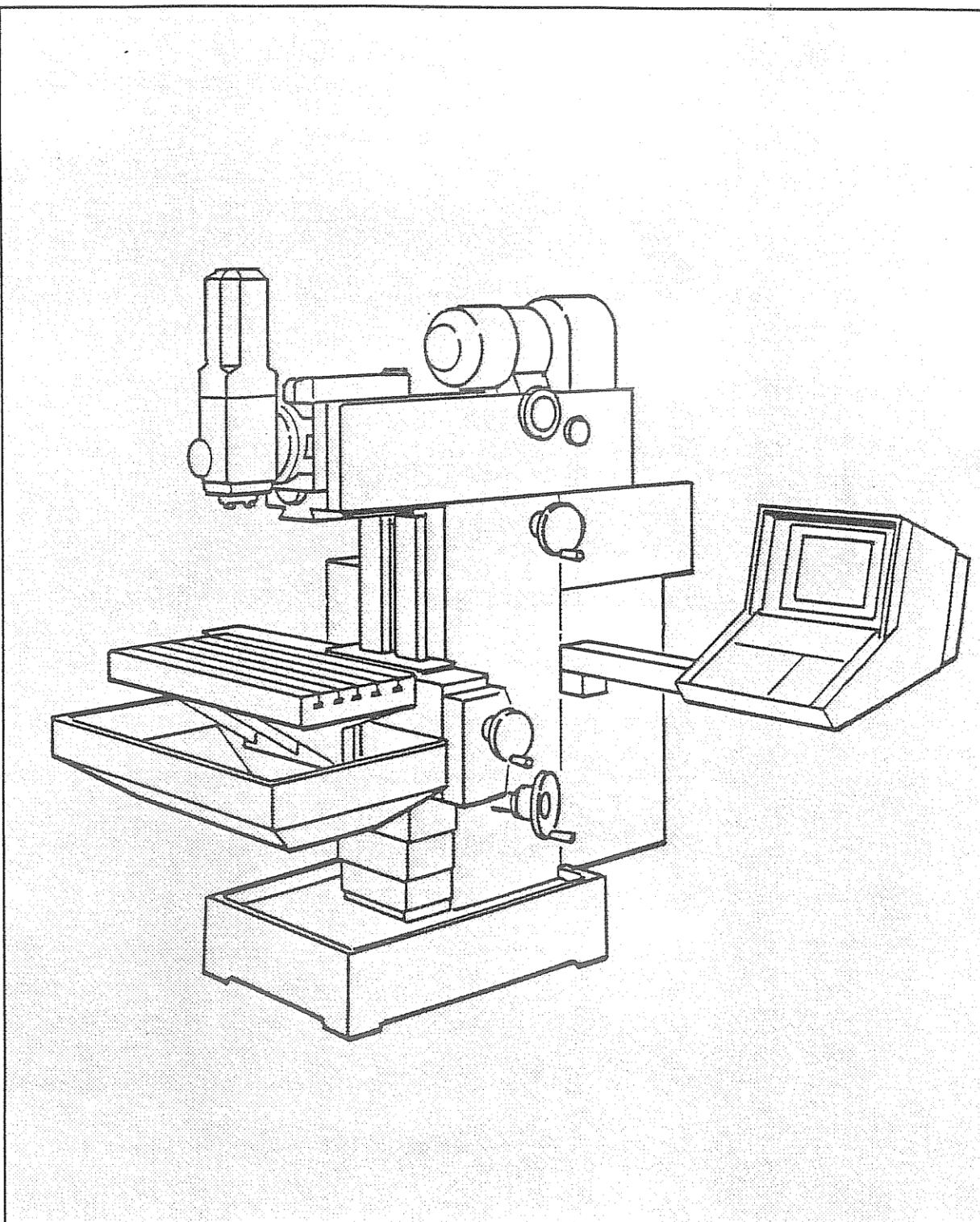


# Operator Manual

No. 76.056151



**MAHO**  
**MH 500W**

53566

## 0 SAFETY REGULATIONS

## 1 BEFORE OPERATING THE MACHINE

## 2 GENERAL DESCRIPTION OF THE MACHINE

## 3 OPERATION OF THE MACHINE

## 4 WORK TABLES

## 5 STEERING

## 6 ACCESSORIES / OPTIONS

## 7 MAINTENANCE

## 8 REMOVAL INSTRUCTIONS

## 9 TRANSMISSION, HYDRAULIC, PNEUMATIC, CENTRAL LUBRICATION PLANS REPLACEMENT AND WEAR PARTS LISTS

## 10 TROUBLESHOOTING

## SECURITY REGULATIONS

The initial commissioning of the MAHO machine tool and instruction of the personnel is carried out by the MAHO service. Unauthorized commissioning of the machine is not permitted, since in this case all warranty claims expire.

The MAHO machine tool may only be operated and serviced by trained and authorized persons!

However, the machine can pose a risk if it is used improperly by untrained persons or if it is not used as intended.

This threatens:

- Dangers to life and limb.
- Danger to the machine and other assets of the user.
- Dangers for efficient work
- the machine.

The MAHO machine tool is equipped with protective devices and monitoring functions for safety in accordance with the applicable accident prevention regulations. Removing or bypassing this device is prohibited.

Also, no protective devices may be modified. Protective covers affecting the operation of the machine are protected by safety switches. These may neither be removed nor be manipulated.

In the event of damage or failure, the machine must be shut down until the protective devices are functional again.

Machine covers that are only to be removed for repair and maintenance must be put back in the original position before starting the machine.

The machine is to be used in accordance with the operating instructions. If the location is changed, a new start-up must be carried out. We recommend MAHO specialists for this.

Electrical faults can only be rectified by authorized specialist personnel.

Service and maintenance work may only be carried out by persons who have been trained and authorized to do so.

There is an increased risk of accidents during service and maintenance work. Therefore, all work must be carried out with the machine shut down.

If, in the course of repairs, it is necessary to loosen attachments of machine add-on parts, e.g. loosening holding brakes on the axles, etc. appropriate measures must be taken to ensure safety.

When transporting, setting up and operating the machine, the following regulations and guidelines must be observed in their latest versions:

- Connection regulations of the responsible power supply company.
- UVV accident prevention regulations.
- DIN regulation 32 541, operation of machines and comparable technical work equipment.
- Regulation for pressure tanks, compressed gas tanks and filling systems.

The machine operator should wear safety goggles and safety shoes as required.

Hydraulic experts must meet the following conditions:

1. Knowledge of applicable regulations.
  - Technical rules for pressure vessels, TRB 003, 004, 005.
  - Pressure Vessel Ordinance ZH 1/400.
2. Based on their training, knowledge and experience gained through practical work, they must guarantee that the examination will be carried out properly and conscientiously.
3. Possess the required personal reliability.

The persons responsible for operation and maintenance must have read and understood the operator's manual.

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## TO OUR CUSTOMERS

This operator's manual contains the essential information required for proper operation and maintenance of your MAHO machine tool. It belongs in the hands of the operating and maintenance personnel.

