OPTIMUM®
MASCHINEN - GERMANY

Operating Manual

Version 1.0.9

Milling machine

OPTImill® MF 2-B

Part no. 3348330

OPTImill® MF 4-B

Part no. 3348340

MF2-B

MF4-B

Table of contents

1 Safety

1.1 Glossary of symbols 6
1.2 Rating plates 6
1.3 Safety instructions (warning notes) 7
1.3.1 Classification of hazards 7
1.3.2 Other pictograms 7
1.4 Intended use 8
1.5 Reasonably foreseeable misuse 9
1.5.1 Avoiding misuse 9
1.6 Possible dangers posed by the milling machine 10
1.7 Qualification of personnel 10
1.7.1 Target group 10
1.7.2 Authorized persons 11
1.8 Operator positions 12
1.9 Safety devices 12
1.9.1 Lockable main switch 13
1.9.2 Emergency-stop push button 13
1.9.3 Control technical protection 13
1.9.4 Prohibition, warning and mandatory signs 13
1.10 Safety check 13
1.11 Personal protective equipment 14
1.12 Safety during operation 14
1.13 Safety during maintenance 15
1.14 Switching-off and securing the milling machine 15
1.14.1 Using lifting equipment 15
1.14.2 Mechanical maintenance work 16
1.15 Accident report 16
1.16 Electronics 16
1.17 Inspection deadlines 17
1.18 Clamping devices for workpieces and tools 17
1.19 Environmental protection and water conservation 17

2 Technical specification

2.1 Electrical connection 18
2.2 Spindle seat 18
2.3 Spindle 18
2.4 Table feed 18
2.5 Milling table 18
2.11 Emissions 19
2.6 Milling head 19
2.7 Work area 19
2.8 Dimensions 19
2.9 Coolant equipment 19
2.10 Environmental conditions 19
2.12 Tools and tool holding fixtures 20

3 Delivery, interdepartmental transport, assembly and commissioning

3.1 Notes on transport, installation, commissioning 21
3.1.1 General risks during internal transport 21
3.2 Unpacking the machine 22
3.2.1 Accessories 22
3.3 Load suspension point 22
3.4 Set-up and assembly 24
3.4.1 Installation plan 24
3.4.2 Requirements regarding the installation site 25
3.5 Machine mounting 25
3.5.1 Anchor-free mounting 25
3.5.2 Anchored mounting 26
3.6 First commissioning 27
3.7 One-component paint 27
3.8 Cleaning the machine 27
3.8.1 Lubrication and oil levels 28
3.9 Function testing and mounting of accessories 28
3.9.1 Assembly of the drawbar 28
3.10 Warming up the machine 28
3.11 Electrical connection 28

MF2B_MF4B_GBIVZ.fm

4 Operation

4.1 Safety ... 30
4.2 Overview ... 31
4.3 Spindle speed ... 32
4.3.1 Operating of spindle gear ... 32
4.3.2 Infinitely variable speed adjustment ... 32
4.3.3 Selecting the speed ... 32
4.4 Switching on the machine ... 33
4.5 Switching off the machine ... 33
4.6 Power failure, Restoring readiness for operation ... 33
4.7 Stopping the machine in an emergency ... 33
4.8 Resetting an emergency stop condition ... 33
4.9 Clamping lever ... 33
4.10 Switching the feed on / off ... 35
4.11 Automatic spindle sleeve feed ... 35
4.12 Inclining the spindle head up or down ... 36
4.13 Orienting the spindle head to the right or left ... 37
4.14 Moving the spindle head-holder forward or back ... 37
4.15 Turning the spindle head-holder ... 38
4.16 Aligning the milling head ... 38
4.17 Clamping a tool ... 39
4.18 Removing tool ... 39
4.19 Adjusting spindle guard ... 39
4.20 Cooling agent ... 40
4.21 Central lubrication ... 40
4.22 Digital position display ... 40

5 Maintenance

5.1 Operating material ... 41
5.1.1 Machine lubricants ... 41
5.1.2 Cooling lubricants ... 41
5.2 Safety ... 42
5.2.1 Preparation ... 42
5.2.2 Restarting ... 42
5.3 Repair ... 43
5.3.1 Customer service technician ... 43
5.3.2 Cleaning the electrical cabinet ... 44
5.3.3 Play adjustment of the machine stand guide in the Z axis ... 44
5.3.4 Play adjustment of the guide in the X axis ... 45
5.3.5 Play adjustment of the guide in the Y axis ... 45
5.4 Adjustment of spindle nuts ... 46
5.4.1 Milling table ... 46
5.5 Quill return spring ... 47
5.6 Replacing of motor, belt and brakes ... 47
5.7 Inspection and maintenance ... 50
5.8 Cooling lubricants and tanks ... 53
5.8.1 Inspection plan for water-mixed cooling lubricants ... 54

6 Ersatzteile - Spare parts

6.1 Ersatzteilbestellung - Ordering spare parts ... 55
6.2 Hotline Ersatzteile - Spare parts Hotline ... 55
6.3 Service Hotline ... 55
6.4 Ersatzteilzeichnungen - Spare part drawings ... 56
6.5 Schaltplan - Wiring diagram ... 72

7 Malfunctions

7.1 Machine malfunctions ... 80

8 Appendix

8.1 Copyright ... 82
8.2 Changes ... 82
8.3 Product follow-up ... 82
8.4 Liability claims for defects / warranty ... 82
8.5 Storage ... 83
8.6 Advice for disposal / Options of re-use ... 84
8.6.1 Decommissioning ... 84
8.6.2 Disposal of new device packaging ... 84
8.6.3 Disposal of the machine ... 84
8.6.4 Disposal of electrical and electronic components ... 84
8.6.5 Disposal of lubricants and coolants ... 85
8.7 Disposal via municipal collection facilities ... 85
8.8 Terminology/Glossary ... 85

8.9 Change information operating manual....86
8.10 Genauigkeit der Maschine - Accuracy of the machine 88

Preface

Dear customer,

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

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

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

Information

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

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

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

The illustration and information included in the present manual can possibly deviate from the current state of construction of your machine. Being the manufacturer we are continuously seeking for improvements and renewal of the products. Therefore, changes might be performed without prior notice. The illustrations of the machine may be different from the illustrations in these instructions with regard to a few details. However, this does not have any influence on the operability of the machine.
Therefore, no claims may be derived from the indications and descriptions. Changes and errors are reserved !

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

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

Optimum Maschinen Germany GmbH

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Email: info@optimum-maschinen.de

1 Safety

This part of the operating instructions

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

In addition to these operation instructions, please observe

- the applicable laws and regulations,
- the statutory provisions for accident prevention,
- the prohibition, warning and mandatory signs as well as the warning notes on the milling machine.

Always keep this documentation close to the milling machine.

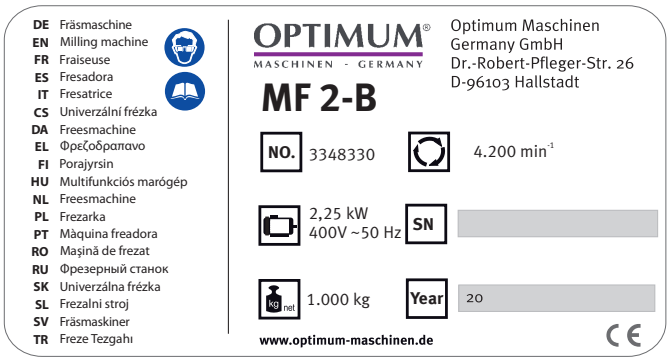
1.1 Glossary of symbols

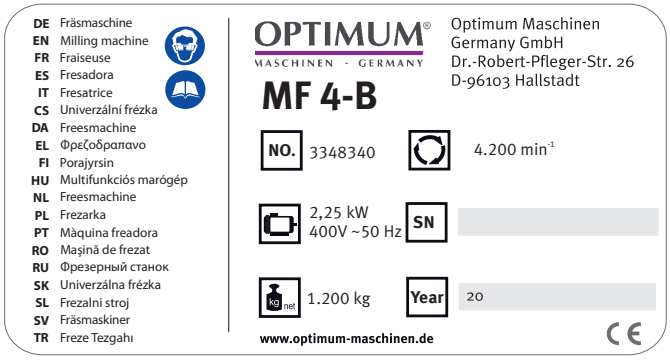
☞ provides further instructions

➜ calls on you to act

- listings

1.2 Rating plates





1.3 Safety instructions (warning notes)

1.3.1 Classification of hazards

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

Symbol	Alarm expression	Definition / consequence
	**DANGER!**	Impending danger that will cause serious injury or death to people.
	WARNING!	A danger that can cause serious injury or death.
	CAUTION!	A danger or unsafe procedure that can cause personal injury or damage to property.
	**ATTENTION!**	Situation that could cause damage to the milling machine and product, as well as other types of damage. No risk of injury to persons.
	**INFORMATION**	Practical tips and other important or useful information and notes. No dangerous or harmful consequences for people or objects.

In case of specific dangers, we replace the pictogram with


general danger


with a warning of


injury to hands,


hazardous electrical voltage,


rotating parts.

1.3.2 Other pictograms


Activation forbidden!


Do not step into the machine!


Do not extinguish with water!


Do not clean with compressed air!


Access forbidden!


Wear safety shoes!


Use ear protection!


Wear protective glasses!


Wear protective gloves!


Warning: biological hazard!


Warning: suspended loads!


Warning of oxidizing substances!


Caution, danger of explosive substances!


Warning: danger of slipping!

Do not turn unless the motor is running!


Filling position: oil


Oil outlet


Protect the environment!


Contact address

1.4 Intended use

WARNING!

In the event of improper use, the milling machine

- **may be a hazard to personnel,**
- **the machine and other property of the operating company and**
- **the functionality of the milling machine may be compromised.**

The 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 when commercial milling and drilling tools are used.
Using this machine it is possible to perform dry processing as well as processing by using cooling lubricants.

The limit values of the balances of the tools need to be observed.

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

The milling machine is designed and manufactured to be used in a non-explosive environment.

If the milling machine is used in any way other than described above, or modified without the approval of Maschinen Germany GmbH, then the milling machine is being used improperly. Intended use

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

We expressly point out that the guarantee or CE conformity will expire, if any constructive, technicalor procedural changes are not performed by the company Optimum Maschinen Germany GmbH.

It is also part of the intended use that you

- the limits of performance of the milling machine are observed,
- the operating manual is observed,
- the inspection and maintenance instructions are observed.

WARNING!

Extremely severe injuries due to non-intended use.

It is forbidden to make any modifications or alternations to the operating parameters values of the milling machine. They could pose an accident hazard to persons and cause damage to the milling machine.

1.5 Reasonably foreseeable misuse

Any other use other than that specified under "Intended use" or any use beyond the described use shall be deemed as non-intended use and is not permissible.

Any other use has to be discussed with the manufacturer.

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

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

Operators must be qualified.

1.5.1 Avoiding misuse

- ➜ Use of suitable cutting tools.
- ➜ Adapting the speed setting and feed to the material and workpiece.
- ➜ Clamp workpieces firmly and free of vibration.
- ➜ Risk of fire and explosion due to the use of flammable materials or cooling lubricants. Before processing inflammable materials (e.g. aluminium, magnesium) or using inflammable auxiliary materials (e.g. spirit), you need to take additional preventive measures in order to avoid health risks.
- ➜ When processing carbons, graphite and carbon-fibre-reinforced carbons, the machine is no longer being used as intended. This causes the warranty to be null and void. When processing carbons, graphite and carbon-fibre-reinforced carbons and similar materials, the machine can be damaged extremely quickly, even if the dusts generated are completely sucked out during the work process.

ATTENTION!

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

WARNING!

Risk of injury caused by flying workpieces.

Clamp the workpiece in the machine vice. Make sure that the workpiece is firmly clamped in the machine vice and that the machine vice is firmly clamped onto the machine table.

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

WARNING!

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

When milling make sure that

- ➜ the corresponding cutting speed is selected,
- ➜ for workpieces with normal strength values, e.g. steel 18-22 m/min,
- ➜ for workpieces with high strength values, 10-14 m/min,

➜ for hard materials commercial cooling / lubricating agents are used.

1.6 Possible dangers posed by the milling machine

The milling machine has been tested for operational safety. The construction and type are state of the art.

Nevertheless, there is a residual risk, as the milling machine operates with

- rotating parts,
- electrical voltage and currents,
- and an automatic feed.

We have used design and safety engineering to minimize the health risk to personnel resulting from these hazards.

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

INFORMATION

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

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

In the event of improper use

- there may be a risk to personnel,
- the milling machine and other property and
- the functionality of the milling machine may be compromised.

Always switch off the milling machine and disconnect it from the mains, when cleaning or maintenance work is carried out.

WARNING!

The milling machine may only be used with fully functional safety devices. Disconnect the milling machine immediately, whenever you detect a failure in the safety devices or when they are not fitted!

All additional parts of the machine which had been added by the customer need to be equipped with the prescribed safety devices. This is your responsibility being the operating company! ☞ **Safety devices on page 12**

1.7 Qualification of personnel

1.7.1 Target group

This manual is addressed to

- the operating companies,
- operators having sufficient specialist knowledge,
- the maintenance personnel.

Consequently, the warning notes refer both to the use of the milling machine and to its maintenance.

Determine clearly and explicitly who will be responsible for the different activities on the milling machine (operation, setting up, maintenance and repair). Please note the name of the responsible person into an operators´s log.

INFORMATION

Unclear responsibilities constitute a safety risk!

Always lock the main switch after switching off the milling machine. This will prevent it from being used by unauthorized persons.

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

Operator

The operator has been instructed by the operating company regarding the assigned tasks and possible risks in case of improper behaviour. Any tasks which need to be performed beyond the operation in standard mode must only be performed by the operator, if so indicated in these instructions and if the operator has been expressively commissioned by the operating company.

Qualified electrician

With professional training, knowledge and experience as well as knowledge of respective standards and regulations, qualified electricians are able to perform work on the electrical system and recognise and avoid any possible dangers.

Qualified electricians have been specially trained for the working environment, in which they are working and know the relevant standards and regulations.

Qualified personnel

Due to their professional training, knowledge and experience as well as knowledge of relevant regulations, qualified personnel are able to perform the assigned tasks and to independently recognise and avoid any possible dangers.

Instructed person

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

1.7.2 Authorized persons

INFORMATION

Sufficient expertise is required for working on the milling machine. No one must work on the machine without having the necessary training, not even for a short while.

WARNING!

Inappropriate operation and maintenance of the milling machine constitutes a danger to the personnel, objects and the environment. Only authorized personnel may operate the milling machine !

Persons authorized to operate and maintain should be trained technical personnel and instructed by the ones who are working for the operating company and for the manufacturer.

Obligations of the operating company

Obligations of the operating company

- ❍ train the personnel,
- ❍ instruct the personnel in regular intervals (at least once a year) on
  - all safety regulations relevant to the milling machine,
  - operation of the milling machine,
  - generally accepted engineering standards.
  - possible emergency situations,
- ❍ check the personnel‘s knowledge level,
- ❍ document training/instruction in a operation book,
- ❍ require personnel to confirm participation in training/instructions by means of a signature,
- ❍ check whether the personnel is working safety and risk-conscious and observes the operating instructions.
- ❍ Define and document the machine inspection deadlines in accordance with section 3 of the Factory Safety Order and perform an operational risk analysis in accordance with section 6 of the Safety at Work Act.

Obligations of the user

Obligations of the operator

- have obtained a training regarding the handling of the milling machine,
- keep an operator‘s log,
- before taking the machine in operation
  - have read and understood the operating manual,
  - be familiar with all safety devices and instructions.

Additional requirements regarding the qualification

For work on the following milling machine parts there are additional requirements:

- Electric components or operating materials: Must only be worked on by a qualified electrician or person working under the instructions and supervision of a qualified electrician.

1.8 Operator positions

The operator position is located in front of the milling machine, to the side of the automatic feed for the cross table or on the control panel.

1.9 Safety devices

The milling machine must only be operated with fully functional safety devices.

Stop the milling machine immediately if there is a failure on the safety device or becomes ineffective.

This is your responsibility!

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

- have eliminated the cause of the fault and
- you have verified that there is no danger to personnel or objects.

WARNING!

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

- **injuries due to tools, workpieces or fragments hereof which are flying off at high speed,**
- **contact with rotating or moving parts,**
- **fatal electrocution,**
- **pulling-in of clothes.**

WARNING!

Although the isolating safety devices provided and delivered with the machine are designed to reduce the risks of workpieces being ejected or parts of tools or workpieces breaking off, they cannot eliminate these risks completely. Always work carefully and observe the limits of the machining process.

The milling machine features the following safety devices:

- a lockable main switch,
- an emergency stop push button,
- a spindle guard,
- a milling table with T-slots to fix the workpiece or the clamping device.

1.9.1 Lockable main switch

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

The power supply is cut off when the master switch is in the off position.

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

WARNING!

Dangerous voltage even if the main switch is switched off.

The areas marked by the pictogram might contain live parts, even if the master switch is switched off.

1.9.2 Emergency-stop push button

CAUTION!

Only press the emergency stop button in a genuine emergency. Do not use the emergency stop button to stop the machine during normal operation.

When the emergency stop is activated, the drive control is switched off.

ATTENTION!

If the emergency-stop push button is activated, the drives are stopped with the maximum possible braking torque. The spindle drive continues to run for a while depending on the moment of inertia of all components and the mass of the tool in use.

After having actuated the emergency switching off push button, turn the knob to the right in order to restart the machine.

1.9.3 Control technical protection

WARNING!

If you bypass a controller you endanger yourself and other persons working on the milling machine.

- **injuries due to tools, workpieces or fragments hereof which are flying off at high speed,**
- **contact with rotating parts,**
- **fatal electrocution,**
- **pulling-in of clothes.**

If you temporarily bypass a controller in exceptional cases (e.g. during electrical repairs), you must continuously monitor the milling machine.

1.9.4 Prohibition, warning and mandatory signs

INFORMATION

All warning and mandatory signs must be legible. They must be checked regularly.

1.10 Safety check

Check the milling machine at least once per shift. Inform the person responsible immediately of any damage, defects or changes in the operating function.

Check all safety devices

- at the beginning of each shift (when the machine is operated continuously),
- once per day (during one-shift operation),
- once per week (when operated occasionally),

- after all maintenance and repair work.

Check that prohibition, warning and information signs and the labels on the milling machine

- are legible (clean them, if necessary)
- and complete (replace them, if necessary).

INFORMATION

Organise the checks according to the following table;

General check		
Equipment	**Check**	**OK**
Protective covers	Firmly bolted and not damaged	
Signs, Markings	Installed and legible	
Date:	**Checked by (signature):**	

Functional check		
Equipment	**Check**	**OK**
Emergency stop push button	After actuating an emergency stop push button the milling machine must be switched off.	
Spindle protection	The spindle drive can only be switched on if the spindle guard is in the machining position.	
Date:	**Checked by (signature):**	

1.11 Personal protective equipment

For certain work personal protective equipment is required.

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

Wear protective gloves when handling pieces or tools with sharp edges.

Wear safety shoes when you assemble, disassemble 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 required personal protective equipment is available at the work place.

CAUTION!

Dirty or contaminated personnel protective equipment can cause illness. It must be cleaned after each use and at least once a week.

1.12 Safety during operation

WARNING!

Before switching the milling machine on, make sure that there is no risk of personal injury or damage to property.

Avoid any unsafe work methods:

- The instructions mentioned in these operating instructions have to be strictly observed during assembly, operation, maintenance and repair.
- Do not work on the milling machine, if your concentration is reduced, for example, because you are taking medication.
- Clamp the workpiece securely and firmly before switching on the milling machine.

WARNING!

When chipping magnesia materials (aluminium-/magnesium alloys), spontaneously inflammable or explosive particles (powder, dust, chips) might be generated, which might cause a fire and/or explosion (deflagration).

Magnesium is designated a dangerous material in the list of dangerous materials and preparations according to para. 4a of the Ordinance of Hazardous Substances.

In case of a fire with magnesium, only use appropriate and admitted extinguishing agents. Never extinguish using water. If burning magnesium is extinguished with water, this might lead to dangerous reactions (hydrogen gas). Water would be decomposed in its components hydrogen (H) and oxygen (O).

Only the following extinguishing agents are permissible:

- **solid extinguishing agent of fire class D (fires involving metals)**
- **dry covering salts for magnesium**
- **a mixture of sand and cast chips**
- **argon (Ar) or nitrogen (N_2)**

If fine mist and smoke is generated at the workplace, suction units must be provided in order to avoid the accumulation of ignitable mixtures and emissions.

We specifically point out the dangers in the description of work with and on the drilling machine.

1.13 Safety during maintenance

Inform the operators in good time of any maintenance and repair works.

Report all safety relevant changes and performance details of the milling machine or their operational behaviour. Any changes must be documented, the operating instructions updated and machine operators instructed accordingly.

1.14 Switching-off and securing the milling machine

Turn off the main switch of the milling machine before starting any maintenance or repair work.

Use a padlock to prevent the switch from being turned on without authorization and keep the key in a safe place.

All machine parts as well as all dangerous voltages are switched off.

Excepted are only the positions which are marked with the adjoining pictogram. These positions may be live, even if the main switch is switched off.

Place a warning sign on the milling machine.

WARNING!

Live parts and moves of machine parts can injure you or others dangerously!

Proceed with extreme caution if you
the milling machine due to required works (e.g. functional control).

1.14.1 Using lifting equipment

WARNING!

The use of unstable lifting and load suspension equipment that might break under load can cause severe injuries or even death. Observe the accident prevention regulations

issued by your Employers Liability Insurance Association or other supervisory authorities responsible for your company.

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

Fasten the loads carefully.

Never walk under suspended loads!

1.14.2 Mechanical maintenance work

Remove or install protection safety devices before starting or after completing any maintenance work; this include:

- covers,
- safety instructions and warning signs,
- grounding cables.

If you remove protective or safety devices, re-fit them immediately after the completing the work.

Check if they are working properly!

1.15 Accident report

Inform your supervisors and Optimum Maschinen Germany GmbH immediately in the event of accidents, possible sources of danger and any actions which almost led to an accident (near misses).

There are many possible causes for "near misses".

The sooner they are notified, the quicker the causes can be eliminated.

INFORMATION

We provide information about the specific dangers when working with and on the milling machine in the descriptions for these types of work.

1.16 Electronics

Have the machine and/or the electric equipment checked regularly. Immediately eliminate all defects such as loose connections, defective wires, etc.

A second person must be present during work on live components to disconnect the power in the event of an emergency. Disconnect the machine immediately if there is a malfunction in the power supply!

Comply with the required inspection intervals in accordance with the factory safety directive, operating equipment inspection.

The operator of the machine must ensure that the electrical systems and operating equipment are inspected with regards to their proper condition, namely,

- by a qualified electrician or under the supervision and direction of a qualified electrician, prior to initial commissioning and after modifications or repairs, prior to recommissioning
- and at set intervals.

The intervals must be set so that foreseeable defects can be detected in a timely manner, when they occur.

The relevant electro-technical rules must be followed during the inspection.

The inspection prior to initial commissioning is not required if the operator receives confirmation from the manufacturer or installer that the electrical systems and operating equipment comply with the accident prevention regulations, see conformity declaration.

Permanently installed electrical systems and operating equipment are considered constantly monitored if they are continually serviced by qualified electricians and inspected by means of measurements in the scope of operation (e.g. monitoring the insulation resistance).

1.17 Inspection deadlines

Define and document the inspection deadlines for the machine in accordance with § 3 of the Factory Safety Act and perform an operational risk analysis in accordance with § 6 of the Work Safety Act. Also use the inspection intervals in the maintenance section as reference values.

1.18 Clamping devices for workpieces and tools

ATTENTION!

Attention when taking over existing clamping devices. Pleased thoroughly check that the clamping device is appropriate for your milling machine.

