OPTIMUM®
MASCHINEN - GERMANY

Operating Manual

Version 1.0.4

Milling machine

OPTImill® MT 60

Part no. 3336090

GB

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Preface

Dear customer,

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

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

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

Information

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

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

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

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

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

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

Optimum Maschinen Germany GmbH

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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.

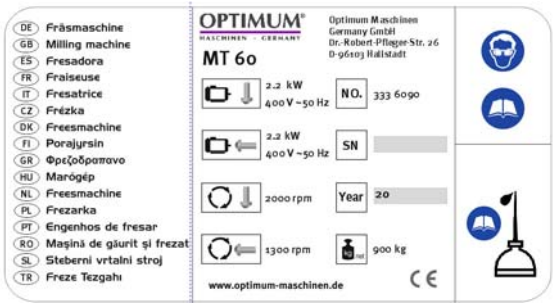
1.1 Glossary of symbols

☞ provides further instructions

➜ calls on you to act

- listings

1.2 Rating plate



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!

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Wear protective gloves!

Warning: biological hazard!

Warning: suspended loads!

Warning of oxidizing substances!

Caution, danger of explosive substances!

Warning: danger of slipping!

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 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.

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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 drill chuck as a milling tool. Never clamp a milling cutter into a 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 caused 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 User positions

The operator position is located in front of the milling machine at the inspection window, 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.

ATTENTION!

If a 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.

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

After having actuated the emergency-stop mushroom switch, turn the knob of the particular push button 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**
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 guard	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.

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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).

1.15 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!

1.16 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!

1.17 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.

1.18 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).

1.19 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.

1.20 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.**

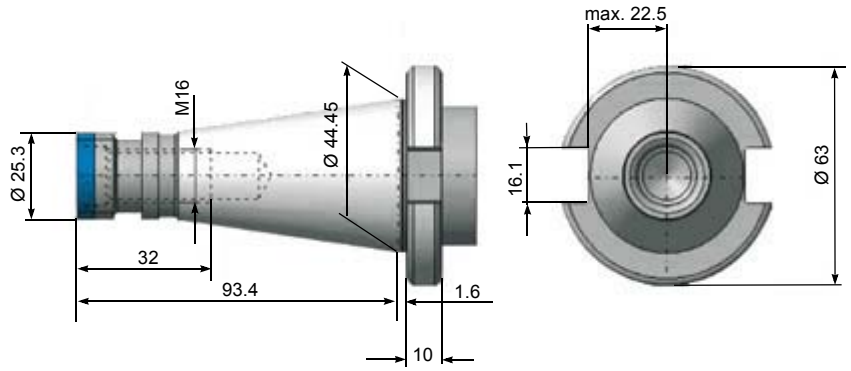
1.21 Environmental protection and water conservation

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.

2.1 Electrical connection	
Total connection	3 x 400V ~ 50Hz (60 Hz)
Fusing performed by the operator	16 A
2.2 Vertical spindle	
Drive motor	2.2 kW
Speed	90 - 2000 rpm
Gear stages	8
Spindle seat	ISO 40 DIN 2080
Draw bar	M16
	
Spindle sleeve travel [mm]	120
Throat [mm]	220 - 600
Distance spindle - table [mm]	125 -465
Quill diameter [mm]	90
Inclination of milling head	± 45°
Automatic spindle sleeve feed [mm/rev]	0.08 | 0.25 | 1
Automatic shut-off spindle sleeve feed [mm]	10 - 120

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2.3 Horizontal spindle	
Spindle seat	ISO 40 DIN 2080
Drive motor	2.2 kW
Throat [mm]	35 - 370
Speed	40 - 1300 rpm
Gear stages	9
2.4 Cross table	
Table size [mm]	1270 x 280
max. load of cross table [kg]	150
T-slot size / distance / number	14mm / 50mm / 4
Table feed X axis drive	1.5 kW
X axis handwheel scale	4 mm/rev - graduation 0.02 mm
Y axis handwheel scale	
Z axis handwheel scale	
2.5 Travels	
X axis automatic / manual [mm]	680 / 750
Y axis manual [mm]	230
Z axis manual [mm]	360
2.6 Dimensions	
	☞ Installation plan on page 24
Total weight [kg]	1300
2.7 Work area	
Keep a work area of at least one metre around the machine free for operation and maintenance.	
2.8 Coolant equipment	
Power of the cooling lubricant pump [W]	40 W
Capacity cooling lubricant tank [L]	12
Delivery height [meter]	3
2.9 Environmental conditions	
Temperature	19 - 21 °C (for an optimum milling result) permissible range + 10° to + 35°C
Admissible relative humidity	5...90 % no condensation 30% to 90% at 35°C 90 % at 21°C
Compressed air	700...1060 hPa
Environmental conditions - storage	5 - 45 °C

2.10 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 80 dB(A) on no-load running at 80% of max. spindle speed and activated automatic feed on no-load running at 80% of the possible feed 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.

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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.

3.3 Accessories

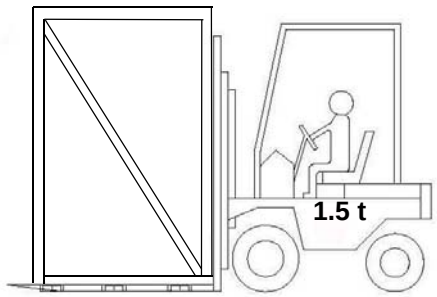
- Draw bar vertical milling
- Draw bar horizontal milling
- Arbor ISO 40 with counter-bearing, 22mm outside diameter
- Arbor ISO 40 with counter-bearing, 27mm outside diameter
- 2 pc. T-slotted nuts M14x55 with nut and washers
- Adapter ISO 40 / B18
- Drill chuck 3 - 16mm, arbor B18
- Drill drift
- Adapter ISO 40 / MT3
- Reduction MT3 / MT2

3.4 Transport

- Weights

☞ Installation plan on page 24

Weight of the milling machine ☞ „ Total weight [kg]“ on page 19



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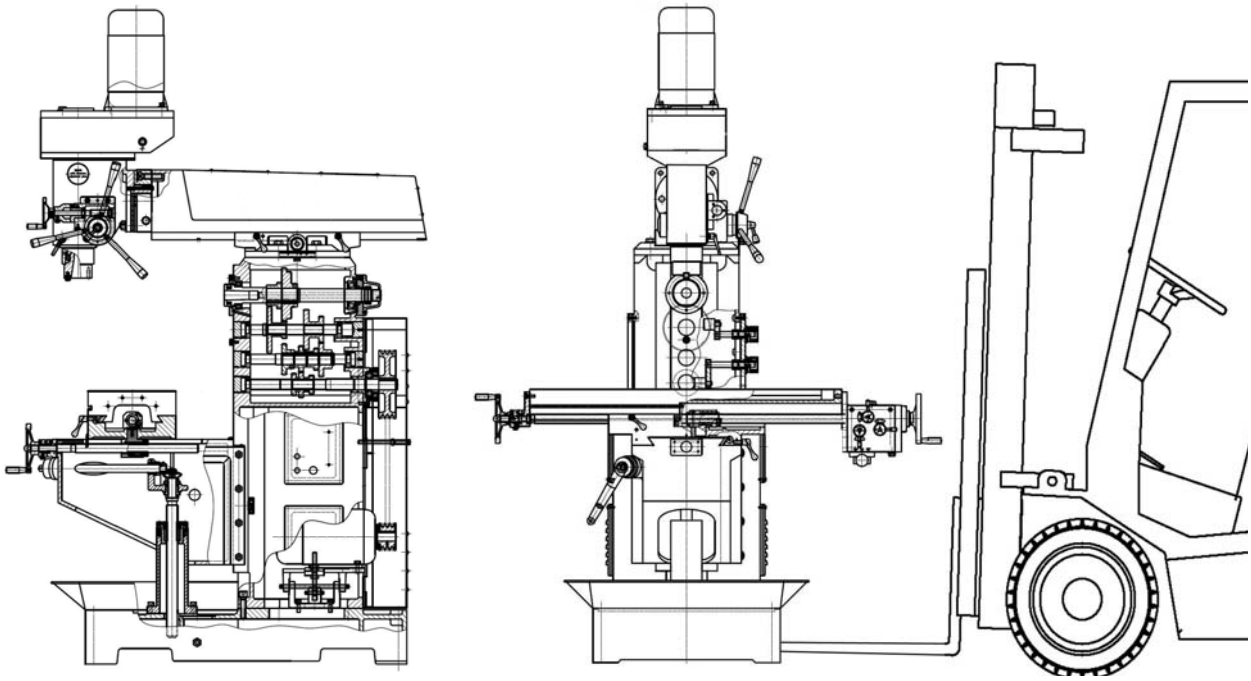
3.5 Load suspension point

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 on the machine base.

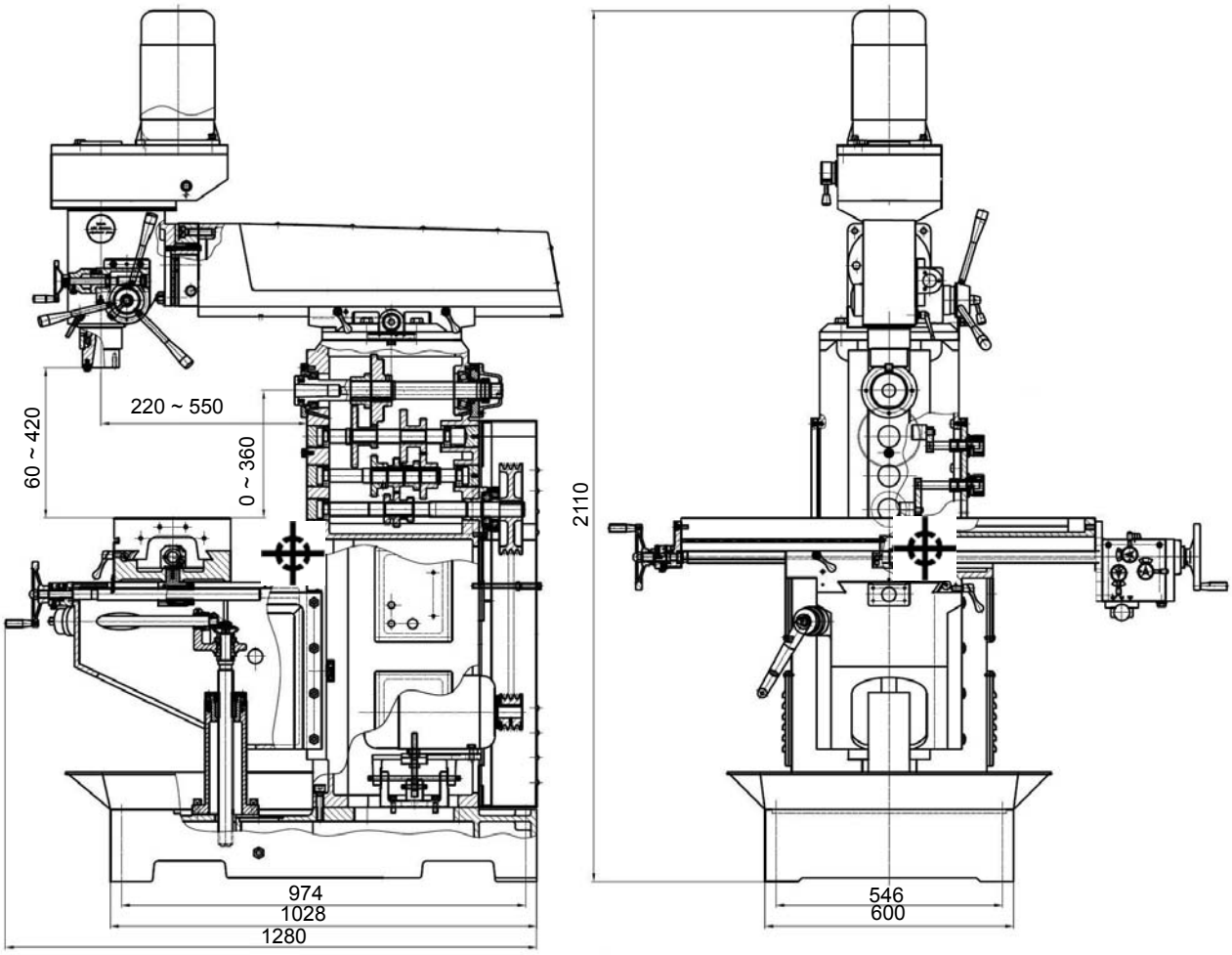
➜ The clamping screws of the milling table and the spindle head bearing must be tightened.



Img. 3-1: Load suspension point

3.6 Set-up and assembly

3.6.1 Installation plan



Center of gravity

3.6.2 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:

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- 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. Pay attention also to the load-bearing capacity and evenness of the floor.
- 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.

3.7 Machine mounting

3.7.1 Anchor-free mounting

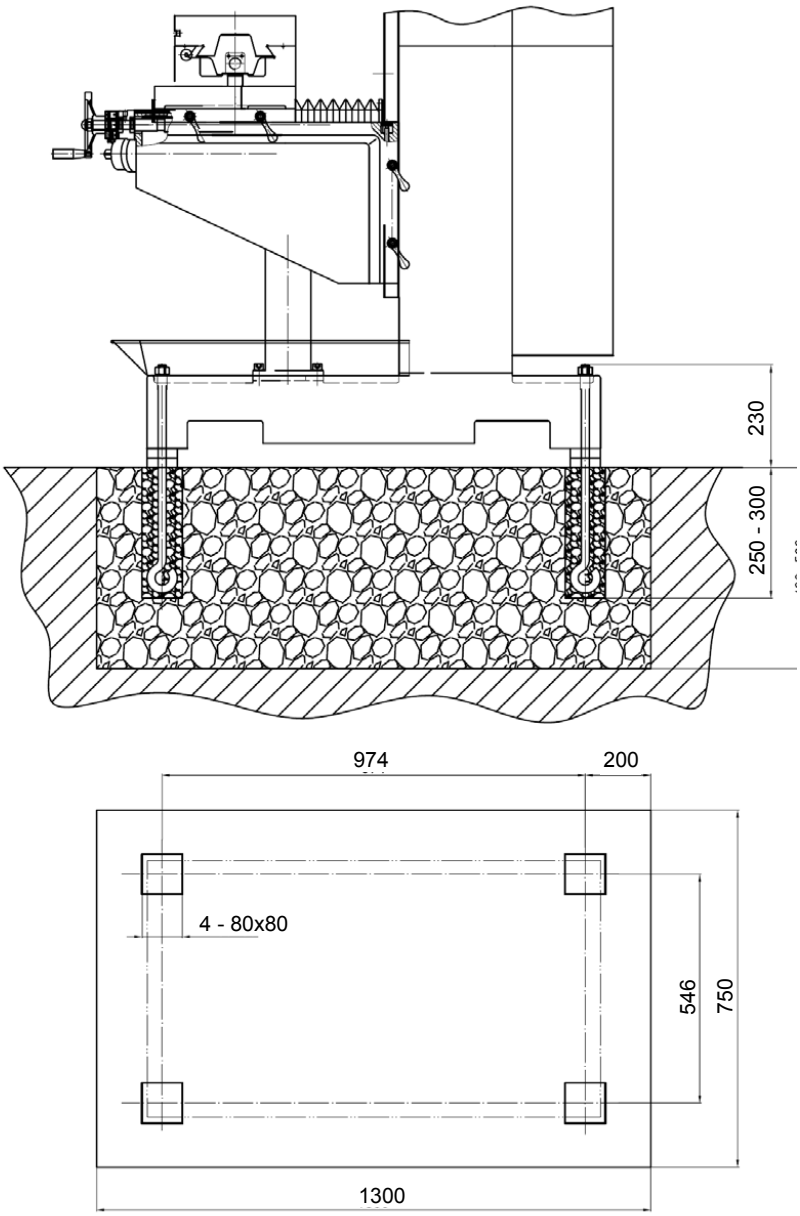
This must be done by laying down a strong base, on each support of the levelling points, between the foundation and the machine foot.

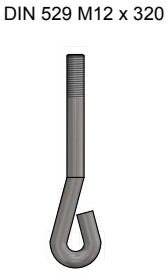
3.7.2 Anchored mounting

Use an anchored mounting to achieve a rigid connection to the substructure. An anchored mounting is always appropriate if the intention is to machine large parts up to the maximum capacity of the drilling-milling machine.

The milling machine is fastened to the floor with four anchor screws DIN 529 M12 x 320 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.3-2: Foundation plan

- ➜ Drilled core holes with a diameter of 80mm and a depth of 250mm to 300mm 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 (0.04mm/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.

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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 0.04mm per 1000mm. 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.

3.8 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!

3.9 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.

3.10 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 57 before switching on the power and putting the machine into service.

3.10.1 Lubrication and oil levels

During the initial lubrication and greasing of your new milling machine, the oil levels are checked and the machine lubricated after cleaning. Only when this has been done can commissioning of the machine proceed.

☞ Inspection and maintenance on page 57

3.11 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.

3.12 Electrical connection

CAUTION!

Lay the connection cable to the electrical cabinet and the cable of the coded connector from the machine to the electrical cabinet in such a way as to prevent a trip 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: 2.5mm^2
- Electric connected load: 4 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.

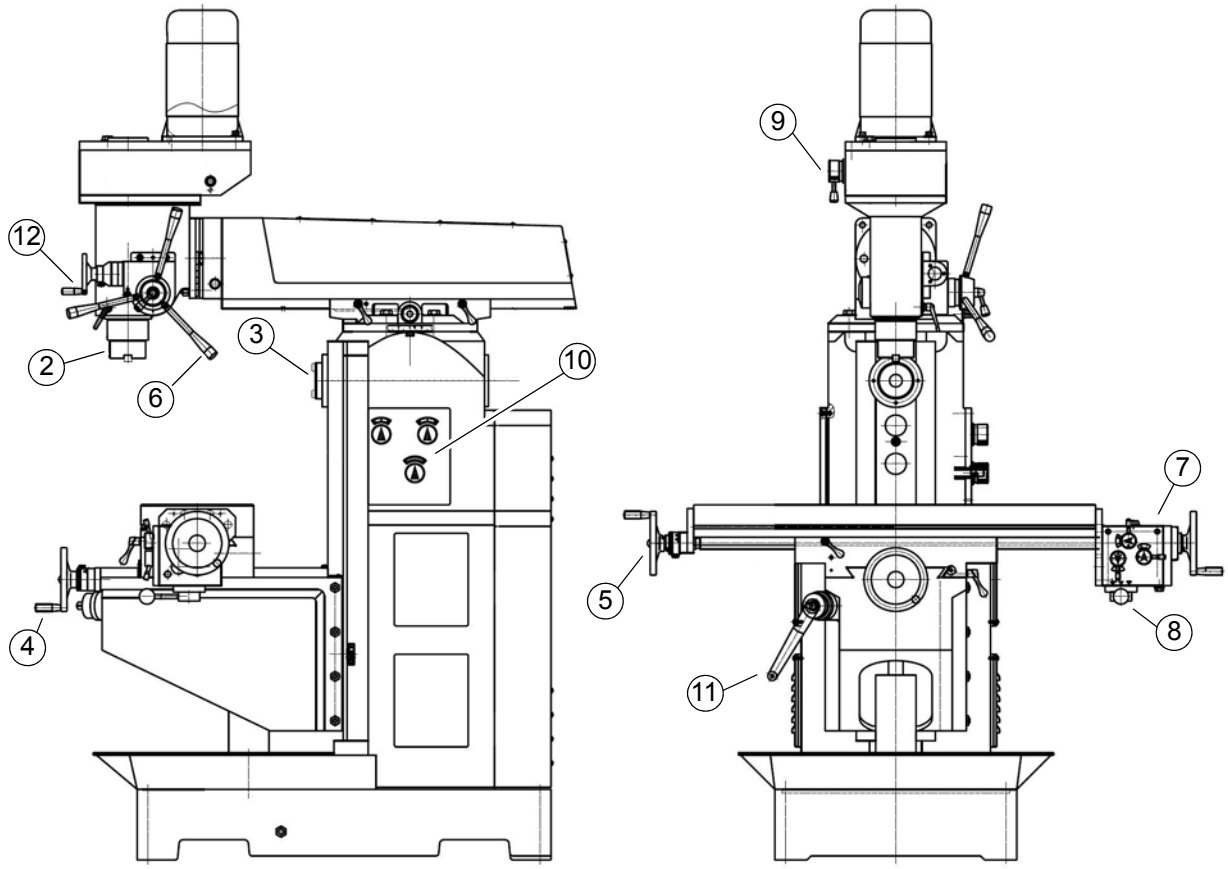
➜ Check the fusing (fuse) of your electrical supply according to the technical instructions regarding the total connected power of the machine.

➜ 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.