The complete technical documentation consists of the following individual instructions, per machine:

### CNC 232

- 2x operator manual
- 1x parts catalogue
- 2x CNC 232 operating and programming instructions

Control-specific details are only listed in the CNC operating instructions and can be taken from them.

The machine may only be started up after the operating and maintenance personnel have carefully read the operator's manual and become thoroughly familiar with all the details.

**The machine must be operated and maintained in accordance with the information in the operator's manual.**

For damage caused by non-observance of this information or by improper standing, we assume no liability!

If faults occur that cannot be remedied by one's own efforts, the cause of the fault must be determined using the operator's manual before the responsible MAHO representative or the MAHO company is informed.

The operator's manual will help you to solve your machining tasks advantageously. We are sure that the delivered MAHO machine tool will fully meet your expectations.

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This technical manual may only be reproduced or made accessible to third parties - even in part - with the express permission of the publisher.

Below are explanations of how to use the manual:

Page numbering

The pages of the manual are numbered consecutively within the chapters according to sections. The page numbers are at the bottom right and are structured so that the page number follows the section number.

EXAMPLE: 3.20-3 means: Chapter 3, Section 20, Page 3

If extensions are made within a section, these are provided with the page number of the previous page and the numbers 1, 2, 3, etc., separated by a period.

EXAMPLE: 3.20-3.1 means: Chapter 3, Section 20, Page 3, Supplement Page 1

Figure and tables are not numbered.

The position numbers in the illustrations refer to the content of the section and can be spread over 2 - 3 illustrations.

If positions of a figure are addressed in the text, they are placed in brackets ( ).

The following notes are used in this manual:

"A NOTICE:" Applies to technical features that the user must take into account.

"DANGER!" Applies to working or operating procedures that must be strictly followed in order to prevent damage or destruction of the system.

"CAUTION!" Applies to work or operating procedures that must be strictly observed in order to exclude any risk to persons and excludes "ATTENTION!" with a.

cross references:

To avoid duplicate descriptions, content-related connections are made in this manual with the help of cross-references.

EXAMPLE: .... as instructed. ....  
see sheet/page....

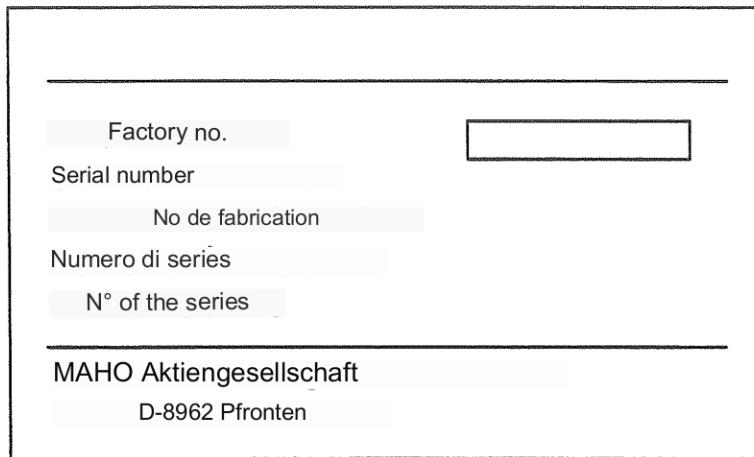
location definition:

The designations front, rear left, right, top and bottom can be seen from the headstock in the direction of the workpiece.

## IMPORTANT NOTE

Factory number:

- The information in this operator's manual only applies to the machine whose serial number is given on the title page.
- For all queries and for all spare parts orders, the serial number of the machine is admitted.
- If the queries refer to a specific sheet of the operator's manual, the sheet number must also be given.



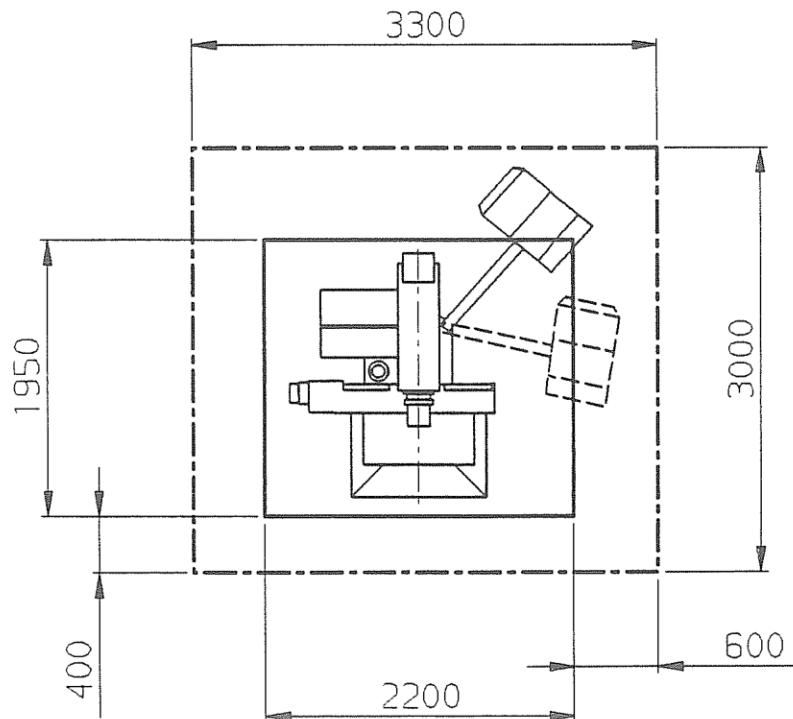
- The serial number plate is attached to the left of the machine.

Before starting up the machine:

