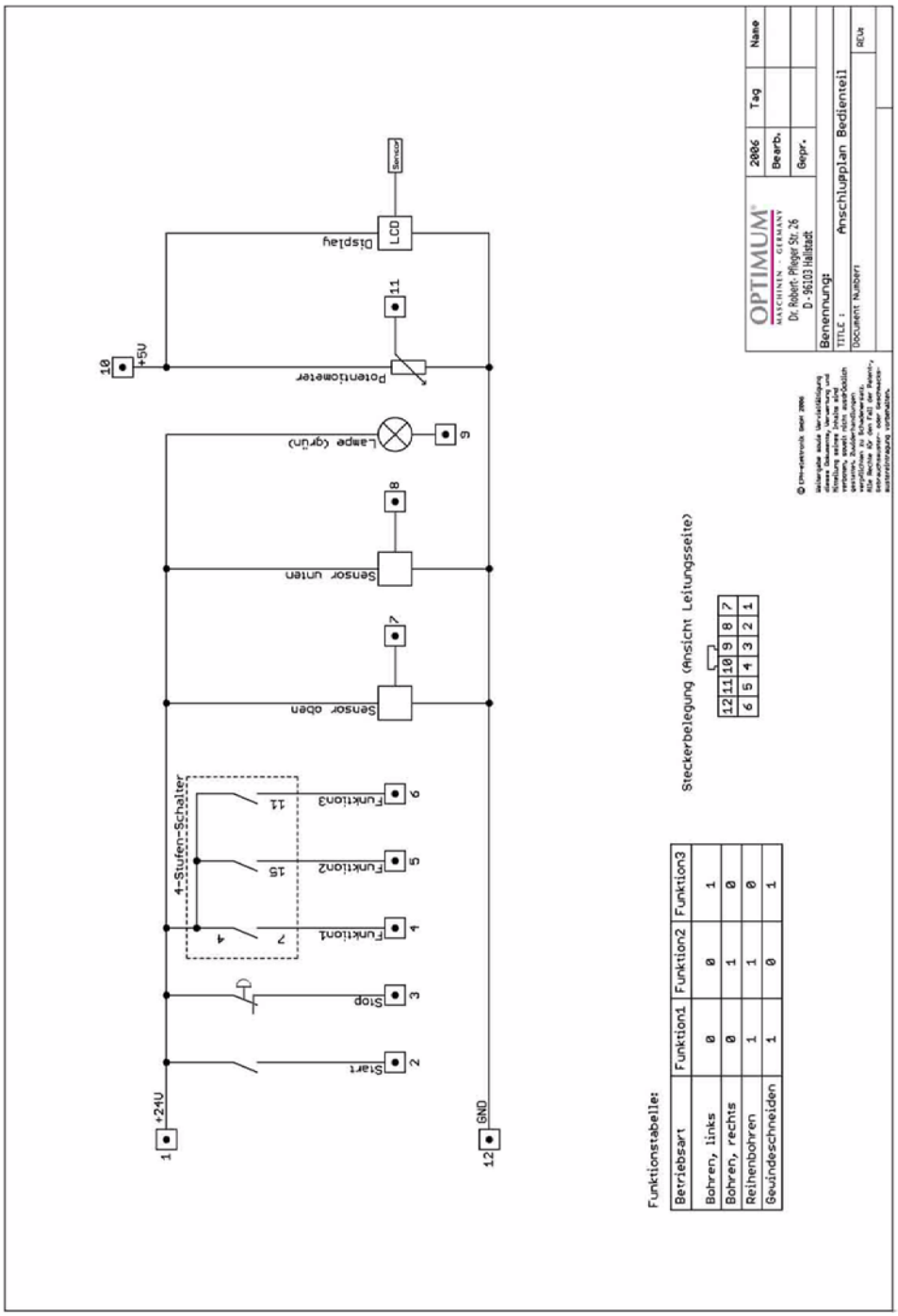
6.7 Fräskopf - Milling head 3 - 3



6.8 Maschinenunterbau (Optional) - Machine stand (option)



6.9 Schaltplan - Wiring diagram



Betriebsart	Funktion1	Funktion2	Funktion3
Bohren, links	0	0	1
Bohren, rechts	0	1	0
Reihenbohren	1	1	0
Gewindeschneiden	1	0	1