- **Only use clamping devices with a complete inherent rigidity.**
- **Contact the manufacturer of the clamping device regarding the reuse of clamping devices after damage to the clamping device due to collisions.**
- **Correctly insert the workpiece and make sure that the machine is proper working condition.**

1.19 Environmental protection and water conservation

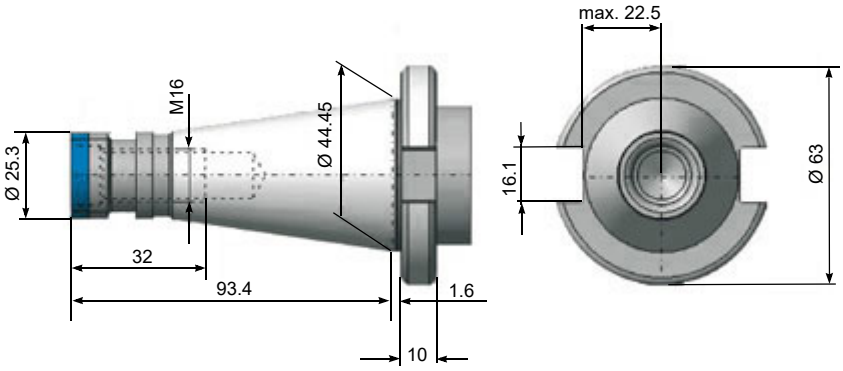
The milling machine is a device to produce, handle and use materials which are hazardous to water according to para. 19g of the Water Resources Law.

Please follow the requirements of the Water Resources Law when operating, decommissioning or disassembling the milling machine or parts hereof. Detailed information regarding this can be found in the Ordinance on Installations for the Handling of Substances Hazardous to Water (VAwS).

2 Technical specification

The following information represents the dimensions and indications of weight and the manufacturer‘s approved machine data.

	MF2-B	MF4-B
2.1 Electrical connection		
Connection	3 x 400V 50Hz (60Hz)	
Fusing performed by the operator	16A	
2.2 Spindle seat		
Spindle seat	ISO 40 DIN 2080	
Draw bar	M16	



2.3 Spindle		
Power of drive at 100% ED	2.2 kW	
Speed [rpm]	60 - 4200 (72 - 5040 ~ 60Hz)	
Gear stages	2	
Infinitely variable speed change		
Maximum distance spindle nose - milling table [mm]	405	
Throat [mm]	15 - 415	0 - 420
Spindle sleeve travel [mm]	127	
Automatic spindle sleeve feed [mm/rev]	0.038 0.076 0.152	
2.4 Table feed		
max. X axis travel (cross table) [mm]	790	920
max. Y axis travel (cross table) [mm]	280	380
max. Z axis travel (cross table carrier) [mm]	390	400
2.5 Milling table		
Table length [mm]	1246	1370
Table width [mm]	230	254

MF2B_MF4B_GB_2.fm

	MF2-B	MF4-B
T-slot size / distance / number	16mm / 63 / 3	
max. load of cross table [kg]	200	300
2.6 Milling head		
Inclination (vertical)	± 45°	
Swivel range (horizontal)	± 90°	
Travel of milling head cantilever [mm]	312	470
2.7 Work area		
Keep a work area of at least one metre around the machine free for operation and maintenance.		
2.8 Dimensions		
☞ Installation plan on page 24		
Machine weight [kg]	1000	1200
2.9 Coolant equipment		
Power of the cooling lubricant pump [W]	90	
2.10 Environmental conditions		
Temperature	19 - 21 °C (for an optimum milling result) Permissible range + 5 ° to + 55 ° C. The average temperature of 50 ° C must not be exceeded within 24 hours.	
Admissible relative humidity	5...95 % no condensation	
Compressed air	700...1060 hPa	
Environmental conditions - storage	-25 ~ +55 °C	

2.11 Emissions

Measurement in operating conditions in accordance with DIN ISO 8525 with surface areas Measurement methods in accordance with DIN 45635.

The generation of noise emitted by the machine is 76 dB(A) to 79 dB(A) on no-load running at 80% of max. spindle speed, measured at a distance of one meter from the machine and at a height of 1.6m.

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

INFORMATION

This numerical value was measured on a new machine under the operating conditions specified by the manufacturer. The noise behaviour of the machine might change depending on the age and wear of the machine.

Furthermore, the noise emission also depends on production engineering factors, e.g. speed, material and clamping conditions.

INFORMATION

The specified numerical value represents the emission level and does not necessarily a safe working level.

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

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

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

Furthermore, it is possible that the admissible exposure level might be different from country to country due to national regulations.
This information about the noise emission should, however, allow the operator of the machine to more easily evaluate the hazards and risks.

CAUTION!

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

We generally recommend the use of noise and ear protection.

2.12 Tools and tool holding fixtures

CAUTION !

When using tools with larger diameters or at higher speeds!

The balancing of the tools has to amount to 0 - 6000 rpm - G 6.3 from a speed of 6000 rpm - G 2.5 according to DIN / ISO 1940.

3 Delivery, interdepartmental transport, assembly and commissioning

3.1 Notes on transport, installation, commissioning

Improper transport, installation and commissioning is liable to accidents and can cause damage or malfunctions to the machine for which we do not assume any liability or guarantee.

Transport the scope of delivery secured against shifting or tilting with a sufficiently dimensioned industrial truck or a crane to the installation site.

WARNING!

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

Note the total weight of the machine. The weight of the machine is indicated in the "Technical data" of the machine. When the machine is unpacked, the weight of the machine can also be read on the rating plate.

Only use transport devices and load suspension gear that can hold the total weight of the machine.

WARNING!

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

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

3.1.1 General risks during internal transport

WARNING: TILTING DANGER!

The machine may be lifted unsecured by a maximum of 2 cm.

Employees must be outside the danger zone, i.e. the reach of the load.

Warn employees and advise them of the hazard.

Machines may only be transported by authorized and qualified persons. Act responsibly during transport and always consider the consequences. Refrain from daring and risky actions.

Gradients and descents (e.g. driveways, ramps and the like) are particularly dangerous. If such passages are unavoidable, special caution is required.

Before starting the transport check the transport route for possible danger points, unevenness and faults.

Danger points, unevenness and disturbance points must be inspected before transport. The removal of danger spots, disturbances and unevenness at the time of transport by other employees leads to considerable dangers.

Careful planning of interdepartmental transport is therefore essential.

3.2 Unpacking the machine

INFORMATION

The milling machine is delivered pre-assembled. It is delivered in a transport box. After the unpacking and the transportation to the installation site it is necessary to mount and assemble the individual components of the milling machine.

Install the machine close to its final position before unpacking. If the packaging shows signs of having possibly been damaged during transport, take the appropriate precautions to prevent the machine being damaged when unpacking. If damage is discovered, the carrier and/or shipper must be notified immediately so the necessary steps can be taken to register a complaint.

Examine the complete machine carefully and check whether all materials, such as shipping documents, instructions and accessories have been delivered with the machine.

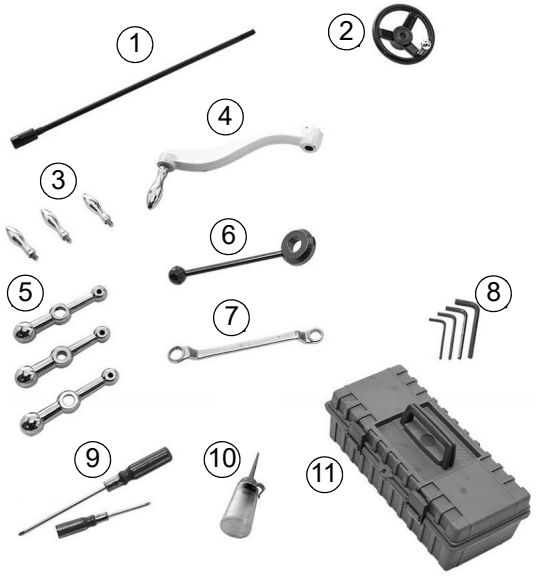
Some of the components shown below can also be already mounted on the machine at factory.

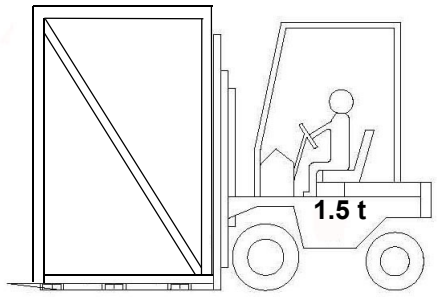
3.2.1 Accessories

- (1) Draw bar
- (2) Handwheel for manual feed
- (3) Handle for table feed
- (4) Lift hand crank for milling table
- (5) Three ball handles for table feed
- (6) Lever for manual spindle sleeve feed
- (7) Ring key
- (8) Hexagon socket wrench
- (9) Screwdriver
- (10) Oil bottle
- (11) Tool box
- Test report machine accuracy
- Operating instructions in printed form

❍ Weights

☞ Installation plan on page 24





3.3 Load suspension point

WARNING!

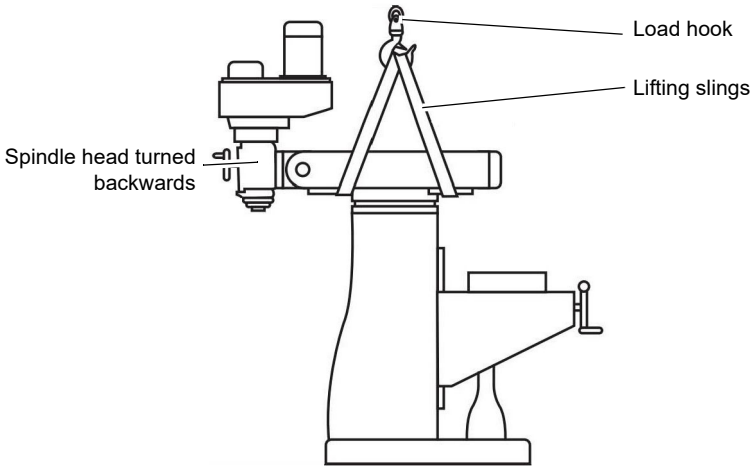
Before lifting the milling machine, check that all clamping screws of the milling table and the spindle head are tightened.

The milling machine is lifted with a forklift or crane as shown in the figure below.

➜ If necessary, turn the milling head into the vertical position. ☞ Aligning the milling head on page 38

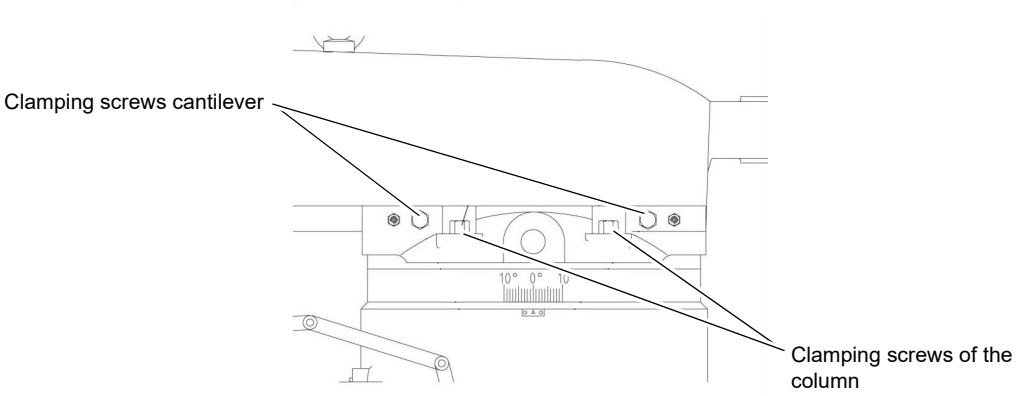
➜ Rotate the spindle head 180 ° to the back.

➜ The clamping screws of the milling table and the spindle head bearing must be tightened. ☞ Clamping lever on page 33



Img. 3-1: Load suspension point

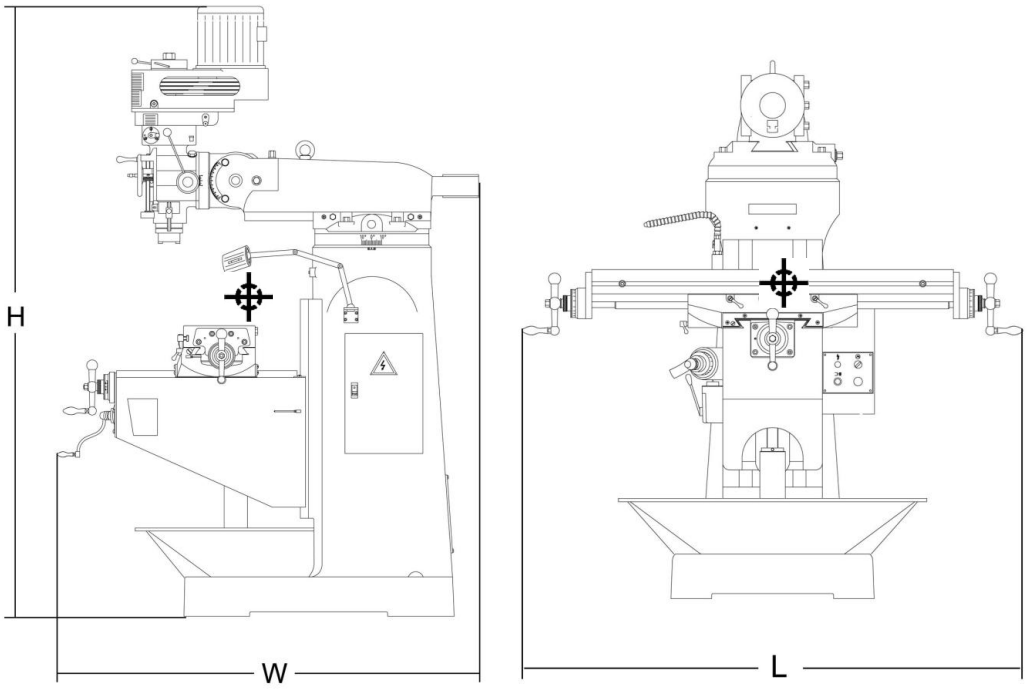
➜ Make sure the clamping screws are tightened on both sides (four pieces each) of the milling head cantilever and column.



Img. 3-2: Clamping screws cantilever, column

3.4 Set-up and assembly

3.4.1 Installation plan



Center of gravity

[mm]	MF2-B	MF4-B
H	2010	2300
W	1600	2160
L	1700	1825

3.4.2 Requirements regarding the installation site

Keep a work area of at least one metre around the machine free for operation and maintenance.

In order to achieve sufficient safety against falls by slipping, the accessible area in the mechanical machining zone of the machine must be equipped with a slip resistance. The slip-resistant mat and/or slip-resistant flooring must be at least R11 in accordance with BGR 181. The determination of this requirement resulted in the risk assessment of the machine.

The used shoes must be suitable for being used in those machining areas. The accessible surfaces must be cleaned.

Organise the working area around the milling machine machine according to the local safety regulations.

INFORMATION

In order to achieve high levels of functionality and machining accuracy, as well as a long service life of the machine, the set-up location should meet certain criteria.

The following points should be noted:

- The device must only be installed and operated in a dry and well-ventilated place.
- Avoid places close to machines which cause chips or dust.
- The installation site must be vibration-free, i.e. located away from presses, planing machines, etc.
- The foundation must be suitable for the milling machine. Also make sure that the floor has sufficient load bearing capacity and is level.
- The substructure must be prepared in such a way as to ensure that, if any lubricant is used, it cannot penetrate the floor.
- Protruding parts - such as the dog, handles, etc. - must be secured, where necessary, by means of on-site measures so that persons are not endangered.
- Provide enough space for set-up and operating personnel and material transport.
- Also bear in mind accessibility for installation and maintenance works.
- Ensure adequate lighting is available (minimum value: 500 Lux, measured at the tool tip). In the event of a lower level of lighting, additional illumination must be provided, e.g. by means of a separate workplace light.

INFORMATION

The main switch of the milling machine must be freely accessible.

3.5 Machine mounting

3.5.1 Anchor-free mounting

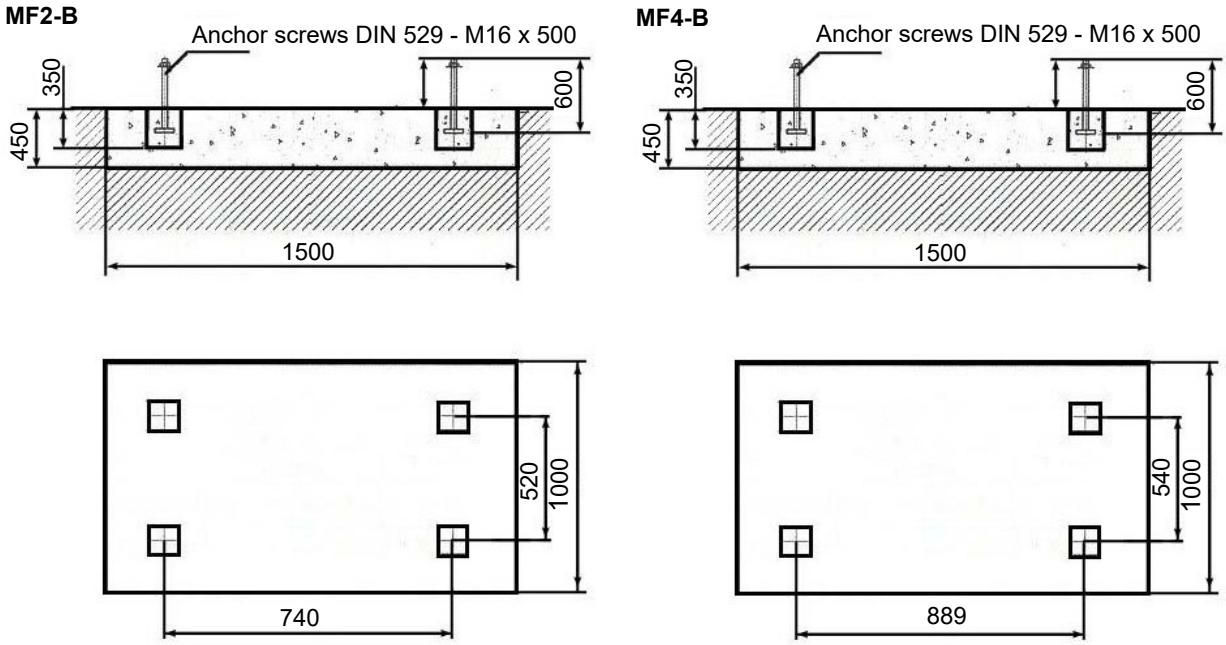
This must be done by laying down a strong base, on each support of the levelling points, between the foundation and the machine foot. Optionally four SE2 damping elements (3381016) can be used. Four additional threaded rods M16 x 250 are required to replace the short thread rods of the SE2 elements.

3.5.2 Anchored mounting

Use an anchored mounting to achieve a rigid connection to the substructure. An anchored assembly is always reasonable if parts are manufactured to the maximum capacity of the milling-machine.

The milling machine is fastened to the floor with four anchor screws DIN 529 M16 x 500 through the machine foot. The anchor screws are not included in the delivery.

The dimensions of the anchor screws are shown in the following drawing.



Img.3-3: Foundation plan

➜ Drilled core holes with a diameter of 120 to 150mm and a depth of 350mm are provided in the foundation.

➜ Raise the machine from the floor and centre in the inner drill holes with the anchor screws.

➜ Roughly align the machine.

➜ Fill the drill holes with concrete and allow to set.

Aligning the machine

➜ Place a machine spirit level (0.05mm/m) on the cross table.

➜ Attach washers and nuts to the anchor screws.

➜ Check the alignment of the milling machine with a machine spirit level on the cross table and place base plates underneath the machine foot.

ATTENTION!

All four corners of the machine foot must lie flat. The maximum height difference of the bearing surfaces after tightening the anchor screws should not exceed 0.05mm per 1000m. We recommend using a machine spirit level to align the milling machine.

➜ The the anchor screw nuts.

➜ Check the alignment of the milling machine again. Re-check the alignment after a few days of use.

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3.6 First commissioning

WARNING!

Commissioning should only take place after proper installation of the machine.

First commissioned of the milling machine by inexperienced personnel constitute a risk to personnel and equipment.

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

☞ Qualification of personnel on page 10

WARNING!

The use of improper tool holders or their operation at inadmissible speeds constitutes a hazard.

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

Only use tool holders in the intended admissible speed range.

Tool holders may only be modified in compliance with the recommendation of OPTIMUM or of the manufacturer of the clamping devices.

ATTENTION!

Before commissioning the machine, all bolts, fastenings and protections must be checked and retightened as necessary!

3.7 One-component paint

The machine is lacquered with a one-component paint. Take this criterion into account when selecting your cooling lubricant and cleaning the machine.

A one-component paint with added solvent sets when the solvent evaporates.

As soon as the paint is applied, the solvent escapes into the air. The binding agent becomes felted and a dry film is formed. This process is reversible, i.e. the binding agent can always be re-softened.

A two-component paint also consists of binding agent and solvent. However, the paint only dries when a setting agent is added. This process is not reversible, i.e. the binding agent cannot be re-softened.

The company Optimum Maschinen Germany GmbH does not assume any guarantee for subsequent damages due to unsuitable cooling lubricants.

3.8 Cleaning the machine

ATTENTION!

Do not use compressed air to clean the machine.

Your new milling machine must be completely cleaned after unpacking to ensure that the moving parts and sliding surfaces cannot be damaged when the machine is operated. Prior to delivery, all blank parts and sliding surfaces in each unit are appropriately lubricated to protect against rust in the period before commissioning. Remove all wrappings and clean all surfaces with a degreaser to soften and remove protective greases and coatings.

Wipe all surfaces with a clean cotton cloth and lubricate the milling machine in accordance with the maintenance section ☞ Inspection and maintenance on page 50 before switching on the power and putting the machine into service.

3.8.1 Lubrication and oil levels

During the initial lubrication and greasing of your new milling machine, the oilers and the manual central lubrication are filled, checked and the machine is lubricated after cleaning. Only when this has been done can commissioning of the machine proceed.

☞ Inspection and maintenance on page 50

3.9 Function testing and mounting of accessories

➜ Mount hand lever, spindle sleeve feed, from the standard accessories on the milling head.

➜ Loosen mechanical limit stops of the travelling axles.

➜ Loosen the clamping level and check the smooth running and mobility of travelling axles and components.

➜ Perform safety check. ☞ Safety check on page 13

➜ The milling head was inclined downwards for transport. Set the milling head straight as described under ☞ Inclining the spindle head up or down on page 36.

➜ The milling head must then be aligned. ☞ Aligning the milling head on page 38

3.9.1 Assembly of the drawbar

The drawbar of the milling machine has a thread adapter M16. This thread adapter is screwed onto the M12 drawbar. For trouble-free operation, the threaded adapter must also be glued to the drawbar. For this purpose, we recommend the use of Loctite screw locking, which is available from specialist dealers.

➜ Remove the threaded adapter from the drawbar.

➜ Apply the Loctite screw lock to the thread and screw back in place.

If necessary, the bonded connection can be loosened again with a hot-air dryer.

Img.3-4: Drawbar for tools and tool holders

3.10 Warming up the machine

ATTENTION!

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

3.11 Electrical connection

CAUTION!

Arrange the machine's connection cable to the electrical cabinet in such a way that it will not cause a tripping hazard.

WARNING!

The three-phase electrical connection may only be performed by an electrician or under the guidance and supervision of an electrician.

Please check that the type of current, voltage and protection fuse correspond to the values specified. A protective earth ground wire connection must be available.

- Min. terminal cross-section per phase and grounding: 2mm^2
- Electric connected load: 3 KVA
- Permissible voltage fluctuations in normal operation: +6% -10% Volt
- Permissible frequency fluctuations: ± 1Hz (50/60 Hz)
- Permissible phase imbalance: 3% or less

ATTENTION!

Ensure that all 3 phases (L1, L2, L3) and the ground wire are connected correctly.

The neutral conductor (N) of its power supply is not connected.

ATTENTION!

Check if the drive motor is turning in the correct rotation direction. If necessary, two phase connections must be swapped.

In the event of an incorrect rotation direction, machine components may be damaged.

The guarantee will become null and void if the machine is connected incorrectly.

➜ Check the fusing (fuse) of your electrical supply according to the technical instructions regarding the total connected power of the machine.

➜ Firmly connect the machine.

Please check that the type of current, voltage and protection fuse correspond to the values specified. A protective earth ground wire connection must be available.

- Main Fuse 16A.

4 Operation

4.1 Safety

The milling machine must only be operated under the following conditions:

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

WARNING!