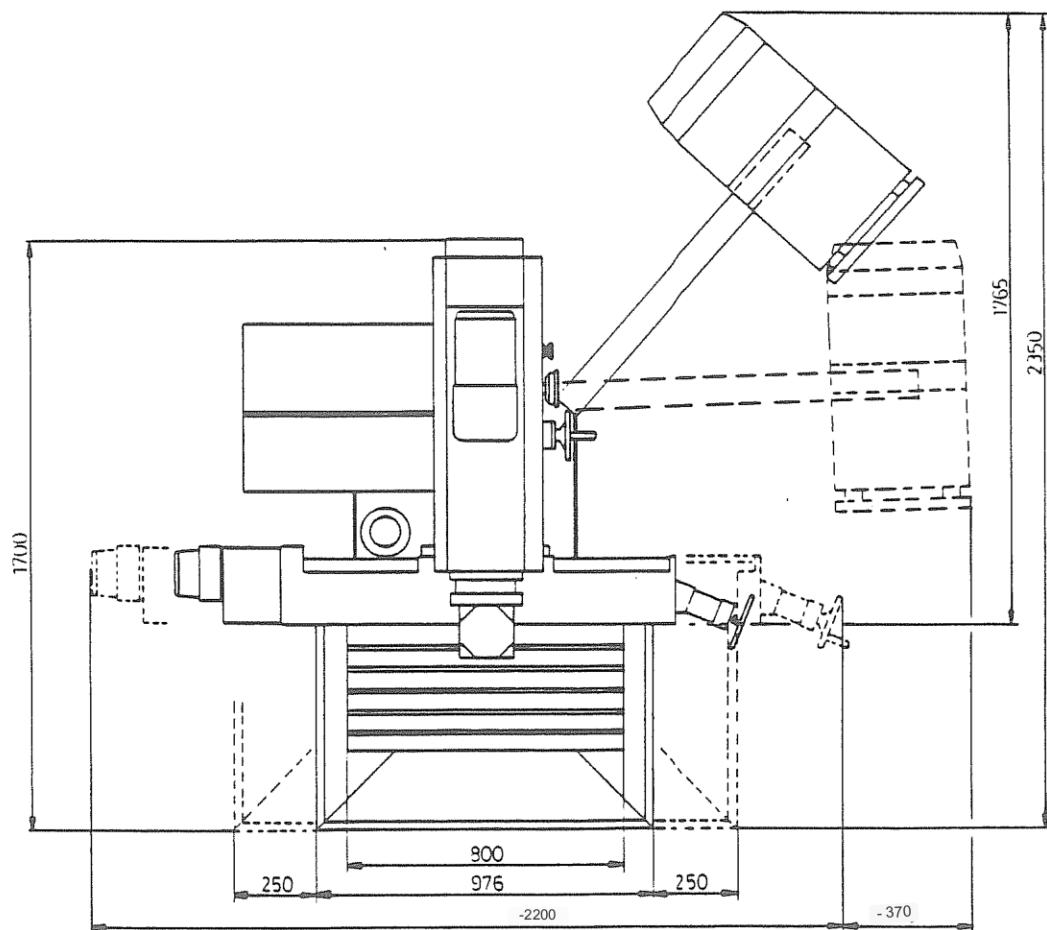
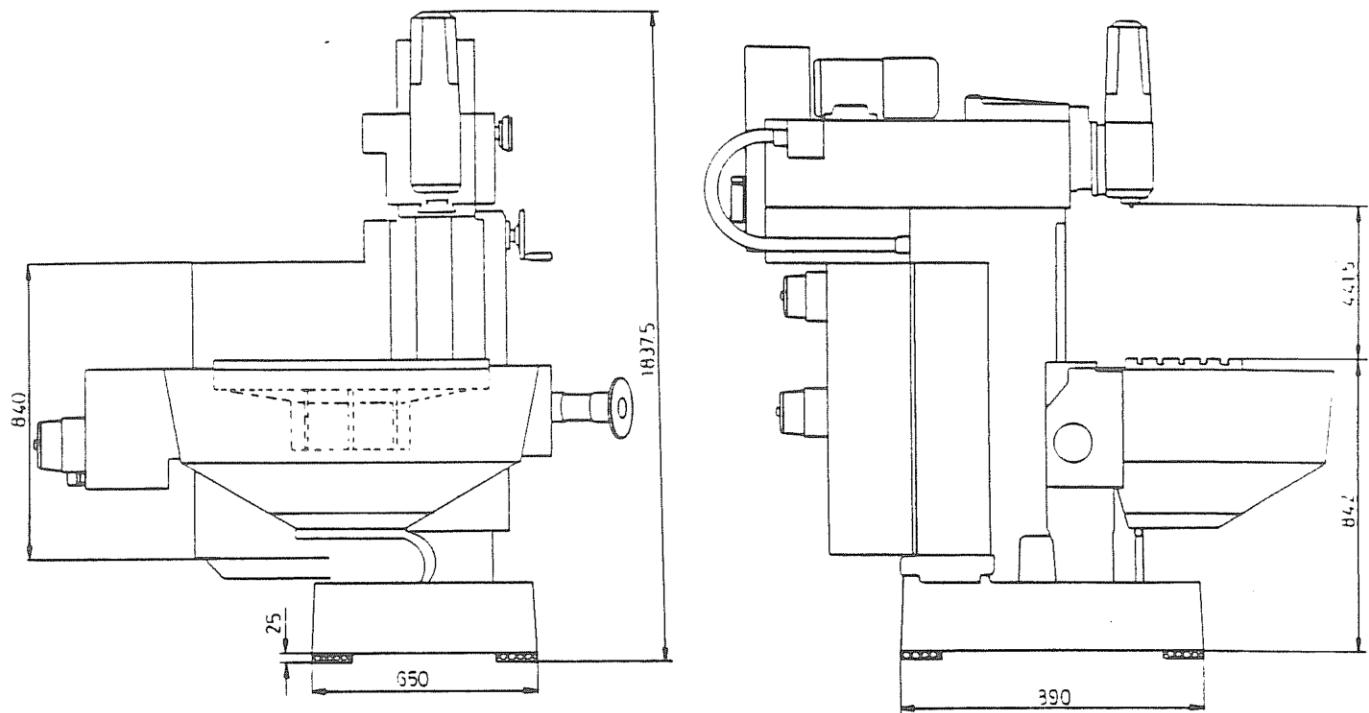
- Read safety regulations and operator's manual carefully.

## FLOOR PLAN AND WORKSPACE PLANNING - DATA

Total space requirement, at least	ca.m <sup>2</sup>	10.00
included in it:		
area for		
■ service		
■ Provision of		
■ maintenance and expansion	ca. m <sup>2</sup>	5.70
Coverage area "F"	ca. m <sup>2</sup>	4.30
height of the machine	ca.m	1.83
weight of the machine cpl. with max. workpiece weight	ca.kg	2 100
Mains connection, total connection value	...KVA	11.00
- free cable length above floor	m	0.50
Max. pre-fuse:	.A	25
-200-220V	.A	
-380-500V	.A	20



## DIMENSIONS, FLOOR PLAN AND WORKSPACE PLAN - DRAWING



---

## PLACING THE MACHINE

---

**Installation site:**

machine weight, max. .... kg 2 100

**Concrete floor and/or ceiling:**

Have the load-bearing capacity checked by a structural engineer according to the applied load per unit area (see sheet 1.04-2) and the resulting force distribution in the concrete floor or ceiling.

**ground level:**

Check the load-bearing capacity of the substrate according to the bearing load per unit area.

In order to ensure that the machine functions correctly, the following details must be observed for the location of the machine:

- It must be free from vibrations.
- It must be free from local, one-sided heating or cooling of the machine, e.g. solar radiation, radiators, drafts, etc.
- It must be free of interfering electrical installations (high frequency).
- A minimum load-bearing capacity must be guaranteed for the total area requirement, this is dependent from the machine equipment.
- A concrete or wooden base is ideal.

**DANGER!**

Mixed floor, i.e. machine stands on concrete and end grain wood floor, is not permissible.

- The unevenness of the floor should not exceed 3mm/m.
- A constant room temperature of max. 35 °C (308 K) must not be exceeded.
- The relative humidity may not exceed 80%.

**A NOTICE:**

Dimensions in the floor plan are approximate and may vary slightly.

Installation preparations:

Lay out the provided damping plates according to the sketch, lift the machine according to Sheet 1.08-1 with a crane and place carefully on the damping plates.