6.10 Teileliste - Parts list

Pos.	Bezeichnung	Designation	Menge	Zeichnungs-nummer	Grösse	Artikel-nummer
			Qty.	Drawing no.	Size	Item no.
1	Säule	Column	1	1026303		033384301
2	Träger Spindelmutter Z-Achse	Support spindle nut z axis	1	1026306		033384302
3	Spindelmutter zweiteilig, Z-Achse Unterteil	Spindle nut two-piece, z axis lower part	1	1026307		033384303
4	Lagerbock Höhenverstellung Z-Achse	Clevis mounting vertical adjustment z axis	1	1026309-0		033384304
5	Flansch, Welle Höhenverstellung Z-Achse	Flange, shaft vertical adjustment z axis	1	1026309		033384305
6	Abdeckblech Säule	Cover plate column	1	1026301		033384306
7	Spindelabdekkung Y und Z Achse	Spindle cover Y and Z axis	1	1015222		033384307
8	Lagerbock, Deckel Säule	Clevis mounting, cover column	1	1026304		033384308
9	Spindel Z-Achse	Spindle z - axis	1	1026308		033384309
10	Lagerdeckel	Bearing cover	1	1015315		0333843010
11	Spindelmutter zweiteilig, Z-Achse Oberteil	Spindle nut two-piece, z axis upper section	1	1026305		0333843011
12	Scheibe	Disk	1	1015302		0333843012
13-1	Kegelzahnrad 21 Zähne	Taper gear wheel 21 teeths	1	1015303_304	21/42,2	03338430131
13-2	Kegelzahnrad 42 Zähne	Taper gear wheel 42 teeths	1	1015303_304	21/42,2	03338430132
14	Welle	Shaft	1	1026310		0333843014
15	Innensechskantschraube	Socket head screw	8	GB 70-85	M8 x 25	0333843015
16	Innensechskantschraube	Socket head screw	8	GB 70-85	M6 x 14	0333843016
17	Innensechskantschraube	Socket head screw	3	GB 70-85	M8 x 20	0333843017
18	Scheibe	Disk	3	GB 97.1-85	8	0333843018
19	Innensechskantschraube	Socket head screw	5	GB 70-85	M8 x 16	0333843019
20	Innensechskantschraube	Socket head screw	3	GB 70-85	M6 x 20	0333843020
21	Federring	Lock washer	3	GB 93-87	M6	0333843021
22	Federring	Lock washer	4	GB 93-87	M8	0333843022
23	Rillenkugellager	Grooved ball bearing	1		6002-2Z	0333843023
24	Schrägkugellager, zweireihig	Skew-angle roller bearing, double-row	1		3204 A-2ZTN9_MT33	0333843024
25	Distanzring	Spacer	1	1015305		0333843025
26	Rillenkugellager	Grooved ball bearing	2		6004-2Z	0333843026
27	Sicherungsring	Snap ring	1	GB 893.1	42	0333843027
28	Sicherungsring	Snap ring	1	GB 893.1	32	0333843028
29	Distanzhülse Kegelzahnrad	Spacer taper gear wheel	1	1026302		0333843029
30	Paßfeder	Key	1	DIN 6885	A 5 x 5 x 20	0333843030
31	Paßfeder	Key	1	DIN 6885	A 6 x 6 x 20	0333843031
32	Nutmutter	Groove nut	2	BF30_DIN_1804	M16x1,5	0333843032
33	Skala Z-Achse	Scale z axis	1	1026501		0333843033
34	Federring	Lock washer	4	GB 93-87	M16	0333843034
35	Distanzhülse	Spacer	4	GB 95-85	16	0333843035
36	Sechskantschraube	Hexagon screw	4	GB/T 1228-91	M16x65	0333843036
37	Faltenbalg	Bellows	1	1026002		0333843037
38	Innensechskantschraube	Socket head screw	4	GB 70-85	M5 x 10	0333843038
39	Skala	Scale	1	1026211		0333843039
40	Handkurbel	Crank	1	B26-01-09		0333843040
41	Griff komplett	Handle complete	1	JB-T7270.4-1994		0333843041
41-1	Hülse	Case	1	JB-T7270.4-1994-1		03338430411
41-2	Schraube	Screw	1	JB-T7270.4-1994-2		03338430412
42	Laufring Skala	Center ring scale	1	1026210_Ring		0333843042
43	Innensechskant - Stiftschraube	Threaded pin	1	GB 77-85	M4 x 6	0333843043
44	Federblech	Spring plate	1	D140-04-09		0333843044
45	Drehlagerbock Fräskopf	Turning clevis mounting milling head	1	1026118		0333843045
49	Handrad	Handwheel	1	1026210		0333843049
50	Klemmutter Handrad	Clamping nut handwheel	1	1026209		0333843050
51	Griff komplett	Handle complete	1	JB-T7270.4-1994		0333843051
51-1	Hülse	Case	1	JB-T7270.4-1994-1		03338430511
51-2	Schraube	Screw	1	JB-T7270.4-1994-2		03338430512
53	Gewindestift	Set screw	1	GB 77-85	M12 x 10	0333843053
54	Paßfeder	Key	1	DIN 6885	A 5 x 5 x	0333843054
55	Federblech	Spring plate	1	D140-04-09		0333843055
56	Skalenring Kreuztisch	Skale ring cross table	1	1026211		0333843056
59	Kreuztischführung	Cross table guidance	1	1026207		0333843059
60	Marke Längenmessung Kreuztisch	Zero point - linear measurement cross table	1	1015204		0333843060
61	Klemmhebel	Locking lever	6	JB-T7270.12-1994		0333843061
65	Innensechskantschraube	Socket head screw	10	GB 70-85	M8 x 16	0333843065
67	Stellschraube Keilleiste	Adjusting screw taper gib	4	1015002		0333843067