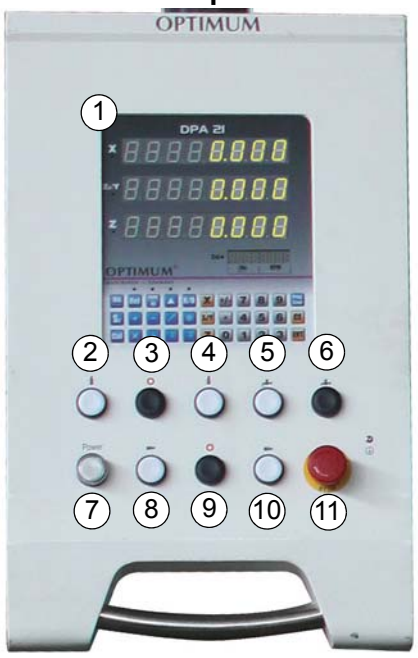
4 Operation

4.1 Overview



Pos.	Designation	Item	Designation
	Control panel with DRO	7	Table feed gear X axis
2	Spindle vertical milling	8	Table feed engaging lever
3	Spindle horizontal milling	9	Vertical milling spindle gear
4	Y axis handwheel for cross table	10	Horizontal milling spindle gear
5	Coupling lever feed Y axis	11	Milling table height adjustment hand crank
6	Spindle sleeve lever vertical spindle	12	Quill fine feed

4.1.1 Control panel



Img.4-1: Control panel

Pos.	Designation	Item	Designation
1	Digital position indicator	7	Control "On"
2	Vertical spindle "Left-handed rotation"	8	Horizontal spindle "Left-handed rotation"
3	Vertical spindle "Rotation off"	9	Horizontal spindle "Rotation off"
4	Vertical spindle "Right-handed rotation"	10	Horizontal spindle "Right-handed rotation"
5	Coolant "On"	11	Emergency stop button
6	Coolant "Off"		

4.2 Switching the milling machine on

ATTENTION!

Wait until the milling machine has come to a complete halt before changing the rotation direction using the rotation direction switch.

➜ Switch on the main switch.

➜ If required, turn the emergency-stop push button to the right in order to release the push button.

➜ Set and close the spindle protection.

➜ Switch the control on.

Img.4-2: Spindle guard

INFORMATION

The control turns on only when all actuators such as the feed lever is in the neutral position.

➜ Switch the control on.

➜ Press the push button for vertical milling or horizontal milling. Observe the direction of rotation.

➜ The milling machine switches on and turns in the preselected rotation direction.

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4.3 Switching the milling machine off

➜ Press the push button "Off" for vertical milling or horizontal milling.
➜ For a long-term standstill of the milling machine switch it off at the master switch.

4.4 Inserting tool

The milling spindle is equipped with a SK40 capture and draw bar M16.

➜ Clean the conical seat in the milling head.
➜ Clean the cone of your tool.
➜ Check that the driving blocks are firmly seated.
➜ Put the tool holder with tool from below into the steep taper of the milling spindle.
➜ Screw the draw bar in the cone of the tool holder.
➜ Tighten the tightening nut.

4.5 Speed variation of vertical / horizontal milling

Set the gearbox to the desired position at standstill.

4.5.1 Speed table horizontal milling

	A		B	
	I	II	I	II
L	90	160	260	460
H	390	690	1130	2000

Img.4-3: Speed table horizontal milling

4.5.2 Speed table vertical milling

	A		B	
	C	D	C	D
I	40	110	270	680
II	60	150	380	950
III	80	200	510	1300

Img.4-4: Speed table vertical milling

4.6 Standard values for cutting speeds

[m/min] with high-speed steel and hard metal for upcut milling.

Tool	Steel	Grey cast iron	Al alloy case-hard-ened
Plain milling cutters and shell end mills [m/min]	10 - 25	10 - 22	150 - 350
Relieved milling cutters [m/min]	15 - 24	10 - 20	150 - 250
Cutter head with SS [m/min]	15 - 30	12 - 25	200 - 300
Cutter head with HM [m/min]	100 - 200	30 - 100	300 - 400

This results in the following standard speeds, dependent on mill diameter, mill type and material.

Tool diameter [mm] shell end mill, helical milling cutter	Steel 10 - 25 m/min	Grey cast iron 10 - 22 m/min	Al-alloy hard-ened 150 - 350 m/min
	Speed [rpm]		
35	91 - 227	91 - 200	1364 - 3183
40	80 - 199	80 - 175	1194 - 2785
45	71 - 177	71 - 156	1061 - 2476
50	64 - 159	64 - 140	955 - 2228
55	58 - 145	58 - 127	868 - 2025
60	53 - 133	53 - 117	796 - 1857
65	49 - 122	49 - 108	735 - 1714

Tool diameter [mm] Form mills	Steel 15 - 24 m/min	Grey cast iron 10 - 20 m/min	Al-alloy hard-ened 150 - 250 m/min
	Speed [rpm]		
4	1194 - 1911	796 - 1592	11937 - 19894
5	955 - 1529	637 - 1274	9549 - 15916
6	796 - 1274	531 - 1062	7958 - 13263
8	597 - 955	398 - 796	5968 - 9947
10	478 - 764	318 - 637	4775 - 7958
12	398 - 637	265 - 531	3979 - 6631
14	341 - 546	227 - 455	3410 - 5684
16	299 - 478	199 - 398	2984 - 4974

4.7 Spindle sleeve feed

4.7.1 Manual spindle sleeve feed

➜ Actuate the quill lever in order to manually lift respectively lower the quill.
❍ You can set the spindle sleeve to a given height using the tightening lever.

ATTENTION!

For all movements of the spindle sleeve you must first loosen the tightening lever!

4.7.2 Automatic spindle sleeve feed

0.08 | 0.25 | 1 mm/rev

➜ Set the feed rate.
➜ Pull out the spindle sleeve lever.
❍ The lever is released when the depth stop comes into contact with the adjusting nut.
➜ Switch on the clockwise spindle rotation.

Img.4-5: Selector switch for spindle sleeve feed

4.7.3 Quill fine feed

➜ Turn the lever clockwise. The sleeve lever moves to the spindle head and activates the coupler of the fine feed.
➜ Turn the quill fine feed handwheel in order to move the quill.

Img.4-6: Spindle sleeve feed

4.8 Moving the cross table up / down

Manual movement on the Z axis

The height adjustment of the milling table is carried out with the hand crank.

➜ Loosen the clamping lever.
➜ Engage the hand crank by pressing into the coupling.
➜ Position the milling table on desired position using the crank.
➜ Make sure to tighten the clamping lever again once you have completed the operation.

4.9 Moving the spindle head-holder forward or back

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

Proceed as follows:

➜ Loosen the clamping lever.
➜ Bring spindle head support with a key on the square drive in the desired position.
➜ Imperatively fasten the clamping screws.

4.10 Moving the cross table left or right (X axis)

There are two ways of moving the cross table on the X axis.

❍ By turning the handwheel on the milling table.
❍ With the automatic table feed.

4.10.1 Manual movement on the X axis

To manually move the cross table, the clamping levers are released and the table is moved with the hand crank.

➜ Loosen the clamping lever.
➜ Engage the hand crank by pressing into the coupling.
➜ Position the milling table on desired position using the crank.
➜ Clamp again if required.

4.10.2 Switching the automatic table feed (X axis) on / off

To automatically move the cross table, the clamping levers are released and the operating mode "rapid traverse" or "feed" is selected via the selector lever. The movement is activated with the directional lever.

ATTENTION!

If the speed of the table feed is changed, the direction lever for the feed must be in neutral middle position (in position "Off“).

ATTENTION!

Loosen the clamping lever on the cross table.

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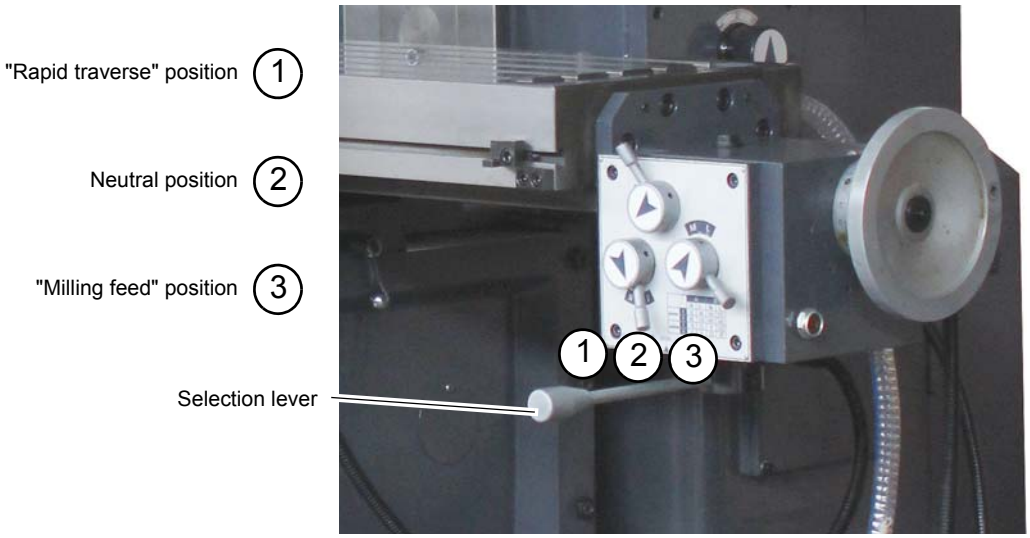
4.10.3 Switching on the rapid taverse

ATTENTION!

The rapid traverse is used exclusively to reach a position quick. The rapid traverse must not be used as milling feed.

➜ Set the selection lever for the table feed into the (1) position.

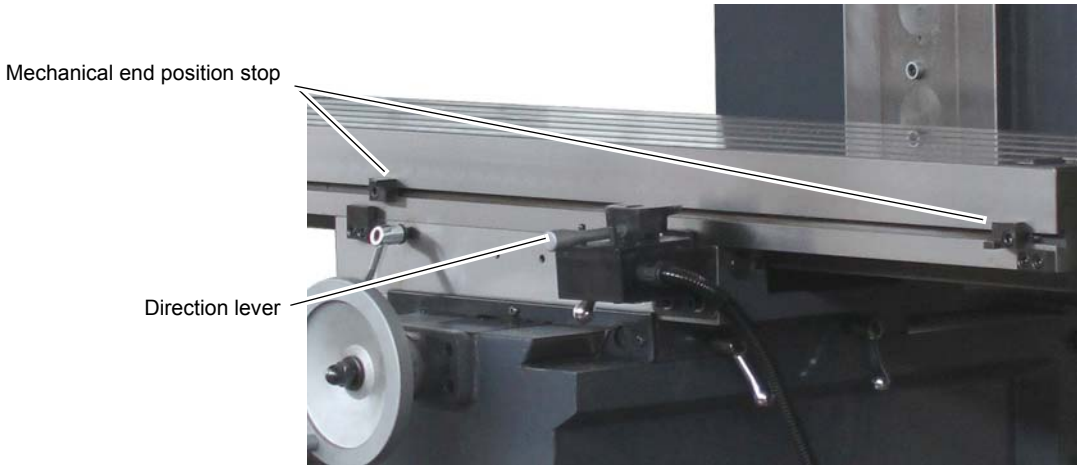


Img.4-7: Selector lever

➜ Loosen clamping lever on the cross table.

➜ In this context, absolutely pay attention that the clamping nuts of the adjustable end stop switch are well tightened.

➜ Turn the direction lever for table feed motion (X axis) to the required feed direction.



Img.4-8: Direction lever

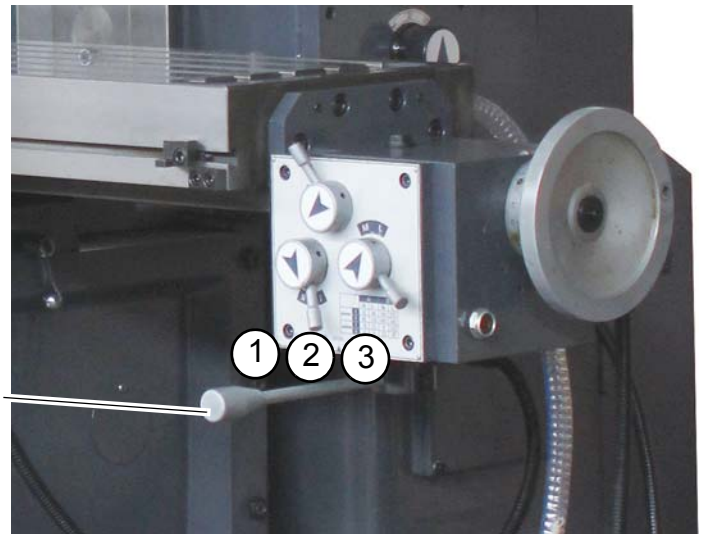
➜ In order to switch off the rapid traverse, turn the direction lever for table feed motion to the neutral position.

4.10.4 Switching the feed

➜ Set the feed rate.

~ 50Hz		A		B	
		M	L	M	L
mm/min	I	32	48	180	275
mm/min	II	80	120	460	700
inch/min	I	1 1/2	2 1/2	9	13 1/2
inch/min	II	4	6	23	35

➜ Set the selection lever for the table feed into the position (3) .



Img.4-9: Selector lever

➜ Loosen clamping lever on the cross table.
➜ Set the position of the mechanical end stops.
➜ Turn the direction lever for table feed motion (X axis) to the required feed direction.
➜ In order to switch off the rapid traverse, turn the direction lever for table feed motion to the neutral position.

4.11 Moving the cross table forward / back (Y axis)

➜ Loosen the clamping lever.
➜ Engage the hand crank by pressing into the coupling.
➜ Position the milling table on desired position using the crank.
➜ Clamp again if required.

4.12 Swivelling the milling head

ATTENTION!

If the milling head is slewn too far oil might escape from the gear. Therefore, we recommend to slew the milling head only as far as no oil escapes while the vertical spindle is running.

INFORMATION

The gear of the milling machine is located in open reservoirs which have to be connected with the ambient air.

The milling head can be swivelled to the right and to the left.

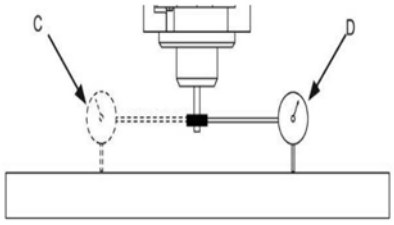
- ➜ Loosen the nuts for clamping the rotary disc maximum of one turn. A complete removal or loosening of the nuts can lead to jamming of the rotary disc.
- ➜ Rotate the square head in order to set the milling head to max. 45 °. Use the scale on the rotary disc to set the angle.
- ➜ Clamp the nuts again after adjusting the required angle.

4.12.1 Setting the milling head to zero position

- ➜ Loosen the nuts to clamp the rotary disc.
- ➜ Turn the square head until the milling head is in the zero position.
- ➜ Retighten the nuts.

INFORMATION

The milling head should be aligned after resetting to the initial position with a dial indicator so that holes can be produced with the spindle sleeve at a right angle.



4.13 Turning the spindle head carrier

It is possible to rotate the spindle head carrier by ± 180°.
The spindle head carrier must be turned by 180 ° for horizontal milling to be able to mount the thrust bearing.
Proceed as follows:

- ➜ Loosen the clamping screws.
- ➜ Crank the spindle head carrier forwards as far as possible in order to pass the operating panel during the turning process. For technical reasons, the control panel has an intended short arm.
- ➜ Position the spindle head carrier to the desired position by turning it by hand.
- ➜ Fasten the clamping screws.

4.14 Conversion to horizontal milling

- ➜ Mount the side milling cutters to the desired position of the milling spindle.
- ➜ Determine the position of the thrust bearing.
- ➜ Turn the spindle head carrier 180°. The vertical milling head must be located behind.
- ➜ Fix the milling spindle by means of the draw bar.

➜ Mount the thrust bearing.

INFORMATION

If the spindle head carrier is not exactly plugged in to "Zero" it is almost not possible to fix the thrust bearing. Therefore if required release the clamping screws by slightly turning the spindle head carrier before plug-in the thrust bearing.

Retighten the clamping screws after plugging them in.

4.15 Cooling

WARNING!

Discharge and overflow of cooling lubricants and lubricants Ensure that cooling lubricants are not discharged onto the floor. Any cooling lubricants that run onto the floor must be removed immediately.

The coolant delivery is switched on and off via a push button on the control panel.
The amount of cooling lubricant can be regulated using the dosing tap.

The friction generated during rotation can cause the edge of the tool to become very hot.

When milling it is necessary to cool down the tool depending on the material. By cooling with an appropriate coolant lubricant you will achieve a better working result and longer durability of the tool.

➜ Adjust the rate of flow by means of the stop and dosing valve.

ATTENTION!

Failure of the pumps in case of dry running. The pump is lubricated by the cooling lubricant. Do not start up the pump without cooling lubricant.

INFORMATION

Use a water-soluble environmentally friendly emulsion as cooling lubricant procured from a specialist retailer.

Respect the environment when disposing of any lubricants and cooling agents.

Follow the manufacturer’s disposal instructions.

5 Operation

When the device is switched on, the digital position indicator starts a self-check.

After the self-check is completed, the position indicator changes to the normal indicator status.

The digital position indicator displays the last data before it is switched off.

- The selected coordinates and the selected tool.
- The metric or Anglo-American measurement system.
- The last displayed values.

5.1 Parameter Settings

- Press the Prog 3sec key for 3 seconds until the X-axis display shows P-10.
- To cancel an entry, press the CE button.
- Press button ENT to save an input.

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5.1.1 Explanation of the Parameters

Meanings of parameters and settings.

Parameters	Axis	Description
P -- 07	X axis	Accuracy of representations on the display: When a higher representational accuracy value than the actual counting resolution is set on the display, the representational accuracy value will be shown accordingly.
P --- 08	Z_0/Y axis	
P --- 09	Y axis	
P --- 10	X axis	Counting direction: The counting direction of the measurement in the positive or negative direction. 0 for a positive counting direction, 1 for a negative counting direction.
P --- 11	Z_0/Y axis	
P --- 12	Y axis	
P --- 13	X axis	Counting resolution of the respective axis The unit is 0.1 mm. Relation: ❍ 5µm = 50 ❍ 2µm = 20 ❍ 10µm = 100 The counting resolution set must correspond to the selected measuring gib or active measuring strip reading device. When a higher representational accuracy value than the actual counting resolution is set on the display, the representational accuracy value will be shown accordingly.
P --- 14	Z_0/Y axis	
P --- 15	Y axis	
P --- 16	X axis	Correction factor: Linear error compensation coefficient. The value range for linear error compensation coefficients extends from -9.999 to 9.999mm, and gives the value to be adjusted per meter.
P --- 17	Z_0/Y axis	
P --- 18	Y axis	
P --- 19	Rotation Speed Signal	The target value of the number of pulses per revolution of the rotation speed signal The number of impulses per revolution of the rotation speed signal depends on the number of output pulses per revolution of the transducer in use (number of permanent magnets). The greater this value is, the higher will be the resolution of the rotation speed. The range of possible setting values extends from 1 to 3600.
P --- 20		Measurement time: The target value of the time for speed measurement. The maximum set value is 10 (i.e. 1 second) and the minimum set value is 1 (i.e. 0.1 second). The greater this value is, the higher will be the resolution of the revolution speed, and the slower this value will be refreshed. The representational accuracy of the rotational speed indicator shown directly on the display = 600 / (number of impulses per revolution x measurement time)

Factory Settings:	
Where delivered as a standalone device.	**In applied delivery state with machine tool.** **Please record the values before making any changes.**
P -- 13 = 50	P -- 07 =
P -- 14 = 50	P -- 08 =
P -- 15 = 50	P -- 09 =
	P -- 10 =
	P -- 11 =
	P -- 12 =
	P -- 13 =
	P -- 14 =
	P -- 15 =
	P -- 16 =
	P -- 17 =
	P -- 18 =
	P -- 19 =
	P -- 20 =

5.2 Description of the Keys

Letters/Symbols on the Keys	Name of the key	Function description
	X axis key	To select the X coordinate axis
	Y axis key	To select the Y coordinate axis
	Z0/Y-axis key (3 axes)	To select the Z0/Y coordinate axis

	Plus and minus signs with numerical keys and decimal point	For input of negative or positive signs For numeric entry For input of decimal places; decimal point
	Delete key	To clear displayed value of a specific axis or to jump back to coordinate points.
	Enter key	To confirm the data input
	Radius or Diameter	X-axis display when used on lathes
	Shift key Metric / inches	Display of values • in the metric system • in the Anglo-American measurement system
	Reference marker function	for setting relative coordinates ☞ Reference marker function on page 44
	Machine zero point	for setting an absolute zero-point in the coordinate system ☞ Machine zero point function on page 44
	Z+Z0 key (3 axes)	For display of the Z+Z0 value Z and Z0 are added
	Programming key	For internal parameter settings ☞ Parameter Settings on page 39
	The calculator function key	☞ Calculator function on page 45

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	Addition	☞ Calculator function on page 45
	Subtraction	
	Multiplication	
	Division	
	Coordinate points along a diagonal line	☞ Coordinate points along a diagonal line on page 46
	Coordinate points on a circle	☞ Coordinate Points on a Circle or Arc on page 47
	Inclined plane function	☞ Inclined Plane on page 50
	Arc function	☞ Arc on page 51
	Tool data function	☞ Tool Data Function on page 54 ☞ Recall of tool data on page 54

5.3 Reference marker function

Set a zero point with preset axis values Set a relative coordinate system based on current machine position

- Press the button 

to activate the reference marker function.

  The LED flashes.

- Press the button 

to exit from the Reference Marker function.

- The set reference mark values are now transferred to the axis display.

Example:

Setting the values.