Align the machine

Align the machine in the Z-axis with a spirit level, if necessary align with shims on the damping plates.

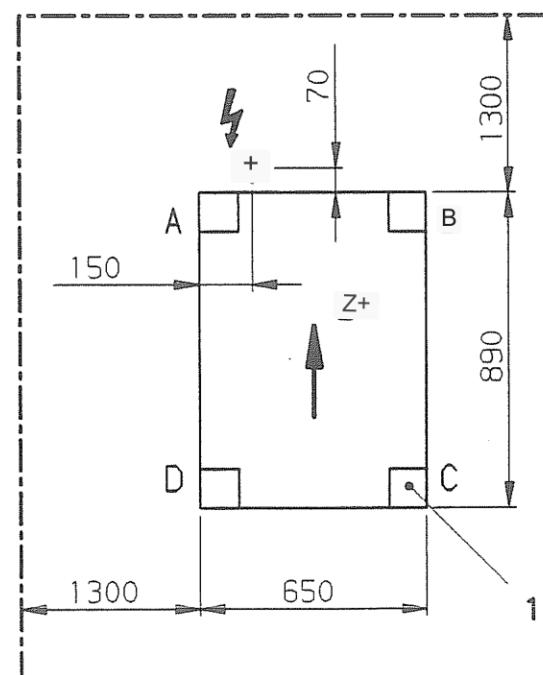
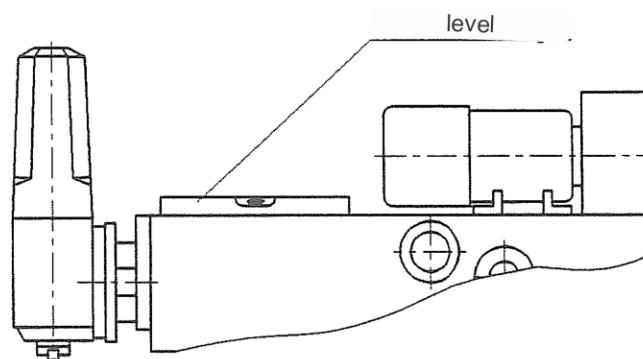
## Pos. 1 damping plates

main circulation:

dimension ..... mm 110 x 110  
quality ..... 4.17.5  
Order No. ..... 27.065763

weight distribution:

on foot A.....	kg	450
on foot B.....	kg	450
on foot C.....	kg	600
on foot D.....	kg	600



TRANSPORTATION OF THE MACHINE

Box packing dimensions

(length x width x height) ..... <sup>m</sup> 2,35 x 2,15 x 2,20

Maximum machine weight:

- with pallet (standard). ....	approx.kg	2 100
- with box (packed seaworthy) .....	approx.kg	2 400
- net, machine only ..... approx.kg		1 800

A NOTICE:

The weight can be up to 5% more due to different wood weights!

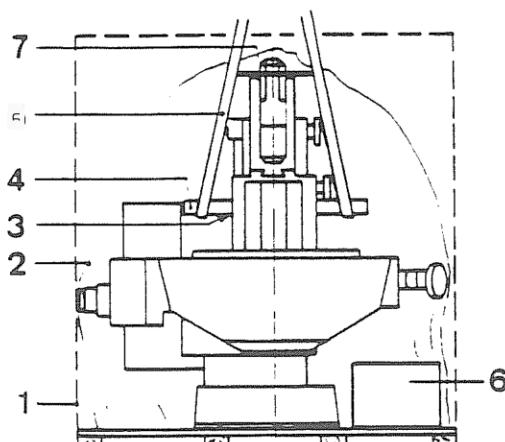
**DANGER!** The machine may only be suspended with the attached special transport device trans-  
be ported!CAUTION! No staying under suspended loads.Carry out a visual inspection of the transport device and carrying ropes (transport  
the).

Fig. 1

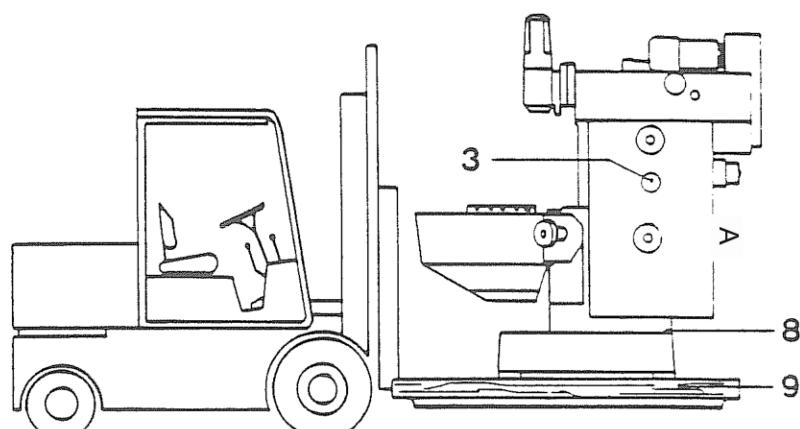


Fig. 2

- Unload the packed machine from the transport device using a forklift, lifting crane or similar.
- Check the machine and accessories for any transport damage.
- Push the transport bar (4) (40 - 50 mm Ø, 1000 mm long) into the opening in the stand.
- Hang the endless hemp rope (5) with a load capacity of at least 3000 kg and a total length of approx. 6 m in the crane hook and the transport bar.

**DANGER!** Place the removed control panel (6) on the work table and secure it against slipping.

cheer!

A NOTICE:

Damage and other defects e.g. B. Incompleteness must be reported immediately in writing to the shipping company or the railway company, the insurance company and MAHO.

- Carry out a hanging test, i.e. by moving the transport bar (4) in the stand, the machine adjust so that it hangs horizontally. Using a spreader piece (7) prevents the rope from chafing on the machine. Put
- the machine down, unscrew the fastening nuts (8) and replace the pallet or crate base (9) lift the machine again.

When using a forklift

Place the machine on the forks of the stacker after placing wooden boards between them (Fig. 2) or hang it up on the forks with a rope (Fig. 3).

If space is unfavorable, use the "Transport-Muli" (Fig. 4).

- Transport the machine to the installation site prepared according to Sheet 1.03-1 and set it down carefully on the laid out damping plates.
- Floor plan and work space planning, see sheet 1.04-1 and -2.