Pos.	Bezeichnung	Designation	Menge	Zeichnungs-nummer	Grösse	Artikel-nummer
			Qty.	Drawing no.	Size	Item no.
68-1	Keilleiste Kreuztisch X-Achse links	Taper gib cross table x axis left side	1	1026204		03338430681
68-2	Keilleiste Kreuztisch Y-Achse hinten	Taper gib cross table y axis back	1	1026214		03338430682
69	Innensechskantschraube	Socket head screw	11	GB 70-85	M8 x 25	0333843069
70	Federring	Lock washer	2	GB 93-87	M8	0333843070
71	Rillenkugellager	Grooved ball bearing	2		6002-2Z	0333843071
72	Sicherungsring	Snap ring	3	GB 893.1	32	0333843072
73	Spindelabdekkung Y und Z Achse	Spindle cover Y and Z axis	1	1015222		0333843073
74	Innensechskantschraube	Socket head screw	2	GB 70-85	M5 x 14	0333843074
75	Zylinderstift	Cylindrical pin	6	GB 120-86	8 x 35	0333843075
76	Maschinenfuss	Machine food	1	1026202		0333843076
77	Lagerbock Spindel Kreuztisch Y-Achse vorne	Clevis mounting spindle cross table y axis in front	1	1026201		0333843077
78	Spindel Y-Achse Kreuztisch	Spindle cross table y axis	1	1026203		0333843078
79	Spindelmutter Kreuztisch Y-Achse	Spindle nut cross table y axis	1	1026213		0333843079
80	Lagerbock Spindel Kreuztisch Y-Achse hinten	Clevis mounting spindle cross table y axis in the back	1	1026208		0333843080
83	Distanzring Lagerbock Kreuztisch X-Achse rechts	Spacer ring clevis mounting cross table x axis right side	2	1026218		0333843083
84	Scheibe	Washer	3	GB 97.1-85	8	0333843084
85	Gummiabdekkung	Rubber cover	1	1026004-A		0333843085
86	Klemmleiste	Strip	1	1026004		0333843086
87	Innensechskantschraube	Socket head screw	2	GB 70-85	M5 x 10	0333843087
88	Sechskantschraube	Hexagon screw	4	GB 5780-86	M14 x 60	0333843088
89	Scheibe	Washer	4	GB 95-85	14	0333843089
90	Federring	Lock washer	4	GB 7244-87	14	0333843090
91	Sechskantmutter	Hexagon nut	4	GB 6170-86	M14	0333843091
92	Axial-Schrägkugellager	Grooved ball bearing	2	7202AC	15x32x11	0333843092
101	Frästisch	Milling table	1	1026206		03338430101
102	Lagerbock Spindel Kreuztisch X-Achse rechts	Clevis mounting spindle cross table x axis right side	1	1026217		03338430102
103	Lagerbock Spindel Kreuztisch X-Achse links	Clevis mounting spindle cross table x axis left side	1	1026212		03338430103
104	Handrad	Handwheel	2	1026210		03338430104
105	Klemmmutter Handrad	Clamping nut handwheel	2	1026209		03338430105
106	Griff komplett	Handle complete	2	JB-T7270.4-1994	JB-T7270.4-1994	03338430106
106-1	Hülse	Case	2	JB-T7270.4-1994-1	JB-T7270.4-1994-1	033384301061
106-2	Schraube	Screw	2	JB-T7270.4-1994-2	JB-T7270.4-1994-2	033384301062
107	Innensechskant - Stiftschraube	Threaded pin	3	GB 77-85	M12 x 10	03338430107
108	Paßfeder	Key	3	DIN 6885	A 5 x 5 x 14	03338430108
109	Federblech	Spring plate	2	D140-04-09		03338430109
110	Skalenring Kreuztisch	Skale ring cross table	2	1026211		03338430110
111	Spindel X-Achse Kreuztisch	Spindle x axis cross table	1	1026215		03338430111
112	Spindelmutter Kreuztisch Y - Achse	Spindle nut cross table y axis	1	1026205		03338430112
116	Rechteckmutter, Nutenstein Endanschlag Kreuztisch X-Achse	Rectangle nut, slots stone end stop, cross table x axis	2	BF46_1015206		03338430116
117	Hülse Endanschlag Kreuztisch X-Achse	Collar end stop, cross table x axis	2	BF46_1015205		03338430117
118	Innensechskantschraube	Socket head screw	2	GB 70-85	M8 x 20	03338430118
119	Innensechskantschraube	Socket head screw	10	GB 70-85	M8 x 16	03338430119
120	Skala Z-Achse	Skale z axis	1	1026504		03338430120
123	Innensechskantschraube	Socket head screw	11	GB 70-85	M8 x 25	03338430123
124	Rillenkugellager	Grooved ball bearing	2		6002-2Z	03338430124
125	Axial-Schrägkugellager	Grooved ball bearing	2	7202AC	15x32x11	03338430125
126	Sicherungsring	Snap ring	3	GB 893.1	32	03338430126
128	Innensechskantschraube	Socket head screw	2	GB 70-85	M5 x 14	03338430128
129	Zylinderstift	Cylindrical pin	6	GB 120-86	8 x 35	03338430129
135	Einschraubanschluss Kühlmittelabfluss	Screwing in connection coolant drainage	1	BF46_1015217		03338430135
136	Scheibe	Washer	1	1026216		03338430136
137	Distanzring Lagerbock Kreuztisch X-Achse rechts	Spacer ring clevis mounting cross table x axis right side	2	1026218		03338430137
145	Halter Schutzeinrichtung komplett	Support protection device complete	1			03338430145
145-1	Gehäuse	Housing	1			033384301451
145-2	Aluminium Profilaufnahme	Aluminium profile admission	1			033384301452
145-3	Deckel	Cover	1			033384301453
145-4	Federblech	Spring plate	1			033384301454
145-5	Stahlkugel	Steel ball	1			033384301455
145-6	Schraube	Screw	2			033384301456
145-7	Mikroschalter	Micro switch	1			033384301457
146	Schutz	Protection	1			03338430146