Stop the machine immediately in the event of any abnormality in operation and make sure it cannot be started up accidentally or without authorisation.

Notify the person responsible immediately of any modification.

WARNING!

Protect your eyes from flying chips and other splinters. Wear protective goggles.

CAUTION!

Different noise levels can be reached depending on the operation. Use ear protection!

CAUTION!

Wear protective gloves when setting up the machine.

Recommended threshold values when lifting and carrying loads				
	Reasonable load in kg and frequency of lifting and carrying			
	Occasionally		More frequently	
Age in years	Women	Men	Women	Men
15 - 18	15	35	10	20
19 - 45	15	55	10	30
above 45	15	45	10	25

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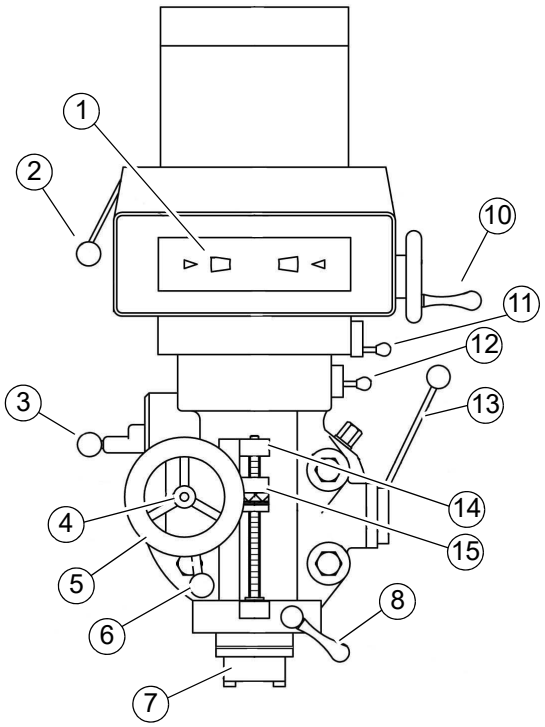
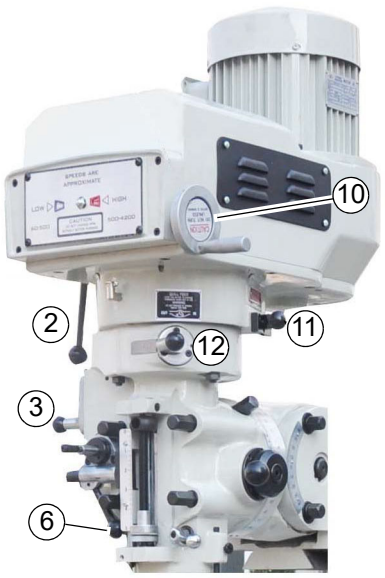
4.2 Overview





CAUTION!
Do not turn unless motor is running!

Pos.	Designation	Item	Designation
1	Speed display (mechanical disc)	8	Clamping lever for spindle sleeve
2	Hand lever mechanical spindle brake	10	Hand wheel for speed change
3	Rotary lever - Spindle sleeve feed	11	Speed gear stage H | L
4	Button for changing the direction of the spindle sleeve feed. ❍ Push in or pull out.	12	On / Off switch of spindle sleeve feed
5	Fine feed hand wheel spindle sleeve	13	Lever for spindle sleeve feed (manual)
6	Lever for drill depth stop The spindle sleeve feed stops at the set drill depth. ❍ Pull out the lever to activate. ❍ Push in the lever to deactivate.	14	Stop for switching off the sleeve feed.
7	Spindle	15	Setting for the drill depth. Shutdown of the sleeve feed if (6) is activated. Rotate to adjust the depth.

4.3 Spindle speed

WARNING!

Never grip the tool to rotate the spindle as this may engage a gear setting.

4.3.1 Operating of spindle gear

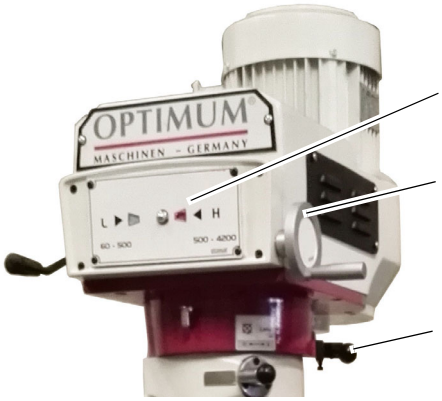
ATTENTION!

Change the gear stage while the drive is stationary.

ATTENTION!

When changing over the gear selector to high or low speed, the turning direction of the spindle is changed too.

Change the rotational direction (2) on the control panel in order to maintain the same rotational direction.



4.3.2 Infinitely variable speed adjustment

ATTENTION!

Change the infinitely variable speed setting only when the spindle is running.

A change of the speed while the spindle is stopped results in damages of the variable speed gear. Only change the speed while the milling spindle is turning.

The milling-machine is equipped with a motor with an infinitely variable mechanic gear. With the V-belt transmission, the V-belt is positioned with the handwheel at the desired V-belt diameter when the milling spindle is rotating. The rotational speed changes as a result. The lower the spindle speed while adjusting, the more difficult it is to turn the handwheel.

4.3.3 Selecting the speed

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

The ideal cutting speed basically depends on the workpiece and the tool material. Higher speeds are possible with tools (mills) made from hard metal or cutting ceramics than with tools made from high-alloy high speed steel (HSS). You will achieve the ideal cutting speed by selecting the correct rotation speed.

Use upcut milling if at all possible. In upcut milling, the direction of feed is opposite to the direction of rotation.

Please refer to a table reference book (e.g. Tabellenbuch Metall, Europa Lehrmittel, ISBN 3808517220) or the following diagrams to determine the correct cutting speed for your tool and the material to be machined.

4.4 Switching on the machine

Switch on the main switch and switch on the control voltage on the control panel.

4.5 Switching off the machine

CAUTION!

Only press the emergency stop button in a genuine emergency. You should not use the emergency-stop button to stop the machine during normal operation.

The life time of the emergency stop impact switch is not designed for operational shut-down of the machine.

➜ Push the button Spindle drive "OFF"

➜ For a longer-term standstill of the machine, switch it off at the main switch.

4.6 Power failure, Restoring readiness for operation

Switch on the control voltage on the control panel again.

4.7 Stopping the machine in an emergency

Press the emergency stop button on the control panel.

ATTENTION!

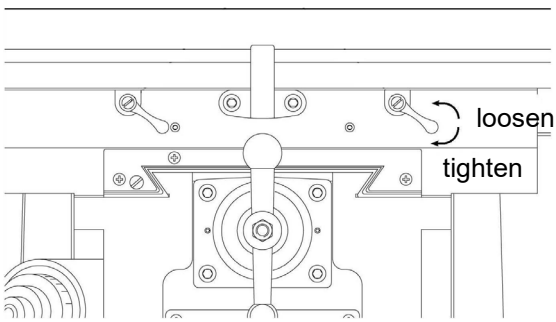
If the emergency-stop push button is activated, the drives are stopped with the maximum possible braking torque. The spindle drive continues to run for a while depending on the moment of inertia of all components and the mass of the tool in use.

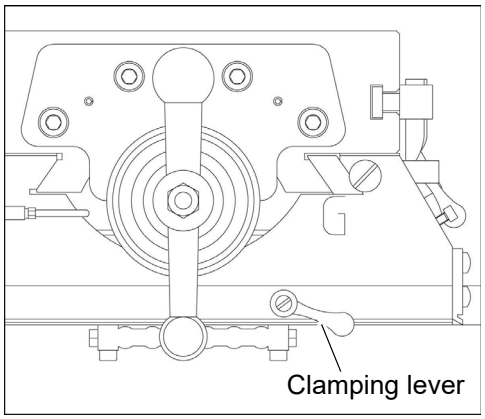
If necessary, use the mechanical spindle brake.

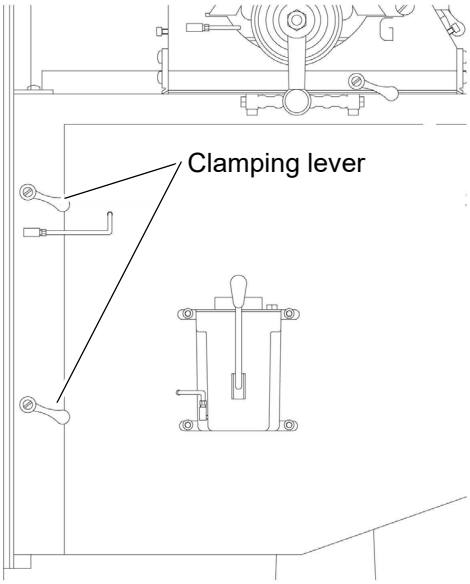
4.8 Resetting an emergency stop condition

After having actuated the emergency stop, turn the knob to the right in order to restart the machine. Switch on the control voltage on the control panel again.

4.9 Clamping lever




Clamping lever


Clamping lever

4.10 Switching the feed on / off

WARNING!

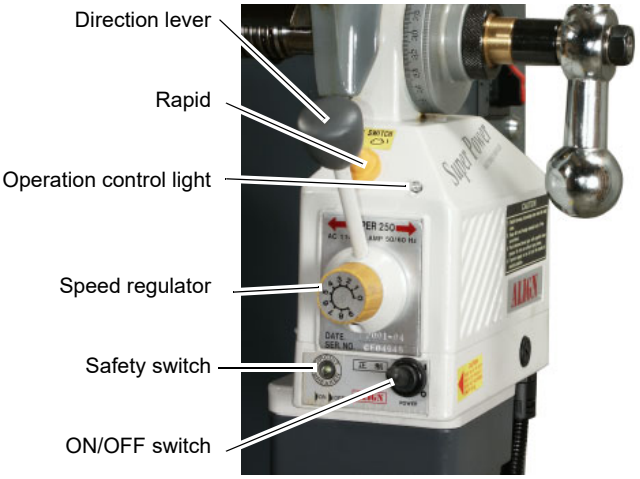
When the feed motor is operating in fast motion, do not touch moving parts or rotating parts.

Make sure there are no other people in the danger zone.

ATTENTION!

Loosen the tightening lever. ☞ **Clamping lever on page 33**

During manual operation the limit stops may collide with the end stop switch. This can cause damage to the end stop switch.



INFORMATION

The circuit is automatically disconnected if a current of 4 A circulates through the safety switch for more than 10 seconds.

To reactivate it, press the safety switch for a moment. The service light will come on again.

4.11 Automatic spindle sleeve feed

WARNING!

Do not engage the spindle sleeve feed at speeds above 3000 rpm

ATTENTION!

Stop the motor before connecting the automatic spindle sleeve feed. After use, disconnect the automatic spindle sleeve feed.

The automatic spindle sleeve feed is linked to the speed of the spindle. The higher the speed, the faster the feed.

Img.4-1: Spindle sleeve feed speed selector

To select the speed of feed of the spindle sleeve using the selector, proceed as follows:

➜ Pull out the round knob.

➜ Turn the lever to the required speed.

➜ Release and engage the round knob in that position.

The following feeds are available:

❍ 0.038 mm/spindle revolution
❍ 0.076 mm/spindle revolution
❍ 0.152 mm/spindle revolution

Once you have chosen the speed of the spindle sleeve, you can turn on the switch for the automatic spindle sleeve feed.

4.12 Inclining the spindle head up or down

INFORMATION

Use a 17/19 polygonal spanner for the clamping screws and movement screws.

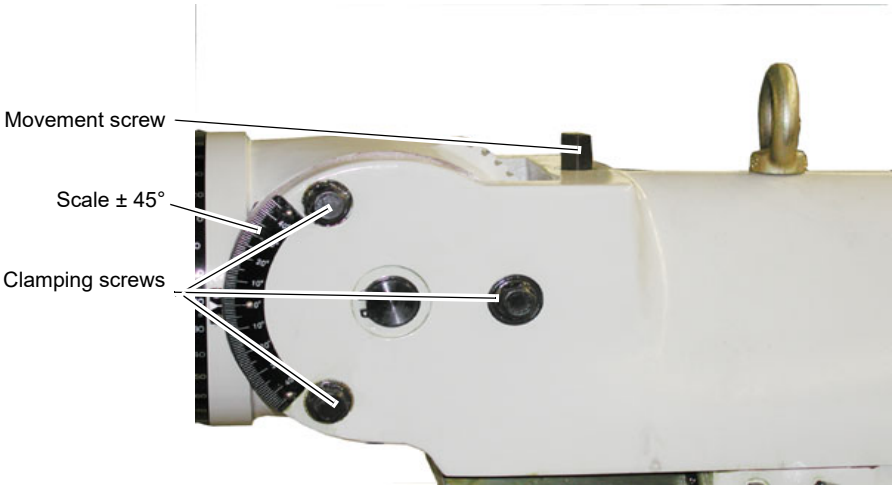
The spindle head can be inclined forward and back 45°.

Proceed as follows:

➜ Loosen the clamping screws (3 units) located on the spindle head-holder.

➜ Position the spindle head in the required position by screwing in or out the movement screw.

➜ You must re-tighten the clamping screws.



Img.4-2: Inclining the spindle head up or down

4.13 Orienting the spindle head to the right or left

The spindle head can be oriented 90° to the right or left.

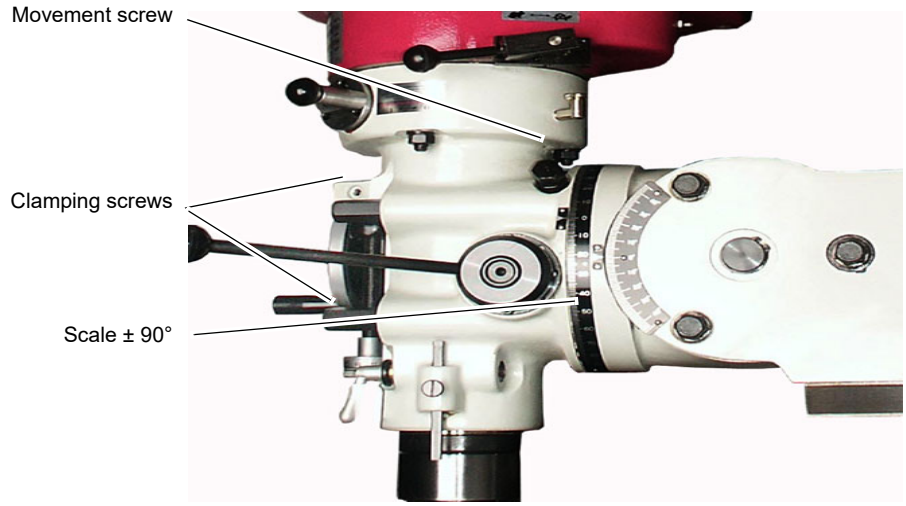
Proceed as follows:

➜ Loosen the clamping screws (4 units).

➜ Position the spindle head in the required position by screwing in or out the movement screw.

➜ Imperatively fasten the clamping screws.

➜ A second person is required to support the spindle head while turning the spindle head back to its initial position with the aid of the movement screw.



Img.4-3: Moving the spindle head to the right or left

4.14 Moving the spindle head-holder forward or back

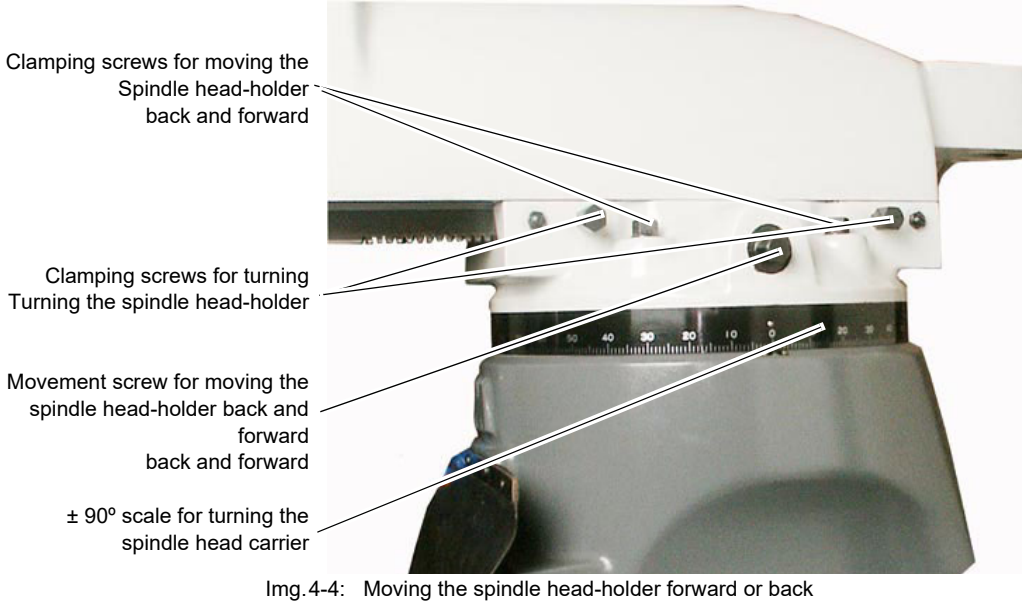
You can move the spindle head-holder forward or back.

Proceed as follows:

➜ Loosen the clamping screws (2 units).

➜ Position the spindle head carrier as required by turning the leading screw.

➜ Imperatively fasten the clamping screws.



Img.4-4: Moving the spindle head-holder forward or back

4.15 Turning the spindle head-holder

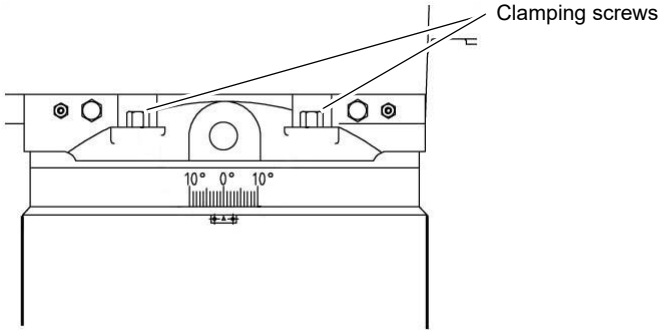
You can turn the spindle head-holder 360°.

Proceed as follows:

➜ Loosen the clamping screws (4 units).

➜ Turn the spindle head carrier to the required position.

➜ Fasten the clamping screws.



4.16 Aligning the milling head

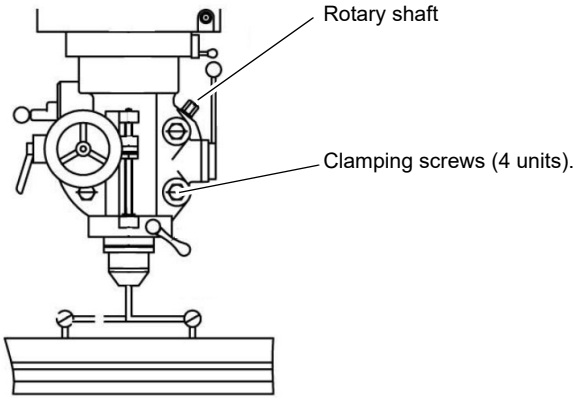
CAUTION!

The milling head is heavy. When tilting or turning the head, a second person should be present while you make the adjustments.

INFORMATION

After returning to the initial position, the milling head should be aligned with a dial gauge in order to ensure the perpendicularity to the milling table.

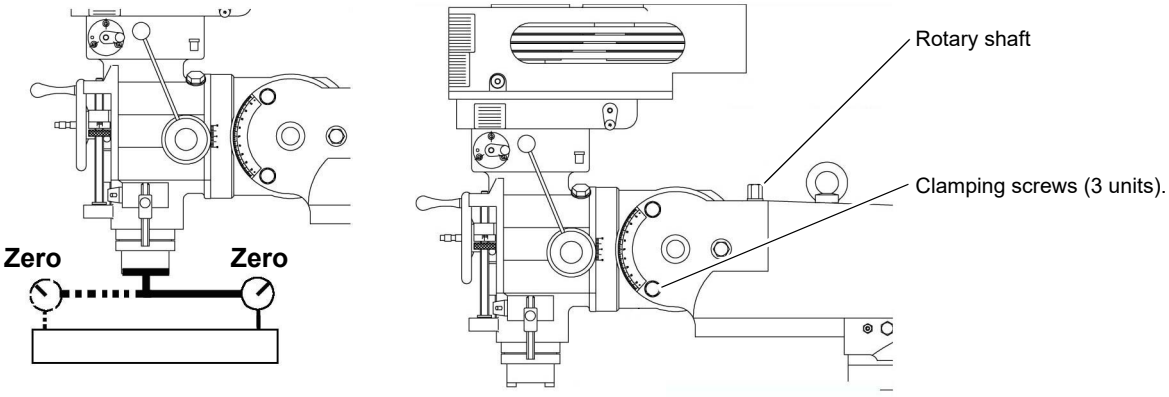
Aligning the milling head in the Z axis:



Aligning the milling head in the Y axis:

INFORMATION

The lock bolts are threaded into T-nuts that travel in a circular slot during head rotation. When rotating the head, it is possible for these T-nuts to jam in the slot preventing movement of head. If this happens, gently rotate each lock bolt, starting with the lower right, until you free up the jammed T-nut. Then continue to rotate head to desired position.



Img. 4-5:

➜ Unscrew the 3 clamping screws next to the milling head.
➜ Place a dial gauge with a 100mm arm in the spindle.
➜ Use the tilt worm to turn the milling head up or down to adjust the squareness to the milling table.
➜ Then re-clamp the 3 clamping screws.

4.17 Clamping a tool

WARNING!

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.

ATTENTION!

The conical seat of the tool and spindle sleeve must be free of grease and dirt.

❍ ISO 40 tool holder, M16 tie rod.
➜ Disassemble the protection cap for the drawbar.
➜ Tighten the tool with a key using the drawbar.
➜ Refit the protective cap of the drawbar.

4.18 Removing tool

➜ Loosen the drawbar by about 4 turns and tap with a rubber mallet on the drawbar to loosen the conical connection.
➜ Then take out the tool completely.

4.19 Adjusting spindle guard

Adjust the spindle guard at the appropriate height.

INFORMATION

The spindle rotation is only released when the spindle guard is closed.

4.20 Cooling agent

WARNING!

Ejection and overflowing of coolants and lubricants. Make sure you do not get the cooling lubricants on the floor. Spilled on the floor cooling agents must be removed immediately.

The flow of cooling agent is activated and deactivated by means of a selector with on the control panel

0 = Deactivate cooling agent feed

1 = switch on coolant delivery.

The amount of coolant is adjusted using the metering valve.

4.21 Central lubrication

➜ Operate the central lubrication system with lever. One pump stroke every 4 - 8 operating hours.

➜ Fill the central lubrication system if necessary. Loosen lid and fill in oil ISO VG 68 up to the maximum marking of the sight glass. „Lubricant“ on page 78

➜ Close the lid again.

4.22 Digital position display

The device provided for the position display of traveling tools respectively tool slides on lathes, milling machines, etc.

Depending on the equipment and year of manufacture, the DPA21 or DPA31Plus is installed in the machine.

5 Maintenance

In this chapter you will find important information about

- Inspection
- Maintenance
- Repair

of the milling machine.

ATTENTION!

Properly performed regular maintenance is an essential prerequisite for

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

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

5.1 Operating material

5.1.1 Machine lubricants

Only use appropriate lubricants which guarantee a safe operation of the machine.

Recommended lubricant class: (ISO VG 68).
Recommended lubricant: Slideway oil Mobil Vactra (Oil No. 2)

5.1.2 Cooling lubricants

In order to avoid interferences during operation the water-mixed cooling lubricant and the slideway oil or grease need to be compatible.

Read also: ☞ Cooling lubricants and tanks on page 53

INFORMATION

The milling machine has been painted with varnish. This fact must be taken into account when selecting your cooling lubricant.

Optimum Maschinen Germany GmbH does not accept any liability for subsequent damages due to unsuitable cooling lubricants.

The flashpoint of the emulsion must be higher than 140°C.

When using non-water-miscible cooling lubricants (oil content > 15%) with a flashpoint, ignitable aerosol air mixtures might develop. There is a potential danger of explosion.

ATTENTION!

Only the correct selection of an appropriate combination of cooling lubricants and slideway oils as well as the proper care and maintenance of the cooling lubricant can ensure that no problems such as stick-slip effects or deposits are resulting.