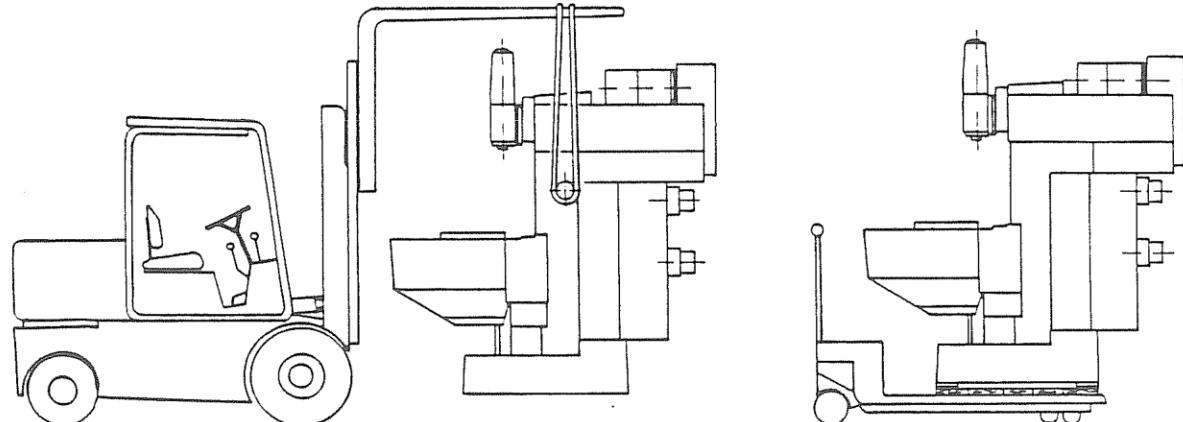


Fig. 3

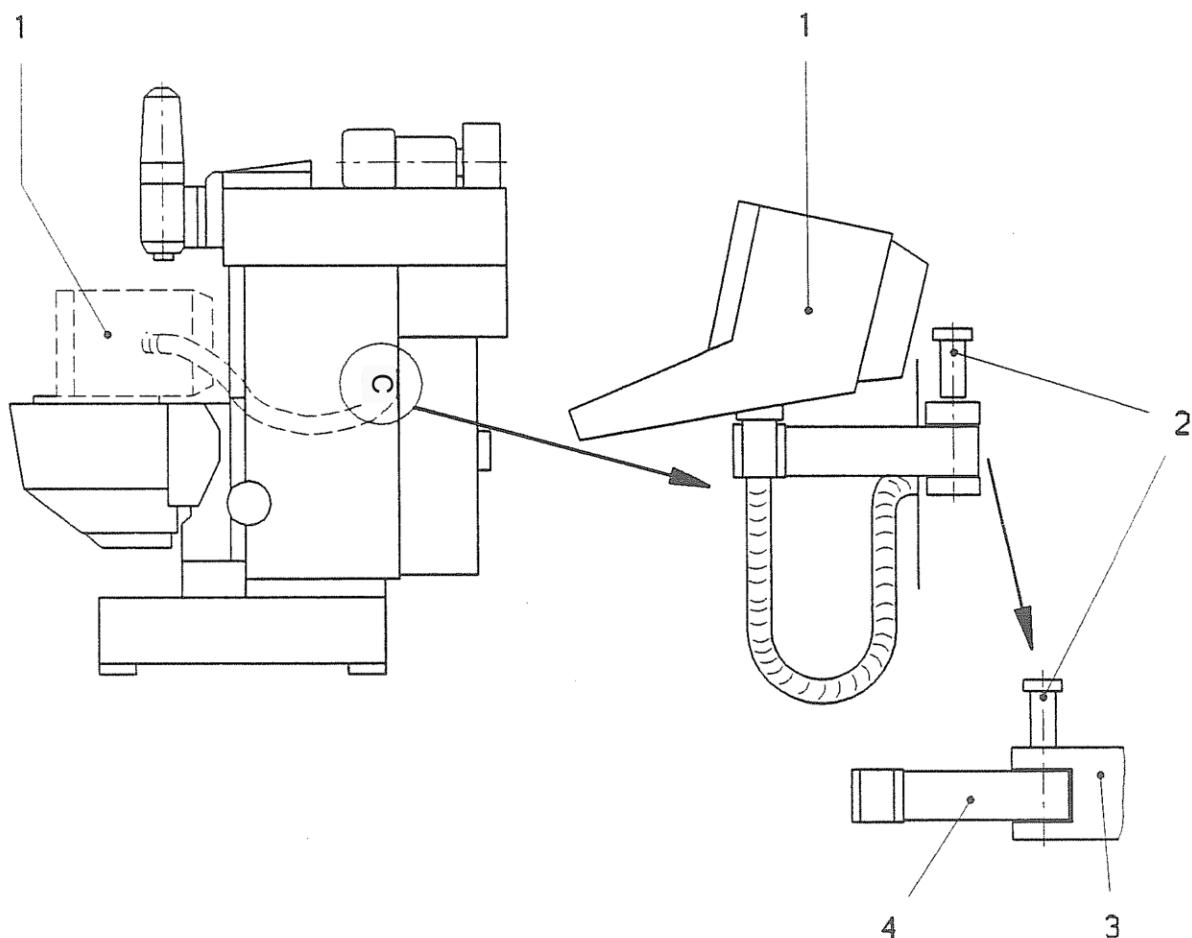
Fig. 4

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ATTACHING THE CONTROL PANEL

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- Pull pivot pin (2) out of support tube (3).
- Insert extension arm (4) into carrier (3) and fasten with pivot pin (2).
- Insert the control panel (1) into the extension arm (4).



## REMOVING THE RUST PREVENTION AGENT

### A NOTICE:

Before removing the anti-rust agent from the machine, no carriage adjustments may affect your lungs.

The machine is protected against corrosion by using CORTEC VCI 137 foam and OMNIOR 535 fluid grease.

Removed:

### A NOTICE:

After handling the foam, wash your hands with soap and water. In the event of prolonged contact with the foam, use protective gloves.

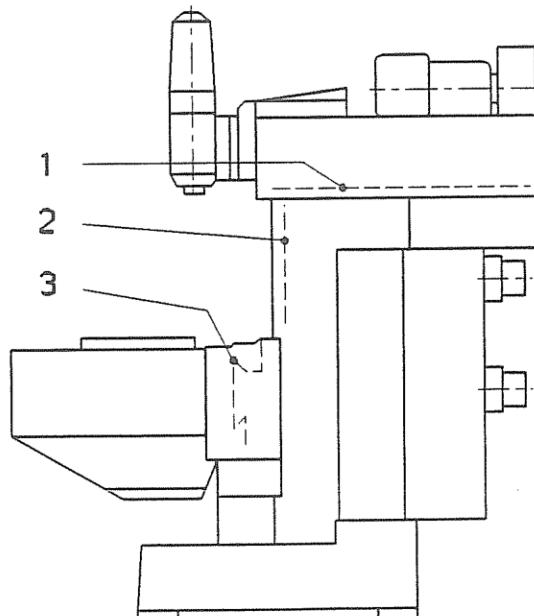
- Carefully remove fluid grease from the bare outer surfaces with a soft cloth soaked in kerosene or an alkaline cleaning agent.
- Never use scrapers or other sharp tools for this work.
- Clean the sliding surfaces of the headstock (1), the cross support (2) and the flat guide on the column from rust and dirt and brush with oil. a)
- Unbutton the bellows on both support end shields and slide surfaces of the lowering Clean the right clamping table (3) with a soft cloth to remove anti-rust grease and brush with oil. a)

### A NOTICE:

The anti-corrosion agents used are environmentally friendly.