After pressing the reference mark function, the following values should be set: 0.500 for the X-axis, 10 for the Y-axis, and 0 for the Z-axis.

Press the following keys in the order shown in order to set these values.

5.4 Machine zero point function

For the setting of an absolute zero point.

Press the button  . The LED flashes.

The axis values shown for the current machine position are reset to zero. Values for the axes may also be input where needed.

When the machine zero point is turned off, the previous values are shown again.

DPA21_GB_3.fm

5.5 Calculator function

Add, subtract, multiply and divide.

❍ Press button 

to start the calculator. The LED lights up.

The number field of the rotation speed indicator is used as the input- and result field.

❍ To exit from the Calculator function, press the 

button.

Keys

❍ 

to add. 

to subtract. 

to multiply.

to divide.

Example:

Press the following keys in the order shown in order to divide the number 46.2 by 2, and transfer the result to the Z-axis.

DPA21_GB_3.fm

5.6 Coordinate points along a diagonal line

Creates a line within a coordinate system, along which a specified number of uniformly spaced coordinate points are defined.

- ❍ The parameters are displayed in the Rotation Speed field.
- ❍ The last value entered for each parameter is displayed in the X axis row.
- ❍ Enter new values in the Y axis row.

5.6.1 Entering the Parameters

Parameters	Description
1 - 1 L_A	Angle of the line on the coordinate axis: X-Y
2 - 1 L_A	Angle of the line on the coordinate axis: Y-Z
3 - 1 L_A	Angle of the line on the coordinate axis: X-Z
Press the key  to select X-Y, Y-Z or X-Z as the coordinate axis. To enter the angle of the line, use the numeric keys and confirm with the  key.	

Parameters	Description
1 - 2 L_d	Length of the line: X-Y
2 - 2 L_d	Length of the line: Y-Z
3 - 2 L_d	Length of the line: X-Z
To enter the length of the line, use the numeric keys and confirm with the  key.	

Parameters	Description
1 - 3 L∏₀.H	Number of coordinate points: X-Y
2 - 3 L∏₀.H	Number of coordinate points: Y-Z
3 - 3 L∏₀.H	Number of coordinate points: X-Z
To enter the number of coordinate points, use the numeric keys and confirm with the  key.	

DPA21_GB_3.fm

5.6.2 Positioning the Coordinate Points

Parameters	Description
1LHo	Coordinate point no.: X-Y
2LHo	Coordinate point no.: Y-Z
3LHo	Coordinate point no.: X-Z

To select the desired coordinate point, press the ENT button.

To select the previous coordinate point, press the CE button.

The machine axes proceed until the positions of the selected coordinate point read 0.000.

INFORMATION

Press the button 0 to temporarily interrupt the function. The display returns to the normal display status. Press the 0 key again to continue with the function.

To exit from the function, press the button.

5.7 Coordinate Points on a Circle or Arc

Creates a circle or arc within a coordinate system, along which a specified number of uniformly spaced coordinate points are defined.

The set coordinate points on the circle or arc run counterclockwise. Coordinate point 2 is located counterclockwise of coordinate point 1.

- The parameters are displayed in the Rotation Speed field.
- The last entered value of each parameter is shown in the row of the X axis.
- Entering a new value is specified in the row of the Y axis.

5.7.1 Entering the parameters

Parameter	Description
1 - 1 CCE ⊓	Coordinate plane of the circle: X-Y
2 - 1 CCE ⊓	Coordinate plane of the circle: Y-Z
3 - 1 CCE ⊓	Coordinate plane of the circle: X-Z
To select X-Y, Y-Z or X-Z as the coordinate plane, press the  key. To enter the midpoint of the circle on the coordinate plane, use the numeric keys and confirm with the  key.	

Parameters	Description
1 - 2 C_d	Diameter of the circle or arc in the coordinate plane: X-Y
2 - 2 C_d	Diameter of the circle or arc in the coordinate plane: Y-Z
3 - 2 C_d	Diameter of the circle or arc in the coordinate plane: X-Z
To enter the diameter of the circle or arc, use the numeric keys and confirm with the  key.	

Parameters	Description
1 - 3 C⊓▫.H	Number of coordinate points: X-Y
2 - 3 C⊓▫.H	Number of coordinate points: Y-Z
3 - 3 C⊓▫.H	Number of coordinate points: X-Z
Input the number of coordinate points using the numeric keys and confirm with the  key.	

Parameters	Description
1 - 4 5_A	Start angle: X-Y
2 - 4 5_A	Start angle: Y-Z
3 - 4 5_A	Start angle: X-Z
To enter the start angle on the coordinate plane, use the numeric keys and confirm with the  key.	

DPA21_GB_3.fm

Parameter	Description
1 - 5 E_A	End angle: X-Y
2 - 5 E_A	End angle: Y-Z
3 - 5 E_A	End angle: X-Z
To enter the end angle on the coordinate plane, use the numeric keys and confirm with the ENT key.	

5.7.2 Positioning to coordinate points

Parameter	Description
1Cho	Coordinate point no.: X-Y
2CHo	Coordinate point no.: Y-Z
3CHo	Coordinate point no.: X-Z
To select the desired coordinate point, press the ENT button. Press button CE to select the desired coordinate point. The machine axes will proceed until the positions of the selected coordinate axes read 0.000.	

INFORMATION

Press the button 0 to temporarily interrupt the function. The display returns to the normal display status. Press the 0 key again to continue with the function.

Press the button to exit from the function.

5.8 Inclined Plane

Creates an inclined plane in a coordinate system such that processes can be carried out on said inclined plane.

- The parameters are displayed in the Rotation Speed field.
- The last entered value of each parameter is shown in the row of the X axis.
- Entering a new value is specified in the row of the Y axis.

5.8.1 Entering the parameters

Parameter	Description
1 - 1 CL_A	Angle of the inclined plane on the coordinate plane: X-Y
2 - 1 CL_A	Angle of the inclined plane on the coordinate plane: Y-Z
3 - 1 CL_A	Angle of the inclined plane on the coordinate plane: X-Z

Press the key  to select X-Y, Y-Z or X-Z as the coordinate plane.

To enter the angle of the inclined plane, use the numeric keys

and confirm with the 

key.

5.8.2 Positioning to a Coordinate Point on the Inclined Plane

Parameters	Description
1A _angle entered	Inclined plane: X-Y
2A_angle entered	Inclined plane: Y-Z
3A_angle entered	Inclined plane: X-Z

The machine axes proceed until the positions of the selected coordinate plane read 0.000.

INFORMATION

Press the button 

to temporarily interrupt the function. The display returns to the normal display status. Press the 0 key again to continue with the function.

Press the button  to exit from the function.

DPA21_GB_3.fm

5.9 Arc

Creates an arc in a coordinate system such that processes can be carried out on said arc.

- The parameters are displayed in the Rotation Speed field.
- The last entered value of each parameter is shown in the row of the X axis.
- Entering a new value is specified in the row of the Y axis.

5.9.1 Entering the parameters

Parameter	Description
1 - 1 ACE∏	Midpoint of the arc on the coordinate plane: X-Y
2 - 1 ACE∏	Midpoint of the arc on the coordinate plane: Y-Z
3 - 1 ACE∏	Midpoint of the arc on the coordinate plane: X-Z
Press the key  to select X-Y, Y-Z or X-Z as the coordinate plane. To enter the end midpoint of the arc, use the numeric keys and confirm with the  key.	

Parameter	Description
1 - 2 5E_d	Radius of the arc on the coordinate plane: X-Y
2 - 2 5E_d	Radius of the arc on the coordinate plane: Y-Z
3 - 2 5E_d	Radius of the arc on the coordinate plane: X-Z
To enter the end radius of the arc, use the numeric keys and confirm with the  key.	

Parameter	Description
1 - 3 0U_S	Machining mode of the arc on the coordinate plane: X-Y
2 - 3 0U_S	Machining of the arc on the coordinate plane: Y-Z
3 - 3 0U_S	Machining of the arc on the coordinate plane: X-Z
To set machining mode of the arc, use the numeric keys 0 or 1. 0 = Machining mode of the arc from the inside. 1 = Machining mode of the arc from the outside. Confirm with the ENT key.	

Parameters	Description
1 - 4 CU_d	Milling tool diameter: X-Y
2 - 4 CU_d	Milling tool diameter: Y-Z
3 - 4 CU_d	Milling tool diameter: X-Z
To enter the diameter of the milling tool, use the numeric keys and confirm with the ENT key.	

Parameter	Description
1 - 5 S_Po	Start position: X-Y
2 - 5 S_Po	Start position: Y-Z
3 - 5 S_Po	Start position: X-Z
To enter the start position, use the numeric keys and confirm with the ENT key.	

DPA21_GB_3.fm

Parameter	Description
1 - 6 E_Po	End position: X-Y
2 - 6 E_Po	End position: Y-Z
3 - 6 E_Po	End position: X-Z
To enter the end position, use the numeric keys and confirm with the ENT key.	

Parameters	Description
1 - 7 CUF	Machining depth: X-Y
2 - 7 CUF	Machining depth: Y-Z
3 - 7 CUF	Machining depth: X-Z
To enter the machining depth, use the numeric keys and confirm with the ENT key.	

5.9.2 Positioning to a Coordinate Point on the Arc

Parameters	Description
1Po	Position: X-Y
2Po	Position: Y-Z
3Po	Position: X-Z
To select the desired coordinate point, press the ENT button. Press button CE to select the desired coordinate point. The machine axes will proceed until the positions of the selected coordinate axes read 0.000. Repeat these steps until the arc has been completely machined.	

INFORMATION

Press the button 0 to temporarily interrupt the function. The display returns to the normal display status. Press the 0 key again to continue with the function.

Press the button to exit from the function.

DPA21_GB_3.fm

5.10 Tool Data Function

Creates up to 99 tool data sets in relation in the coordinate system.

Usage of the tool data function makes it possible to establish a specific relationship between the tool data in the coordinate system and the displayed values.

INFORMATION

The Save function for tool data only works when the Reference Mark function is activated. ☞

Reference marker function on page 44.

Saved values remain even by loss of electric power.

Example:

Tool data nr. 2 should lie at X = 1.000 and Y = 2.000 to the shown values.

Press the following keys in the order shown in order to input the values X = 1.000 and Y = 2.000 under tool data nr. 2.

5.10.1 Recall of tool data

Example:

The tool data set nr. 2 should be used at the currently displayed position.

Press the following keys in the order shown in order to use tool data set nr. 2.

DPA21_GB_3.fm

6 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.

6.1 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.

6.1.1 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.

6.1.2 Restarting

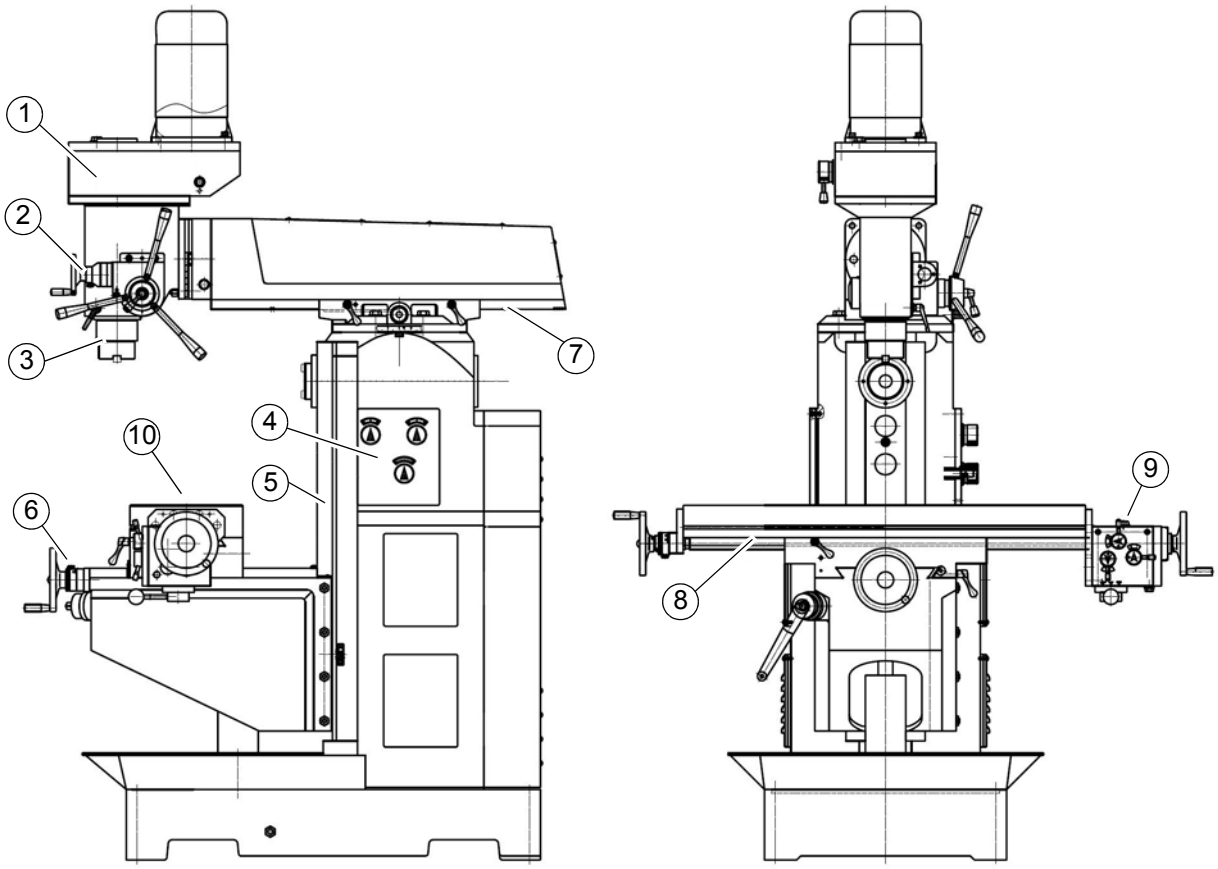
Before restarting, run a safety check.

☞ Safety check on page 14

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.

6.2 Overview of lubrication points



Pos.	Designation	Item	Designation
1	Vertical spindle gear	5	Guide track
2	Fine feed	6	Y axis
3	Spindle sleeve	7	Guide track
4	Horizontal spindle gear	8	Guide track
5	Guide track	9	Feed gear
6	Coolant "Off"	10	Surface of cross table

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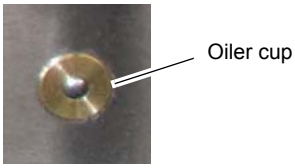
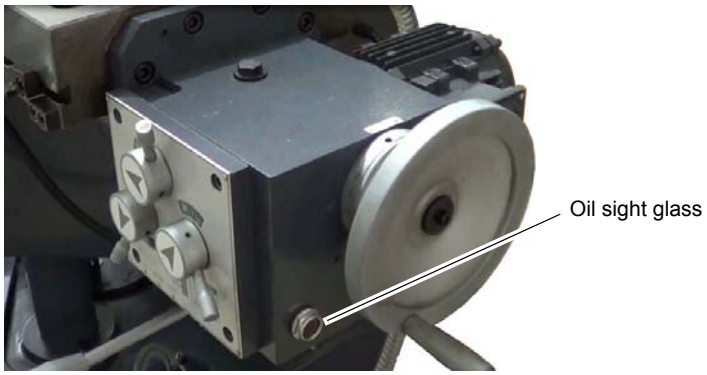
6.3 Inspection and maintenance

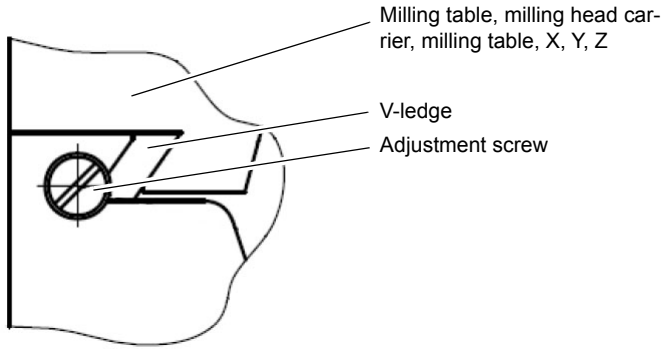
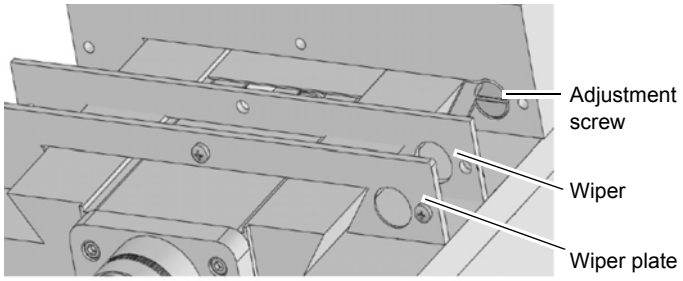
The type and level of wear depends to a large extent on the individual usage and operating conditions. Any indicated intervals therefore are only valid for the corresponding approved conditions. ☞ Technical specification on page 18

Interval	Where?	What?	How?
Start of work, after every maintenance or repair work	**Milling machine**	☞ Safety check on page 14	
Start of work, after every maintenance or repair work	**Moving machine parts**	Oiling	➜ All mobile machine parts such as guides, feed screws, spindle nuts must be oiled in regular intervals. ➜ Always slightly oil bare surfaces. ➜ Lubricate the cross table lifting spindle with bearing grease. ➜ Oil at these lubricating point positions.  Img.6-1: Oiler cup

<table>
<tr><th>Interval</th><th>Where?</th><th>What?</th><th>How?</th></tr>
<tr><td></td><td>Spindle gear
Vertical milling</td><td rowspan="3">Oil level control</td><td>➜ The oil level must at least attain the centre resp. top marking of the oil sight glass.</td></tr>
<tr><td rowspan="2">Start of work,
after every maintenance or repair work</td><td>Spindle gear
Horizontal milling</td></tr>
<tr><td>Feed gear</td><td>➜ The oil level must at least attain the centre resp. top marking of the oil sight glass.
 

Img.6-2: Gear feed oil sight glass</td></tr>
<tr><td>The first time after 3 month, then every 6 months</td><td>Spindle gear
Vertical milling</td><td>Oil change</td><td>➜ For oil change use an appropriate collecting tray of sufficient capacity.
➜ Have the milling spindle run for a few minutes, the oil will heat up and will slightly penetrate from the opening.
➜ Unscrew the screw from the drain hole.
➜ Unscrew the screw from the filler hole.
➜ Close the drain hole if no more oil drains.
➜ Fill up to the middle of the reference mark of the oil sight glass into the filler hole using a suitable container.</td></tr>
<tr><td>The first time after 3 month, then every 6 months</td><td>Spindle gear
Horizontal milling</td><td>Oil change</td><td>➜ For oil change use an appropriate collecting tray of sufficient capacity.
➜ Have the milling spindle run for a few minutes, the oil will heat up and will slightly penetrate from the opening.
➜ Unscrew the screw from the drain hole.
➜ Unscrew the screw from the filler hole.
➜ Close the drain hole if no more oil drains.
➜ Fill up to the middle of the reference mark of the oil sight glass into the filler hole using a suitable container.</td></tr>
</table>

Interval	Where?	What?	How?
The first time after 3 month, then every 6 months	**Feed gear**	Oil change	➜ For oil change use an appropriate collecting tray of sufficient capacity. ➜ Travel the table in the rapid mode back and forth, the oil heats up and easily penetrates from the drain opening. ➜ Unscrew the screw from the drain hole. ➜ Unscrew the screw from the filler hole.  Img.6-3: Filler hole feed gear ➜ Close the drain hole if no more oil drains. ➜ Fill up to the middle of the reference mark of the oil sight glass into the filler hole using a suitable container.
The first time after 20 hours of operation, then every month	**V-belt Horizontal milling**	Check Readjusting	➜ Check if the V-belts are porous or worn. ➜ Press the finger on the V-belt. The V-belt should push through by about 5 mm at a force of about 30 Newton (3 kg).

Interval	Where?	What?	How?
When necessary	**Guideways**	Readjusting	➜ Readjust the guides by means of the corresponding V-ledge. ➜ If necessary disassemble the wipers in order to attain the readjusting screws of the corresponding V-ledges. ➜ Use a screwdriver to turn the adjusting screw clockwise until the movement in the respective guideway is still easily possible.  Img.6-4: V-ledge ➜ Dismantle the wiper plate and wiper in order to reach the adjustment screw.  Img.6-5: Y axis V-ledge
As required but at least once per year	**Coolant equipment**	Replacing	➜ Fill in coolant, replace if necessary. ➜ Wash the cooling lubricant pump. ☞ Cooling lubricants and tanks on page 62 ☞ Inspection plan for water-mixed cooling lubricants on page 63

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6.4 Repair

6.4.1 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.

6.5 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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6.5.1 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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7 Ersatzteile - Spare parts

7.1 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.*

7.1.1 Wichtiger Hinweis - Important note

INFORMATION

Um Ihnen eine erfolgreiche Ersatzteilversorgung zu ermöglichen, ist es zwingend erforderlich die Seriennummer Ihrer Fräsmaschine zu erhalten. Ihre MT60 Fräsmaschine kann sich erheblich in diversen Teilen und deren Kompatibilität zu anderen MT60 Fräsmaschinen unterscheiden. Bitte haben Sie Verständnis dafür, dass ansonsten eine erfolgreiche Ersatzteilversorgung für Ihre MT60 Fräsmaschine nicht möglich ist.