The selection of cooling lubricants and slideway oils, lubricating oils or greases as well as their care are being determined by the machine operator or operating company.

Therefore, Optimum Maschinen Germany GmbH cannot be held liable for machine damages caused by unsuitable coolants and lubricants as well as by inadequate maintenance and servicing of the coolant. In case of problems with the cooling lubricant and the slideway oil or grease, please contact your mineral oil supplier.

We would like to ask you to have the following machine-related properties of the cooling lubricant confirmed in writing by the manufacturer of the cooling lubricant.

- The products must comply with the provisions of the current statutory regulations and the employers' liability insurance association.
- Request documentation for the products such as the product description VKIS and EC safety data sheet from the cooling lubricants manufacturer. The EC safety data sheet gives you information about the water hazard class.

They need to be environmentally friendly and workplace-friendly. Thus, they need to be free of nitrite, PCB, chlorine and nitrosatable diethanolamine (DEA), according to TRGS 611.

- The manufacturer should be able to provide a certificate concerning skin tolerance.
- The mineral oil content according to DIN 51417 should be at least 40% in the concentrate.
- If possible, it should be universally applicable for all chippings and materials.
- Long service life of the emulsion e.g. long-term stable and resistant to bacteria.
- Safe corrosion protection according to DIN 51360/2.
- Re-emulsifiable and non-adhesive according to VKIS sheet 9: Sticking and residue behaviour.
- It should not attack the varnish of the machine according to VDI 3035.
- It should not attack any machine elements (metals, elastomers).
- Low foaming behaviour of the emulsion.
- It should be as finely dispersed as possible in order to avoid clogging in the needle slot screen.

5.2 Safety

WARNING!

The consequences of incorrect maintenance and repair work may include:

- **Severe injuries of persons working on the milling machine,**
- **damage to the milling machine.**

Maintenance and repair work on the milling machine must be carried out by qualified technical personnel only.

Validation

Check and maintain all safety-relevant stop, control and measuring devices (validation).

Documentation

Record all tests and works in a operator's log resp. log book.

5.2.1 Preparation

WARNING!

Only carry out work on the milling machine, if the main switch is switched off and secured against restarting by means of a padlock.

☞ Switching-off and securing the milling machine on page 15. Attach a warning label.

5.2.2 Restarting

Before restarting, run a safety check. ☞ Safety check on page 13

WARNING!

Before starting the milling machine, it is essential that you ensure that this does not constitute a risk to personal safety or damage to the milling machine.

5.3 Repair

5.3.1 Customer service technician

For any repair work request the assistance of an authorised customer service technician. Contact your specialist dealer if you do not have customer service's information or contact Stürmer Maschinen GmbH in Germany who can provide you with a specialist dealer's contact information. Optionally, the company Stürmer Maschinen GmbH

Dr.-Robert-Pfleger-Str. 26

D- 96103 Hallstadt

can provide a customer service technician, however, the request for a customer service technician can only be made via your specialist dealer.

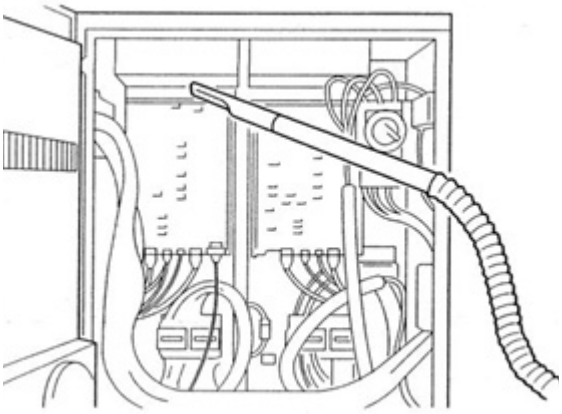
If the repairs are carried out by qualified technical personnel, they must follow the indications given in these operating instructions.

Optimum Maschinen Germany GmbH accepts no liability nor does it guarantee against damage and operating malfunctions resulting from failure to observe these operating instructions.

For repairs, only use

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

5.3.2 Cleaning the electrical cabinet



Although the electrical cabinet is constructed to shut off external air, foreign particles such as dust and dirt may enter the cabinet when the door is open.

Accumulation of foreign particles on the printed circuit boards or other electronic components could cause machine malfunction.

Clean the inside of the electrical cabinet regularly.

Remove dust inside electrical cabinet with a vacuum cleaner. Do not use compressed air to clean the electrical cabinet.

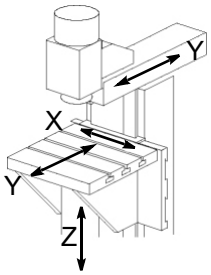
Never touch circuit boards or parts around the connector. Also avoid hitting these parts with the vacuum.

We recommend that the electrical cabinet is cleaned every 1000 operating hours.

5.3.3 Play adjustment of the machine stand guide in the Z axis

By adjusting the tapered gib.

Remove the wipers and covers to expose the set screws.



Perform measurement at the top:

If possible, use a dial gauge with drag pointer.

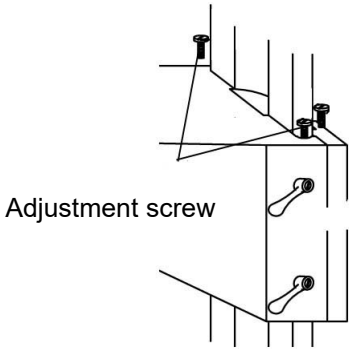
➜ Position the dial gauge at the height of the top V-ledge.

➜ Press the machine stand down on the left and the milling table on the right side and release.

➜ Read the dial gauge, the deviation must be less than 0.025/300mm.

In the event of a larger deviation, push the V-ledge with the adjusting screw slightly.

Position the dial gauge on the underside and use the same method if the deviation is too large.

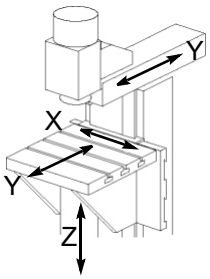


5.3.4 Play adjustment of the guide in the X axis

By adjusting the tapered gib.

Remove the wipers and covers to expose the set screws.

If possible, use a dial gauge with drag pointer.



➜ Press the milling table down on the left side and release.

➜ Read the dial gauge.

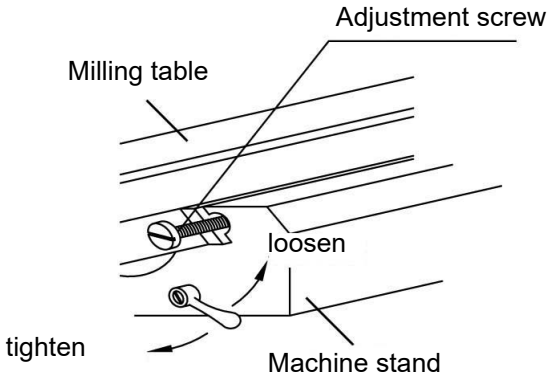
➜ Press the milling table up on the left side and release.

➜ Read the dial gauge, the deviation must be less than 0.025/300mm.

In the event of a larger deviation, push the V-ledge with the adjusting screw slightly.

Perform measurement on the right:

Position the dial gauge on the right side and proceed using the same method.



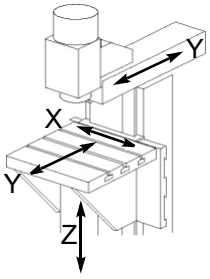
Img.5-1: Adjust guide, X axis

5.3.5 Play adjustment of the guide in the Y axis

By adjusting the tapered gib.

Remove the wipers and covers to expose the set screws.

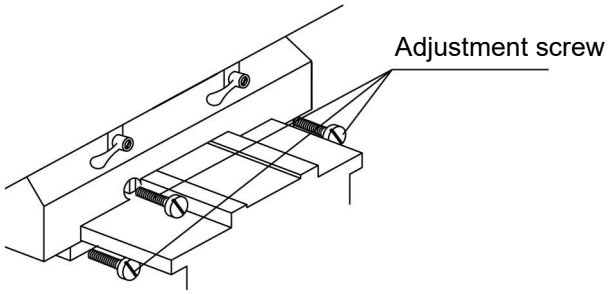
If possible, use a dial gauge with drag pointer.



➜ Move the milling table.

➜ Read the dial gauge, the deviation must be less than 0.025/300mm.

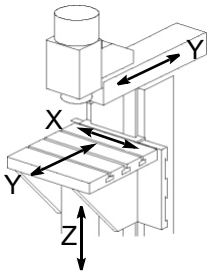
In the event of a larger deviation, push the V-ledge with the adjusting screw slightly.



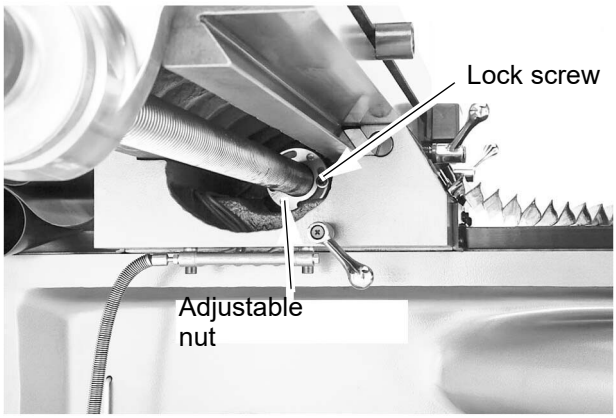
5.4 Adjustment of spindle nuts

5.4.1 Milling table

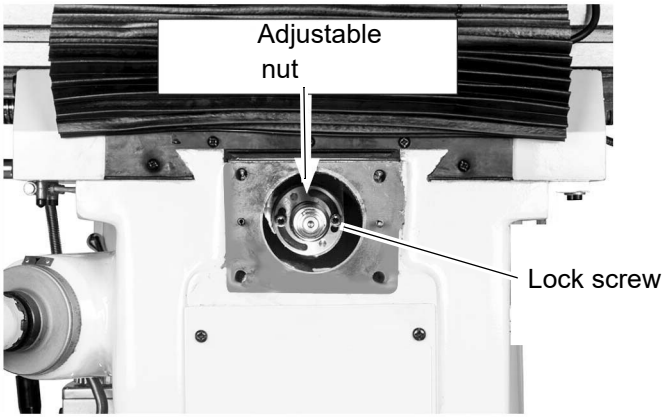
The spindles with two spindle nuts are located under the work table. One nut is fixed, the other nut with ring slot is adjustable.



X axis

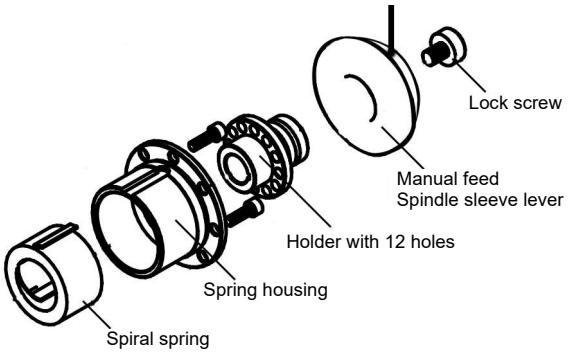


Y axis



5.5 Quill return spring

Replacing



- Move the quill up to end position, and dismantle manual feed hand base.
- Remove the 12-hole bracket.
- Rotate the spring retainer counterclockwise to release the spring tension.
- Remove the spring from the holder.
- Insert a new spring into the holder and test the spring tension as required.
- Then reassemble these parts.

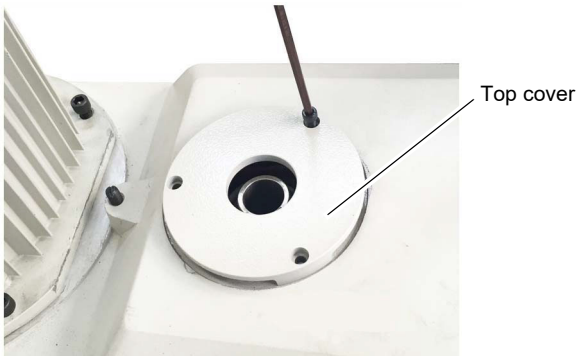
5.6 Replacing of motor, belt and brakes

Img.5-2:

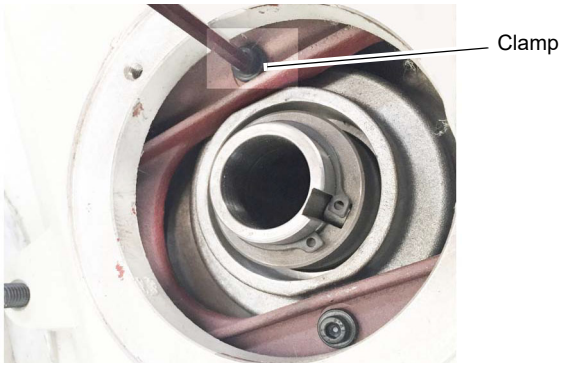
- Turn on the spindle and set it to high speed.
- Remove drawbar.
- Remove the rear cover of the head.
- Remove motor mounting screws, remove engine (pull engine forward and upward).
- Remove the side cover of the milling head and drive belt and insert a new drive belt. Install dismounted parts again.

Replacing of toothed belt or brake

❍ Remove the top cover.



❍ Unscrew the speed change disc.
❍ Loosen the clamp.



❍ Remove the screws for the upper housing of the milling head and the rear gearbox housing.

❍ Remove the upper housing from the gearbox housing.

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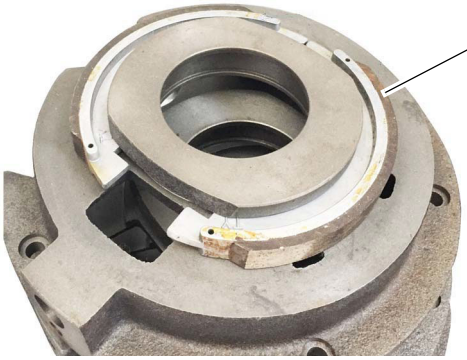
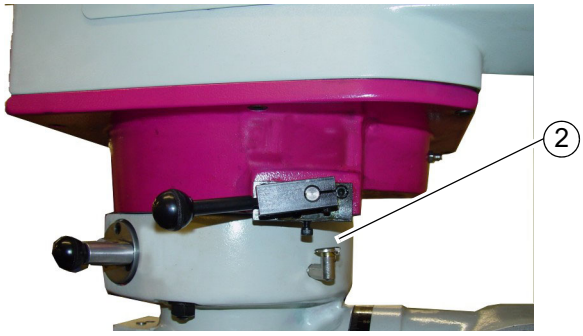
❍ Remove all parts step by step and replace the timing belt or brake assembly.

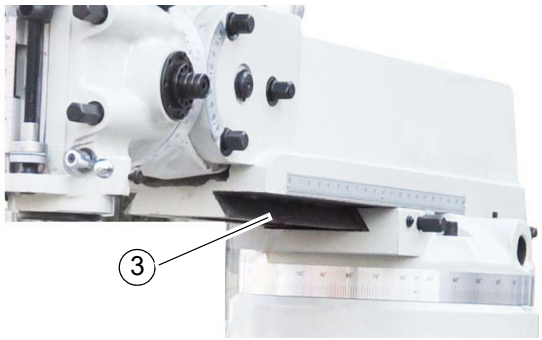
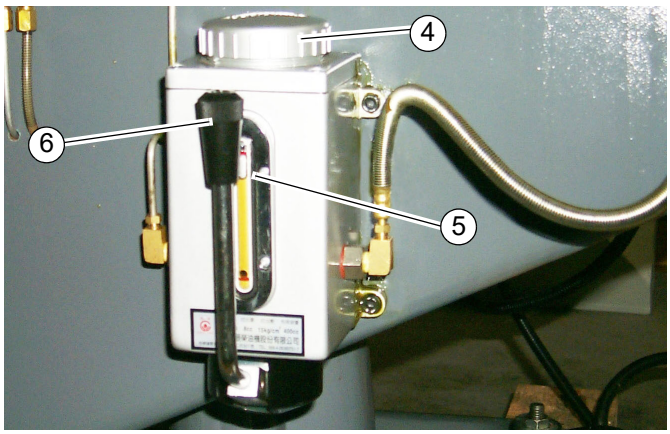


❍ Reassemble all components in the reverse order.

5.7 Inspection and maintenance

The type and level of wear depends to a large extent on the individual usage and operating conditions. Any indicated intervals therefore are only valid for the corresponding approved conditions. ☞ Technical specification on page 18

Interval	Where?	What?	How?
Start of work, after every maintenance or repair work	**Milling machine**	➜ ☞ Safety check on page 13	
		➜ Check all clamping screws for tightness.	
every day	**Cross table**	Oiling	The milling machine is equipped with a central lubrication system. Thus most lubrication points are supplied with oil. ➜ Oil all bare steel surfaces. Use an acid-free oil, e.g. weapon oil or motor oil.
every day	**Spindle sleeve**	Oiling	➜ Fill the quill oil on the oiler (1). (ISO VG 68).  Img.5-3: Quill oiler
every 40 operating hours	**Spindle gear**	Oiling	➜ Fill the gear on the oiler (2). (ISO VG 68).  Img.5-4: Gear oiler

Interval	Where?	What?	How?
every 40 operating hours	**Milling head boom**	Greasing	➜ Grease the guide track (3) on milling head boom with a thin layer.  Img.5-5: Guide track
every 4 - 8 operating hours	**Central lubrication**	Oil and refill	➜ Operate central lubrication system with lever (6). One pump stroke every 4 - 8 operating hours. ➜ Fill the central lubrication system if necessary. Unscrew cover (4) and top up with machine oil ISO VG 68 up to the maximum marking on the inspection glass (5). ➜ Close the cover again.  Img.5-6: Cross table central lubrication
every 40 operating hours	**Milling table**	Lubricating	➜ Grease the spindle of the cross table with bearing grease on the grease nipple (7).  Img.5-7: Lifting spindle

Interval	Where?	What?	How?
weekly	Cooling lubricant lubricant	Fill level status control	 **CAUTION !** **The cooling lubricant needs to be checked at least weekly, including during downtimes, with regard to its concentration, ph-value, bacteria and fungal decay.**
		Measure pH value	Check the pH value. If required, replace the cooling lubricant. ☞ Inspection plan for water-mixed cooling lubricants on page 54
Empirical value of the operator	Chip collecting tray	Cleaning	 **CAUTION!** **Wear protective gloves and use suitable tools to remove the chips.**
If necessary	Spindle nuts	Readjusting	☞ Adjustment of spindle nuts on page 46
If necessary	Guide track	Readjusting	☞ Play adjustment of the machine stand guide in the Z axis on page 44 ☞ Play adjustment of the guide in the Y axis on page 45 ☞ Play adjustment of the guide in the X axis on page 45
If necessary	Spindle brake	Replacing	☞ Replacing of motor, belt and brakes on page 47
If necessary	Return spring Spindle sleeve	Replacing	☞ Quill return spring on page 47

5.8 Cooling lubricants and tanks

CAUTION!

The cooling lubricant can cause diseases. Avoid direct contact with cooling lubricant or parts covered in cooling lubricant.

Cooling lubricant circuits and tanks for water-cooling lubricant mixtures must be completely emptied, cleaned and disinfected as needed, but at least once per year or every time the cooling lubricant is replaced.

If fine chips and other foreign matters are accumulated in the coolant tank, the machine can no longer be correctly supplied with coolant. Furthermore, the lifetime of the coolant pump is reduced.

When processing cast iron or similar materials generating fine chips, cleaning the coolant tank more often is recommended.

Limit values

The cooling lubricant must be replaced, the cooling lubricant circuit and tank emptied, cleaned and disinfected if

- the pH value drops by more than 1 based on the value during initial filling. The maximum permissible pH value during initial filing is 9.3
- there is a perceivable change in the appearance, odour, floating oil or increase of the bacteria to more than 10/6/ml
- there is an increase in nitrite content to more than 20 ppm (mg/1) or nitrate content to more than 50 ppm (mg/1)
- there is an increase in the N-nitrosodiethanolamine (NDELA) to more than 5 ppm (mg/a)

CAUTION!

Comply with the manufacturer's specifications for mixture ratios, hazardous substances, e.g. system cleaners, including their permissible minimum use times.

CAUTION!

Since the cooling lubricant escapes under high pressure, pumping out the coolant by using the existing cooling lubricant pump via a pressure hose into a suitable tank is not recommended.

ENVIRONMENTAL PROTECTION

During work on the cooling lubricant equipment please make sure that

- **collector tanks are used with sufficient capacity for the amount of liquid to be collected.**
- **liquids and oils should not be spilled on the ground.**

Clean up any spilled liquid or oils immediately using proper oil-absorption methods and dispose of them in accordance with current statutory environmental regulations.

Collect leakages

Do not re-introduce liquids spilled outside the system during repair or as a result of leakage from the reserve tank, instead collect them in a collecting container for disposal.

Disposal

Never dump oil or other substances which are harmful to the environment into water inlets, rivers or channels. Used oils must be delivered to a collection centre. Consult your supervisor if you do not know where the collection centre is.

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5.8.1 Inspection plan for water-mixed cooling lubricants

Company: No.: Date: used cooling lubricant			
size to be checked	Inspection methods	Inspection intervals	Procedure and comment
noticeable changes	Appearance, odour	daily	Find and rectify causes, e.g. skim off oil, check filter, ventilate cooling lubricant system
pH value	Laboratory techniques electrometric with pH meter (DIN 51369) Local measurement method: with pH paper (Special indicators with suitable measuring range)	weekly [1)]	if pH value decreases > 0.5 based on initial filing: Measures in accordance manufacturer's recommendations > 1.0 based on initial filing: Replace cooling lubricant, clean cooling lubricant circulation system
Usage concentration	Manual refractometer	weekly [1)]	Method results in incorrect values with tramp oil content
Base reserve	Acid titration in accordance with Manufacturer's recommendation	as required	Method is independent of tramp oil content
Nitrite content	Test sticks method or laboratory method	weekly [1)]	> 20 mg/L nitrite: Replace cooling lubricant or part or inhibiting additives; otherwise NDELA (N-nitrosodiethanolamine) in the cooling lubricant system and in the air must be determined > 5 mg/L NDELA in the cooling lubricant system: Replacement, clean and disinfect cooling lubricant circulation system, find nitrite source and, if possible, rectify.
Nitrate/nitrite content of the preparation water, if this is not removed from the public grid	Test sticks method or laboratory method	as required	Use water from the public grid if there is water from the pubic grid has > 50 mg/l nitrate: Inform the waterworks

[1)] The specified inspection intervals (frequency) are based on continuous operation. Other operational conditions can result in other inspection intervals; exceptions are possible in accordance with Sections 4.4 and 4.10 of the TGS 611.