- a) The oil used in the central lubrication must be used; see sheet 7.06-1 "LUBRICANT RECOMMENDATIONS".

■ It is essential to avoid mixing oils!

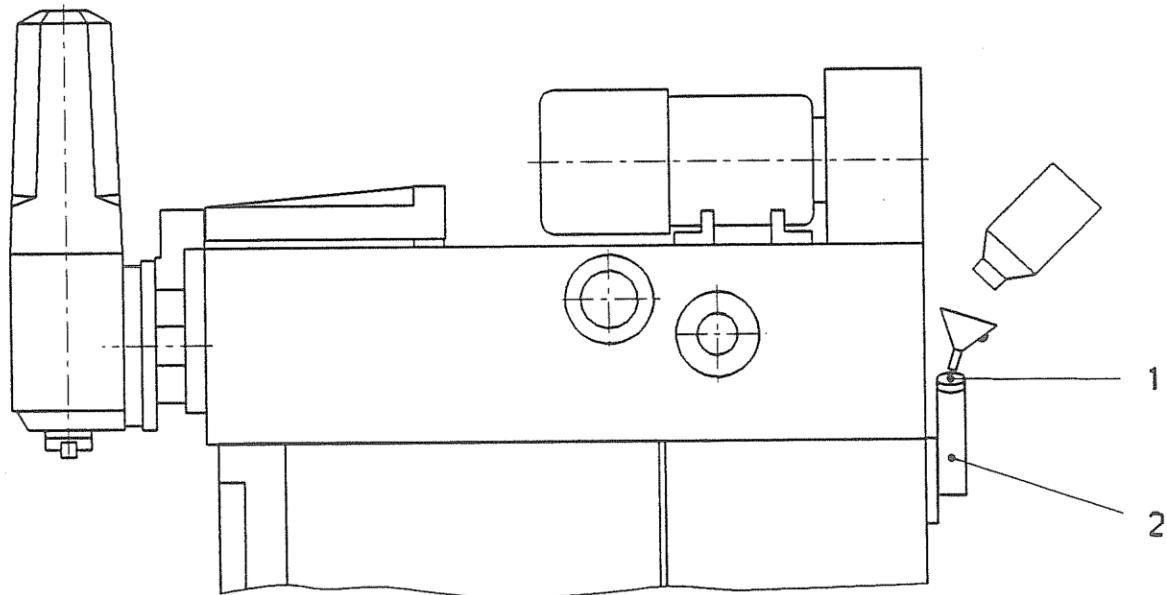


## FILLING THE DRIVE GEAR OIL BATH IN THE HEADSTOCK

To transport the machine, the oil in the work spindle drive is drained and must be to be refilled.

**DANGER!** Check whether the machine is aligned in the Z-axis with a spirit level, adjust if necessary.

- Unscrew the lower filler screw (1). Fill 0.7
- 1 from the can supplied with the designation "CL 46" (Aral-Sumurol CM 46) into a measuring container and pour into the sight glass connector (2) on the headstock.
- Wait about 10 minutes, then read off the oil level at the sight glass socket (2), if necessary top up the remaining quantity with a measuring container until the oil level has reached the corresponding mark.
- Reinstall the filler plug (1).

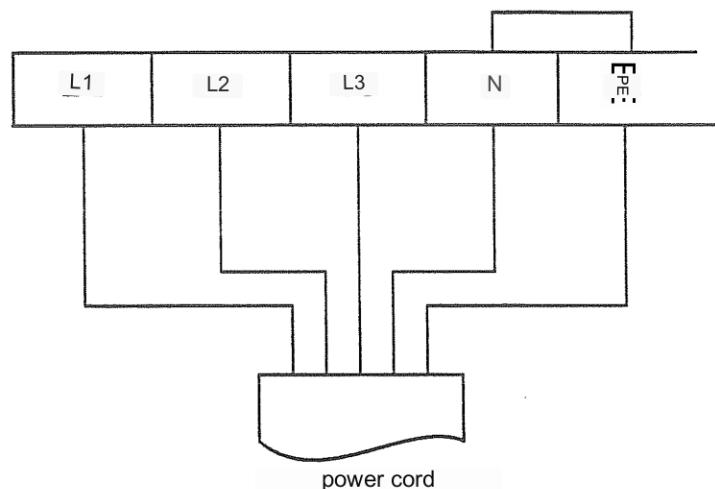


**CONNECTING TO THE ELECTRICAL MAINS**

The connection regulations of the responsible power supply company must be observed!

**DANGER!** This work should only be carried out by a MAHO specialist.

**CAUTION!** The protective earth connection must be carried out with particular care. Mistakes  
can mean danger to life.



total connection value .....	.KVA	11
Max. backup at:		
200-220V .....	A	25
380-500V .....	A	20

Retighten all screw terminals on the terminal strips, contactors, relays and fuses in the control cabinet; they may have become loose due to vibration during transport.

Switch on the main switch -Q1- on the control cabinet only after the clockwise rotating field has been established and carry out a functional test in accordance with the instructions on Sheets 3.01-1 to 3.01-2.

**A NOTICE:** The electrical documentation is in a pocket on the inside of the control cabinet door and must remain in the machine!

**DANGER!** When pre-connecting peripheral devices (reader punch, corner milling head, internal grinding device) determine the voltage of the socket.

Fuses may only be replaced with equivalent types.

Settings on the adjustment potentiometer, adjustment switches, machine parameters, etc. may only be changed by customer service personnel.

## COMMISSIONING CHECKLIST

The machine may only be put into operation by qualified personnel in accordance with the following instructions.

- o Check for proper installation.
- o Check electrical voltages.
- o Turn on the main switch.
- o Check the voltage at the power terminals.
- o Check control voltage.
- o Check supply voltage, relays and solenoid valves 24V.
- o Check oil levels.
- o Fill cooling lubricant system.
  - o Check the PH value of the cooling lubricant.
  - o Switch on the machine.
- o Press EMERGENCY STOP button and check function.
- o Check the hydraulic and pneumatic system pressure.
- o Check the hydraulic lines and connections for leaks.
- o Checking the safety devices (safety circuit, sliding doors, pivoting flaps).
- Types of oil, see sheets 7.06-1 to 7.06-3.
- Cooling lubricants, see sheets 7.07-3.1 to 7.07-3.5.