In order to enable a successful spare parts supply, it is absolutely necessary to obtain the serial number of your milling machine. Your MT60 milling machine can differ considerably in various parts and their compatibility with other MT60 milling machines. Please understand that otherwise a successful spare parts supply for your MT60 milling machine is not possible.

7.2 Hotline Ersatzteile - Spare parts Hotline

+49 (0) 951-96555 -118

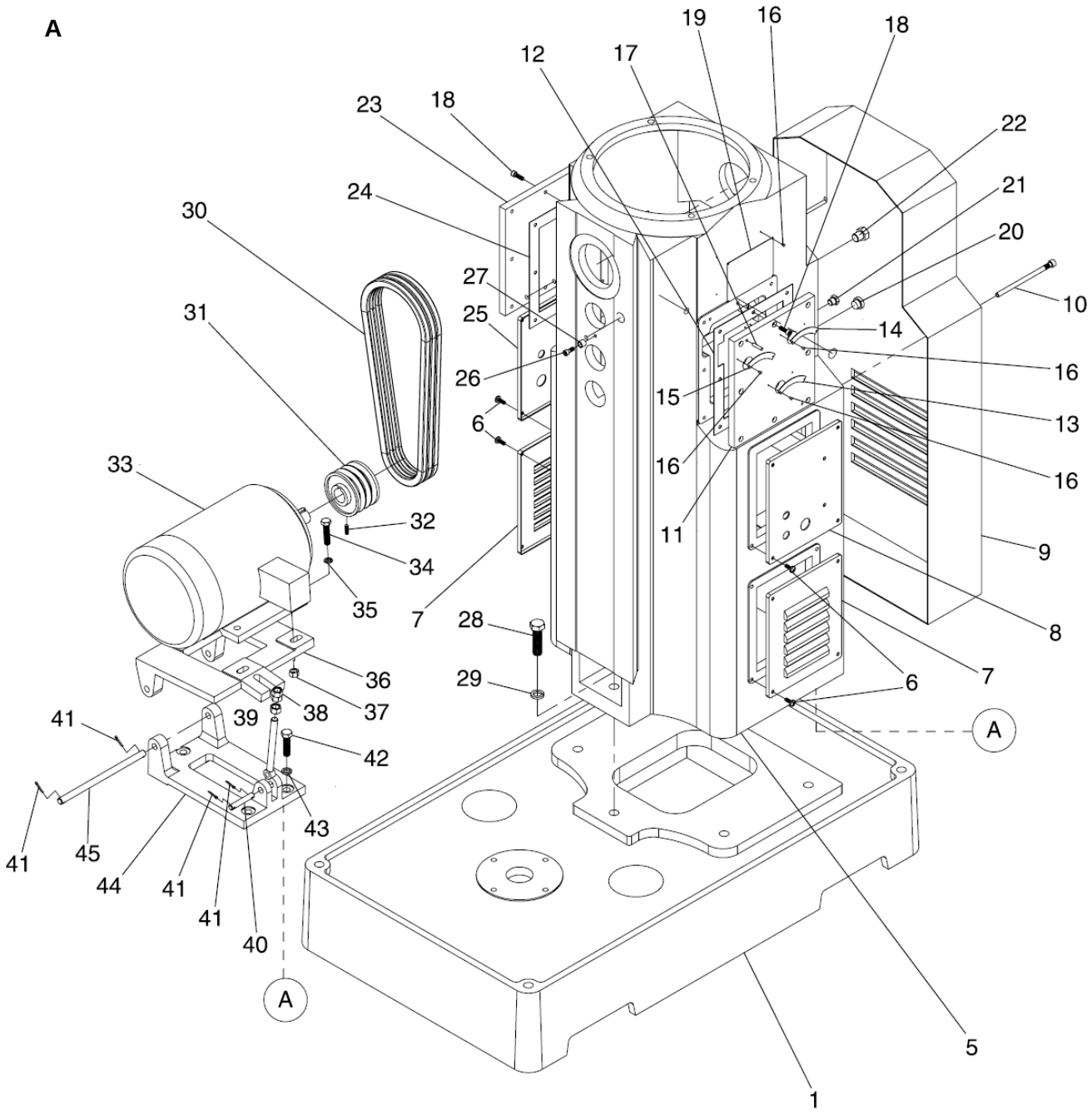
ersatzteile@stuermer-maschinen.de

7.3 Service Hotline

+49 (0) 951-96555 -100

service@stuermer-maschinen.de

7.4 Maschinenfuß und Säule - Base & Column



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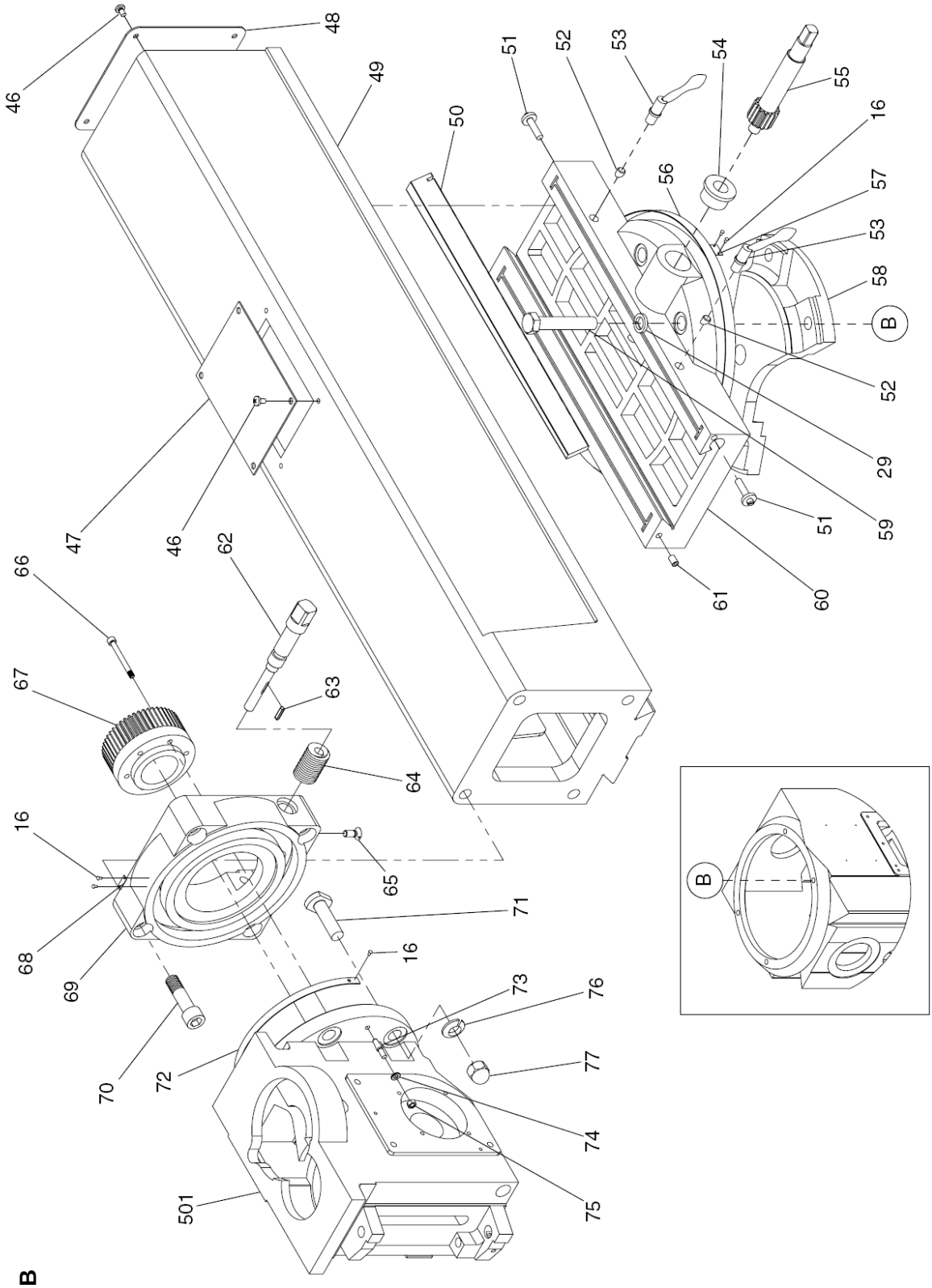

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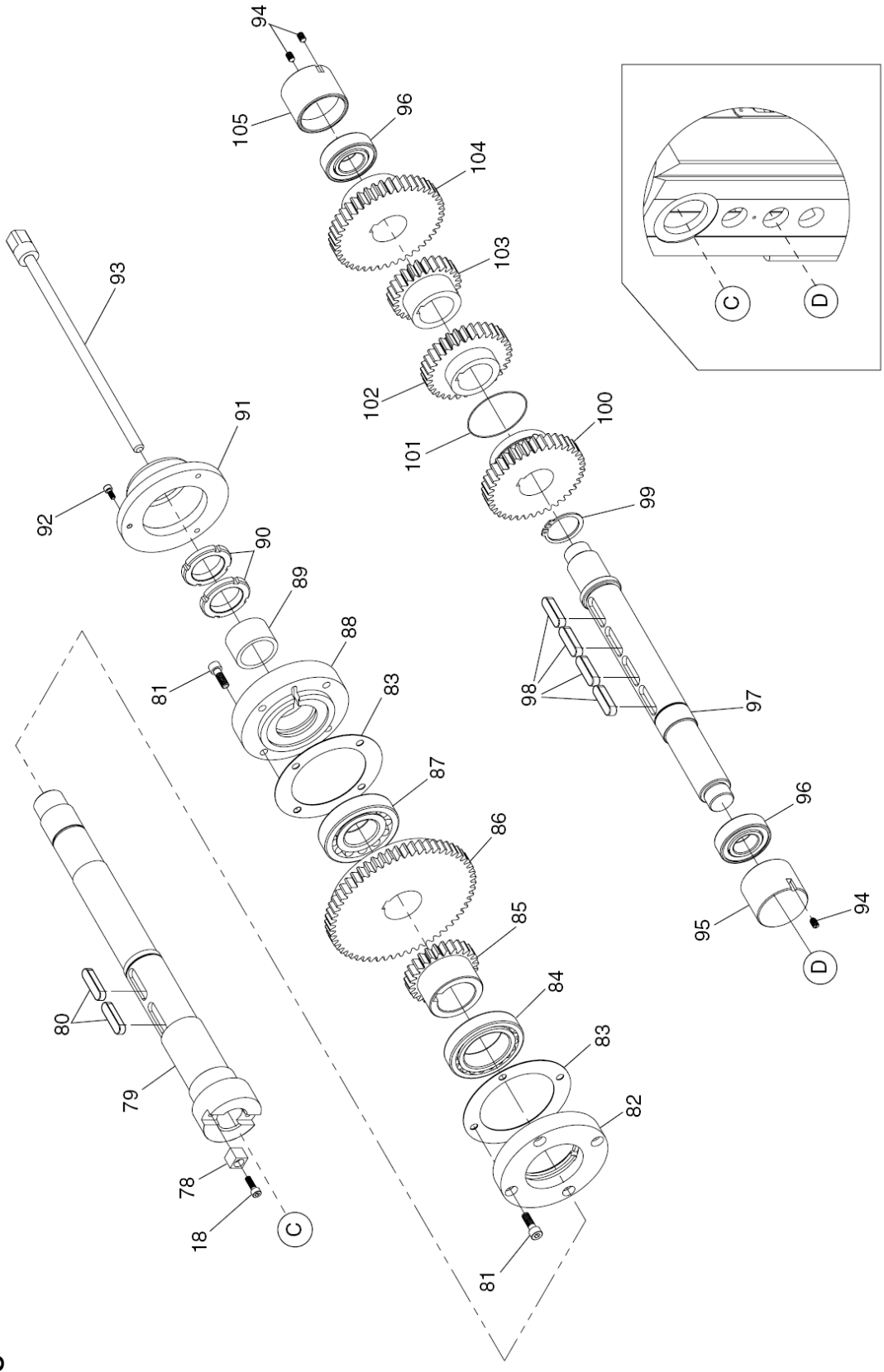

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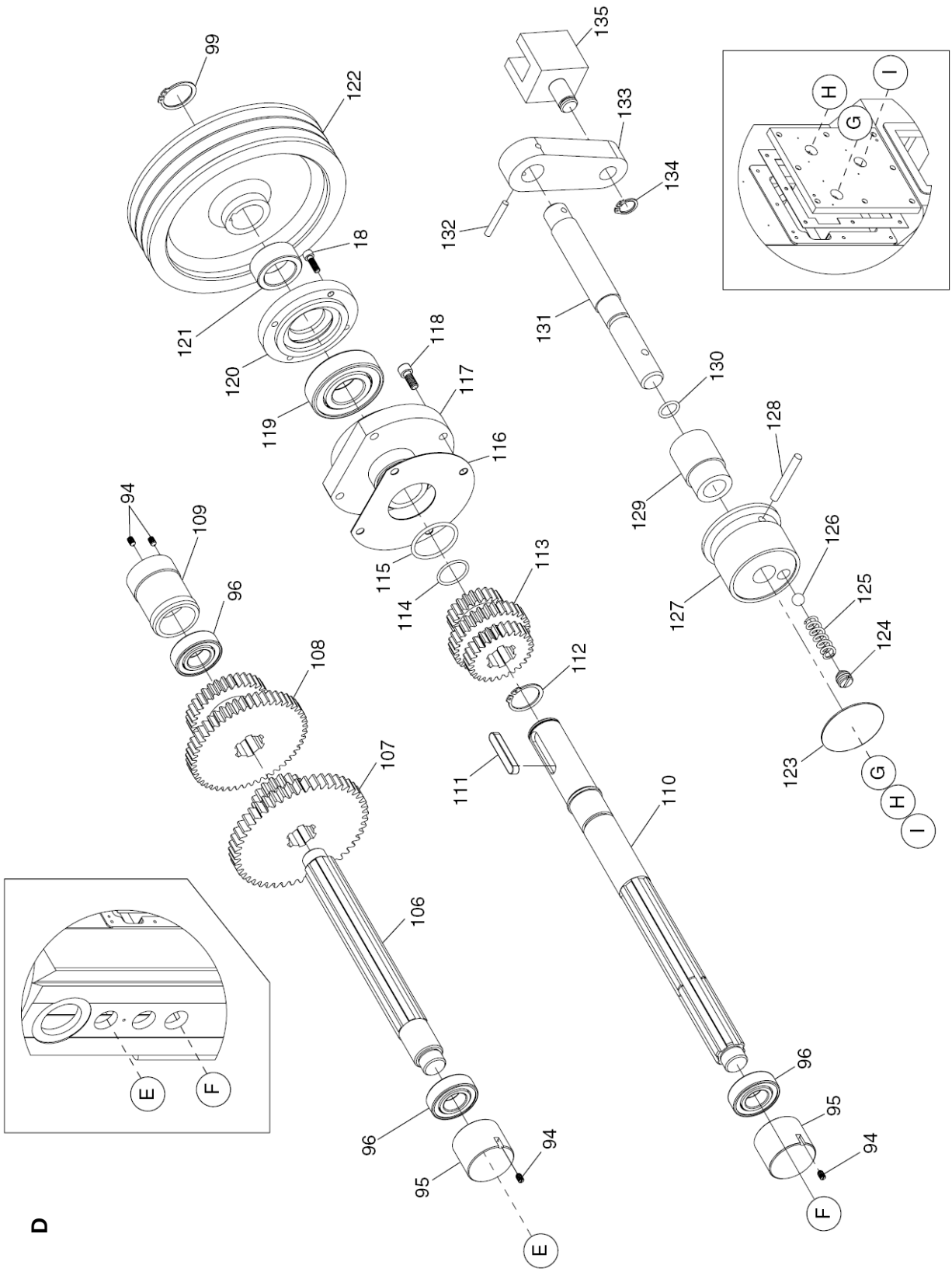
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MT60_parts.fm

MT60 - Ersatzteilliste Maschinenfuß und Säule - Base & Column part list					
Pos.	Bezeichnung	Designation	Menge	Grösse	Artikelnummer
			Qty.	Size	Item no.
1	Grundplatte	Base	1		03336090101
5	Säule	Column	1		03336090105
6	Kreuzschlitzschraube	Phlp Hd Scr	16	M6x16	
7	Abdeckung	Cover	2		03336090107
8	Abdeckung	Cover	1		03336090108
9	Rückseitiger Zugang	Rear Access Panel	1		03336090109
10	Knopf	Knob	1	M10x155	
11	Vertikale Getriebeabdekkung	Vertical gear chang cover	1		03336090111
12	Dichtung	Gasket	1		03336090112
13	Anzeigeplatte	Indicator Plate	1		03336090113
14	Anzeigeplatte	Indicator Plate	1		03336090114
15	Anzeigeplatte	Indicator Plate	1		03336090115
16	Niet	Rivet	12	2.5x4	03336090116
17	Kegelstift	Taper Pin	4	5x25	03336090117
18	Innensechskantschraube	Cap Screw	20	M6x20	
19	Tabelle vertikales Getriebe	Vertical Gear Chart	1		03336090119
20	Ölschauglas	Oil Sight Glass	1		03336090120
21	Ölverschluss	Oil Plug	1	10-1x8	03336090121
22	Ölverschluss	Oil Plug	1	M16-1.5x8	03336090122
23	Abdeckung	Cover	1		03336090123
24	Dichtung	Gasket	1		03336090124
25	Abdeckung	Cover	1		03336090125
26	Innensechskantschraube	Cap Screw	1	M6-1x16	
27	Weg-Anschlag	Way Stop	1		03336090127
28	Sechskantschraube	Hex Bolt	5	M16-2x60	
29	Sicherungsscheibe	Lock Washer	9	16mm	
30	Keilriemen	V-Belt	3	A 1397 Li	03336090130
31	Keilriemenscheibe	V-Belt Pulley	1		03336090131
32	Stiftschraube	Set Screw	1	M8-1.25x16	
33	Motor	Motor	1	3HP/220V/3PH	03336090133
34	Sechskantschraube	Hex Bolt	4	M10-1.5x45	
35	Sicherungsscheibe	Lock Washer	4	10mm	042SR10W
36	Motorbefestigungsplatte	Motor Mount Plate	1		03336090136
37	Sechskantmutter	Hex Nut	4	M10-1.5	
38	Sechskantmutter	Hex Nut	2	M12-1.75	
39	Einstellbolzen	Adjusting Bolt	1		03336090139
40	Welle	Shaft	1		03336090140
41	Kerbstift	Cotter Pin	4	2.5x16	03336090141
42	Sechskantschraube	Hex Bolt	3	M10-1.5x45	
43	Sicherungsscheibe	Lock Washer	3	10mm	
44	Motorbefestigungsplatte	Motor Base Plate	1		03336090144

45	Welle	Shaft	1		03336090145
46	Kreuzschlitzschraube	Plph Hd Scr	8	M6-1x10	
47	Abdeckung	Cover	1		03336090147
48	Abdeckung	Cover	1		03336090148
49	Fräskopfausleger	Ram	1		03336090149
50	Leiste Ausleger	Ram Gib	1		03336090150
51	Einstellschraube Leiste	Gib Adjusting Screw	2		03336090151
52	Sicherungsbuchse	Lock Bushing	2		03336090152
53	Griff	Handle	2		03336090153
54	Buchse	Bushing	1		03336090154
55	Zahnradwelle	Gear Shaft	1		03336090155
56	Gradskala	Graduated Scale	1		03336090156
57	Anzeigeplatte	Indicator Plate	1		03336090157
58	Montageplatte	Mounting Plate	1		03336090158
59	Sechskantschraube	Hex Bolt	4	M16x90	
60	Grundplatte Ausleger	Ram Base	1		
61	Öler	Ball Oiler	2		03336090161
62	Welle	Shaft	1		03336090162
63	Passfeder	Key	1	4x20	03336090163
64	Schneckenrad	Worm Gear	1		03336090164
65	Befestigungsschraube	Locating Screw	1		03336090165
66	Kugellager	Ball Bearing	2	51102	04051102
67	Zahnrad	Gear	1		03336090167
68	Anzeigeplatte	Indicator Plate	1		03336090168
69	Spindelstockbefestigungsplatte	Headstock mounting plate	1		03336090169
70	Innensechskantschraube	Cap Screw	4	M16x60	
71	T-Schraube	T-Bolt	4		03336090171
72	Sicherungsscheibe	Lock Washer	4	16mm	
73	Sechskantmutter	Hex Nut	4	M10	
74	Scheibe	Washer			
75	Mutter	Nut	2		
76	Federscheibe	Spring washer	1		
77	Hutmutter	Cap nut	2		
78	Mitnehmer	Square Key	8		03336090178
79	Horizontalspindel	Horizontal Spindle	1		03336090179
80	Passfeder	Key	2	12x45	03336090180
81	Innensechskantschraube	Cap Screw	1	M8x25	
82	Endabdeckung	End Cover	1		03336090182
83	Dichtung	Gasket	1		03336090183
84	Kugellager	Ball Bearing	1	32011-P5	04032011
85	Zahnrad	Gear	1	26T	03336090185
86	Zahnrad	Gear	1	57T	03336090186
87	Kugellager	Ball Bearing	2	30308-P5	04030308
88	Endabdeckung	End Cover	1		03336090188
89	Buchse	Bushing	3		03336090189
90	Nutmutter	Spanner Nut	1		03336090190