Editor:

Signature:

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6 Ersatzteile - Spare parts

6.1 Ersatzteilbestellung - *Ordering spare parts*

Bitte geben Sie folgendes an - *Please indicate the following :*

- Seriennummer - *Serial No.*
- Maschinenbezeichnung - *Machines name*
- Herstellungsdatum - *Date of manufacture*
- Artikelnummer - *Article no.*

Die Artikelnummer befindet sich in der Ersatzteilliste. *The article no. is located in the spare parts list.* Die Seriennummer befindet sich am Typschild. *The serial no. is on the rating plate.*

6.2 Hotline Ersatzteile - Spare parts Hotline

+49 (0) 951-96555 -118

ersatzteile@stuermer-maschinen.de

6.3 Service Hotline

+49 (0) 951-96555 -100

service@stuermer-maschinen.de

6.4 Ersatzteilzeichnungen - Spare part drawings

A Fräskopf Getriebe, Teil A - Gearbox milling head, part A

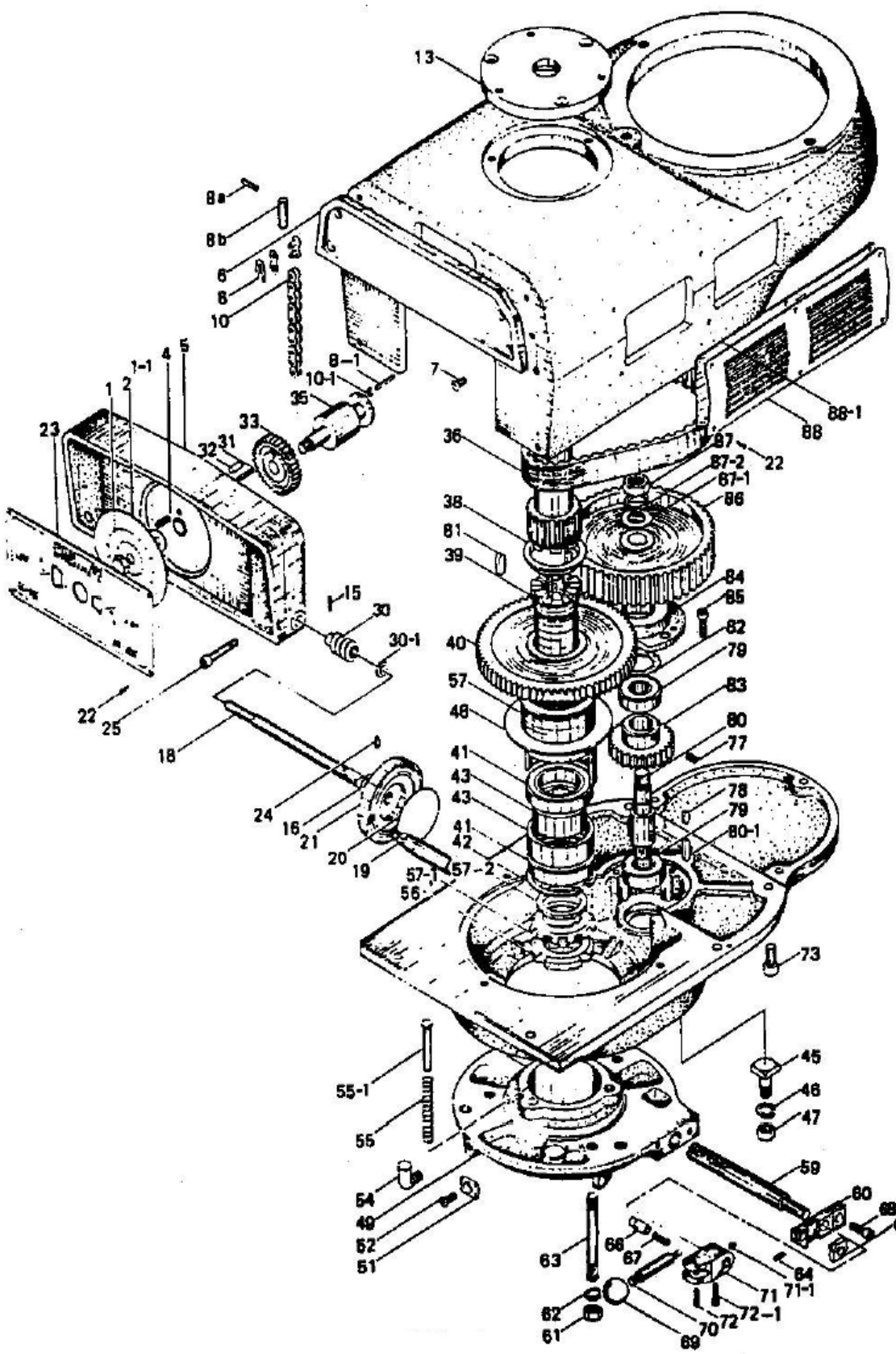

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Abb.6-1: Fräskopf - Milling head - part A

Fräskopf stufenloses mechanisches Getriebe, Teil A - Infinitely variable mechanical gearbox milling head, part A					
Pos.	**Bezeichnung**	**Description**	**Verweis Reference**	**Artikelnummer Item no.**	
				MF2-B	**MF4-B**
1	Schraube	Screw	VA 1		
2	Drehzahlanzeige	Speed indicator	VA 2	033483300102	033483400102
3	Kupferlager	Copper bearing	VA 3		
4	Stiftschraube	Set screw	VA 4		
5	Halterung	Bracket	VA 5	033483300105	033483400105
8	Kette	Chain	VA 8	033483300108	033483400108
8-1	Spannstift	Dowel pin	VA 8-1		
8-a	Spannstift	Dowel pin	VA 8-a		
8-b	Distanzstück	Space	VA 8-b		
8-c	Kerbstift	Cotter pin	VA 8-c		
10	Kette Drehzahlveränderung	Speed change chain	VA 10	033483300110	033483400110
13	Lagerdeckel	Bearing cover	VA 13	033483300113	033483400113
15	Spannstift	Dowel pin	VA 15		
16	Feder	Spring	VA 16		
17	Kupferlager	Copper bearing	VA 17	033483300117	033483400117
18	Welle Drehzahlveränderung	Speed change shaft	VA 18	033483300118	033483400118
19	Griff	Handle	VA 19	033483300119	033483400119
20	Markenbezeichnung	Mark brand	VA 20	033483300120	033483400120
21	Handrad Drehzahlveränderung	Speed change wheel	VA 21	033483300121	033483400121
22	Schraube	Screw	VA 22		
23	Platte	Plate	VA 23	033483300123	033483400123
24	Stiftschraube	Setscrew	VA 24		
25	Schraube	Screw	VA 25		
30	Schnecke	Worm	VA 30	033483300130	033483400130
31	Kupferlager	Copper bearing	VA 31		
32	Spannstift	Dowel pin	VA 32		
33	Zahnrad Drehzahlveränderung	Speed change gear	VA 33	033483300133	033483400133
35	Rad	Wheel	VA 35	033483300135	033483400135
36	Keilriemen	Belt	VA 36	033483300136	033483400136
38	Kupplung Pinole	Clutch quill	VA 38	033483300138	033483400138
39	Hülse Spindelzahnrad	Spindle gear sleeve	VA 39	033483300139	033483400139
40	Baugruppe Spindelzahnrad	Spindle gear assembly	VA 40	033483300140	033483400140
41	Kugellager	Ball bearing	VA 41		
42	Ring	Ring	VA 42		
43	Distanzscheibe Zahnradlager	Gear bearing space	VA 43		
45	T-Schraube	T bolt	VA 45		
46	Unterlegscheibe	Washer	VA 46		
47	Mutter	Nut	VA 47		
48	Unterlegscheibe	Washer	VA 48		
49	Kupplungshalter	Clutch bracket	VA 49	033483300149	033483400149
51	Kupplung	Clutch	VA 51	033483300151	033483400151
52	Schraube	Screw	VA 52		
54	Öler	Oil cup	VA 54		
55	Feder	Spring	VA 55		
56	Sicherungsmutter Lager	Bearing lock nut	VA 56		
57	Lager Pinole	Bearing quill	VA 57	033483300157	033483400157
57-2	Unterlegscheibe	Washer	VA 57-2	0334833001572	0334834001572
58	Federring	Spring ring	VA 58		
59	verzahnte Welle	Pinion shaft	VA 59	033483300159	033483400159
60	Bremsensatz	Brake set	VA 60	033483300160	033483400160
61	Mutter	Nut	VA 61		
62	Sicherungsscheibe	Lock washer	VA 62		
63	Schraube	Bolt	VA 63		
64	Stiftschraube	Setscrew	VA 64		
65	Einstellplatte	Adjusting plate	VA 65	033483300165	033483400165
66	Bremshebel	Brake lever	VA 66	033483300166	033483400166
67	Feder	Spring	VA 67		
68	Stiftschraube	Setscrew	VA 68		
69	Kugelgriff	Handle ball	VA 69	033483300169	033483400169
70	Kurbel Drehzahlveränderung	Speed change crank	VA 70	033483300170	033483400170
71	Anschlag verzahnte Welle	Pinion stop block	VA 71	033483300171	033483400171
72	Spannstift	Dowel pin	VA 72		
72-1	Schraube	Screw	VA 72-1		
73	Schraube	Screw	VA 73		
77	Schraube	Screw	VA 77		
78	Passfeder	Key	VA 78		
79	Kugellager	Ball bearing	VA 79		
80	Vorgelegewelle	Pinion counter shaft	VA 80	033483300180	033483400180
81	Passfeder	Key	VA 81		
82	Federring	Spring ring	VA 82		
83	Zahnrad	Gear	VA 83	033483300183	033483400183

Fräskopf stufenloses mechanisches Getriebe, Teil A - Infinitely variable mechanical gearbox milling head, part A					
Pos.	**Bezeichnung**	**Description**	**Verweis Reference**	**Artikelnummer Item no.**	
				MF2-B	**MF4-B**
84	Zahnrad Lagerdeckel	Pinion bearing cover	VA 84	033483300184	033483400184
85	Schraube	Screw	VA 85		
86	Zahnriemenscheibe	Timing pulley	VA 86	033483300186	033483400186
87	Sicherungsmutter	Locknut	VA 87		
88	Schutz	Guard	VA 88	033483300188	033483400188
89	Schraube	Screw	VA 89		

B Fräskopf Getriebe, Teil B - Gearbox milling head, part B

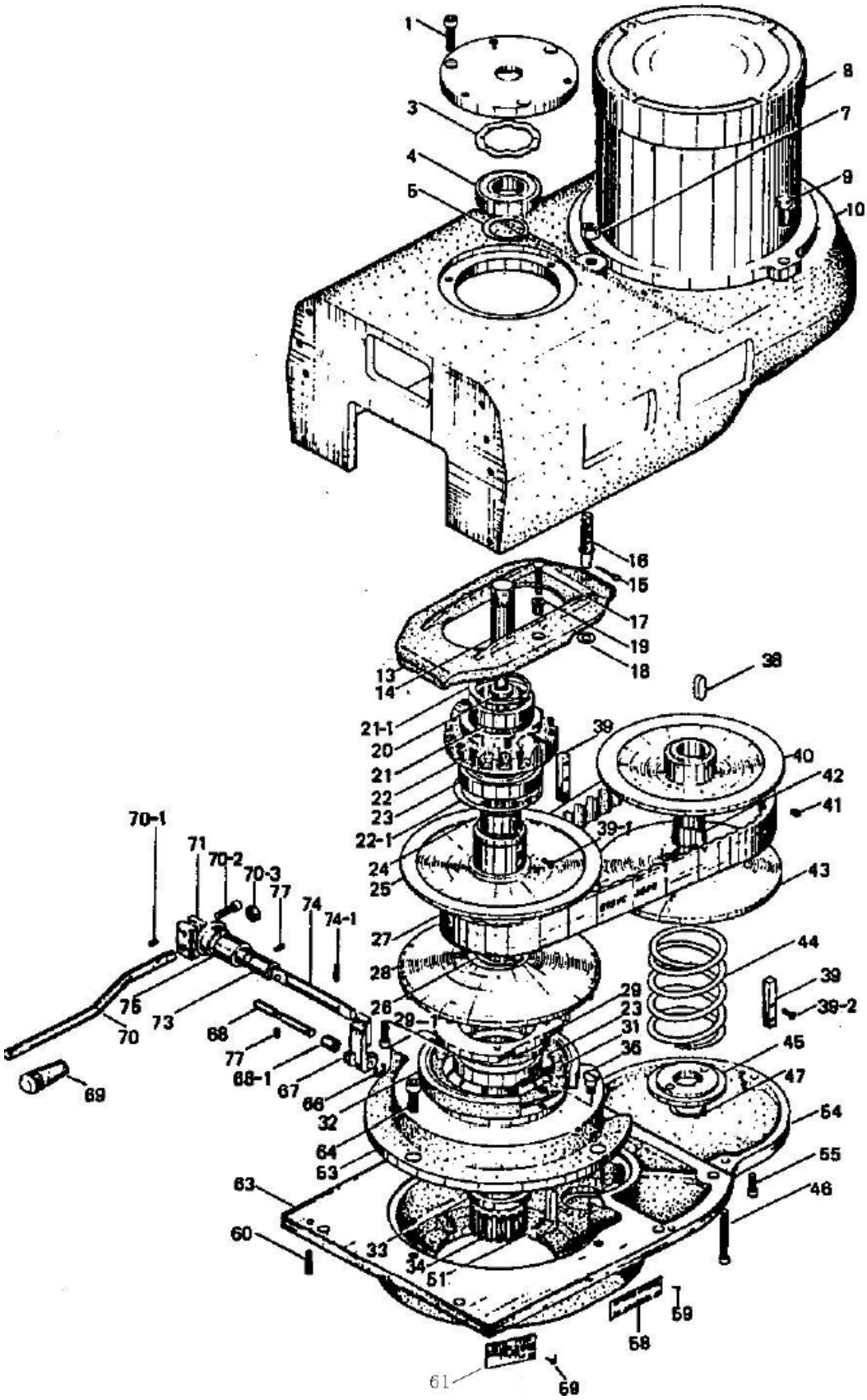


Abb.6-2: Fräskopf - Milling head - part B

MF2B_MF4B_parts.fm

Fräskopf stufenloses mechanisches Getriebe, Teil B - Infinitely variable mechanical gearbox milling head, part B					
Pos.	**Bezeichnung**	**Description**	**Verweis Reference**	**Artikelnummer Item no.**	
				MF2-B	**MF4-B**
1	Schraube	Screw	VB 1		
3	Federscheibe	Spring washer	VB 3		
4	Kugellager	Ball bearing	VB 4		
5	Federring	Spring ring	VB 5		
7	Sicherungsmutter	Lock nut	VB 7		
8	Motor	Motor	VB 8	033483300208	033483400208
8-1	Motor Lüfterdeckel	Motor fan cover		0334833002081	0334833002081
9	Schraube	Screw	VB 9		
H8018	Unterlegscheibe	Washer	VB H8018		
13	Gehäuseplatte	Housing plate	VB 13	033483300213	033483400213
14	Gelenkwelle	Joint shaft	VB 14	033483300214	033483400214
15	Sicherungsstift	Lock pin	VB 15		
16	Schraube	Bolt	VB 16		
17	Schraube	Screw	VB 17		
18	Unterlegscheibe	Washer	VB 18		
19	Hülse Bolzen	Bolt sleeve	VB 19		
20	Unterlegscheibe	Washer	VB 20		
22	Lagergehäuse	Bearing housing	VB 22	033483300222	033483400222
23	Kugellager	Ball bearing	VB 23		
24	Kupferhülse	Copper sleeve	VB 24	033483300224	033483400224
25	Variator Drehzahlscheibe	Vari. Speed disk	VB 25	033483300225	033483400225
26	Ring	Ring	VB 26		
27	Keilriemen	Belt	VB 27	033483300227	033483400227
28	befestigte Platte	Fixed disk	VB 28	033483300228	033483400228
29	Bremse	Brake	VB 29	033483300229	033483400229
29-1	Schraube	Screw	VB 29-1		
31	Feder Bremse	Brake spring	VB 31	033483300231	033483400231
32	Baugruppe Bremse	Brake assembly	VB 32	033483300232	033483400232
33	Distanzscheibe Spindelriemenscheibe	Spindle pulley space	VB 33		
34	Riemenscheibe Spindel	Spindle pulley	VB 34	033483300234	033483400234
35	Schraube	Bolt	VB 35		
36	Bremsspindel	Brake arbor	VB 36	033483300236	033483400236
37	Spannstift	Dowel pin	VB 37		
38	Passfeder	Key	VB 38		
39	Passfeder	Key	VB 39		
40	feste Drehzahlscheibe	Fixed speed disk	VB 40	033483300240	033483400240
41	Stiftschraube	Setscrew	VB 41		
42	Kupferhülse	Copper sleeve	VB 42	033483300242	033483400242
43	Variator Baugruppe Drehzahlscheibe	Vari. Speed disk assembly	VB 43	033483300243	033483400243
44	Feder	Spring	VB 44		
45	Federgehäuse	Spring house	VB 45		
46	Schraube	Screw	VB 46		
47	Ring	Ring	VB 47	033483300247	033483400247
51	Passfeder	Key	VB 51		
53	Abdeckplatte Pumpe	Pulley cover plate	VB 53	033483300253	033483400253
54	Abdeckung Motorscheibe	Motor pulley cover	VB 54	033483300254	033483400254
55	Schraube	Screw	VB 55		
58	Kennzeichnung	Mark	VB 58	033483300258	033483400258
59	Niet	Rivet	VB 59		
60	Kegelstift	Taper pin	VB 60		
61	Kennzeichnung Pinolenvorschub	Quill feed mark	VB 61	033483300261	033483400261
63	Getriebeabdeckung	Gear box cover	VB 63	033483300263	033483400263
64	Schraube	Screw	VB 64		
66	Ring	Ring	VB 66		
67	Nadel	Needle	VB 67	033483300267	033483400267
68	Welle	Shaft	VB 68	033483300268	033483400268
69	Kugel	Ball	VB 69	033483300269	033483400269
70	Bremsgriff	Brake handle	VB 70	033483300270	033483400270
71	Stift Bremsverriegelung	Brake lock pin	VB 71	033483300271	033483400271
72	Stiftschraube	Setscrew	VB 72		
73	Hülse Bremswelle	Brake shaft sleeve	VB 73	033483300273	033483400273
74	Bremswelle	Brake shaft	VB 74	033483300274	033483400274
77	Schraube	Screw	VB 77		

C Fräskopf - Milling head

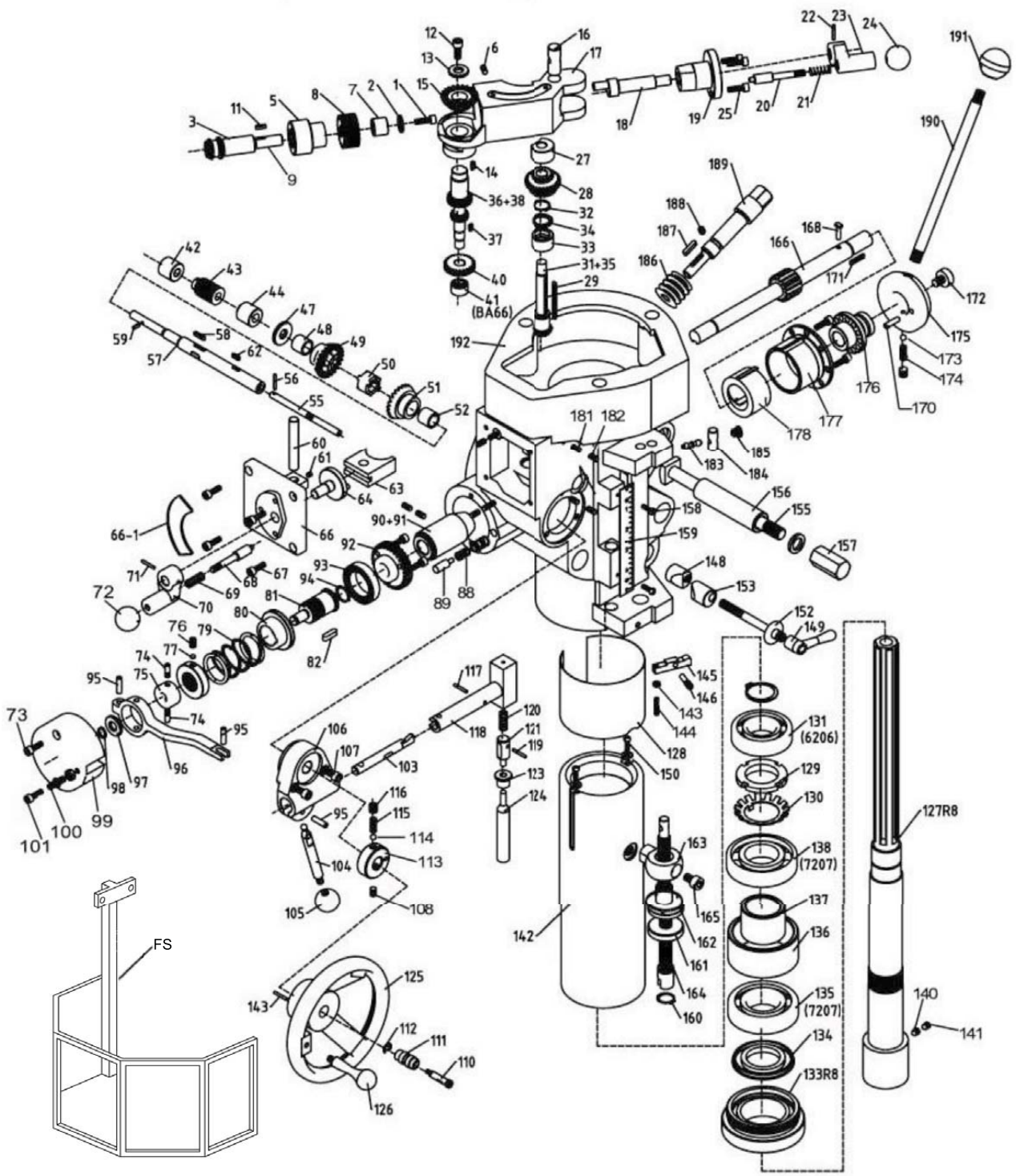


Abb.6-3: Fräskopf - Milling head

MF2B_MF4B_parts.fm

Fräskopf - Milling head					
Pos.	**Bezeichnung**	**Description**	**Verweis Reference**	**Artikelnummer Item no.**	
				MF2-B	**MF4-B**
1	Schraube	Screw	B1		
2	Unterlegscheibe	Washer	B2		
3	Kegelradwelle	Bevel pinion shaft	B3	033483300303	033483400303
5	Buchse	Bushing	B5	033483300305	033483400305
6	Stift	Pin	B6		
7	Schneckenabstandhalter	Worm spacer	B7	033483300307	033483400307
8	Vorschubschnecke	Feed worm	B8	033483300308	033483400308
9	Schneckenwelle	Worm shaft	B9	033483300309	033483400309
11	Passfeder	Key	B11		
12	Schraube	Screw	B12		
13	Unterlegscheibe	Washer	B13		
14	Passfeder	Key	B14		
15	Umkehrzahnrad	Reversing gear	B15	033483300315	033483400315
16	Spannstift	Dowel pin	B16		
17	Schneckenhalterung	Worm bracket	B17	033483300317	033483400317
18	Exzenterwelle	Eccentric shaft	B18	033483300318	033483400318
19	Wellengehäuse	Shaft housing	B19	033483300319	033483400319
20	Stange	Bar	B20	033483300320	033483400320
21	Feder	Spring	B21		
22	Stift	Pin	B22		
23	Kurbel	Crank	B23	033483300323	033483400323
24	Kunststoffkugel	Plastic ball	B24	033483300324	033483400324
25	Schraube	Screw	B25		
27	Kupferhülse	Copper sleeve	B27		
28	Zahnradkombination	Multi-gear	B28	033483300328	033483400328
29	Passfeder	Key	B29		
31	Welle Zahnradkombination	Multi-gear shaft	B31	033483300331	033483400331
32	Sicherungsring	Retaining ring	B32		
33	Kupferhülse	Copper sleeve	B33	033483300333	033483400333
34	Unterlegscheibe	Washer	B34		
35	Welle Umkehrzahnrad	Reversing gear shaft	B35	033483300335	033483400335
36	Vorschubzahnrad	Feed gear	B36	033483300336	033483400336
37	Passfeder	Key	B37		
38	Welle Zahnradkombination	Multi-gear shaft	B38	033483300338	033483400338
40	Kupfer Schneckenrad	Cooper worm wheel	B40	033483300340	033483400340
41	Lager BA66	Bearing BA66	B41		
42	Kupferhülse	Copper sleeve	B42		
43	Auto. Vorschubschnecke	Auto. Feed worm	B43	033483300343	033483400343
44	Kupferhülse	copper sleeve	B44		
47	Druckscheibe	Thrust washer	B47	033483300347	033483400347
48	Buchse	Bushing	B48		
49	Kegelzahnrad	Bevel Pinion	B49	033483300349	033483400349
50	Kupplung	Clutch	B50	033483300350	033483400350
51	Kegelzahnrad	Bevel pinion	B51	033483300351	033483400351
52	Kupferhülse	Copper sleeve	B52		
55	Zugstange Vorschubkontrolle	Feed control pull bar	B55	033483300355	033483400355
56	Stift Ø3 x 20	Pin Ø3 x 20	B56		
57	Vorschubschneckenwelle	Feed worm shaft	B57	033483300357	033483400357
59	Stift Ø3 x 16	Pin Ø3 x 16	B59		
60	Schiebewelle	Sliding shaft	B60	033483300360	033483400360
61	Schraube	Screw	B61		
62	Passfeder	key	B62		
63	Gabel Vorschubänderung	Feed changing fork	B63	033483300363	033483400363
64	Exzenterwelle	Eccentric shaft	B64	033483300364	033483400364
66	Kupplungsplatte	Clutch plate	B66	033483300366	033483400366
67	Schraube	Screw	B67		
68	Ausrichtungsleiste	Alignment bar	B68	033483300368	033483400368
69	Feder	Spring	B69		
70	Kurbel Vorschubänderung	Feed change crank	B70	033483300370	033483400370
71	Stift Ø3 x 20	Pin 3 x 20	B71		
72	Kunststoffkugel	Plastic ball	B72		
73	Schraube	Screw	B73		
74	Schraube	Screw	B74		
75	Kupferhülse	Copper sleeve	B75		
76	Schraube	Screw	B76		
77	Messingstecker	Brass plug	B77		
79	Feder	Spring	B79		
80	Überlastkupplung	Overload clutch	B80	033483300380	033483400380
81	Wellenhülse	Shaft sleeve	B81	033483300381	033483400381
82	Passfeder	Key	B82		
88	Feder	Spring	B88		