Date:

commissioning engineer

Signature:

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Sheet

## GENERAL DESCRIPTION OF THE MACHINE

Technical specifications .....	2.01-1
	2.01-2
Designation of the machine components .....	2.02-1
	to 2.02-7
The directions of movement .....	2.03-1
command station	
- Function of the controls .....	2.04-1
	until 2.04-3

**TECHNICAL SPECIFICATIONS****WORKSPACE****Adjustment of the cross support**

- in the horizontal longitudinal axis (X-axis) .....	mm	500
- in the vertical axis (Y-axis) .....	mm	380

**Adjustment of the headstock**

- in the horizontal transverse axis (Z-axis) .....	mm	350
--	----	-----

**WORK SPINDLES**

Tool holder quill .....	ISO	40
stroke of the vertical work spindle .....	mm	50
Clamping force of the tool clamp ISO type B, clamping spigot .....	CN	9.5

**SPEEDS AND FEEDRATES**

Working spindle speeds, directly programmable .....	rpm	63-4000
---	-----	---------

**Feeds, directly programmable**

- in the X, Y and Z axes .....	mm/min.	1-2000
--------------------------------	---------	--------

**Eilgang**

- in the X and Z axes .....	m/min.	4
- in the Y axis .....	m/min.	2

**ELECTRICAL EQUIPMENT**

a)

Tension .....	V	220/380
frequency .....	Hz	50/60
Total connection value of the machine .....	KVA	11

**CNC CONTROL b)**

Resolution of the linear measuring systems .....	mm	0.001
measured value displays .....	Screen	

## WEIGHT AND SPACE REQUIREMENTS

Machine weight (with vertical milling head, fixed angle table, and control cabinet)	.....	approx.kg	1 800
Machine dimensions (standard)			
length	.....	mm	1 650
Broad	.....	mm	2 220
Height	.....	mm	1 840

## Remarks:

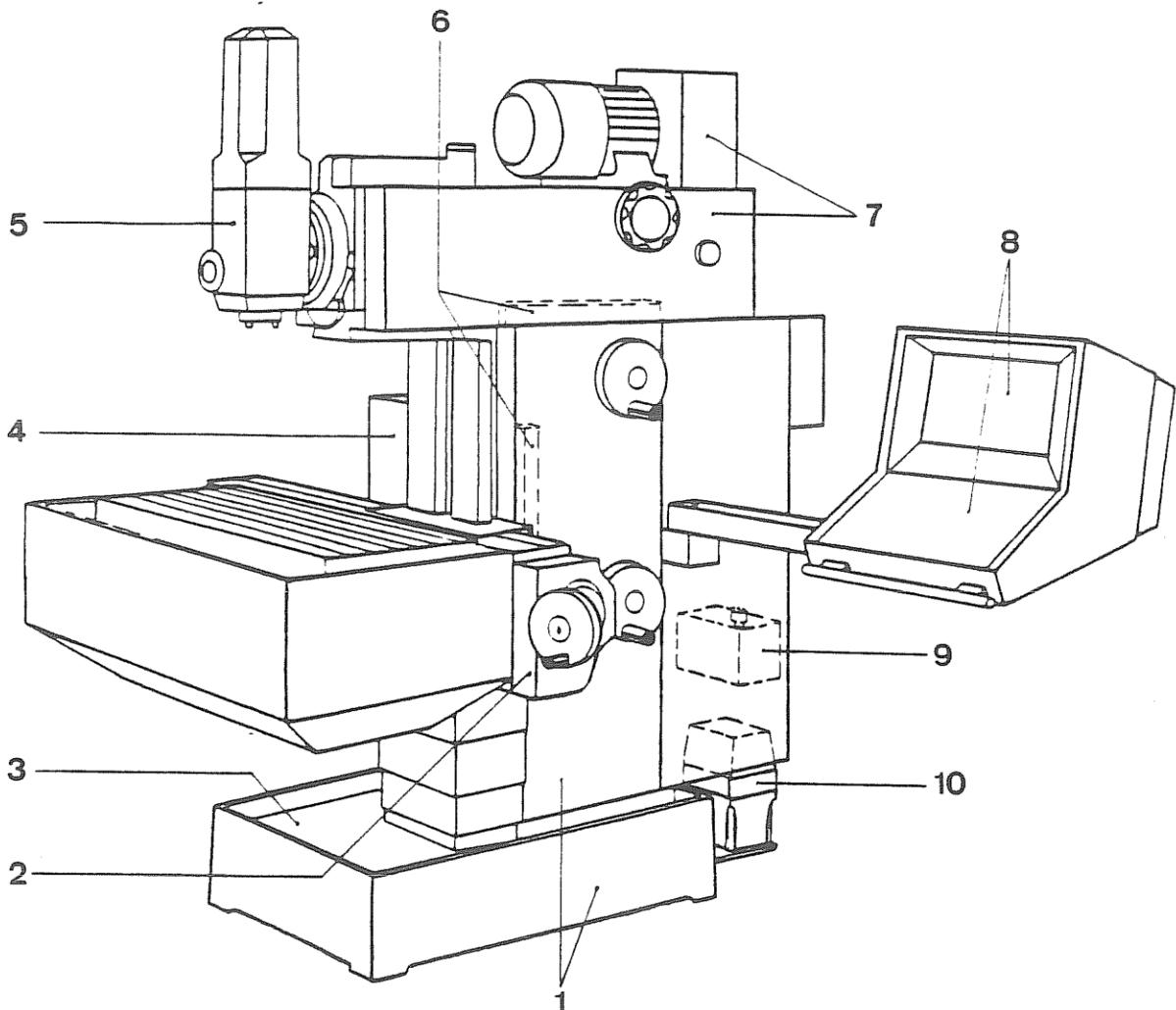
- a) Normal execution
- b) The CNC control is described in a separate manual.

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IDENTIFICATION OF THE MAIN COMPONENTS

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## Machine overview



1 machine stand with foot.

2 cross supports with vertical clamping table.

3 coolant tanks.

4 Electrical system with CNC control.

5 Vertical milling head with work spindle.

6 measuring system

7 headstock with horizontal work spindle and variator.