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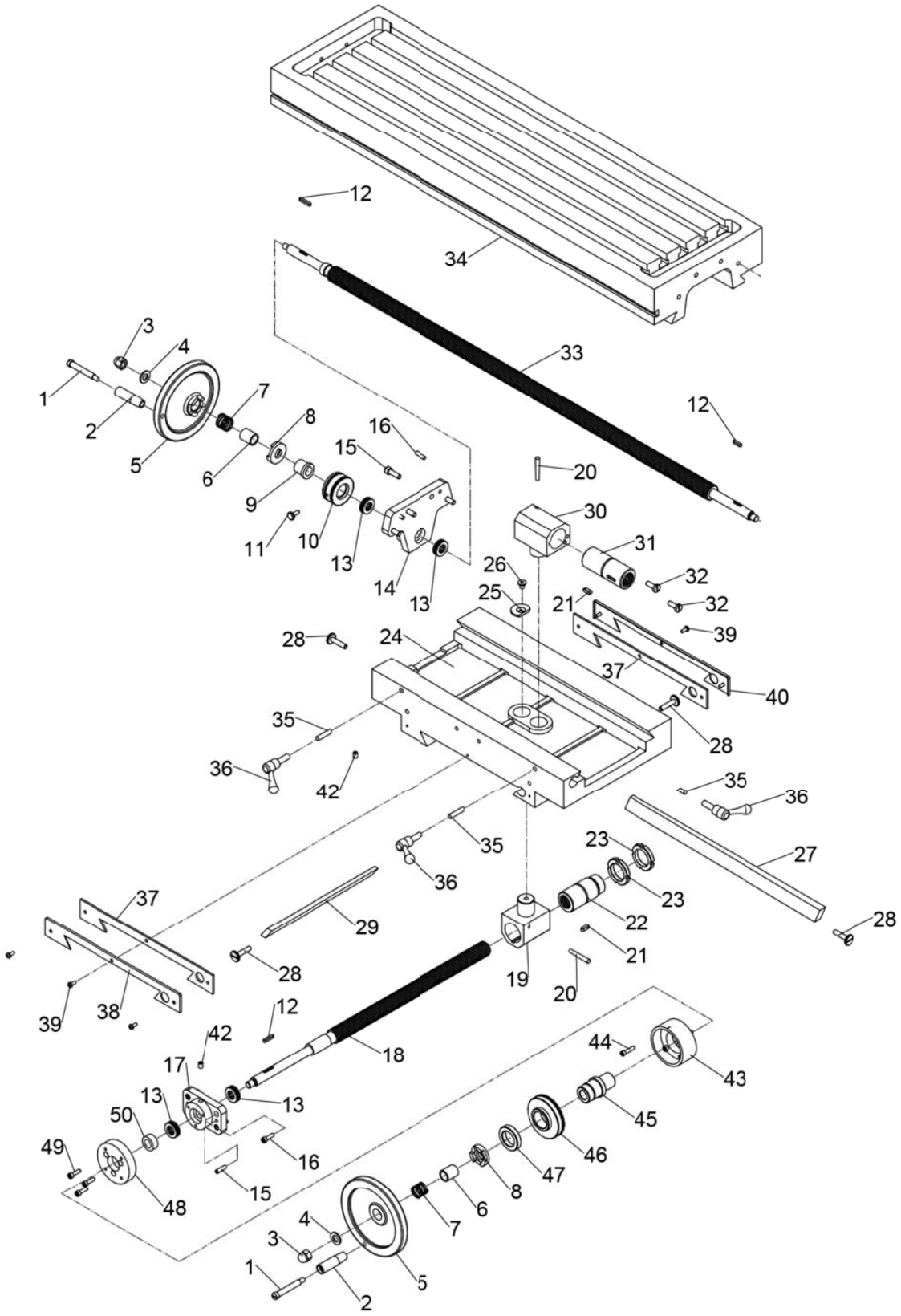
91	Abdeckung	Cover	5		03336090191
92	Innensechskantschraube	Cap Screw	3	M5x12	
93	Horizontale Anzugsstange	Horizontal Spindle Drawbar	5		03336090193
94	Stiftschraube	Set Screw	1	M6x10	
95	Verschlusskappe	Plug	4		03336090195
96	Kugellager	Ball Bearing	2	6205	0406205
97	Welle	Shaft	1		03336090197
98	Passfeder	Key	1	10x10x36	03336090198
99	Sicherungsring	Ext Retaining Ring	1	35mm	042SRW
100	Zahnrad	Gear	1	38T	033360901100
101	Spezieller Halter	Special Retainer	1		033360901101
102	Zahnrad	Gear	1	33T	033360901102
103	Zahnrad	Gear	1	26T	033360901103
104	Zahnrad	Gear	1	43T	033360901104
105	Verschlusskappe	Plug	1		033360901105
106	Nutwelle	Spline Shaft	1		033360901106
107	Zahnrad	Gear	1	48/17T	033360901107
108	Zahnrad	Gear	1	50/33T	033360901108
109	Verschlusskappe	Plug	1		033360901109
110	Nutwelle	Spline Shaft	1		033360901110
111	Passfeder	Key	1	10x55	033360901111
112	Sicherungsring	Ext Retaining Ring	1	34mm	042SR34W
113	Zahnrad	Gear	1	27/32/22T	033360901113
114	O-Ring	O-Ring	1	30x2.65	033360901114
115	O-Ring	O-Ring	4	45x3.55	033360901115
116	Dichtung	Gasket	1		033360901116
117	Flansch	Flange	1		033360901117
118	Innensechskantschraube	Cap Screw	1	M8x20	
119	Kugellager	Ball Bearing	1	6307	0406307ZZ
120	Abdeckung	Cover	3		033360901120
121	Buchse	Bushing	3		033360901121
122	Keilriemenscheibe	V-Belt Pulley	3		033360901122
123	Anzeigeplatte	Indicator Plate	3		033360901123
125	Druckfeder	Compression Spring			033360901125
126	Stahlkugel	Steel Ball		8mm	033360901126
127	Griffbasis	Handle Base			033360901127
128	Kegelstift	Taper Pin		4x30	033360901128
129	Buchse	Bushing			033360901129
130	O-Ring	O-Ring		11.2x2.65	033360901130
131	Welle	Shaft			033360901131
132	Kegelstift	Taper Pin		4x30	033360901132
133	Kipphebel	Rocker Arm			033360901133
134	Sicherungsring	Ext Retaining Ring		12mm	042SR12W
135	Schaltgabel	Shifting Fork			033360901135

7.5 Frästisch - Milling table



Img.7-1: Frästisch - Mill table

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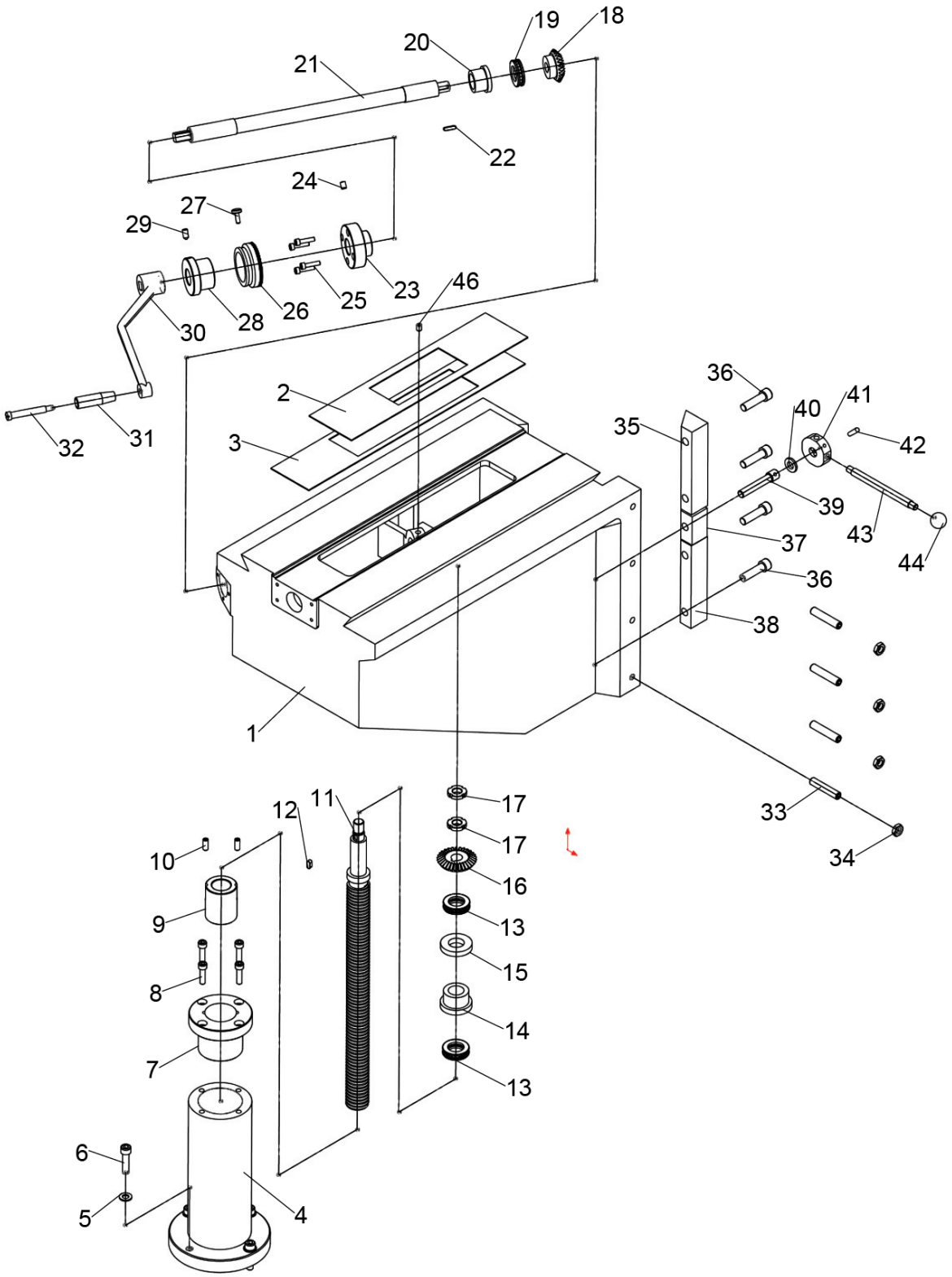
MT60 - Ersatzteilliste Frästisch - Milling table					
Pos.	Bezeichnung	Designation	Menge	Grösse	Artikelnummer
			Qty.	Size	Item no.
1	Griffwelle	Handle Spindle	3		03336090201
2	Kegelknopf	Taper Knob	3		03336090202
3	Sechskantmutter	Hex Nut	3	M12-1.75	
4	Sicherungsscheibe	Lock Washer	3	12mm	
5	Handrad	Hand Wheel	3		03336090205
6	Buchse	Bush	2		03336090206
7	Feder	Spring	2		03336090207
8	Anschluss	Connect	2		03336090208
9	Manschette	Collar	1		03336090209
10	Skalenring	Scale Ring	2		03336090210
11	Innensechskantschraube	Cap Screw	2	M6-1x16	
12	Passfeder	Key	2	5x20	042P5520
13	Kugellager	Ball Bearing	4	51103	04051103
14	Halterung	Support	1		03336090214
15	Innensechskantschraube	Cap Screw	8	M8x25	
16	Stift	Pin	4	6x25	03336090216
17	Halterung	Support	1		03336090217
18	Lange Leitspindel	Long Lead Screw	1		03336090218
19	Lagergehäuse	Bearing Housing	1		03336090219
20	Kegelstift	Taper Pin	1	6x40	03336090220
21	Passfeder	Key	2	6x22	03336090221
22	Gewindebuchse	Threaded Bushing	1		03336090222
23	Nutmutter	Spanner Nut	2		03336090223
24	Sattel	Saddle	1		03336090224
25	Kappe	Cap	1		03336090225
26	Flanschschraube	Flange Screw	1	M8x16	03336090226
27	Leiste Längsachse	Longitudinal Gib	1		03336090227
28	Einstellschraube Leiste	Gib Adjusting Screw	4		03336090228
29	Leiste Querachse	Cross Gib	1		03336090229
30	Lagergehäuse	Bearing Housing	1		03336090230
31	Buchse	Bushing	1		03336090231
32	Spezialschraube	Special Screw	2		03336090232
33	Gewindespindel Längsachse	Longitudinal Lead Screw	1		03336090233
34	Tisch	Table	1		03336090234
35	Sicherungsbuchse	Lock Bushing	4		03336090235
36	Klemmschraube	Clamp Bolt	4	M10x40	
37	Filzdichtung	Felt Gasket	1		03336090237
38	Abdeckung Abstreifer	Wiper Cover	4		03336090238
39	Kreuzschlitzschraube	Phlp Hd Screw	4	M5x12	
40	Öler	Oil Cup 8	4		03336090240
43	Hülse	Sleeve	1		03336090243

44	Schraube	Screw	4	M6x25	
45	Buchse	Bush	1		03336090245
46	Skalenring	Scale ring	1		03336090246
47	Spannmutter	Clamping nut	1		03336090247
48	Ring	Ring	1		03336090248
49	Schraube	Screw	3	M6x16	
50	Buchse	Bushing	1		03336090250

7.6 Frästischverstellung - Milling table adjusting



Img.7-2: Frästischverstellung - Milling table adjusting

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MT60 - Ersatzteilliste Frästischverstellung - Milling table ajusting part list					
Pos.	Bezeichnung	Designation	Menge	Grösse	Artikelnummer
			Qty.	Size	Item no.
1	Tischträger	Knee	1		03336090301
2	Wegschiene klein	Way slide small	1		03336090302
3	Wegschiene mittel	Way slide medium	1		03336090303
4	Säule Tischträger	Knee column	1		03336090304
5	Sicherungsscheibe	Lock Washer	4	10mm	042SR10W
6	Innensechskantschraube	Cap Screw	4	M10x40	
7	Manschette	Collar	1		03336090307
8	Innensechskantschraube	Cap Screw	4	M8x30	
9	Gewindebuchse	Threaded Bushing	1		03336090309
10	Stiftschraube	Set Screw	2	M8x20	
11	Gewindespindel Tischträger	Knee Lead Screw	1		03336090311
12	Passfeder	Key	4	6x12	042P6612
13	Kugellager	Ball Bearing	2	51105	04051105
14	Manschette	Collar	1		03336090314
15	Einstellscheibe	Adjust Washer	1		03336090315
16	Kegelzahnrad	Conical Gear	1		03336090316
17	Rundmutter	Circular Nut	2	M16x1.5	03336090317
18	Kegelzahnrad	Conical Gear	1		03336090318
19	Kugellager	Ball Bearing	1	51105	04051105
20	Manschette	Collar	1		03336090320
21	Welle	Shaft	1		03336090321
22	Passfeder	Key	2	5x18	042P5518
23	Manschette	Collar	1		03336090323
24	Öler	Oiler	1		03336090324
25	Innensechskantschraube	Cap Screw	4	M6x25	
26	Skalenring	Scale Ring	1		03336090326
27	Rändelschraube	Knurled Thumb Scr	1	M6x16	03336090327
28	Manschette	Collar	1		03336090328
29	Stiftschraube	Set Screw	1	M8x16	
30	Griff	Handle	1		03336090330
31	Kegelknopf	Taper Knob	1		03336090331
32	Griffschraube	Handle screw	1		03336090332
33	Stiftschraube	Set Screw	4	M12x60	
34	Sechskantmutter	Hex Nut	4	M12	
35	Leiste Tischträger lang	Knee Gib Long	1		03336090335
36	Innensechskantschraube	Cap Screw	4	M12x45	
37	Leiste Tischträger kurz	Knee Gib Short	1		03336090337
38	Leiste Tischträger lang	Knee Gib Long	1		03336090338
39	Spezialschraube	Special Screw	1		03336090339
40	Spezielle flache Unterlegscheibe	Special Flat Wascher	1		03336090340

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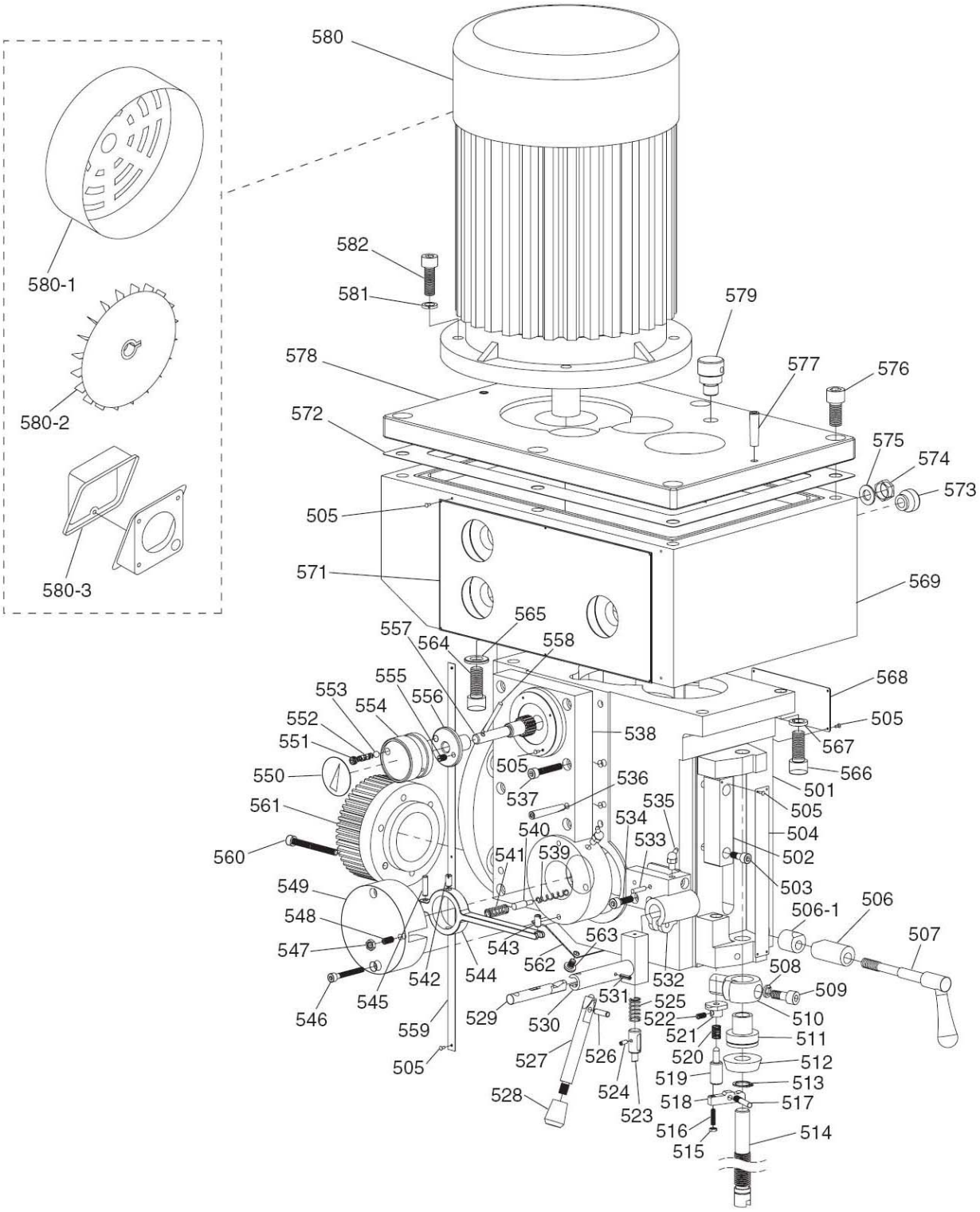
41	Verschlusshülse	Lock Sleeve	1		03336090341
42	Kegelstift	Taper Pin	1	5x40	03336090342
43	Klemmgriff	Lock Handle	1		03336090343
44	Kugelknopf	Ball Knob	1		03336090344
46	Stiftschraube	Set Screw	1	M8x12	