Pos.	Bezeichnung	Designation	Menge	Zeichnungs-nummer	Grösse	Artikel-nummer
			Qty.	Drawing no.	Size	Item no.
147	Aluminiumprofil	Aluminium profile	1			03338430147
148	Klemmschraube	Clamping scew	1			03338430148
149	Innensechskantschraube	Socket head screw	2	GB 70-85	M6 x 20	03338430149
150	Senkschraube mit Kreuzschlitz	Recessed countersunk flat head screw	2	GB 819-85	M5 x 12	03338430150
154	Innensechskantschraube	Socket head screw	2	GB 70-85	M6 x 10	03338430154
160	Gehäuse Fräskopf	Housing milling head	1	1026104_A		03338430160
164	Drehlagerbock Fräskopf	Turning clevis mounting milling head	1	1026118		03338430164
165	Halter	Support	1	1026103		03338430165
173	Innensechskant - Stiftschraube	Threaded pin	2	GB 77-85	M4 x 6	03338430173
174	Gewindestift geschlitzt mit langem Zapfen	Hexagon socket set scres with half-dog point	1	GB 79-85	M8 x 2	03338430174
175	Sechskantmutter	Hexagon nut	1	GB 6170-86	M8	03338430175
198	Rillenkugellager	Grooved ball bearing	1		6308-2RZ	03338430198
201	Gegenhalter	Holder	1	1026113		03338430201
212	Zylinderstift	Cylindrical pin	2	GB 119-86	A 8 x 50	03338430212
213	Innensechskantschraube	Socket head screw	1	GB 70-85	M10 x 30	03338430213
214	Federring	Lock washer	1	GB 93-87	M10	03338430214
215	Führungsstück	Guiding piece	1	1026119		03338430215
216	Sechskantschraube	Hexagon screw	1	GB 5782-86	M12x60	03338430216
217	Federring	Lock washer	4	GB 93-87	M12	03338430217
218	Scheibe	Washer	1	GB 96-85	12	03338430218
219	Vierkantschraube	Square head bolt	1	GB 35-88	M12x80	03338430219
220	Scheibe	Washer	3	GB 97.1-85	12	03338430220
221	Sechskantmutter	Hexagon nut	3	GB 6170-86	M12	03338430221
222	Vierkantschraube	Square head bolt	2	GB 35-880	M12x50	03338430222
223	Verzahnte Welle	Toothed shaft	1	1026127		03338430223
224	Mitnehmerscheibe Spiralfeder	Driving disk spiral spring	1	1026135		03338430224
225	Schneckenrad	Taper gear wheel	1	1026125		03338430225
226	Paßfeder	Key	1	DIN 6885	A 6 x 6 x 16	03338430226
227	Griffhebel	Lever	3	1026124		03338430227
228	Druckfeder Feinvorschub	Compression spring micro feed	1			03338430228
228-1	Druckfeder Feinvorschub	Compression spring micro feed	1			033384302281
229	Klemmbolzen Pinole rechts	Clamping pin spindle sleeve right side	1	1026129		03338430229
230	Klemmbolzen Pinole links	Clamping pin spindle sleeve left side	1	1026130		03338430230
231	Klemmhebel Pinole	Release handle sleeve	1			03338430231
232	Rändelscheibe Kupplung Feinvor-schub	Knurling tool disk clutch micro feed	1	BF46_1015128-1		03338430232
233	Gewindestange Feinvorschub	Threaded rod micro feed	1	BF46_1015128-2		03338430233
234	Spannstift, Rändelscheibe Kupp-lung-Gewindestange	Spring pin, threaded rod - knurling disk clutch	1	GB 879-86	4 x 24	03338430234
235	Sicherungsring	Snap ring	1	GB 894.1 - 22	22	03338430235
236	Aufnahmescheibe Schaltgabel	Support shift fork	1	1026132		03338430236
237	Senkschraube mit Kreuzschlitz	Recessed countersunk flat head screw	3	GB 819-85	M5x10	03338430237
238	O-Ring	O-ring	1	GB 3452-1	20 x 2.65 G	03338430238
239	O-Ring	O-ring	1	GB 3452-1	6.9 x 1.8 G	03338430239
240	Welle Schaltgabel	Shaft shift fork	1	1026131		03338430240
241	Arm Schaltgabel	Arm shift fork	1	1026121		03338430241
242	Schaltgabel	Shift fork	1	1026120		03338430242
243	Sicherungsring	Snap ring	1	GB 894.1	10	03338430243
244	Innensechskant - Stiftschraube	Threaded pin	1	GB 80-85	M5 x 8	03338430244
245	Wahldrehschalter Getriebe	Choice rotary switch transmission	1	BF46_1015132		03338430245
246	Innensechskant - Stiftschraube	Threaded pin	1	GB 77-85	M8 x 8	03338430246
247	Stahlkugel	Steel ball	1			03338430247
248	Positionsdekkel Wahldrehschalter	Position cover choice rotary switch	1	BF46_1015506		03338430248
249	Schneckenwelle	Worm shaft	1			03338430249
250	Zylinderstift	Cylindrical pin	1	GB 120-86	8 x 50	03338430250
251	Skalenring Feinvorschub Pinole	Scale ring micro feed spindle sleeve	1	BF46_1015130		03338430251
252	Rändelscheibe Feinvorschub Pin-ole	Knurling tool disk micro feed spindle sleeve	1	BF46_1015131		03338430252
253	Innensechskant - Stiftschraube	Threaded pin	1	GB 77-85 - M6 x 8	M6 x 8	03338430253
254	Federblech	Spring plate	1	D140-04-09		03338430254
255	Abdeckung Federhaeuse	Barrier barrel	1	1026128		03338430255
256	Innensechskantschraube	Socket head screw	3	GB 70-85	M5 x 8	03338430256
257	Spiralfeder - Rückholfeder Pinole	Spiral spring - return spring spindle sleeve	1	BF46_1015137		03338430257
258	Abeckung Spiralfeder	Cover spiral spring	1	BF46_1015120		03338430258
259	Innensechskantschraube	Socket head screw	3	GB 70-85	M5 x 12	03338430259
260	Zylinderschraube mit Kreuzschlitz	Recessed head raised fillister head screw	1	GB 822-88	M5 x 10	03338430260