MF2B_MF4B_parts.fm

Fräskopf - Milling head					
Pos.	**Bezeichnung**	**Description**	**Verweis Reference**	**Artikelnummer Item no.**	
				MF2-B	**MF4-B**
89	Stange	Bar	B89	033483300389	033483400389
90	Buchse	Bushing	B90		
92	Vorschubschneckenrad	Feed worm wheel	B92	033483300392	033483400392
93	verzahnter Kupplungsring	Teethed clutch ring	B93	033483300393	033483400393
94	Sicherungsring	Retaining ring	B94		
95	Stift	Pin	B95		
96	Vorschubsteuerhebel	Feed control lever	B96	033483300396	033483400396
97	Unterlegscheibe	Washer	B97		
98	Sicherungsring	Retaining ring	B98		
99	Kupplungsplatte	Clutch plate	B99	033483300399	033483400399
100	Stiftschraube	Setscrew	B100		
101	Sicherungsmutter	Locknut	B101		
103	Schiebewelle	Slide shaft	B103	0334833003103	0334834003103
104	Vorschubsteuerhebel	Feed control lever	B104	0334833003104	0334834003104
105	Kunststoffkugel	Plastic ball	B105		
106	Halterung Vorschubauslösung	Feed trip bracket	B106	0334833003106	0334834003106
107	Schraube	Screw	B107		
108	Schraube	Screw	B108		
110 ~ 112	Zughebel	Pull lever	B110?112	0334833003110	0334834003110
113	Handrad Kupplung	Hand wheel clutch	B113	0334833003113	0334834003113
114	Stahlkugel	Steel Ball	B114		
115	Feder	Spring	B115		
116	Schraube	Screw	B116		
118	Schiebeblock	Slide block	B118		
119	Stift	Pin	B119		
120	Feder	Spring	B120		
121	Anschlagkolben	Stop plunger	B121	0334833003121	0334834003121
123	Druckstößel	Plunger pushing	B123	0334833003123	0334834003123
124	Schiebestange	Push bar	B124	0334833003124	0334834003124
125	Handrad	Handwheel		0334833003125	0334834003125
127	Spindel	Spindle		0334833003127	0334834003127
128	Pinoleneinfassung	Quill Skirt		0334833003128	0334834003128
129	Sicherungsmutter	Locknut			
130	Sicherungsscheibe	Lockwasher			
131	Lager	Bearing			
132	Hülse	Sleeve			
133	Nasenstück	Nose - piece		0334833003133	0334834003133
134	Spindel Schutzrohr	Spindle Dirt Shield		0334833003134	0334834003134
135	Lager	Bearing			
136	(Abstandshalter Lager groß)	(Bearing Spacer - Large)			
137	(Abstandshalter Lager klein)	(Bearing Spacer - Small)			
138	Lager	Bearing			
140	Spezial Stiftschraube	Special Socket Set Screw		0334833003140	0334834003140
141	Spannzangenschraube	Collet Alignment Screw		0334833003141	0334834003141
142	Pinole	Quill		0334833003142	0334834003142
144	Stiftschraube	Socket Set Screw			
145	Vorschubhebel	Feed Trip Lever		0334833003145	0334834003145
146	Auslösehebel	Trip Lever Pin		0334833003146	0334834003146
148	Hülse Pinolenverriegelung	Quill lock Sleeve		0334833003148	0334834003148
149	Klemmgriff	Lock Handle		0334833003149	0334834003149
151	Filzscheibe	Felt Washer			
152	Sicherungsbolzen Pinole	Quick Lock Bolt			
153	Verschlusshülse Pinole mit Gewinde	Quill Lock Sleeve Tapped			
155	T-Nut Baugruppe	T - Slot Assy			
156	Distanzstück unterer Klemmblock (2 erf.)	Lower Clamping Blot Spacer (2 req.)			
157	Sicherungsmutter	Locknut			
158	Chem schwarze RD. HD. Schrauben (2 erf.)	Chem Blacked RD. HD. Screws(2 req.)			
159	Mikrometer-skala	Micrometer Scale		0334833003159	0334834003159
160	Sicherungsring	Snap Ring			
161	Stopp Mutter - Pinole Feinvorschub	Quill Micro - stop Nut		0334833003161	0334834003161
162	Mutter Mikrometer	Micrometer Nut			
163	Stop Knopf Pinole	Quill Stop Knob		0334833003163	0334834003163
164	Schraube - Pinole Feinvorschub	Quill Stop Micro - screw			
165	Schraube	Screw			
166	verzahnte Pinolenwelle	Quill Pinion Shaft		0334833003166	0334834003166
168	Federstift	Spring Pin			
169	RD. Kopfschrauben (2 erf.)	RD. Head Screw(2 Req.)			
170	Spannstift	Roll Pin			

Fräskopf - Milling head					
Pos.	**Bezeichnung**	**Description**	**Verweis Reference**	**Artikelnummer Item no.**	
				MF2-B	**MF4-B**
171	Passfeder	Key			
172	Hubschraube verzahnte Welle	Pinion shaft Hub Screw		0334833003172	0334834003172
173	Stahlkugel	Steel Ball			
174	Druckfeder	Compression Spring		0334833003174	0334834003174
175	Nabe Zahnstangeneinzugsgriff	Rack Feed Handle Hub		0334833003175	0334834003175
176	Nabenhülse verzahnte Welle	Pinion Shaft Hub Sleeve		0334833003176	0334834003176
177	Federdeckel	Spring Vover		0334833003177	0334834003177
178	Spiralfeder (Baugruppe Spiralfeder)	Spiral spring (Clock Spring Assy.)		0334833003178	0334834003178
180	Pinolenwelle	Quill Pinion		0334833003180	0334834003180
181	Stiftschraube	Socket Set screw			
182	Sicherungsschraube	Lock screw			
183	Kugel Hebel Umkehrung	Reverse Trip Ball Lever		0334833003183	0334834003183
184	Auslösestange Vorschubumkehrung	Feed Reverse Trip Plunger		0334833003184	0334834003184
185	Schraube Auslösestange Vorschubumkehrung	Reverse/Trip Ball Lever Screw			
186	Schneckenrad	Worm Gear		0334833003186	0334834003186
187	Passfeder	Key			
188	Stiftschraube	Socket Set Screw			
189	Einstell-Schneckenwelle	ADJ Worm Shaft		0334833003189	0334834003189
190	Griff Nabe verzahnte Welle	Pinion Shaft Hub Handle		0334833003190	0334834003190
191	Schwarze Kunststoffkugel	Black Plastic Ball Handles			
192	Pinolengehäuse	Quill Housing		0334833003192	0334834003192

D Maschinenkörper - Machine body

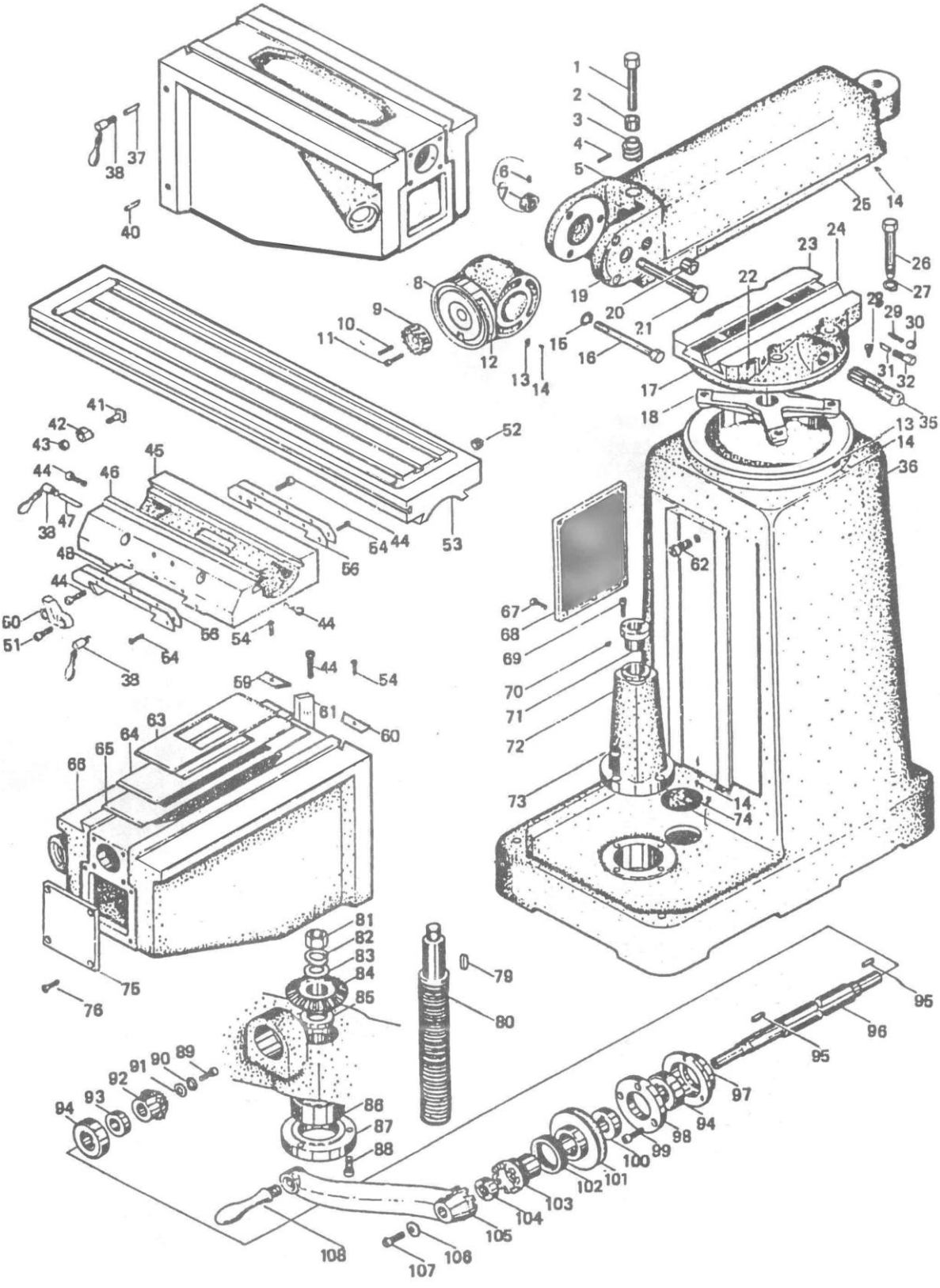


Abb.6-4: Maschinenkörper - Machine body

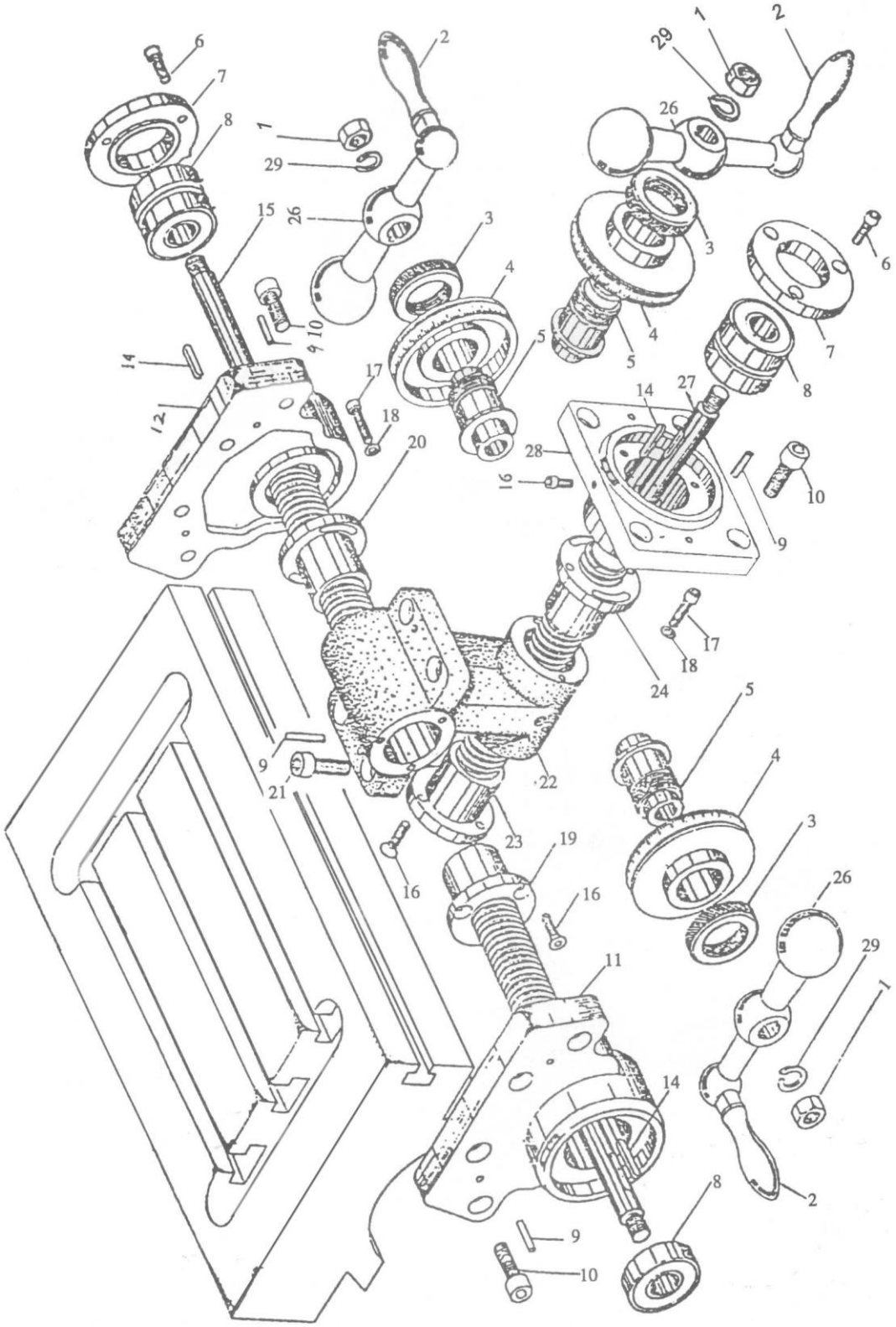
MF2B_MF4B_parts.fm

Maschinenkörper - Machine body					
Pos.	**Bezeichnung**	**Description**	**Verweis Reference**	**Artikelnummer Item no.**	
				MF2-B	**MF4-B**
1	Schneckenwelle	Worm shaft	C001	033483300401	033483400401
2	Hülse der Schneckenwelle	Sleeve of worm shaft	C002	033483300402	033483400402
3	Schnecke	Worm	C003	033483300403	033483400403
4	Federstift	Spring pin	C004		
5	Fräskopfausleger	Ram	C005		
8	Adapter	adapter	C008	033483300408	033483400408
9	Schnecke	Worm	C009	033483300409	033483400409
10	Federstift	Spring pin	C010		
11	Innen Sechskantschraube	Hex. Socket screw	C011		
12	Kennzeichnung	Mark	C012	033483300412	033483400412
13	Nullanzeige	Zero indicator	C013		
14	Niet	Rivet	C014		
15	Federscheibe	Spring lock washer	C015		
16	Sicherungsschraube	Lock screw	C016		
17	Kennzeichnung	Mark	C017	033483300417	033483400417
18	Halterung	Bracket	C018	033483300418	033483400418
19	Lineal	Ruler	C019	033483300419	033483400419
20	Hülse	Sleeve	C020	033483300420	033483400420
21	Achse des Adapters	Axle of adapter	C021	033483300421	033483400421
22	Nullanzeige	Zero indicator	C022	033483300422	033483400422
23	Revolver	Turret	C023	033483300423	033483400423
24	Leiste	Gib	C024	033483300424	033483400424
25	Lineal	Ruler	C025	033483300425	033483400425
26	Befestigungsschraube	Bracket screw	C026		
27	Federscheibe	Spring lock washer	C027		
28	Stiftschraube	Set screw	C028		
29	Sicherungsschraube	Lock screw	C029		
30	Innensechskant schraube	Hex. Head screw	C030		
31	Sicherungsstift	Lock pin	C031		
32	Sicherungsschraube	Lock screw	C032		
35	Zahnradwelle	Gear shaft	C035	033483300435	033483400435
36	Körper	Body	C036	033483300436	033483400436
37	Sicherungsstift	Lock pin	C037		
38	Klemmgriff	Lock handle	C038	033483300438	033483400438
40	Sicherungsstift	Lock pin	C040		
41	Einstellgriff	Travel set handle	C041	033483300441	033483400441
42	Block Einstellgriff	Travel set block	C042	033483300442	033483400442
43	Mutter	Nut	C043		
44	Einstellschraube für Leiste	Adjusting screw for gib	C044	033483300444	033483400444
45	Sattel	Saddle	C045	033483300445	033483400445
46	Leiste des Tisches	Gib of table	C046	033483300446	033483400446
47	Sicherungsstift	Lock pin	C047		
48	Leiste des Sattels	Gib of saddle	C048	033483300448	033483400448
50	Verfahranschlag	Travel stop block	C050	033483300450	033483400450
51	Innensechskantschraube	Hex. Socket screw	C051		
106	Unterlegscheibe	Washer	C106		
107	Innensechskantschraube	Hex. Socket screw	C107		
52	Schraubverschluss	Screw plug	C052		
53	Arbeitstisch	Work table	C053	033483300453	033483400453
54	Linsenkopfschraube	Round head screw	C054		
56	Ölabstreifer	Oil scraper	C056		
59	Rechter Ölabstreifer	Right oil scraper	C059		
60	Linker Ölabstreifer	Left oil scraper	C060		
61	Leiste des Tischträgers	Gib of knee	C061	033483300461	033483400461
62	Stellschraube verfahren	Travel set screw	C062		
63	Späneschutz	Chip guard	C063	033483300463	033483400463
64	Späneschutz	Chip guard	C064	033483300464	033483400464
65	Späneschutz	Chip guard	C065	033483300465	033483400465
66	Tischträger	Knee	C066	033483300466	033483400466
67	Innensechskantschraube	Hex. Socket screw	C067		
68	Seitliche Abdeckplatte	Side cover plate	C068	033483300468	033483400468
69	Innensechskantschraube	Hex. Socket screw	C069		
70	Öldüse	Oil nozzle	C070		
71	Hubmutter	Elevating nut	C071		
72	Halterung Gewindespindel	Lead screw bracket	C072	033483300472	033483400472
73	Innensechskantschraube	Hex. Socket screw	C073		
74	Spaltfilter	Filter screen	C074	033483300474	033483400474
75	Vordere Abdeckung	Front cover	C075	033483300475	033483400475
76	Innensechskantschraube	Hex. Socket screw	C076		
77	Innensechskantschraube	Hex. Socket screw	C077		
79	Passfeder	Key	C079		

MF2B_MF4B_parts.fm

Maschinenkörper - Machine body					
Pos.	**Bezeichnung**	**Description**	**Verweis Reference**	**Artikelnummer Item no.**	
				MF2-B	**MF4-B**
80	Gewindespindel anheben	Elevating lead screw	C080	033483300480	033483400480
81	Sechskant schraube	Hex. Head nut	C081		
83	Unterlegscheibe	Washer	C083		
84	Kegelrad	Bevel gear	C084	033483300484	033483400484
85	Unterlegscheibe	Washer	C085		
86	Lager	Bearing	C086		
87	Lagerschutz	Bearing shield	C087		
88	Innensechskantschraube	Hex. Socket screw	C088		
89	Innensechskantschraube	Hex. Socket screw	C089		
92	Kegelzahnrad	Pinion bevel gear	C092	033483300492	033483400492
94	Lager	Bearing	C094		
95	Passfeder	Key	C095		
96	Hebewelle	Elevating shaft	C096	033483300496	033483400496
97	Lagerbock	Baring bracket	C097	033483300497	033483400497
98	Lagerschutz	Bearing shield	C098	033483300498	033483400498
99	Innensechskantschraube	Hex. Socket screw	C099		
100	Unterlegscheibe	Washer	C100		
101	Wählscheibe	Dial plate	C101	0334833004101	0334834004101
102	Mutter	Nut	C102		
103	Kupplungshülse	Clutch sleeve	C103	0334833004103	0334834004103
105	Hubkurbel	Elevating crank handle	C105	0334833004105	0334834004105
108	Griff	Handle	C108	0334833004108	0334834004108

E Frästisch - Milling table



MF2B_MF4B_parts.fm

Abb.6-5: Frästisch - Milling table

Frästisch - Milling table					
Pos.	**Bezeichnung**	**Description**	**Verweis Reference**	**Artikelnummer Item no.**	
				MF2-B	**MF4-B**
1	Sechskant schraube	Hex. Head nut	D001		
2	Griff	Handle	D002	033483300602	033483400602
3	Sicherungsmutter Wahlscheibe	Dial plate lock nut	D003		
4	Wählscheibe	Dial plate	D004	033483300604	033483400604
5	Halter Wählscheibe	Dial plate holder	D005	033483300605	033483400605
6	Schraube	Screw	D006		
7	Lagerschutz	Bearing shield	D007		
8	Lager	Bearing	D008		
9	Stift	Pin	D009		
10	Schraube	Screw	D010		
11	linker Lagerbock	Left bearing bracket	D011	033483300611	033483400611
12	rechter Lagerbock	Right bearing bracket	D012	033483300612	033483400612
13	Lager	Bearing	D013		
14	Passfeder	Key	D014		
15	Gewindespindel Längsachse	Longitudinal feed screw	D015	033483300615	033483400615
16	Schraube	Screw	D016		
17	Schraube	Screw	D017		
18	Unterlegscheibe	Washer	D018		
19	Mutter Gewindespindel Längsachse	Longitudinal feed nut	D019		
20	Mutter Gewindespindel Längsachse	Longitudinal feed nut	D020		
21	Schraube	Screw	D021		
22	Halterung Vorschubmutter	Feed nut bracket	D022	033483300622	033483400622
23	Vorschubmutter Querachse	Cross lead feed nut	D023	033483300623	033483400623
24	Vorschubmutter Querachse	Cross lead feed nut	D024	033483300624	033483400624
26	Handkurbel	Crank handle	D026	033483300626	033483400626
27	Schraube Quervorschub	Cross feed screw	D027		
28	Lagerbock	Bearing bracket	D028	033483300628	033483400628
29	Sicherungsscheibe	Lock washer	D029		