7.7 Fräskopf - Milling head



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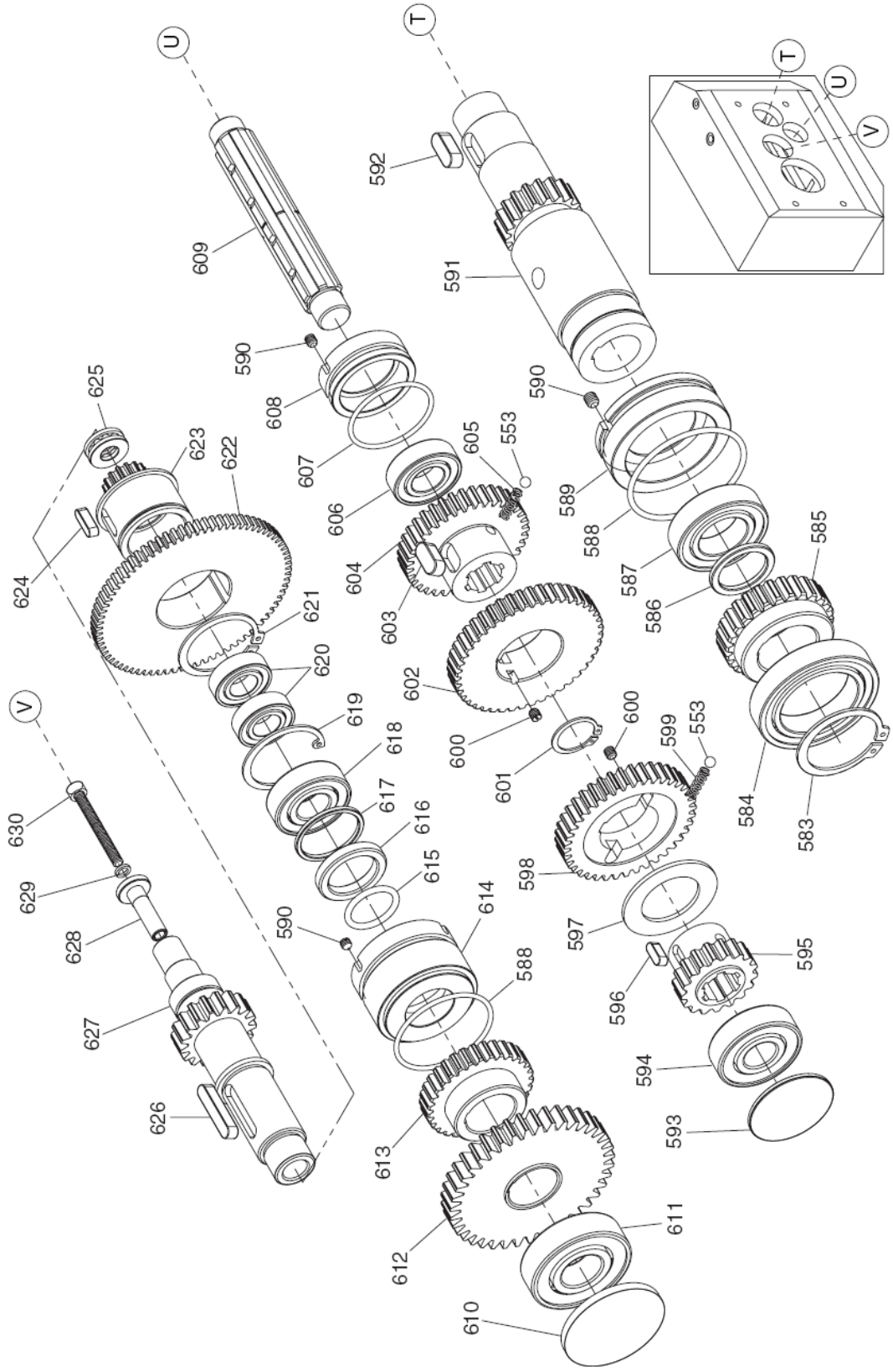
Img.7-3: Fräskopf - Milling head

7.8 Fräskopf - Milling head



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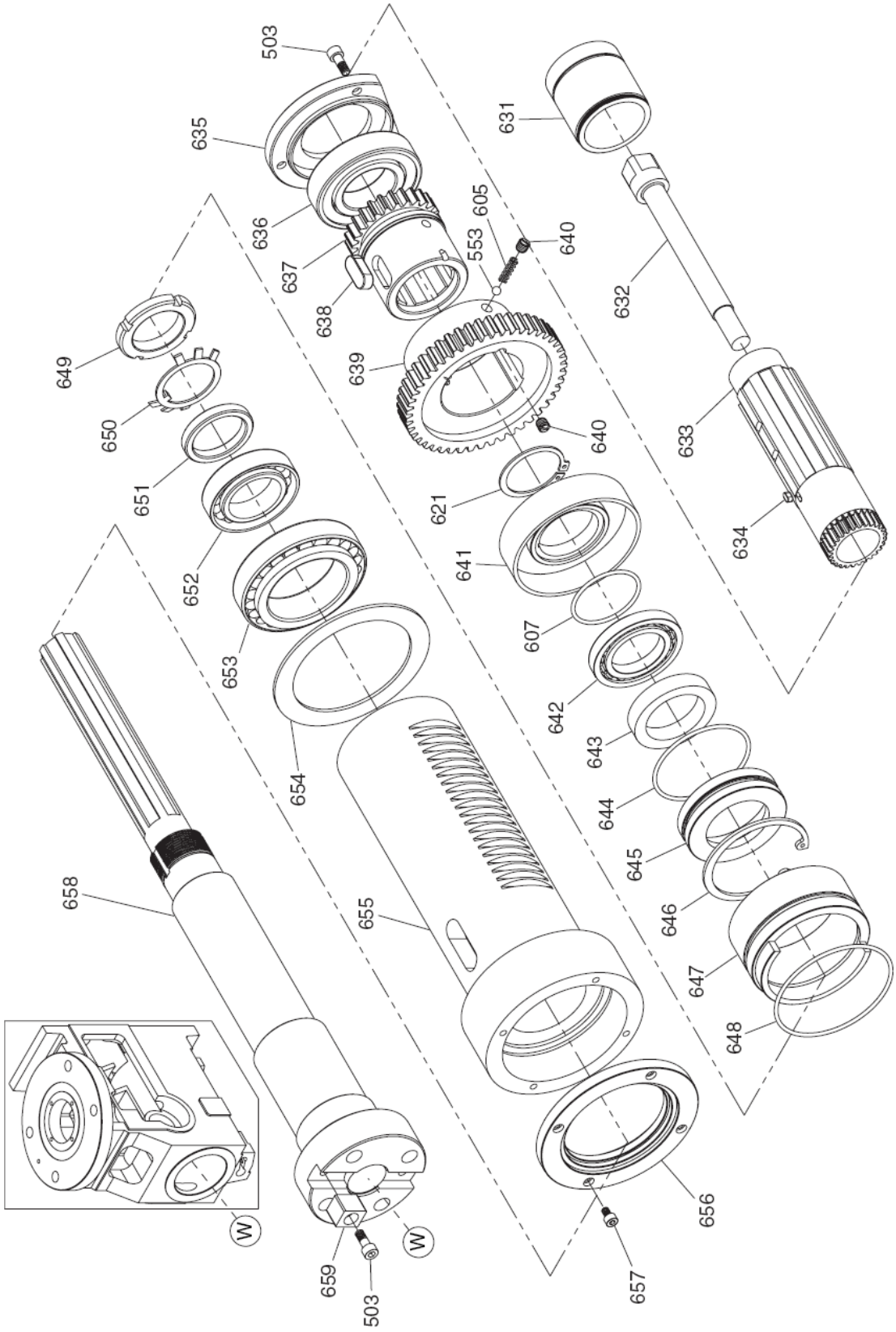
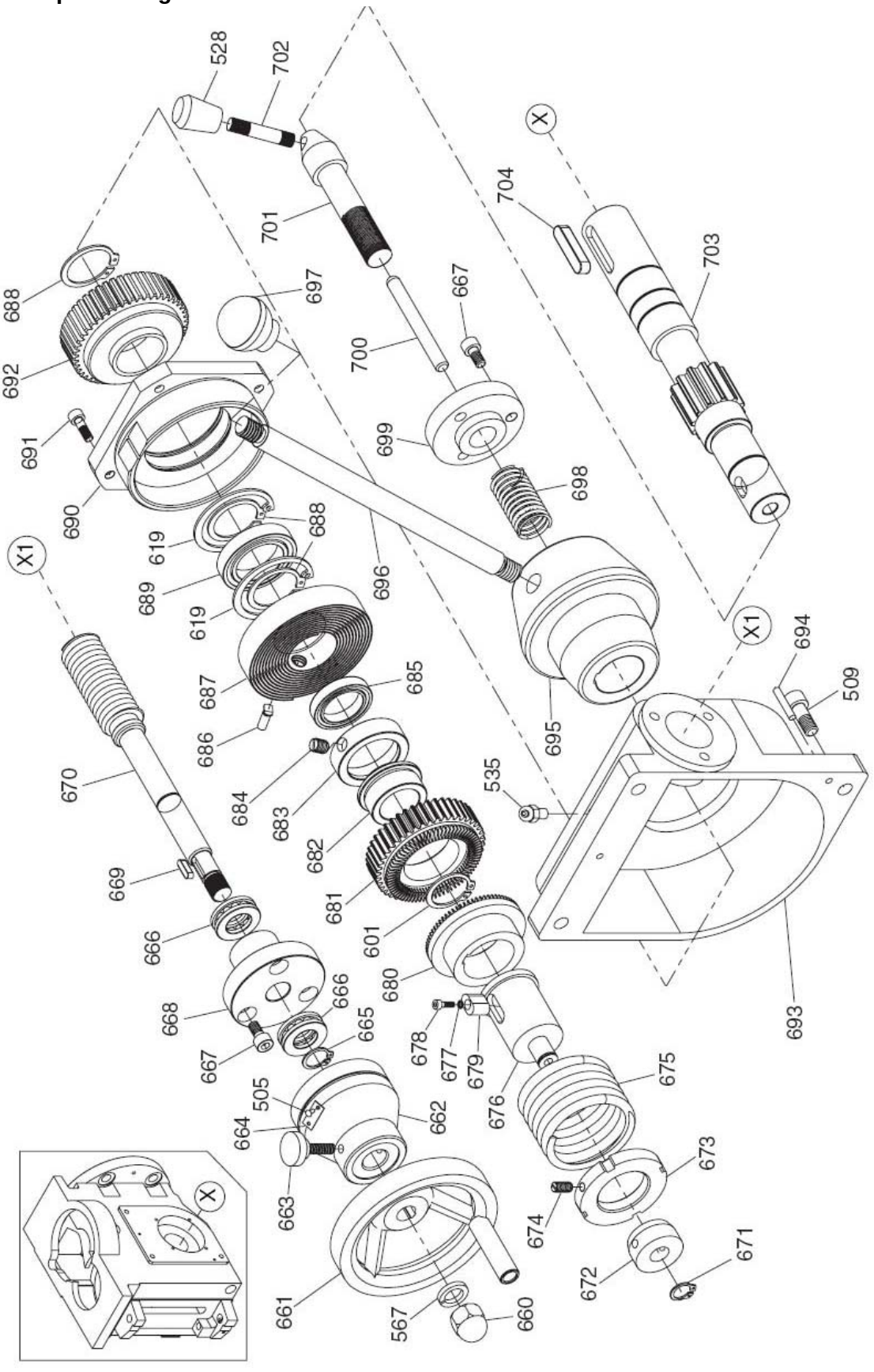
Img. 7-4: Fräskopf - Milling head

7.9 Fräskopf - Milling head



Img. 7-5: Fräskopf - Milling head

7.10 Fräskopf - Milling head



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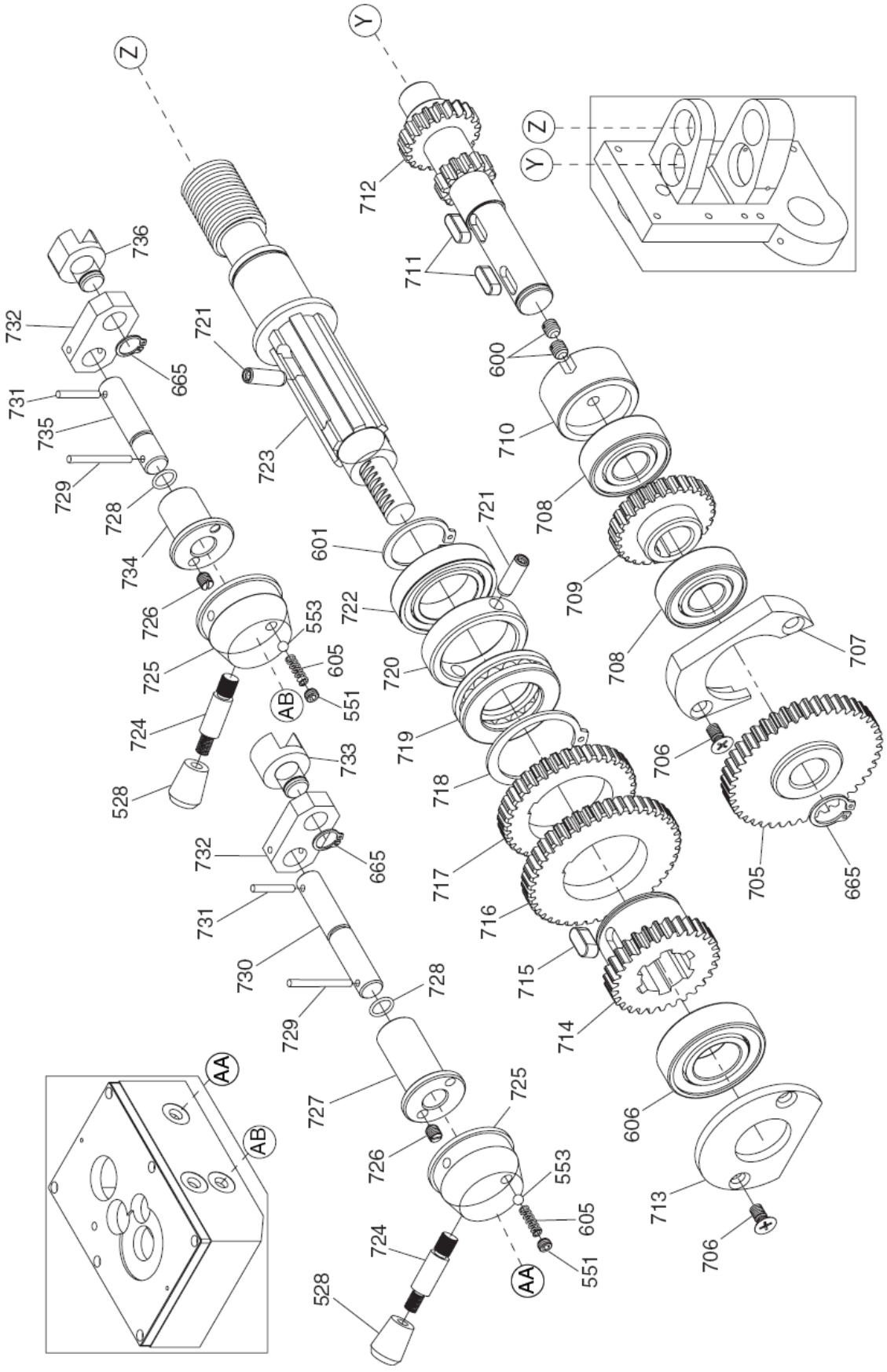
Img.7-6: Fräskopf - Milling head

7.11 Fräskopf - Milling head



Img. 7-7: Fräskopf - Milling head

Ersatzteilliste Fräskopf - Milling head part list					
Pos.	Bezeichnung	Designation	Menge	Grösse	Artikelnummer
			Qty.	Size	Item no.
501	Spindelstock	Headstock	1		033360904501
502	Rechteckiger Block	Rectangular Block	1		033360904502
503	Innensechskantschraube	Cap Screw	1	M6-1x16	
504	Gradskala	Graduated Scale	1		033360904504
505	Niet	Rivet	1	2x5	033360904505
506	Sicherungsbuchse	Lock Bushing	1		033360904506
506-1	Sicherungsbuchse	Lock Bushing	1		033360904506-1
507	Klemmgriff	Locking Handle	1		033360904507
508	Sicherungsscheibe	Lock Washer	1	8mm	042SR8W
509	Innensechskantschraube	Cap Screw	1	M8-1.25x20	
510	Begrenzungsanschlag	Limit Stop Bracket	1		033360904510
511	Gewindebuchse	Threaded Bushing	1		033360904511
512	Begrenzungsring	Limit Stop Ring	1		033360904512
513	Sicherungsring	Ext Retaining Ring	1	16mm	042SR16W
514	Gewindewelle	Threaded Shaft	1		033360904514
515	Niedrige Sechskantmutter	Thin Hex Nut	1	M4-0.7	
516	Stiftschraube	Set Screw	1	M4-0.7x16	
517	Gewindestift	Threaded Pin	1	M6-1	
518	Hebel	Lever	1		033360904518
519	Stift	Pin	1		033360904519
520	Druckfeder	Compression Spring	1		033360904520
521	Manschette	Collar	1		033360904521
522	Stiftschraube	Set Screw	1	M5-0.8x10	
523	Welle	Shaft	1		033360904523
524	Spannstift	Roll Pin	1	3x10	033360904524
525	Druckfeder	Compression Spring	1		033360904525
526	Stift	Pin	1	5x18	033360904526
527	Steuerhebel	Control Lever	1		033360904527
528	Hebelknopf	Lever Knob	1		033360904528
529	Welle	Shaft	1		033360904529
530	Halterung	Bracket	1		033360904530
531	Spannstift	Roll Pin	1	3x14	033360904531
532	Halterung	Bracket	1		033360904532
533	Kegelstift	Taper Pin	1	4x18	033360904533
534	Innensechskantschraube	Cap Screw	1	M6-1x20	
535	Schmiernippel	Grease Fitting	1		033360904535
536	Kegelstift	Threaded Taper Pin	1	M6-1x45	033360904536
537	Innensechskantschraube	Cap Screw	1	M6-1x35	
538	Halterung	Bracket	1		
539	Druckfeder	Compression Spring	1		033360904539
540	Stift	Pin	1		033360904540
541	Druckfeder	Compression Spring	1		033360904541

542	Gewindestift	Threaded Pin	1	M6-1x16	
543	Gewindestift	Threaded Pin	1	M5-0.8x14	
544	Anschlussstange	Connecting Rod	1		033360904544
545	Stift	Pin	1	5x20	033360904545
546	Innensechskantschraube	Cap Screw	1	M5-0.8x40	
547	Niedrige Sechskantmutter	Thin Hex Nut	1	M6-1	
548	Stiftschraube	Set Screw	1	M6-1x14	
549	Abdeckung	Cover	1		033360904549
550	Anzeigeplatte	Indicator Plate	1		033360904550
551	Stiftschraube	Set Screw	1	M8-1.25x5	
552	Druckfeder	Compression Spring	1		033360904552
553	Stahlkugel	Steel Ball	1	6mm	042KU06
554	Knopf	Knob	1		033360904554
555	Stiftschraube	Set Screw	1	M6-1x10	
556	Manschette	Collar	1		033360904556
557	Zahnrad	Gear	1	18T	033360904557
558	Kegelstift	Taper Pin	1	4x40	033360904558
559	Gradskala	Graduated Scale	1		033360904559
560	Innensechskantschraube	Cap Screw	1	M6-1x60	
561	Kegelrad	Bevel Gear	1	50T	033360904561
562	Abdeckung	Cover	1		033360904562
563	Flanschschraube	Flange Screw	1	M6-1x8	033360904563
564	Innensechskantschraube	Cap Screw	1	M12-1.75x30	
565	Flache Scheibe	Flat Washer	1	12mm	
566	Innensechskantschraube	Cap Screw	1	12-1.75x30	
567	Sicherungsscheibe	Lock Washer	1	12mm	042SR12W
568	Informationsplatte	Information Plate	1		033360904568
569	Getriebekasten	Gear Box	1		033360904569
571	Informationsplatte	Information Plate	1		033360904571
572	Dichtung	Gasket	1		033360904572
573	Ölschauglas	Oil Sight Glass	1		033360904573
574	Ölverschluss	Oil Plug	1		033360904574
575	Flache Scheibe	Flat Washer	1	10mm	
576	Innensechskantschraube	Cap Screw	1	M12-1.75x25	
577	Kegelstift	Threaded Taper Pin	1	8x35	033360904577
578	Getriebeabdeckung	Gear Box Cover	1		033360904578
579	Ölverschluss Einfüllöffnung	Oil Fill Plug	1		033360904579
580	Motor	Motor	1	3HP/220V/3PH	033360904580
580-1	Abdeckung Motorlüfter	Motor Fan Cover	1		033360904580-1
580-2	Motorlüfter	Motor Fan	1		033360904580-2
580-3	Motoranschlussdose	Motor Junction Box	1		033360904580-3
581	Sicherungsscheibe	Lock Washer	1	10mm	042SR10W
582	Innensechskantschraube	Cap Screw	1	M10-1.5x30	
583	Sicherungsring	Ext Retaining Ring	1	40mm	042SR40W
584	Kugellager	Ball Bearing	1	6908	0406908ZZ
585	Zahnrad	Gear	1	26T	033360904585