Pos.	Bezeichnung	Designation	Menge	Zeichnungs-nummer	Grösse	Artikel-nummer
			Qty.	Drawing no.	Size	Item no.
261	Innensechskant - Stiftschraube	Threaded pin	2	GB879-86	M3x10	03338430261
262	Scheibe	Washer	1	BF46_1015140		03338430262
263	Innensechskantschraube	Socket head screw	2	GB 70-85	M6 x 10	03338430263
264	Gewindestange Bohrtiefenanschlag	Threaded rod drilling depth stop	1	1026122		03338430264
265	Rändelscheibe Bohrtiefenanschlag	Knurling tool disk drilling depth stop	1	BF46_1015123		03338430265
266	Bohrtiefenanschlag	Drilling depth stop	1	BF46_1015122		03338430266
267	Spannstift	Spring pin	1	GB 879-86	3 x 14	03338430267
268	Innensechskant - Stiftschraube	Threaded pin	1	GB 78-85	M5 x 16	03338430268
269	Ölschauglas	Oil sight glas	1			03338430269
270	Sechskantschraube	Hexagon screw	1			03338430270
271	Innensechskantschraube	Socket head screw	14	GB 70-85	M4 x 8	03338430271
273	Stellschraube Keilleiste	Adjusting screw taper gib	2	BF46_1015002		03338430273
274	Keilleiste Fräskopf	Taper gib milling head	1	1026001		03338430274
275	Winkelskala	Angle scale	2	1026503		03338430275
276	Digitale Anzeige Feinvorschub (Bohrtiefe)	Digital indicator micro feed (drilling depth)	1			03338430276
276-1	Schutzabdeckung	Prodective cover	1			033384302761
276-2	Innensechskantschraube	Hexagon socket screw	2			033384302762
277	Innensechskant - Stiftschraube	Threaded pin	2	GB 77-85	M6 x 20	03338430277
278	Marke Winkelskala Säule	Zero point - scale column	2	DM14-BP-07-2		03338430278
280	Anzeiger Bohrtiefenanschlag	indicator drilling depth stop	1			03338430280
281	Innensechskantschraube	Socket head screw	1	GB 70-85	M4 x 10	03338430281
282	Scheibe	Washer	1	GB 955-87	4	03338430282
283	Blende Fräskopf	Screen milling head	1			03338430283
284	Blende Getriebe	Screen gearbox	1			03338430284
285	Sechskantmutter	Hexagon nut	4			03338430285
286	Sensor Endschalter	Sensor position switch	2			03338430286
287	Winkel Endschalter	Angle plate position switch	1			03338430287
288	Innensechskantschraube	Socket head screw	6	GB 70-85	M3 x 6	03338430288
289	Leiste Endschalter	Band position switch	1			03338430289
305	Nabe Sterngriff Pinolenvorschub	Hub star grip spindle sleeve feed	1	1026126-A		03338430305
310	Fräskopf Gehäusedekkel	Milling head housing cover	1	1026133		03338430310
311	Motorhaube	Motor cover	1	1026112		03338430311
312	Spindel	Spindle	1	1026101		03338430312
314	O-Ring	O-ring	1	GB 3452-1	65 x 3.55 G	03338430314
315	Distanzring	Spacer	1	1026102		03338430315
316	Pinole	Spindle sleeve	1	1026105		03338430316
317	Innensechskantschraube	Socket head screw	6	GB 70-85	M5 x 10	03338430317
318	Scheibe	Washer	6	GB 97.1-85	5	03338430318
319	Kegelrollenlager	Taper roller bearing	1	33207_Q		03338430319
320	Innensechskantschraube	Socket head screw	1	GB 70-85	M8 x 16	03338430320
322	Kegelrollenlager	Taper roller bearing	1	GB/T 297-94 - 33006		03338430322
323	Klemmmutter Spindellager	Clamping nut spindle bearings	1	1026106		03338430323
324	Innensechskantschraube	Socket head screw	6	GB 70-85	M4 x 12	03338430324
325	Sicherungsring	Snap ring	1	GB 893.1	68	03338430325
326	Radial-Wellendichtring	Radial rotary shaft seal	1	GB 13871 - FormFB	50 x 68 x 8	03338430326
327	Verzahnte Antriebswelle	Toothed drive shaft	1	1026107		03338430327
328	Rillenkugellager	Grooved ball bearing	1	6010-2RZ		03338430328
329	Welle	Shaft	1	1026115-A		03338430329
330	Stirnrad 41 Zähne, Modul 1.5, geradverzahnt	Gear wheel of 41 teeth, module 1.5, straight tooths	1	1026108		03338430330
331	Sicherungsring	Snap ring	1	GB 894.1	35	03338430331
332	Stirnrad 56 Zähne, Modul 1.5, geradverzahnt	Gear wheel of 56 teeth, module 1.5, straight tooths	1	1026109		03338430332
333	Stirnrad 31 Zähne Modul 2, geradverzahnt	Gear wheel of 31 teeth, module 2, straight tooths	1	1026111		03338430333
334	Paßfeder	Key	1	DIN 6885	A 8 x 7 x 18	03338430334
335	Stirnrad 57 Zähne Modul 2, geradverzahnt	Gear wheel of 57 teeth, module 2, straight tooths	1	1026110		03338430335
336	Sicherungsring	Snap ring	1	GB 894.1	42	03338430336
337	Paßfeder	Key	1	DIN 6885	A 10 x 8 x 22	03338430337
338	Distanzring	Spacer	1	1026117-0		03338430338
339	Sicherungsring	Snap ring	2	GB 894.1	15	03338430339
340	Rillenkugellager	Grooved ball bearing	2	6002-2Z		03338430340
341	Sicherungsring	Snap ring	2	GB 893.1	32	03338430341
342	Lagerdeckel	Bearing cover	1	1026134		03338430342
343	Paßfeder	Key	1	DIN 6885	A 5 x 5 x 12	03338430343
344	Rillenkugellager	Grooved ball bearing	1	6308-2RZ		03338430344
345	Belüftungsschraube Getriebe	Vent screw transmission	1	BF46_1015142		03338430345
346	Stirnrad 45 Zähne Modul 2, geradverzahnt	Gear wheel of 45 teeth, module 2, straight tooths	1	1026114		03338430346