F Zentralschmierung - Central lubricating system

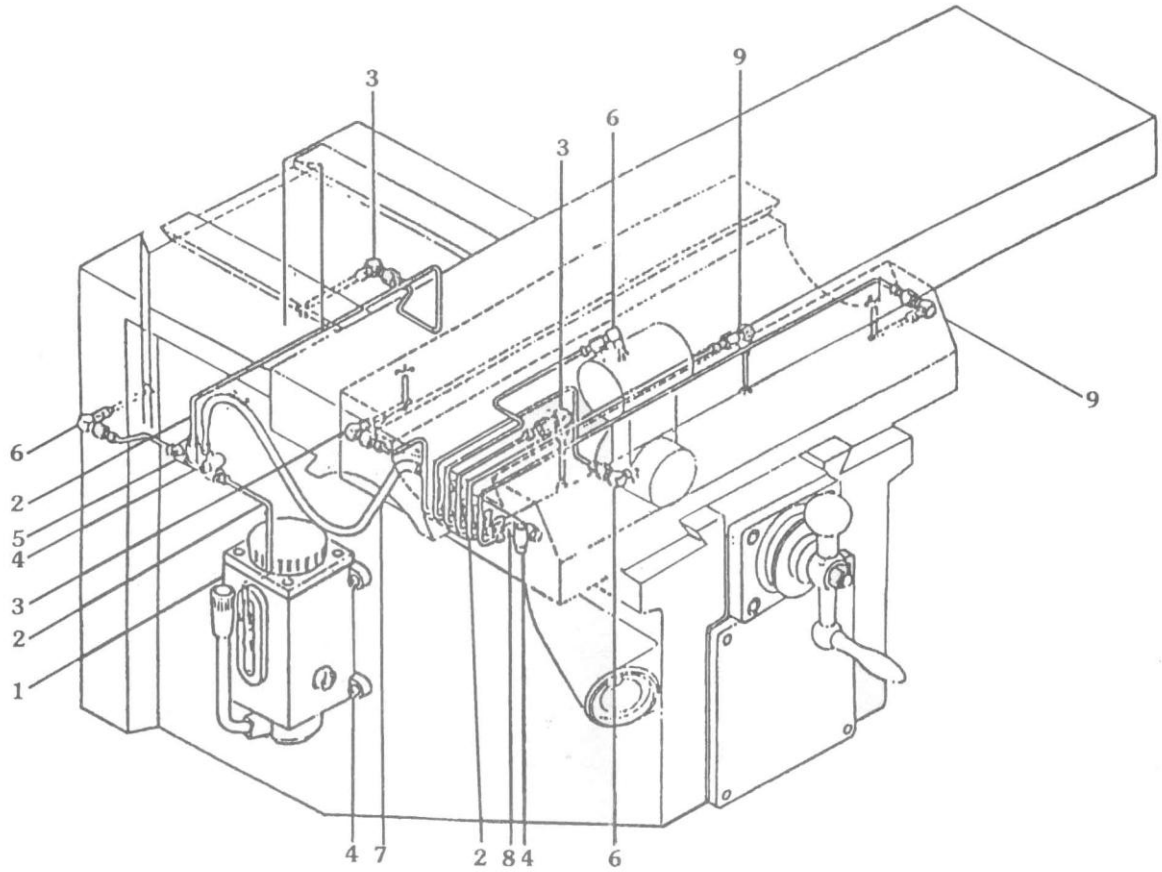


Abb.6-6: Schmiersystem - Lubricating system

Zentralschmierung - Central lubricating system					
Pos.	**Bezeichnung**	**Description**	**Verweis Reference**	**Artikelnummer Item no.**	
				MF2-B	**MF4-B**
1	Handpumpe Öl	Hand oil pump	B001	033483300501	033483400501
2	Rohr Ø4	Pipe Ø4	B002		
3	Ölverhältnis Verteiler	Ratio oil distributor	B003		
4	Schrauben	screws	B004		
5	A Typ Ölverteiler	A type oil distributor	B005		
6	Ölverhältnis Verteiler	Ratio oil distributor	E006		
7	flexibler Stahlschlauch	Steel flexible tube	E007		
8	A Typ Ölverteiler	A type oil distributor	E008		
9	Ölverhältnis Verteiler	Ratio oil distributor	E009		

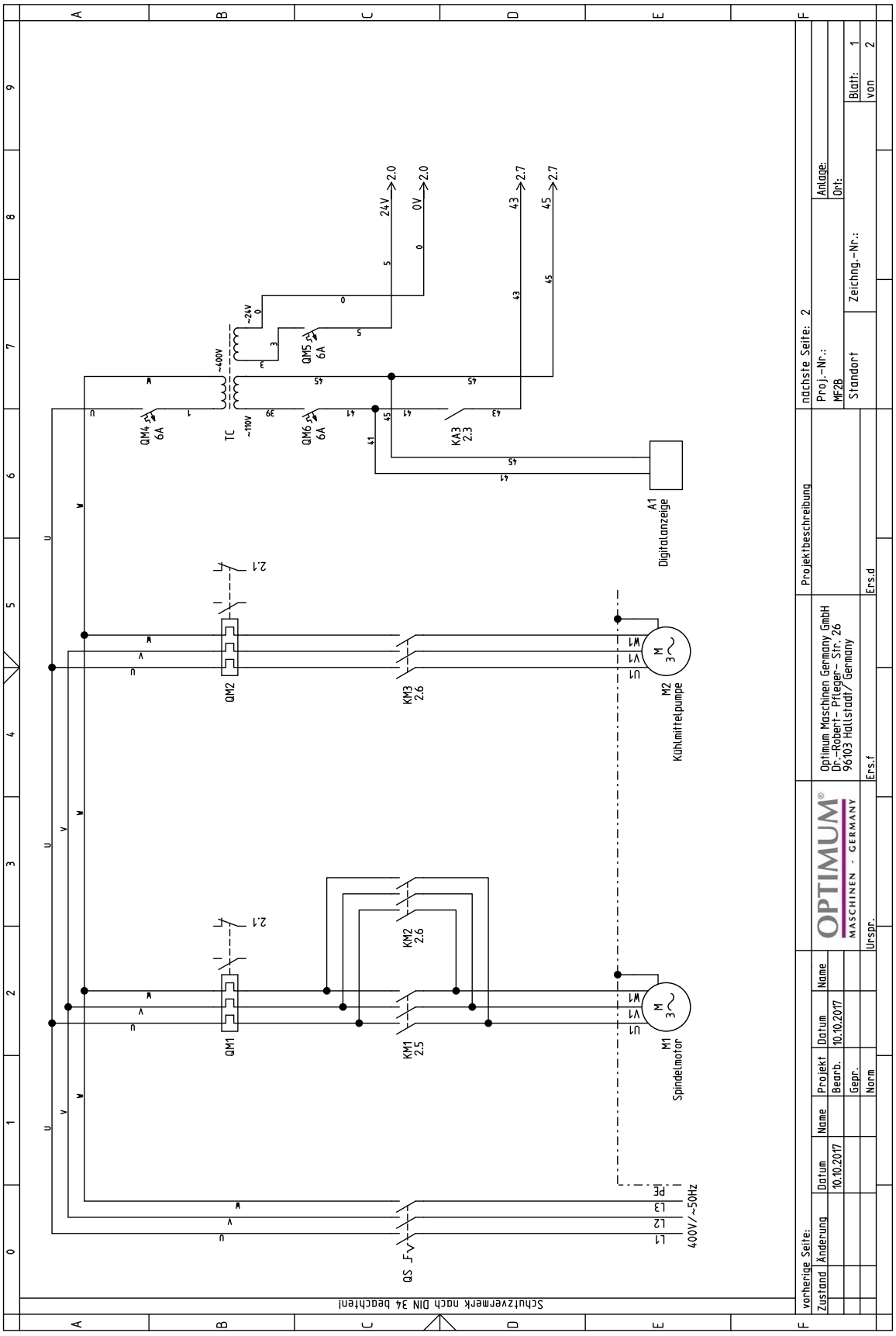
MF2B - Messleisten - measuring gibs					
Pos.	**Bezeichnung**	**Description**	**Menge Qty.**	**Grösse Size**	**Artikelnummer Item no.**
0	Messleiste	Measuring gib	1	ML470	3384147
0	Messleiste	Measuring gib	1	ML970	3384197
0	Digitalpositionsanzeige DPA 2000	Digital position indicator DPA 2000	1		3384001
0	Digitalpositionsanzeige DPA21	Digital position indicator DPA21	1		3384020
0	Digitalpositionsanzeige DPA31-3	Digital position indicator DPA31-3	1		3384031

MF2B_MF4B_parts.fm

MF4B - Messleisten - Measuring gibs					
Pos.	**Bezeichnung**	**Description**	**Menge** **Qty.**	**Grösse** **Size**	**Artikelnummer** **Item no.**
0	Messleiste	Measuring gib	1	ML420	3384142
0	Messleiste	Measuring gib	1	ML470	3384147
0	Messleiste	Measuring gib	1	ML970	3384197
0	Digitalpositionsanzeige DPA21	Digital position indicator DPA21	1		3384020
0	Digitalpositionsanzeige DPA31-3	Digital position indicator DPA31-3	1		3384031
0	Digitalpositionsanzeige DPA 2000	Digital position indicator DPA 2000	1		3384001

6.5 Schaltplan - Wiring diagram

G MF2-B 1-2



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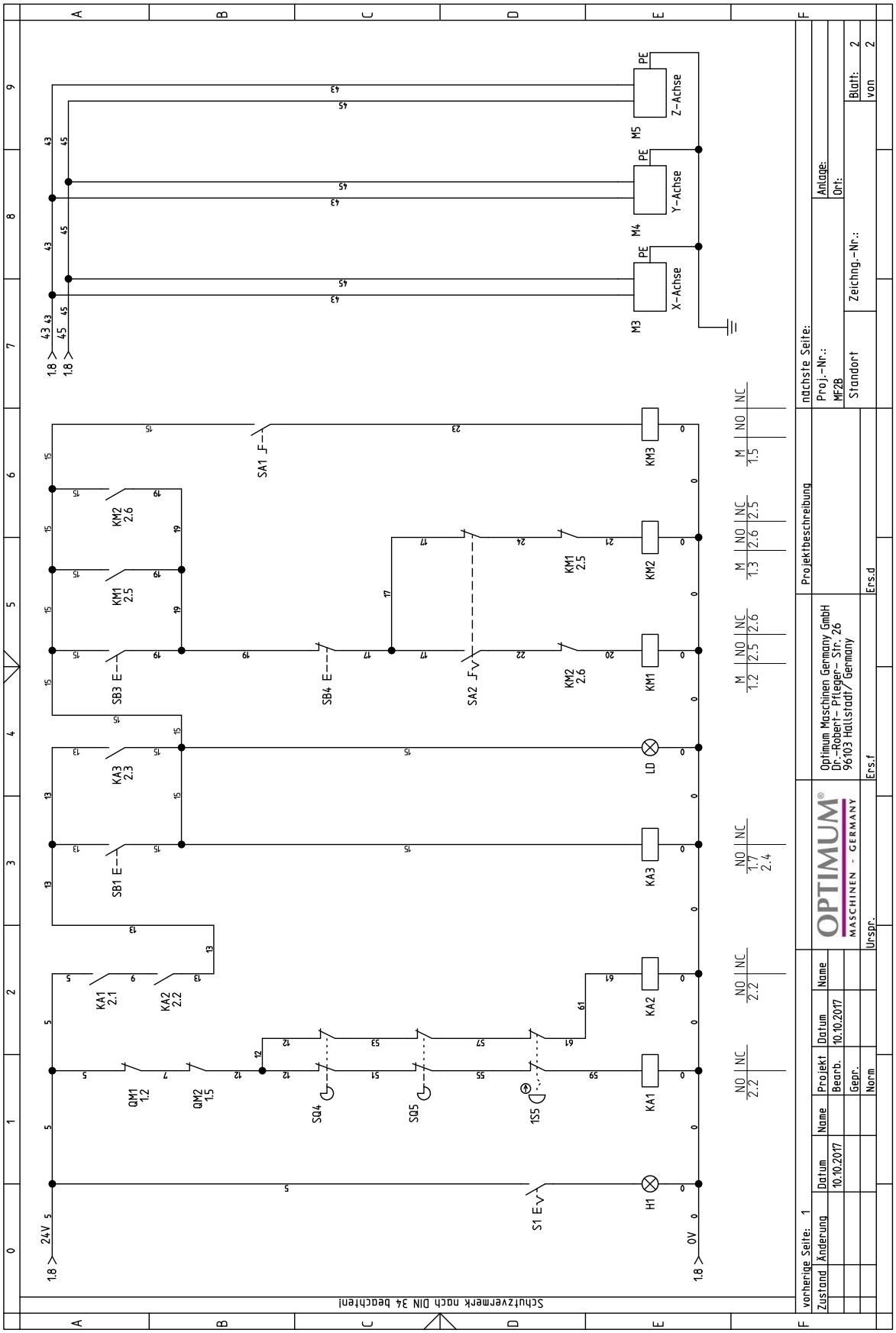
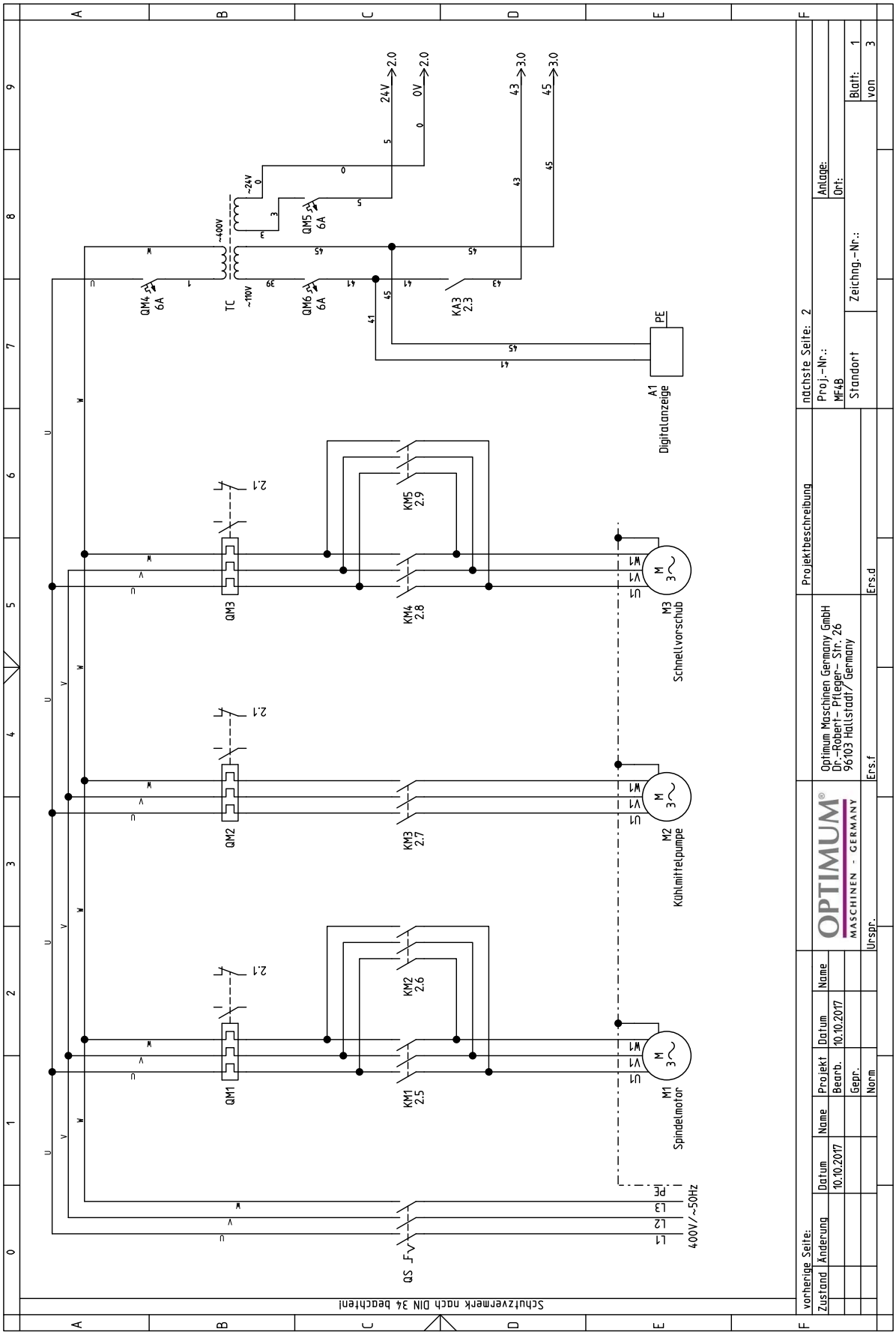
H MF2-B 2-2

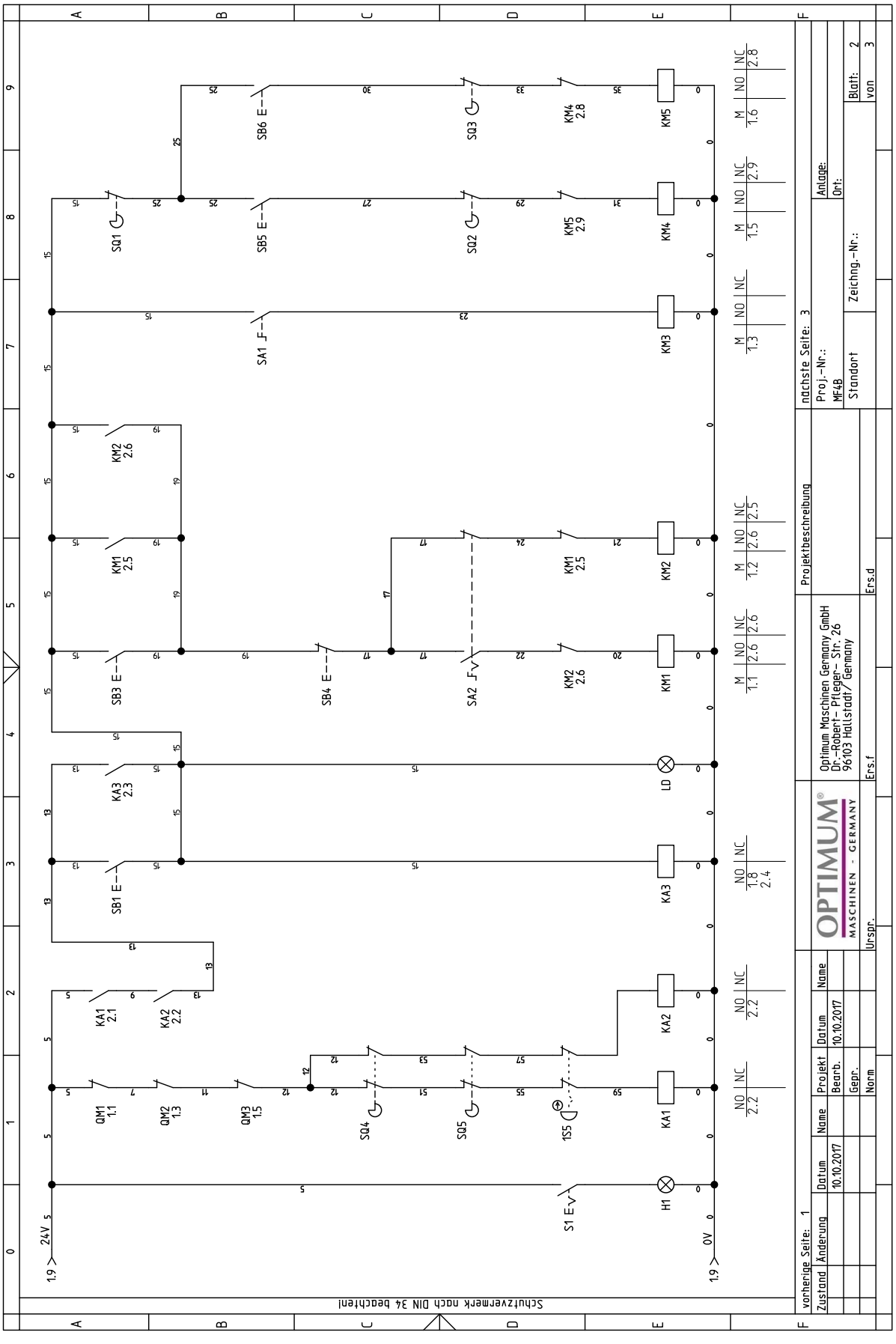

Z-Achse
Y-Achse
X-Achse
M5
M4
M3
PE
SA1
SA2
SB1
SB3
SB4
KM1
KM2
KM3
KA1
KA2
KA3
QM1
QM2
SQ4
SQ5
1S5
S1
H1
LD
KA1 2.1
KA2 2.2
KA3 2.3
KM1 2.5
KM2 2.6
QM1 1.2
QM2 1.5
24V
0V
Optimum Maschinen Germany GmbH
Dr.-Robert-Pfleger-Str. 26
96103 Hallstadt/Germany
Projektbeschreibung
nächste Seite:
vorherige Seite: 1
Schutzvermerk nach DIN 34 beachten!

I MF4-B 1-3



MF2B_MF4B_parts.fm

J MF4-B 2-3



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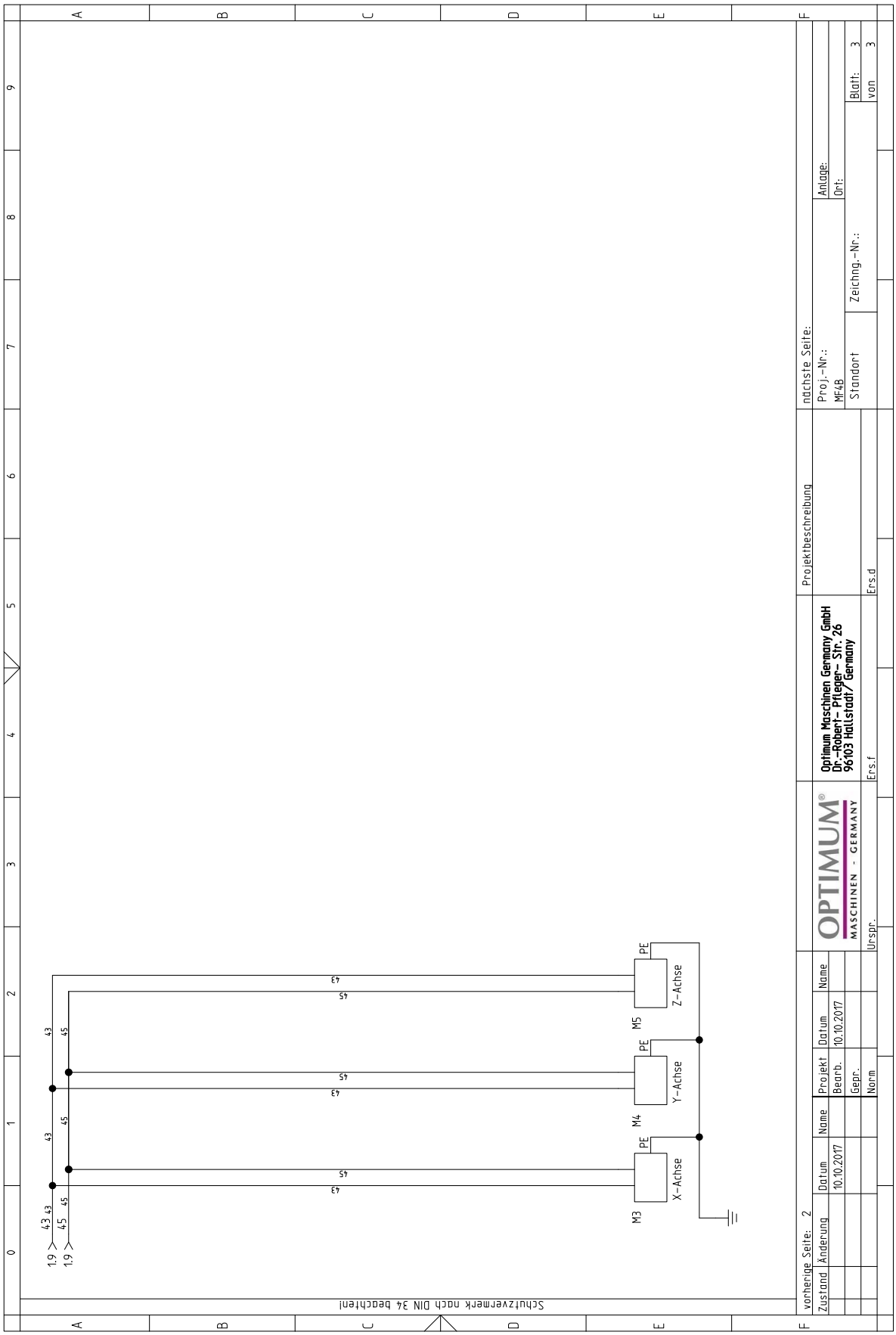
K MF4-B 3-3