586	Manschette	Collar	1		033360904586
587	Kugellager	Ball Bearing	1	6055ZZ	
588	O-Ring	O-Ring	1	56x2.65	033360904588
589	Manschette	Collar	1		033360904589
590	Stiftschraube	Set Screw	1	M6-1x6	
591	Zahnradwelle	Gear Shaft	1	18T	033360904591
592	Passfeder	Key	1	8x8x20	042P8820
593	Abdeckung	Cover	1		033360904593
594	Kugellager	Ball Bearing	1	6304ZZ	0406304ZZ
595	Zahnrad	Gear	1	17T	033360904595
596	Passfeder	Key	1	6x6x16	042P6616
597	Sicherungsring	Retainer	1		033360904597
598	Zahnrad	Gear	1	39T	033360904598
599	Druckfeder	Compression Spring	1		033360904599
600	Stiftschraube	Set Screw	1	M6-1x6	
601	Sicherungsring	Ext Retaining Ring	1	25mm	042SR25W
602	Zahnrad	Gear	1	44T	033360904602
603	Passfeder	Key	1	10x10x20	033360904603
604	Zahnrad	Gear	1	36T	033360904604
605	Druckfeder	Compression Spring	1		033360904605
606	Kugellager	Ball Bearing	1	6004ZZ	0406004ZZ
607	O-Ring	O-Ring	1	47.5x2.65	033360904607
608	Manschette	Collar	1		033360904608
609	Welle	Shaft	1		033360904609
610	Abdeckung	Cover	1		033360904610
611	Kugellager	Ball Bearing	1	6305ZZ	0406305ZZ
612	Zahnrad	Gear	1	39T	033360904612
613	Zahnrad	Gear	1	31T	033360904613
614	Manschette	Collar	1		033360904614
615	O-Ring	O-Ring	1	26.5x1.8	033360904615
616	Öldichtung	Oil Seal	1		033360904616
617	Distanzstück	Spacer	1		033360904617
618	Kugellager	Ball Bearing	1	6204ZZ	0406204ZZ
619	Sicherungsring	Int Retaining Ring	1	47mm	042SR47I
620	Kugellager	Ball Bearing	1	6003ZZ	0406003ZZ
621	Sicherungsring	Ext Retaining Ring	1	47mm	042SR47I
622	Zahnrad	Gear	1	77T	033360904622
623	Zahnrad	Gear	1	15T	033360904623
624	Passfeder	Key	1	6x6x20	042P6620
625	Drucklager	Thrust Bearing	1	51100	04051100
626	Passfeder	Key	1	8x8x40	033360904626
627	Zahnradwelle	Gear Shaft	1	39T	033360904627
628	Buchse	Bushing	1		033360904628
629	Sicherungsscheibe	Lock Washer	1	6mm	
630	Innensechskantschraube	Cap Screw	1	M6-1x55	
631	Kappe Anzugsstange	Drawbar Cap	1		033360904631

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632	Vertikale Anzugsstange	Vertical Drawbar	1		033360904632
633	Keilbuchse	Spline Bushing	1		033360904633
634	Passfeder	Key	1	4x4x8	042P4410
635	Flansch	Flange	1		033360904635
636	Kugellager	Ball Bearing	2	6208ZZ	0406208ZZ
637	Zahnrad	Gear	1	25T	033360904637
638	Passfeder	Key	1	12x12x28	033360904638
639	Zahnrad	Gear	1	47T	033360904639
640	Stiftschraube	Set Screw	1	M8-1.25x8	
641	Manschette	Collar	1		033360904641
642	Kugellager	Ball Bearing	1	6009	0406009R
643	Öldichtung	Oil Seal	1		033360904643
644	O-Ring	O-Ring	1	69x2.65	033360904644
645	Manschette	Collar	1		033360904645
646	Sicherungsring	Int Retaing Ring	1	75mm	042SR75W
647	Manschette	Collar	1		033360904647
648	O-Ring	O-Ring	1	85x2.65	033360904648
649	Nutmutter	Spanner Nut	1		033360904649
650	Nutscheibe	Keyed Washer		39mm	033360904650
651	Distanzstück	Spacer	1		033360904651
652	Schrägkugellager	Ang Contact Bearing	1	7008AC	
653	Kugellager	Ball Bearing	1	32012	04032012
654	Distanzstück	Spacer	1		033360904654
655	Pinole	Quill	1		033360904655
656	Abdeckung	Cover	1		033360904656
657	Innensechskantschraube	Cap Screw		M5-0.8x8	
658	Vertikale Spindel	Vertical Spindle	1		033360904658
659	Passfeder	Key	1		033360904659
660	Hutmutter	Cap nut	1	M12-1.75	033360904660
661	Handrad	Handwheel	1		033360904661
662	Wahlscheibe	Graduated Dial	1		033360904662
663	Rändelschraube	Knurled Screw	1		033360904663
664	Anzeigeplatte	Indicator Plate	1		033360904664
665	Sicherungsring	Ext Retaining Ring	1	15mm	042SR15I
666	Drucklager	Thrust Bearing	1	51102	04051102
667	Innensechskantschraube	Cap Screw	1	M6-1x12	
668	Befestigungsflansch	Retaining Flange	1		033360904668
669	Passfeder	Key	1	4x4x14	042P4414
670	Schneckenrad	Worm Gear	1		033360904670
671	Sicherungsring	Ext Retaining Ring	1	12mm	042SR12W
672	Manschette	Collar	1		033360904672
673	Nutmutter	Spanner Nut	1		033360904673
674	Stiftschraube	Set Screw	1	M6-1x12	
675	Druckfeder	Compression Spring	1		033360904675
676	Kegelhülse	Spline Sleeve	1		033360904676
677	Sicherungsscheibe	Lock Washer	1	3mm	033360904677

678	Innensechskantschraube	Cap Screw	1	M3-0.5x10	
679	Passfeder	Key	1		033360904679
680	Kupplung	Clutch	1		033360904680
681	Zahnrad	Gear	1	44T	033360904681
682	Manschette	Collar	1		033360904682
683	Manschette	Collar	1		033360904683
684	Stiftschraube	Set Screw	1	M8-1.25x10	
685	Kugellager	Ball Bearing	1	61805	04061805R
686	Stift	Pin	1		033360904686
687	flache Spiralfeder	Flat Coil Spring	1		033360904687
688	Sicherungsring	Ext Retaining Ring	1	30mm	042SR30W
689	Kugellager	Ball Bearing	1	61906	04061906R
690	Federgehäuse	Spring Box	1		033360904690
691	Innensechskantschraube	Cap Screw	1	M5-0.8x16	
692	Kegelrad	Bevel Gear	1	47T	033360904692
693	Getriebegehäuse	Gear Housing	1		033360904693
694	Kegelstift	Taper Pin	1	4x24	033360904694
695	Nabe Handgriff	Handle Hub	1		033360904695
696	Griff	Handle	1		033360904696
697	Kugelknopf	Ball Knob	1		033360904697
698	Druckfeder	Compression Spring	1		033360904698
699	Abdeckung	Cover	1		033360904699
700	Welle	Shaft	1		033360904700
701	Sicherungsschraube	Lock Bolt	1		033360904701
702	Griff	Handle	1		033360904702
703	Zahnradwelle	Gear Shaft	1	12T	033360904703
704	Passfeder	Key	1	8x8x36	033360904704
705	Zahnrad	Gear	1	43T	033360904705
706	Senkkopfschraube	Countersunk head screw	1	5-0.8x10	033360904706
707	Distanzstück	Spacer	1		033360904707
708	Kugellager	Ball Bearing	1	6202ZZ	0406202ZZ
709	Zahnrad	Gear	1	27T	033360904709
710	Abdeckung	Cover	1		033360904710
711	Passfeder	Key	1	5x5x14	042P5516
712	Zahnradwelle	Gear Shaft	1	20/13T	033360904712
713	Flansch	Flange	1		033360904713
714	Zahnrad	Gear	1	29T	033360904714
715	Passfeder	Key	1	6x6x14	042P6614
716	Zahnrad	Gear	1	43T	033360904716
717	Zahnrad	Gear	1	36T	033360904717
718	Sicherungsring	Ext Retaining Ring	1	36mm	
719	Drucklager	Thrust Bearing	1	51101	04051101
720	Manschette	Collar	1		033360904720
721	Gewindestift	Threaded Pin	1	M6-1x8	
722	Kugellager	Ball Bearing	1	6905	0406905
723	Schneckenrad	Worm Gear	1		033360904723

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724	Griff	Handle	1		033360904724
725	Nabe Handgriff	Handle Hub	1		033360904725
726	Stiftschraube	Set Screw	1	M8-1.25x10	
727	Buchse	Bushing	1		033360904727
728	O-Ring	O-Ring	1	11.8x1.8	033360904728
729	Kegelstift	Taper Pin	1	4x45	033360904729
730	Welle	Shaft	1		033360904730
731	Kegelstift	Taper Pin	1	4x30	033360904731
732	Wippe	Rocker Ram	1		033360904732
733	Schaltgabel	Shifting Fork	1		033360904733
734	Buchse	Bushing	1		033360904734
735	Welle	Shaft	1		033360904735
736	Schaltgabel	Shifting Fork	1		033360904736

7.12 Vorschubgetriebe X-Achse - Feed gear X-Axis 1 - 3

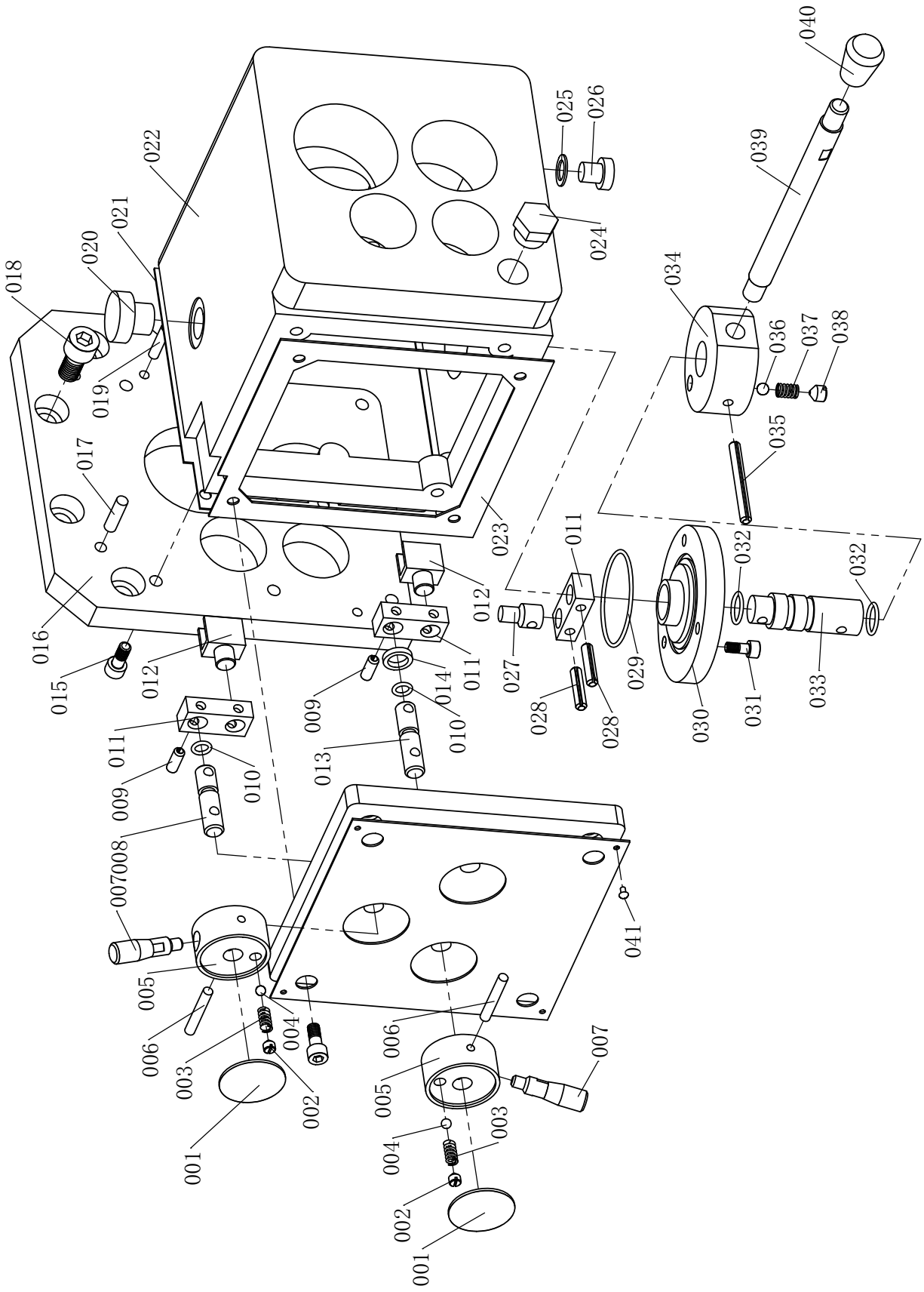

Abb.7-8: Vorschubgetriebe X-Achse - Feed gear X-Axis 1 - 3

7.13 Vorschubgetriebe X-Achse - Feed gear X-Axis 2 - 3

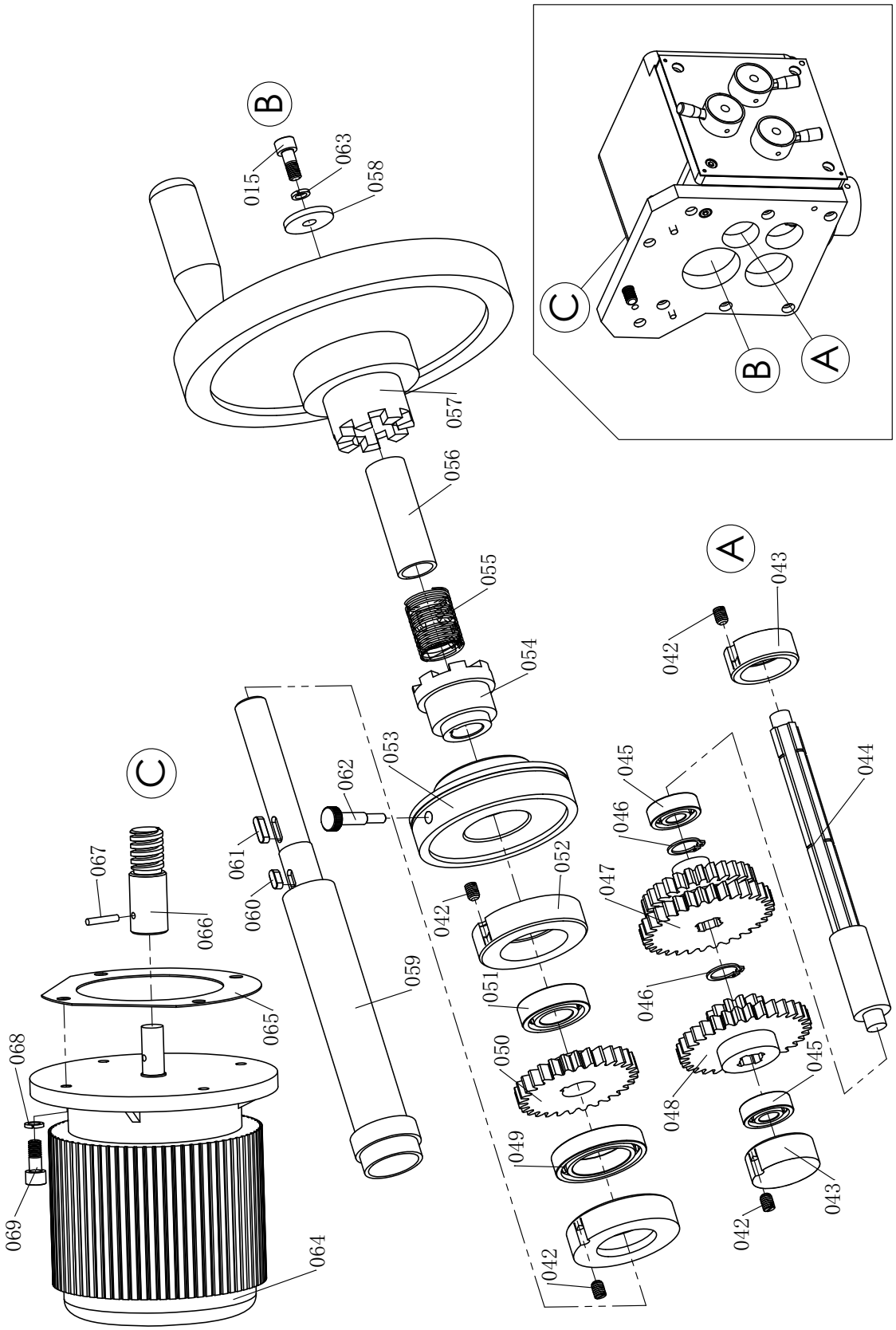

Abb. 7-9: Vorschubgetriebe X-Achse - Feed gear X-Axis 2 - 3

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7.14 Vorschubgetriebe X-Achse - Feed gear X-Axis 3 - 3

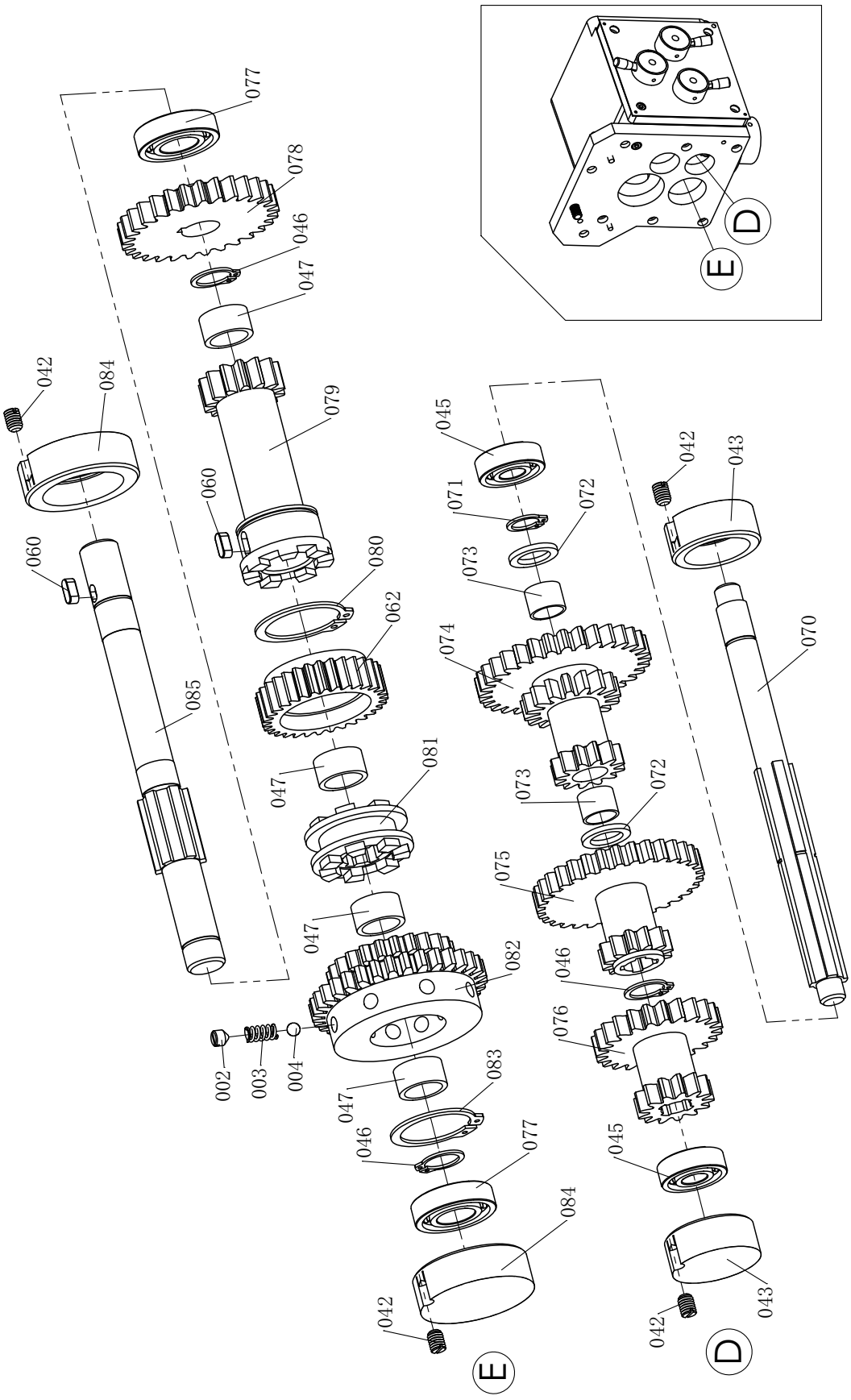

Abb.7-10: Vorschubgetriebe X-Achse - Feed gear X-Axis 3 - 3

MT60 - Ersatzteilliste Vorschubgetriebe X-Achse - Spare parts list feed gear X-Axis					
Pos.	Bezeichnung	Designation	Menge	Grösse	Artikelnummer
			Qty.	Size	Item no.
001	Anzeige	Indicator drop	3		03336090801
002	Gewindestift	Grub screw	12		03336090802
003	Feder	Spring	3		03336090803
004	Stahlkugel	Steel ball	12		03336090804
005	Nabe	Handle seat	3		03336090805
006	Kegelstift	Taper pin	3	5x35	
007	Handhebel	Handle lever	3		03336090807
008	Welle	Shaft	2		03336090808
009	Zylinderstift	Cylindrical pin	3	5x16	
010	O-Ring	O-Ring	3	6,9x1,8	
011	Platte	Connecting plate	3		03336090811
012	Schaltgabel	Shifting fork	3		03336090812
013	Welle	Shaft	1		03336090813
014	Scheibe	Washer	1	15x10,5x3	
015	Innensechskantschraube	Socket head screw	10	M6x15	
016	Grundplatte	Side plate	2		03336090816
017	Zylinderstift	Cylindrical pin	2	6x24	
018	Innensechskantschraube	Socket head screw	4	M10x20	
019	Kegelstift	Taper pin	2	5x24	
020	Verschlussschraube	Plug screw	1	M16x1,5	
021	Dichrung	Seal	1		03336090821
022	Gehäuse	Box	1		03336090822
023	Dichtung	Seal	1		03336090823
024	Schraube	Screw	1		03336090824
025	Aluscheibe	Aluminum washer	1		03336090825
026	Ablassschraube	Plug screw	1	M10x1	
027	Welle	Shaft	1		03336090827
028	Zylinderstift	Cylindrical pin	2	5x25	
029	O-Ring	O-Ring	1	1,8x46,2	
030	Flansch	Flange	1		03336090830
031	Innensechskantschraube	Socket head screw	7	M5x12	
032	O-Ring	O-Ring	1	13,2x2,65	
033	Welle	Shaft	1		03336090833
034	Aufnahme	Handle	13		03336090834
035	Zylinderstift	Cylindrical pin	1	5x50	
036	Stahlkugel	Steel ball	1	6	042KU06
037	Feder	Spring	1	1x6x10	
038	Gewindestift	Grub screw	1	M8x8	
039	Handhebel	Handle lever	1		03336090839
040	Knopf	Taper knob	1		03336090840
041	Niet	Rivet	4	2,5x4	03336090841
042	Gewindestift	Grub screw	1	M6x6	