Pos.	Bezeichnung	Designation	Menge	Zeichnungs-nummer	Grösse	Artikel-nummer
			Qty.	Drawing no.	Size	Item no.
348	Rillenkugellager	Grooved ball bearing	1	6206-2Z		03338430348
349	Stirnrad-Motor 23 Zähne Modul 2, geradverzahnt	Gear wheel motor of 23 teeth, module 2, straight tooths	1	1026116		03338430349
350	Sicherungsring	Snap ring	1	GB 893.1	62	03338430350
351	Sicherungsring	Snap ring	1	GB 894.1	30	03338430351
352	Abdeckkappe Anzugsstange	Cover screw rod	1	DM14-01-09		03338430352
353	Motor	Motor	1			03338430353
354	Paßfeder	Key	1	CNS 169	6 x 6 x 28	03338430354
355	Innensechskantschraube	Socket head screw	4	GB 70-85	M8 x 25	03338430355
356	Federring	Lock washer	10	GB 93-87	M8	03338430356
357	Innensechskantschraube	Socket head screw	6	GB 70-85	M8 x 35	03338430357
360	Winkel Drehzahlmesser	Angle rotational-speed	1			03338430360
361	Sensor Drehzahlmesser	Rotational-speed sensor	1			03338430361
362	Sechskantmutter	Hexagon nut	2			03338430362
363	Innensechskantschraube	Socket head screw	2	GB 70-85	M3 x 6	03338430363
367	Anzugsstange MK3 Spindel	Screw rod MK3 spindle	1			03338430367
370	Innensechskantschraube	Socket head screw	14	GB 70-85	M4 x 8	03338430370
371	Schaltkasten - Abdeckung mit Wärmeableitung	Electric box - cover with heat dissipation	1			03338430371
372	Schaltkasten - Gehäuse	Electric box - housing	1			03338430372
373	Schaltkasten - Schaltertafel	Electric box - switch plate	1			03338430373
374	Schaltkasten - Deckel	Electric box - cover	1			03338430374
375	Zugentlastung Anschlusskabel Schaltkasten	Strain relief lead switchbox	2			03338430375
376	Hauptschalter	Main switch	1			03338430376
378	Innensechskantschraube	Socket head screw	3	GB 70-85	M5 x 20	03338430378
380	Federring	Lock washer	3	GB 93-87	M5	03338430380
383	Not Aus Schlagschalter	Emergency OFF push button	1			03338430383
384	Potentiometer	Potentiometer	1			03338430384
385	Drucktaster Aus	Push button off	1			03338430385
386	Drucktaster Ein	Push button on	1			03338430386
387	Elektronische Anzeige	Electronic display	1			03338430387
388	Schalter Drehrichtung	Change over switch	1			03338430388
390	Innensechskantschraube	Socket head screw	4	GB 70-85	M3 x 10	03338430390
391	Steuerplatine	Control board	1	BF46_03338453700		03338430391
400	Sechskantschraube	Hexagon screw	4	GB 5780-86	M14x60	03338430400
401	Scheibe	Washer	4	GB 95-85	14	03338430401
402	Sechskantmutter	Hexagon nut	4	GB 6170-86	M16	03338430402
403	Scheibe	Washer	4	GB 95-85	16	03338430403
404	Maschinenunterbau komplett, optional	Machine stand complete, option	1			03338430404
404-1	Maschinenunterbau	Machine stand	1			033384304041
404-2	Befestigungsblech Kühlmittelpumpe	Fixing plate coolant pump	1			033384304042
404-3	Tür Maschinenunterbau	Door machine stand	1			033384304043
406	Nivellier- Schwingelement SE1 komplett, optional	Levelling- damping element SE1 complete, option	1			03381012
	Nivellier- Schwingelement SE2 komplett, optional	Levelling- damping element SE2 complete, option	1			03381016
406-1	Nivellier- Schwingelement SE1	Levelling- damping element SE1	1			033810121
	Nivellier- Schwingelement SE2	Levelling- damping element SE2	1			033810161
406-2	Sechskantmutter SE1	Hexagon nut SE1	1			033810122
	Sechskantmutter SE2	Hexagon nut SE2	1	GB 6170-86	M12	033810162
406-3	Scheibe SE1	Washer SE1	1			033810123
	Scheibe SE2	Washer SE2	1	GB 95-85	12	033810163
410	Innensechskantschraube	Socket head screw	4	GB 70-85	M5 x 10	03338430410
411	Universal-Kühlmitteleinrichtung 230 V komplett, optional	Universal coolant adjustment 230 V complete, option	1			03352002
	Universal-Kühlmitteleinrichtung 400 V komplett, optional	Universal coolant adjustment 400 V complete, option	1			03352001
411-1	Schalter-Stecker-Kombination 230 V	ON/OFF switch combination 230 V	1			033520021
	Schalter-Stecker-Kombination 400 V	ON/OFF switch combination 400 V	1			033520011
411-2	Kühlmittelbehälter 230 V	Coolant reservoir 230 V	1			033520022
	Kühlmittelbehälter 400 V	Coolant reservoir 400 V	1			033520012
411-3	Kühlmittelumpe 230 V	Coolant pump 230 V	1			033520023
	Kühlmittelumpe 400 V	Coolant pump 400 V	1			033520013
411-4	Kühlmittelschlauch 230 V	Coolant hose 230 V	1			033520024
	Kühlmittelschlauch 400 V	Coolant hose 400 V	1			033520014