MF2B_MF4B_parts.fm

MF2B - MF4B - Elektrische Bauteile - Electrical components					
Pos.	**Bezeichnung**	**Description**	**Menge Qty.**	**Grösse Size**	**Artikelnummer Item no.**
				MF2-B	MF4-B
1S5	Not-Halt-Schalter	Emergency stop button			
A1	Digitalanzeige	Digital display			
H1	Maschinenlampe	Machine lamp			
KA1	Relais Sicherheitsteuerung	Relay safety control			
KA2	Relais Sicherheitsteuerung	Relay safety control			
KA3	Relais Steuerung	Relay control			
KM1	Schütz Spindel Vorlauf	Contactor spindle CW			
KM2	Schütz Spindel Rücklauf	Contactor spindle CCW			
KM3	Schütz Kühlmittelpumpe	Contactor coolant pump			
LD	Betriebsleuchte	Work light			
M1	Spindelmotor	Spindle motor			
M2	Kühlmittelpumpe	Coolant pump			
M3	Schnellvorschub X-Achse	Rapid speed X-axis			
M4	Schnellvorschub Y-Achse	Rapid speed Y-axis			
M5	Schnellvorschub Z-Achse	Rapid speed Z-axis			
QM1	Motorschutzschalter Spindelmotor	Spindle motor safety switch			
QM2	Motorschutzschalter Kühlmittelpumpe	Coolant pump safety switch			
QM4	Sicherungsautomat	Automatik fuse			
QM5	Sicherungsautomat	Automatik fuse			
QM6	Sicherungsautomat	Automatik fuse			
QS	Hauptschalter	Main switch			
S1	Schalter Maschinenlampe	Machine lamp switch			
SA1	Schalter Kühlmittelpumpe	Coolant pump switch			
SA2	Drehrichtungsschalter Spindel	Change-over switch			
SB1	Taster Steuerung Ein	Button control ON			
SB3	Taster Spindel Ein	Button spindle ON			
SB4	Taster Spindel Aus	Button spindle OFF			
SQ4	Sicherheitsschalter Fräsfutterschutz	Mill chuck safety switch			
SQ5	Schalter Schaltschranktür	Cabinet door switch			
TC	Transformator	Transformator			
QM3	Motorschutzschalter Schnellvorschub	Rapid speed safety switch			
M3	Schnellvorschub	Rapid speed			
SQ1	Schalter Schnellvorschub	Switsch rapid speed			
SB5	Taster Schnellvorschub Vorlauf	Button rapid speed CW			
SB6	Taster Schnellvorschub Rücklauf	Button rapid speed CCW			
SQ2	Endschalter Schnellvorschub	Rapid feed end switch			
SQ3	Endschalter Schnellvorschub	Rapid feed end switch			
KM4	Schütz Schnellvorschub Vorlauf	Contactor rapid feed CW			
KM5	Schütz Schnellvorschub Rücklauf	Contactor rapid feed CCW			

Schmierstoffe Lubricant Lubrifiant	Viskosität Viskosity Viscosité ISO VG DIN 51519 mm²/s (cSt)	Kennzeich- nung nach DIN 51502	ARAL	BP	Esso	Klüber Lubrication	Mobil	Shell	Texaco
Getriebeöl Gear oil Huile de réducteur	VG 680	CLP 680	Aral Degol BG 680	BP Energol GR-XP 680	SPARTAN EP 680	Klüberoil GEM 1-680	Mobilgear 636	Shell Omala S2 GX 680	Meropa 680
	VG 460	CLP 460	Aral Degol BG 460	BP Energol GR-XP 460	SPARTAN EP 460	Klüberoil GEM 1-460	Mobilgear 634	Shell Omala S2 GX 460	Meropa 460
	VG 320	CLP 320	Aral Degol BG 320	BP Energol GR-XP 320	SPARTAN EP 320	Klüberoil GEM 1-320	Mobilgear 632	Shell Omala S2 GX 320	Meropa 320
	VG 220	CLP 220	Aral Degol BG 220	BP Energol GR-XP 220	SPARTAN EP 220	Klüberoil GEM 1-220	Mobilgear 630	Shell Omala S2 GX 220	Meropa 220
	VG 150	CLP 150	Aral Degol BG 150	BP Energol GR-XP 150	SPARTAN EP 150	Klüberoil GEM 1-150	Mobilgear 629	Shell Omala S2 GX 150	Meropa 150
	VG 100	CLP 100	Aral Degol BG 100	BP Energol GR-XP 100	SPARTAN EP 100	Klüberoil GEM 1-100	Mobilgear 627	Shell Omala S2 GX100	Meropa 100
	VG 68	CLP 68	Aral Degol BG 68	BP Energol GR-XP 68	SPARTAN EP 68	Klüberoil GEM 1-68	Mobilgear 626	Shell Omala S2 GX 68	Meropa 68
	VG 46	CLP 46	Aral Degol BG 46	BP Bartran 46	NUTO H 46 (HLP 46)	Klüberoil GEM 1-46	Mobil DTE 25	Shell Tellus S2 MX 46	Anubia EP 46
	VG 32	CLP 32	Aral Degol BG 32	BP Bartran 32	NUTO H 32 (HLP 32)	Klübersynth GEM 4- 32 N	Mobil DTE 24	Shell Tellus S2 MX 32	Anubia EP 32
Hydrauliköl Hydraulic oil Huile hydraulique	VG 32	CLP 32	Aral Vitam GF 32	BP Energol HLP HM 32	NUTO H 32 (HLP 32)	LAMORA HLP 32	Mobil Nuto HLP 32	Shell Tellus S2 M 32	Rando HD HLP 32
	VG 46	CLP 46	Aral Vitam GF 46	BP Energol HLP HM 46	NUTO H 46 (HLP 46)	LAMORA HLP 46	Mobil Nuto HLP 46	Shell Tellus S2 M 46	Rando HD HLP 46
Getriebefett Gear grease Graisse de réducteur		G 00 H-20	Aral FDP 00 (Na-verseift) Aralub MFL 00 (Li-verseift)	BP Energrease PR-EP 00	FIBRAX EP 370 (Na-verseift)	MICROLUB E GB 00	Mobilux EP 004	Shell Alvania GL 00 (Li-verseift)	Marfak 00

Spezialfette, wasserabweisend Special greases, water resistant Graisses spéciales, déperlant			Aral Aralub	Energrease PR 9143		ALTEMP Q NB 50 Klüberpaste ME 31-52	Mobilux EP 0 Mobil Greaserex 47		
Wälzlagerfett Bearing grease Graisse de roulement		K 3 K-20 (Li-verseift)	Aralub HL 3	BP Energrease LS 3	BEACON 3	CENTOPLE X 3	Mobilux 3	Shell Alvania R 3 Alvania G 3	Multifak Premium 3
Öle für Gleitbahnen Oils for slideways Huiles pour glissières	VG 68	CGLP 68	Aral Deganit BWX 68	BP Maccurat D68	ESSO Febis K68	LAMORA D 68	Mobil Vactra Oil No.2	Shell Tonna S2 M 68	Way lubricant X 68
Öle für Hochfrequenzspindeln Oils for Built-in spindles Huiles pour broches à haute vitesse	VG 68		Deol BG 68	Emergol HLP-D68	Spartan EP 68		Drucköl KLP 68-C	Shell Omala 68	
Fett für Zentralschmierung (Fließfett) Grease for central lubrication Graisse pour lubrification centrale	NLGI Klasse 000 NLGI class 000		ARALUB BAB 000	Grease EP 000	Shell Gadus S4 V45AC	CENTOPLE X GLP 500	Mobilux EP 023		Multifak 264 EP 000
Fett für Hochfrequenzspindeln Grease for Built-in spindles Graisse pour broches à haute vitesse	METAFLUX-Fett-Paste (Grease paste) Nr. 70-8508 METAFLUX-Moly-Spray Nr. 70-82 Techno Service GmbH ; Detmolder Strasse 515 ; D-33605 Bielefeld ; (++49) 0521- 924440 ; www.metaflux-ts.de								
Kühlschmiermittel Cooling lubricants Lubrifiants de refroidissement			Aral Emusol	BP Sevora	Esso Kutwell		Mobilcut	Shell Adrana	Chevron Soluble Oil B

7 Malfunctions

7.1 Machine malfunctions

Malfunction	Cause/ possible effects	Solution
Noise during work.	Spindle runs dry. Tool blunt or incorrectly clamped.	Grease spindle Use new tool and check clamping.
Tool "burnt".	Incorrect speed. Chips are not coming out of the drilled hole. Blunt tool. Operating without cooling agent.	Choose a different speed, excessive feed. Retract tool more often during work. Sharpen or replace tool. Use coolant.
Tool running off-centre or "hopping"	Tool deformed Bearings worn down in the spindle head. Tool badly clamped. Defective clamping chuck.	Replace the tool. Have the bearings in the spindle head replaced. Clamp the tool properly. Replace the clamping chuck.
Taper cannot be inserted in quill.	Remove any dirt, grease or oil from the internal conical surface of the spindle sleeve or the taper.	Clean surfaces well. Keep surfaces free from grease.
Motor does not start.	Motor is wrongly connected. Defective fuse.	Have it checked by qualified personnel.
Motor is overheating and there is no power.	Motor overloaded. Insufficient mains voltage. Motor wrong connected.	Reduce feed, disconnect if necessary and have it checked by authorised personnel. Have it checked by authorised personnel.
Precision of the work deficient.	Heavy and unbalanced or deformed work-piece. Inexact horizontal position of the work-piece holder.	Balance the piece statically and secure without straining. Adjust workpiece-holder.
Spindle bearing overheating.	Bearing worn down. Bearing pretension is too high. Working at high speeds for a long time.	Replace. Reduce bearing clearance in the fixed bearing. Reduce feed rate.

Malfunction	Cause/ possible effects	Solution
Rattle the spindle if the workpiece surface is rough.	Excessive slack in bearing. Spindle moves up and down. Adjustment strip loose. Chuck loose. Tool is blunt. The workpiece is not fastened.	Readjust the bearing slack or replace the bearing. Readjust bearing slack (fixed bearing). Adjust strip to the correct slack using the adjusting screw. Check, re-tighten. Sharpen or renew the tool. Clamp the workpiece firmly.
The threaded adapter of the drawbar loosens.	Threaded adapter not glued to drawbar.	☞ Assembly of the drawbar on page 28

8 Appendix

8.1 Copyright

Optimum Maschinen Germany GmbH

8.2 Changes

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!

8.3 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 inform us of the following:

- Modified settings
- Any experiences with the milling machine which might be important for other users
- Recurring malfunctions
- Difficulties with the documentation

Optimum Maschinen Germany GmbH

Dr.-Robert-Pfleger-Str. 26
D-96103 Hallstadt, Germany

email: info@optimum-maschinen.de

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 were promised in the framework of a single contractual provision.

- 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. Title to replaced products or components is transferred to OPTIMUM Maschinen Germany GmbH.
- The automatically generated original proof of purchase which shows the date of purchase, the type of machine and the serial number, if applicable, is the precondition in order to assert liability or warranty claims. If the original proof of purchase is not presented, we are not able to perform any services.
- Defects resulting from 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
  - Unauthorized 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

- Neither are the following items covered by liability or warranty claims:
  - Wearing parts and components which are subject to normal and intended wear, such as V-belts, ball bearings, lighting, filters, seals, etc.
  - Non reproducible software errors
- Any services, which OPTIMUM GmbH or one of its agents performs in order to fulfil any additional warranty are neither an acceptance of the defects nor an acceptance of its obligation to compensate. These services neither delay nor interrupt the warranty period.
- The court of jurisdiction for legal disputes between businessmen is Bamberg.
- If any of the aforementioned agreements is totally or partially inoperative and/or invalid, a provision which nearest approaches the intent of the guarantor and remains within the framework of the limits of liability and warranty which are specified by this contract is deemed agreed.

8.5 Storage

ATTENTION!

Incorrect and improper storage might result in damage or destruction of electrical and mechanical machine components.

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

Follow the instructions and information on the transport box:

- **Fragile goods**
  (Goods require careful handling)

- **Protect against moisture and humid environment**

- **Prescribed position of the packing case (Marking of the top surface - arrows pointing to the top)**

- **Maximum stacking height**

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

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

8.6 Advice for disposal / Options of re-use

Please dispose of your machine in an environmentally friendly way, not by disposing of the waste not in the environment, but by acting 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.

8.6.1 Decommissioning

CAUTION !

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

Cut the connection cable.

Remove all environmentally hazardous operating fluids from the used device.

If applicable remove batteries and accumulators.

Disassemble the machine if required into easy-to-handle and reusable assemblies and component parts.

Dispose of machine components and operating fluids using the intended disposal methods.

8.6.2 Disposal of new device packaging

All used packaging materials and packaging aids from 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 passed to a collection station or to the appropriate waste management enterprise.

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

8.6.3 Disposal of the machine

INFORMATION

Please take care in your interest and in the interest of the environment that all component parts of the machine are only disposed of in the intended and admitted way.

Please note that the electrical devices comprise a variety of reusable materials as well as environmentally hazardous components. Please ensure that these components are disposed of separately and professionally. 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.

8.6.4 Disposal of electrical and electronic components

Please make sure that the electrical components are disposed of professionally and according to the statutory provisions.

The device is composed of electrical and electronic components and must not be disposed of as household waste. According to the European Directive regarding electrical and electronic used devices and the implementation of national legislation, used power tools and electrical machines need to be collected separately and supplied to an environmentally friendly recycling centre.

As the machine operator, you should obtain information regarding the authorised collection or disposal system which applies for your company.

Please make sure that the electrical components are disposed of professionally and according to the legal regulations. Please only throw depleted batteries in the collection boxes in shops or at municipal waste management companies.

8.6.5 Disposal of lubricants and coolants

ATTENTION!

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

INFORMATION

Used coolant emulsions and oils should not be mixed since it is only possible to reuse oils without pre-treatment when they have not been mixed.

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

8.7 Disposal via municipal collection facilities

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

The sign on the product or on its packing indicates that the product must not be handled as common household waste, but that is needs to be disposed of at a central collection point for recycling. Your contribution to the correct disposal of this product will protect the environment and the public health. Incorrect disposal constitutes a risk to the environment and public health. Recycling of material will help reduce the consumption of raw materials. For further information about the recycling of this product, please consult your District Office, municipal waste collection station or the shop where you have purchased the product.

8.8 Terminology/Glossary

Term	Explanation
Cross table	Supporting surface, clamping surface for the workpiece with traverse in X and Y directions
Taper mandrel	Tool housing taper, drill taper, drill chuck taper.
Workpiece	piece to be milled, drilled or machined.
Draw bar	Threaded rod to fix the taper mandrel in the quill.
Drill chuck	Drill bit adapter
Collet	Holder for end mill
Drill-mill head	Upper part of the milling machine
Quill	Hollow shaft in which the milling spindle turns.
Milling spindle	Shaft activated by the motor
Drilling table	Supporting surface, clamping surface
Taper mandrel	Cone of the drill or of the drill chuck
Spindle sleeve lever	Manual operation for the drill feed

Term	Explanation
Quick action - Drill chuck	Drill bit adapter can be fixed by hand.
Tool	Milling cutter, drill bit, etc.

8.9 Change information operating manual

Chapter	Short summary	new version number
3.9.1 ; 7	Assembly of the drawbar	1.0.1
4.14	second person	1.0.2
2	tech. data, spindle speed	1.0.3
3	In-house transport	1.0.4
parts	Update parts list milling table	1.0.5
0 ; 4	Image with DPA21	1.0.6
	DPA31 added	1.0.7
	DPA31Plus added ; V250 chapter removed, does not fit the axis drive used.	1.0.8
2.4 ; 4	Technical data ; DPA removed from manual	1.0.9

EC Declaration of Conformity

according to Machinery Regulation 2023/1230 Annex V Part A

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

hereby declares that the following product

Product designation: Hand-controlled milling machine

Type designation: MF2-B
MF4-B

fulfils all the relevant provisions of the Machinery Regulation specified above and the additionally applied directives (in the following) - including the changes which applied at the time of the declaration.

Description:

Hand-controlled milling machine with continuously operated axles up to 2 m/min feed and / or with rapid traverse controlled up to 5 m/min by command device with self-acting reset (jogging switch).

The following additional EU directives have been applied:

EMC Directive 2014/30/EU ; Restriction of the use of certain hazardous substances in electrical and electronic equipment 2015/863/EU

The following harmonized standards were applied:

EN ISO 16090-1: 2019-12 Machine tools safety - Machining centres, Milling machines, Transfer machines - Part 1: Safety requirements

EN 60204-1: 2019-06 Safety of machinery - Electrical equipment of machines - Part 1: General requirements

EN 13849-1: 2016-06 Safety of machinery - Safety related parts of controls - Part 1: General design principles

EN 13849-2: 2013-02 Safety of machinery - Safety related parts of controls - Part 2: Validation

EN ISO 12100: 2011-03 Safety of machinery - General principles for design - Risk assessment and risk reduction

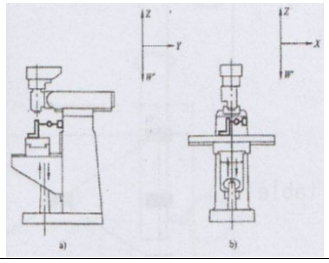
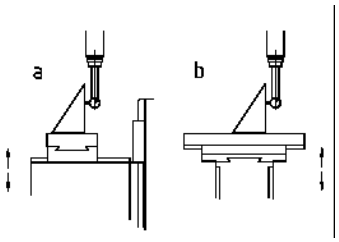
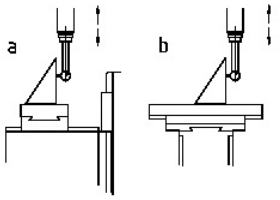
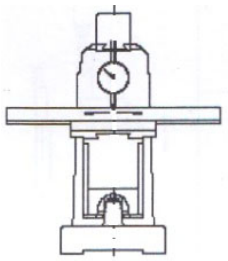
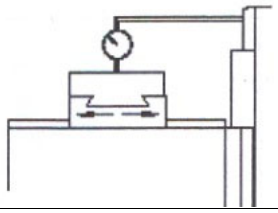
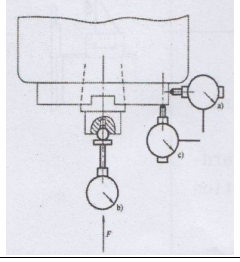
Name and address of the person authorized to compile the technical file:

Kilian Stürmer, phone: +49 (0) 951 96555 - 800

Kilian Stürmer (CEO, General Manager)
Hallstadt, 2023-11-08

8.10 Genauigkeit der Maschine - *Accuracy of the machine*

Das Ergebnis der Prüfung liegt der Maschine separat bei.
The result of the test are attached separately to the machine.

Nr. *No.*	Prüfgegenstand *Inspection item*	Diagramm *Diagram*		Toleranz *Tolerance*	Tatsächlich *Actual*
1	Geradlinigkeit der vertikalen Tischträgerbewegung *Straightness of knee vertical movement*	a) in Y-Z Ebene *a) in Y-Z surface* b) in X-Z Ebene *b) in X-Z surface*		0.025/300	
2	Rechtwinkligkeit der Oberseite des Tisches zur Tischträgerbewegung *Squareness of upper surface of table to knee movement*	Rechts- und Linksrichtung *Right and left direction*		0.025/300	
		Vorwärts- und Rückwärtsrichtung *Forward and backward direction*		0.025/300	
3	Rechtwinkligkeit der vertikalen Bewegung der Pinole mit Tischfläche *Squareness of vertical movement of the spindle quill with table surface*	Rechts- und Linksrichtung *Right and left direction*		Per 0.020/125	
		Vorwärts- und Rückwärtsrichtung *Forward and backward direction*		0.020/125	
4	Parallelität der rechten und linken Bewegung des Tisches auf die obere Fläche *Parallelism of right and left movement of table to its upper surface*			0.02/300	
5	Parallelität der Vorwärts- und Rückwärtsbewegung des Tisches auf die obere Fläche *Parallelism of forward and backward movement of table to its upper surface*			0.02/300	
6	Rundlaufgenauigkeit am Spindelende *End of spindle Run out*			0.01	

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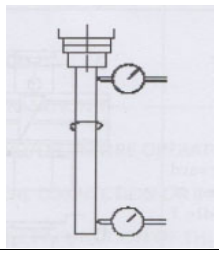
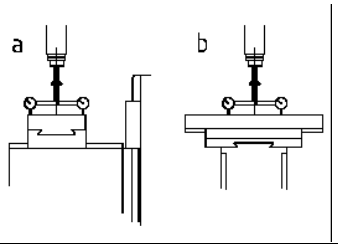
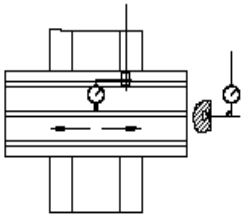
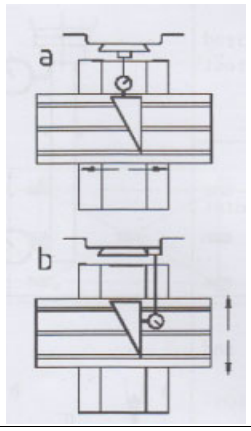
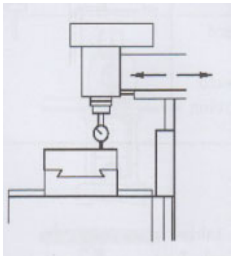
Nr. *No.*	Prüfgegenstand *Inspection item*	Diagramm *Diagram*		Toleranz *Tolerance*	Tatsächlich *Actual*
7	Rundlaufgenauigkeit des Spindelkegels *Spindle taper hole run-out*	Am Ende der Prüfstange *End of test bar*		0.01	
		Abstand von 200 *Distance 200*		0.02	
8	Rechtwinkligkeit der Spindelmittellinie zur Tischoberfläche *Squareness of spindle center line to table surface*	Rechts- und Linksrichtung *Right and left direction*		0.025/300	
		Vorwärts- und Rückwärtsrichtung *Forward and backward direction*		0.025/300	
9	Parallelität der rechten und linken Bewegung des Tisches zur seitlichen Fläche der mittleren T-Nut des Tisches *Parallelism of right and left movement of table to side of middle T slot of table*			0.015/300 max.0.04	
10	Rechtwinkligkeit der Kreuztischbewegung zur Längsbewegung *Squareness of table cross movement to longitudinal movement*			0.02/300	
G12	Parallelität der Fräskopfbewegung zur Tischoberfläche *Parallelism of ram movement to table surface*			0.035/300	

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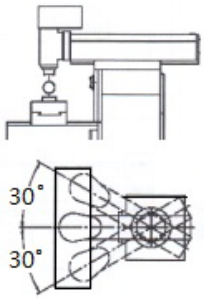
Nr. *No.*	Prüfgegenstand *Inspection item*	Diagramm *Diagram*		Toleranz *Tolerance*	Tatsächlich *Actual*
G13	Parallelität des geschwenkten Fräskopfes zur Tischoberfläche *Parallelism of ram swivel to table surface*			0.035	

Index

A
Accessories 22
Accident report 16
Anchored mounting 26
C
Commissioning 27
Coolant 40
Cooling lubricant 41
Cooling lubricants 41
Copyright 82
Customer service 43
Customer service technician 43
D
Disinfection
Cooling lubricant tank 53
Disposal 85
E
EC - declaration of conformity 87
Electrical connection 18
Electronics 16
Emergency stop
resetting 33
Emergency-stop button 13
Environmental conditions 19
F
First commissioning 27
H
Hotline Ersatzteile 55
I
Inspection 50
Interdepartmental transport 21
L
Lubrication 28
M
Main switch 15
Maintenance work 16
Maintenance, Inspection 41
Malfunctions 80
Master switch 13
Mounting
anchored 26
O
Obligations
of the operating company 11
of the operator 12
Operating material 41
Operation 30
Operator's log 42
P
Power failure 33
Prohibition, warning and mandatory signs 13
Protective
equipment 14
Q
Qualification of personnel
Safety 10
R
Restoring
readiness for operation 33
S
Service Hotline 55
Spare parts Hotline 55
Specialist dealer 43
Spindle seat 18
Switching
on the machine 33
Switching off the machine 33
T
Technical specification 18
Electrical connection 18
Environmental conditions 19
Spindle seat 18
Work area 19
Transport 21
U
Using lifting equipment 15
W
Warming up the machine 28
Work area 19