043	Lagerbock	Bearing housing	4		03336090843
044	Welle	Spline shaft	1		03336090844
045	Kugellager	Ball bearing	1	6000-2Z	0406000R
046	Sicherungsring	Retaining ring	4	15	042SR15W
047	Zahnrad	Gear	1	28Z	03336090847
048	Zahnrad	Gear	1	12Z	03336090848
049	Kugellager	Ball bearing	1	61906-2Z	04061906R
050	Zahnrad	Gear	1	29Z	03336090850
051	Kugellager	Ball bearing	1	6003-2Z	0406003ZZ
052	Lagerbock	Bearing housing	1		03336090852
053	Skalenring	Dial	1		03336090853
054	Kupplung	Clutch	1		03336090854
055	Feder	Spring	1	1x22x30	03336090855
056	Hülse	Sheath	1		03336090856
057	Handrad	Handwheel	1		03336090857
058	Scheibe	Washer	1	25x7x3	
059	Welle	Shaft	1		03336090859
060	Passfeder	Fitting key	2	4x10	042P4410
061	Passfeder	Fitting key	1	4x14	042P4414
062	Rändelschraube	Knurled screw	1		03336090862
063	Federring	Spring washer	1	6	
064	Motor	Motor	2		03336090864
065	Dichtung	Seal	1		03336090865
066	Schnecke	Worm	1		03336090866
067	Kegelstift	Taper bolt	1	5x35	
068	Federring	Spring washer	1	8	
069	Innensechskantschraube	Socket head screw	6	M8x20	
070	Welle	Shaft	1		03336090870
071	Sicherungsring	Retaining ring	1	12	042SR12W
072	Scheibe	Washer	1	19x13x2	
073	Gleitlager	Sliding bearing	2		03336090873
074	Zahnrad	Gear	1	12Z/16Z/32Z	03336090874
075	Zahnrad	Gear	1	12Z/32Z	03336090875
076	Zahnrad	Gear	1	13Z/23Z	03336090876
077	Kugellager	Ball bearing	2	6002-2Z	0406002ZZ
078	Zahnrad	Gear	1	2Z/29Z	03336090878
079	Zahnrad	Gear	1	2Z/14Z	03336090879
080	Sicherungsring	Retaining ring	1	32	042SR32W
081	Kupplung	Clutch	1		03336090881
082	Zahnrad	Gear	1	23Z/33Z	03336090882
083	Sicherungsring	Retaining ring	1	30	042SR30W
084	Lagerbock	Bearing housing	2		03336090884
085	Welle	Shaft	1		03336090885

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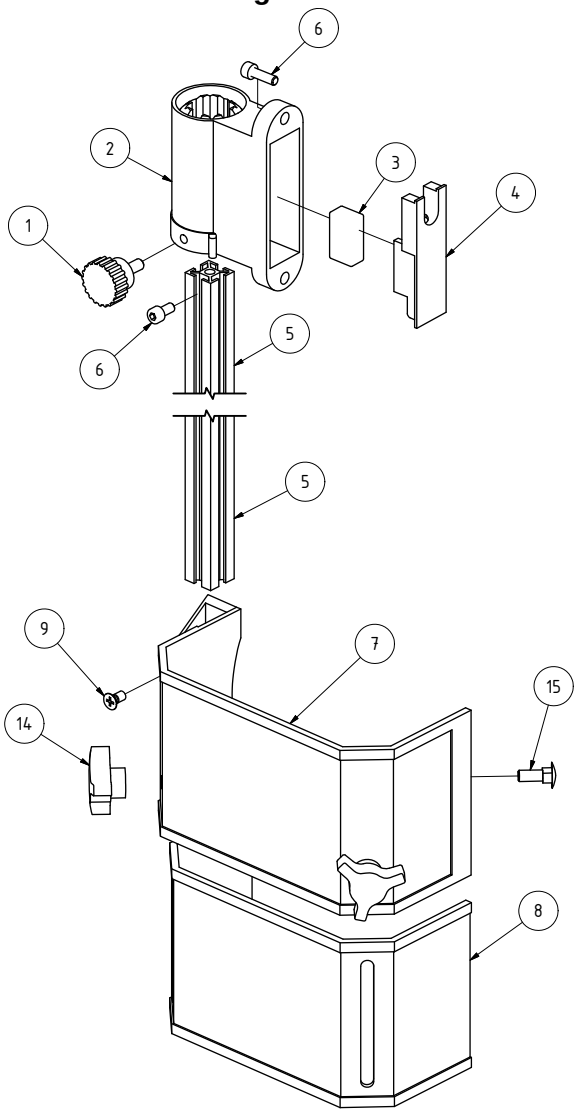
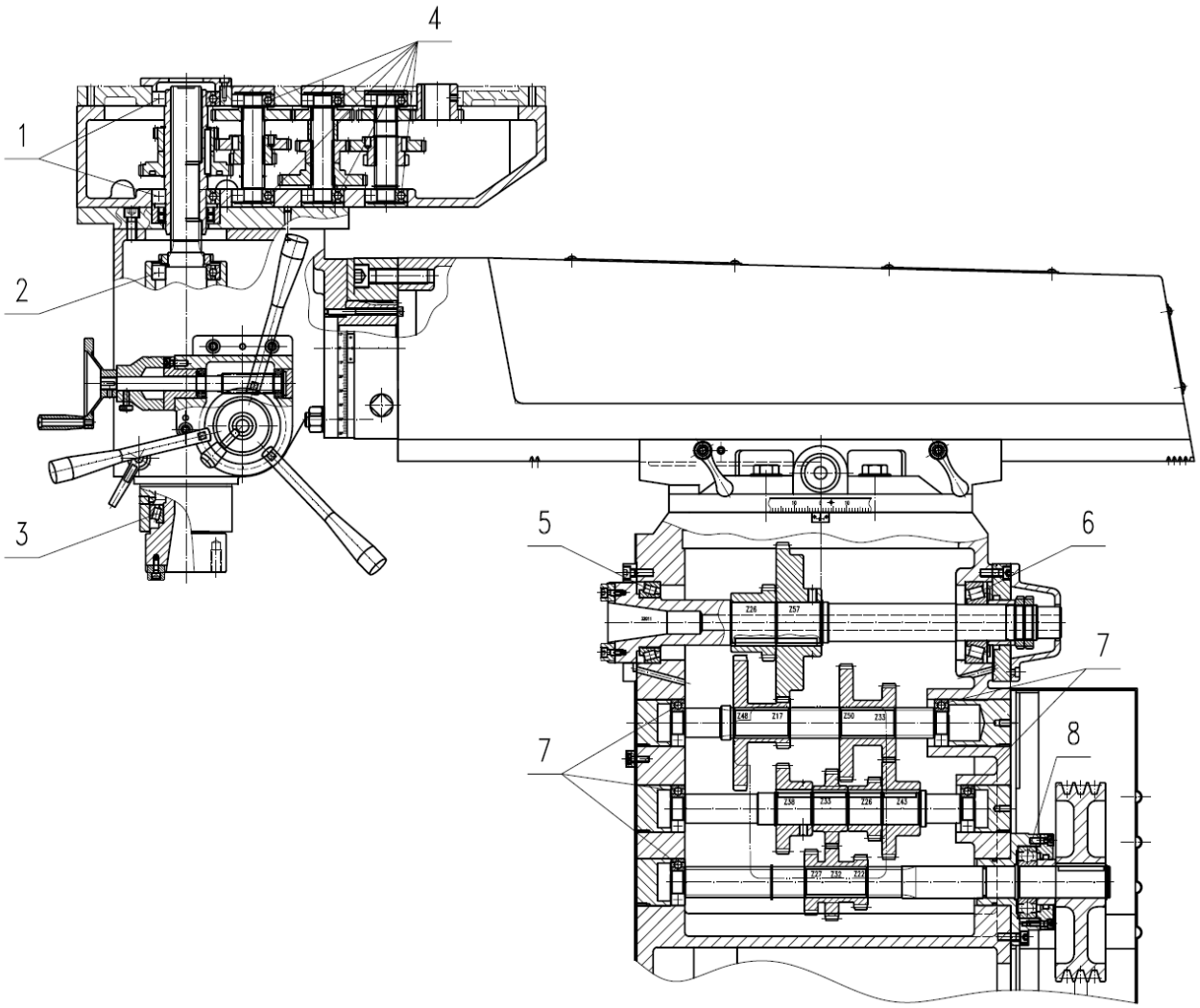
7.15 Fräsfutterschutz - Milling chuck cover



Fräsfutterschutz - Milling chuck cover

MT60 - Teileliste Fräsfutterschutz - Parts list milling chuck cover					
Pos.	Bezeichnung	Description	Menge	Grösse	Artikelnummer
			Qty.	Size	Item no.
1	Rändelschraube	Knurled screw	1	033360907	
2	Halterung	Fixture	1		0302024149CPL
3	Mikroschalter	Microswitch	1		
4	Platte	Plate	1		
5	Alu- Profil	Aluminium profile	1		
6	Schraube	Screw	2	M5x10	
7	Fräsfutterschutz A	Mill chuck cover A	1		
8	Fräsfutterschutz B	Mill chuck cover B	1		
9	Schraube	Screw	2	M5x10	
14	Rändelmutter	Knurled nut	2		
15	Klemmschraube	Clamping screw	2		
CPL	Fräsfutterschutz komplett	Chuck protection complete	1		03336090FS

Lagerübersicht - Bearing overview



MT60 - Ersatzteilliste Lager - Bearing part list					
Pos.	Bezeichnung	Designation	Menge	Grösse	Artikelnummer
			Qty.	Size	Item no.
1	Lager	Bearing	2	6009-/P5	0406009R
2	Lager	Bearing	1	6009/P5	0406009R
3	Lager	Bearing	1	32010/P5	04032010
4	Lager	Bearing	6	6204/P5	0406204
5	Lager	Bearing	1	32011/P5	04032011
6	Lager	Bearing	1	30308/P5	
7	Lager	Bearing	5	205	
8	Lager	Bearing	1	307	

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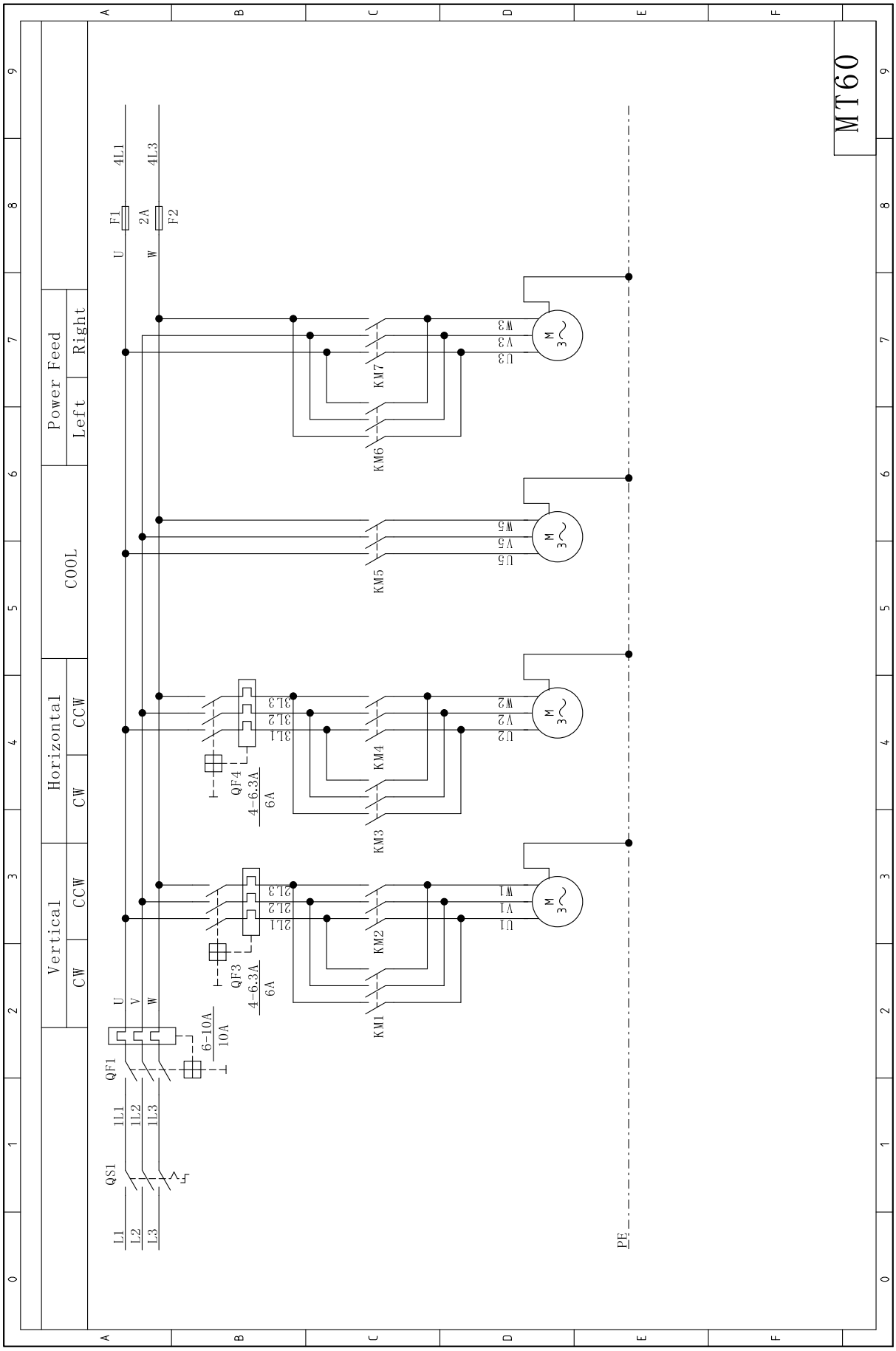
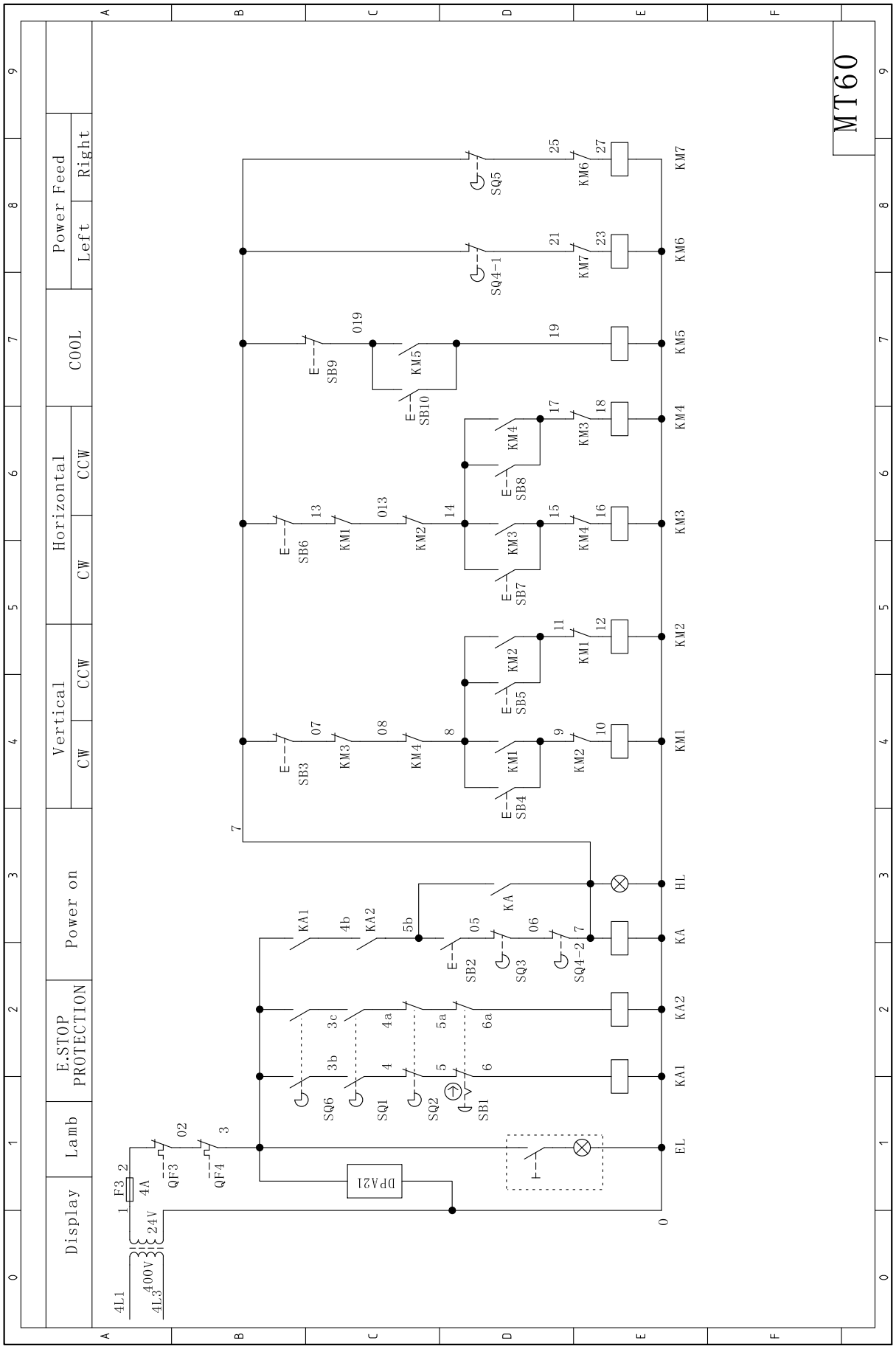
7.16 Schaltplan - Wiring diagram 1 - 2



7.17 Schaltplan - Wiring diagram 2 - 2



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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 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 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 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 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 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 100	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 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 S 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 S 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)	MICRO-LUBE GB 00	Mobilux EP 004	Shell Alva-nia 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	CENTO-PLEX 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	CENTO-PLEX 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	Schneidöl Aquacut C1, 10 L Gebinde, Artikel Nr. 3530030 EG Sicherheitsdatenblatt http://www.optimum-daten.de/data-sheets/Optimum-Aquacut_C1-EC-datasheet_3530030_DE.pdf		Aral Emusol	BP Sevora	Esso Kutwell		Mobilcut	Shell Adrana	Chevron Soluble Oil B

8 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.

9 Appendix

9.1 Copyright

Optimum Maschinen Germany GmbH

9.2 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!

9.3 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

9.4 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.

9.5 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. ☞ Environmental conditions - storage on page 19

9.6 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.

9.6.1 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.

9.6.2 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.

9.6.3 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.

9.6.4 Disposal of electrical and electronic components

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

The machine contains electrical and electronic components and must not be disposed of as household waste. According to the European Directive 2011/65/EU 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.

9.6.5 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.

9.7 Disposal through 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.

9.8 Change information operating manual

Chapter	Short summary	new version number
parts	Spindle on milling table adjusting	1.0.1
2	Net weight of machine from 900 to 1300kg	1.0.2
Spare parts 9.1.1	Important notes of spare part supply	1.0.3
3	Interdepartmental transport	1.0.4

9.9 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
Quick action - Drill chuck	Drill bit adapter can be fixed by hand.
Tool	Milling cutter, drill bit, etc.

EC Declaration of Conformity

according to Machinery directive 2006/42/EC, Annex II 1.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: MT 60

fulfills all the relevant provisions of the directive 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

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

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

EN 13849-1:2015 - Safety of machinery - Safety related parts of controls - Part 1: General design principles

EN 13849-2:2012 - Safety of machinery - Safety related parts of controls - Part 2: Validation

EN ISO 12100:2013 - Safety of machinery - General principles for design - Risk assessment and risk reduction

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

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Kilian Stürmer (CEO, General Manager)
Hallstadt, 2019-12-11

MT60_CE_en.fm

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  - OPTImill MT 60 Zubehör

- OPTImill Zubehör

Ihr Ersatzteil nicht in den Listen?
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- Drucklufttechnik / Kompressoren