Pos.	Bezeichnung	Designation	Menge	Zeichnungs-nummer	Grösse	Artikel-nummer
			Qty.	Drawing no.	Size	Item no.
411-5	Flexibler Kühlmittelschlauch 230 V	Flexible coolant hose 230 V	1			033520025
	Flexibler Kühlmittelschlauch 400 V	Flexible coolant hose 400 V	1			033520015
411-6	Befestigung Magnetfuss 230 V	Attachment magnet foot 230 V	1			033520026
	Befestigung Magnetfuss 400 V	Attachment magnet foot 400 V	1			033520016
411-7	Kugelhahn 230 V	Ball valve 230 V	1			033520027
	Kugelhahn 400 V	Ball valve 400 V	1			033520017
411-8	Schlauchbinder 230V	Hose binder 230 V	1			033520028
	Schlauchbinder 400V	Hose binder 400 V	1			033520018
411-9	Schlauchverbinder 230 V	Hose fitting 230 V	1			033520029
	Schlauchverbinder 400 V	Hose fitting 400 V	1			033520019
412	Innensechskantschraube	Socket head screw	4	GB 70-85	M5 x 50	03338430412
412-1	Innensechskantschraube	Socket head screw	2	GB 70-85	M4 x 10	033384304121
412-2	Auffangblech	Plate	1		4	033384304122
412-3	Innensechskantschraube	Socket head screw	4	GB 70-85	M4 x 10	033384304123
412-4	Scheibe	Washer	4	GB 97.1-85	4	033384304124
412-5	Auffangblech	Plate	1			033384304125

7 Anomalies

7.1 Anomalies in the drilling-milling machine

Problem	Cause/ possible effects	Solution
drilling-milling machine does not start	• Start sequence not followed.	• ☞ „Starting the drilling-milling machine“ on page 23 • Have it checked by authorised personnel.
Tool „burn“.	• Incorrect speed. • The chips have not been removed from the bore hole. • Tool blunt. • Operating without cooling agent.	• Select another speed, feed too high. • Retract tool more often • Sharpen and replace tool. • Use coolant.
Impossible to insert holding taper into the spindle sleeve.	• Remove any dirt, grease or oil from the internal conical surface of the spindle sleeve or the holding taper.	• Clean surfaces well. Keep surfaces free of grease.
Taper cannot be squeezed out	• Optional MT 3 taper seat shrinked on morse cone.	• Have the machine heat-up at highest speed for about two minutes and then try again to disassemble the taper.
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 lever of the movement axes not tightened. • Loose collet chuck, loose drill chuck, loose draw-in rod • Tool blunt. • Workpiece is not fixed. • Excessive slack in bearing. • Working spindle goes up and down.	• Perform conventional milling machining. • Tighten clamping lever • Check, re-tighten. • Sharpen or replace tool • Secure the workpiece properly. • Readjust bearing slack or replace bearing. • Readjust bearing slack or replace bearing.
Fine feed of spindle sleeve does not work	• Fine feed is not correctly activated • Clutch of the fine feed does not engage, is dirty, smeared, worn or defective	• ☞ „Manual spindle sleeve feed with the fine feed“ on page 27 • Clean, replace

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 holding, 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 drilling-milling 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 advancing the bit
Quick-action drill chuck	Bit holding fixture can be tightened manually.
Workpiece	Piece to be drilled or machined.
Tool	Milling cutter, drill bit, countersink, etc.

8.3 Warranty

Within the terms of warranty, the company Optimum warrants for a perfect quality of its products and will reimburse any cost for overhaul or exchange of defective parts in case of construction error, fault in material and / or defect of fabrication.

The term of warranty for commercial use is 12 months and for use as an amateur it is 24 months. Condition for a warranty claim due to construction errors, faults in material, and / or defects of fabrication is:

- Proof of purchase and that the instructions for use had been followed.
  In order to assert the claim of warranty, you have to present a typescript original receipt of purchase. It must comprise the complete address, date of purchase and type designation of the product.
  The instruction for use for the corresponding device as well as the safety information need to be observed. Damages due to operator's mistakes may not be accepted as warranty claims.
- Correct use of the devices.
  The products of the company Optimum had been designed and built for certain purposes. They are listed in the operation manual.
  The warranty claim may not be accepted if the operating manual is not being followed or if it is used for a purpose which has not been intended or with improper accessory.
- Maintenance work and cleaning.
  It is absolutely necessary to maintain and clean the machine in regular intervals according to the prescriptions of the instruction for use.
  By intervention of a third party, any warranty claim will expire. Maintenance work and cleaning are usually not part of the claim of warranty.
- Original spare parts
  Make sure to use only original spare parts and original accessory. This can be acquired from authorised distributors of the machine.
  When other than original parts are being used, consequential damages may occur and dangerous accidents will increase. Disassembled or partially disassembled devices and devices which are repaired with foreign parts are excluded from warranty claims.
- Wearing parts
  Certain components are subject to wear out by time respectively a standard wear by use on the corresponding machine.
  Among these components are e.g. V-belts, ball bearings, switches, mains cables, gaskets, and washers, etc. These wearing parts are not part of the warranty.

8.4 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 handled as common household waist, 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 fellowmen. 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.

8.5 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 .

8.6 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

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

D-96103 Hallstadt

Fax +49 (0) 951 - 96 822 - 22
E-Mail: info@optimum-maschinen.de

8.7 EC Declaration of Conformity

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

hereby declares that the following product,

Type of machine: Drilling-Milling machine

Name of machine: BF 30 Vario

Relevant EU directives:

Machinery Directive 98/37/EG, Annex II A

EMC Directive 89/336/EWG

Low Voltage Directive 73/23/EWG

meets the provisions of the aforementioned directive, including any amendments valid at the time of this statement.

In order to ensure conformity, the following harmonised standards in particular have been applied:

EN 13128: 2001	Safety of machine tools: Milling and drilling machines
EN 62079	Preparing of instructions - structuring, content and presentation (IEC 62079:2001)

Thomas Collrep
(Manager)

Kilian Stürmer
(Manager)

Hallstadt, 16 / 09 / 2008

9 Index