8 Control panel for CNC control.

9 hydraulic system

10 central lubrication pump

Machine stand with foot

1 machine stand

2 steel flat guide

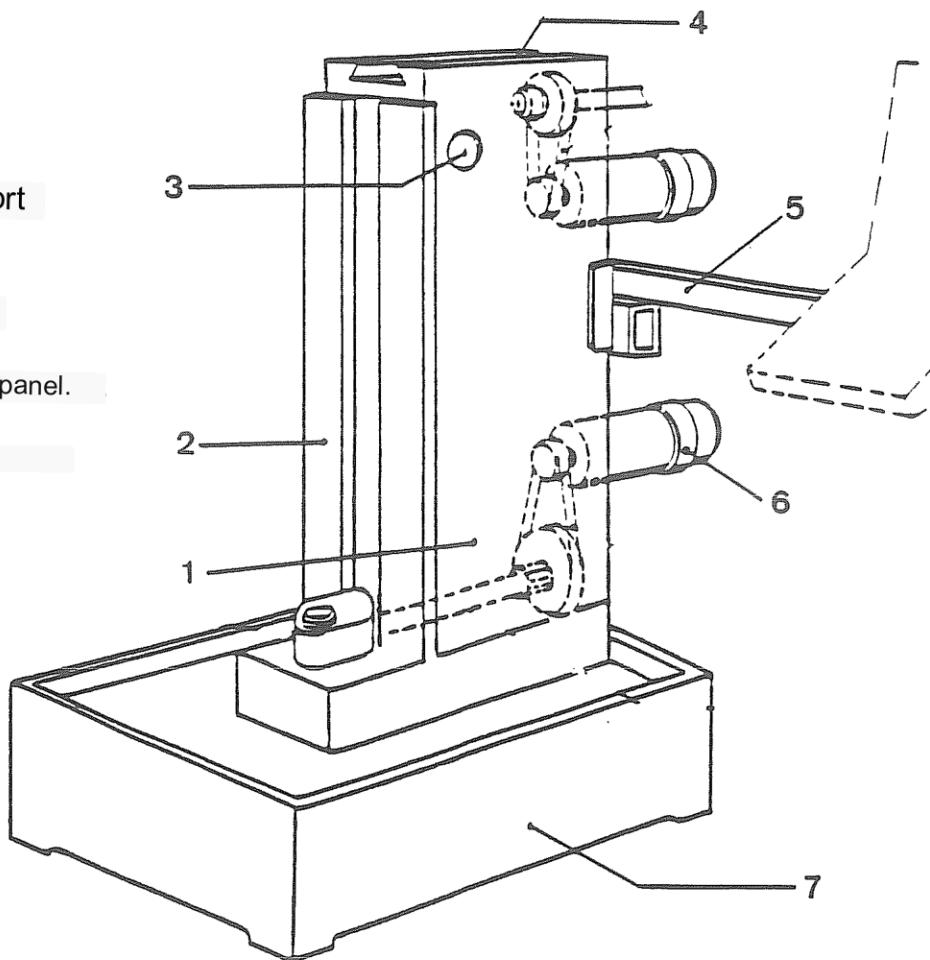
3 opening for transport  
the machine.

4 headstock guide

5 Swivel arm for control panel.

6 Y-axis feed drive.

7 stand base



Kreuzsupport

1 Vertical slide Y-axis.

2 longitudinal slides

3 DC motor X axis.

4 toothed belts X-axis.

5 ball screw X axis.

6 steel flat guide Y-axis.

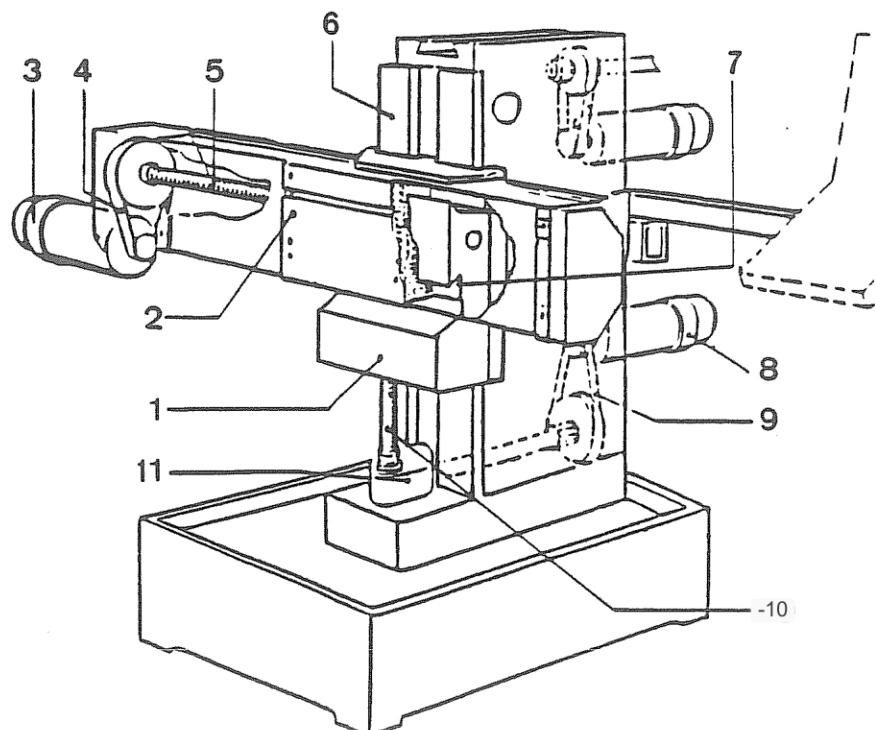
7 prism guide

8 DC motor Y axis.

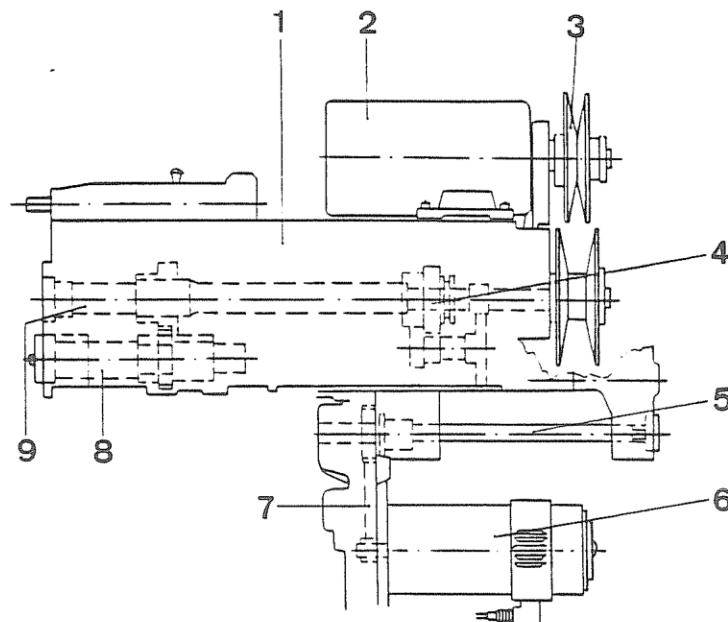
9 toothed belt Y-axis.

10 ball screw Y axis.

11 bevel gears



### headstock



1 headstock housing

2 main motor

3 variator

4 gears

5 Z axis ball screw.

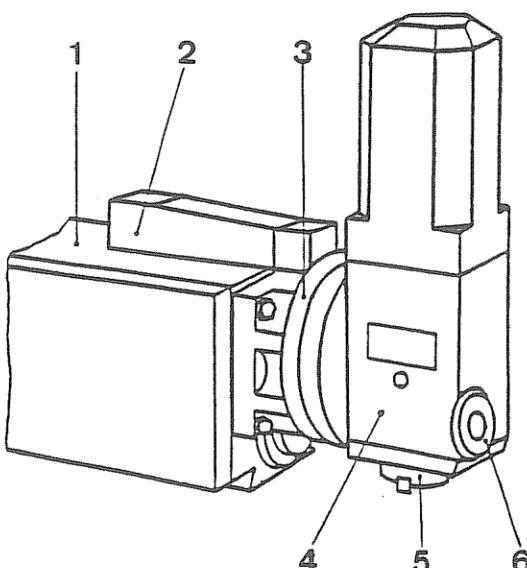
6 DC motor

7 Z-axis toothed belt

8 horizontal work spindle

9 Vertical milling head drive shaft

### vertical milling head



1 headstock

2 swivel arm

3 intermediate flange

4 milling head housing

5 vertical work spindle

6 quill adjustment device

The measuring systems

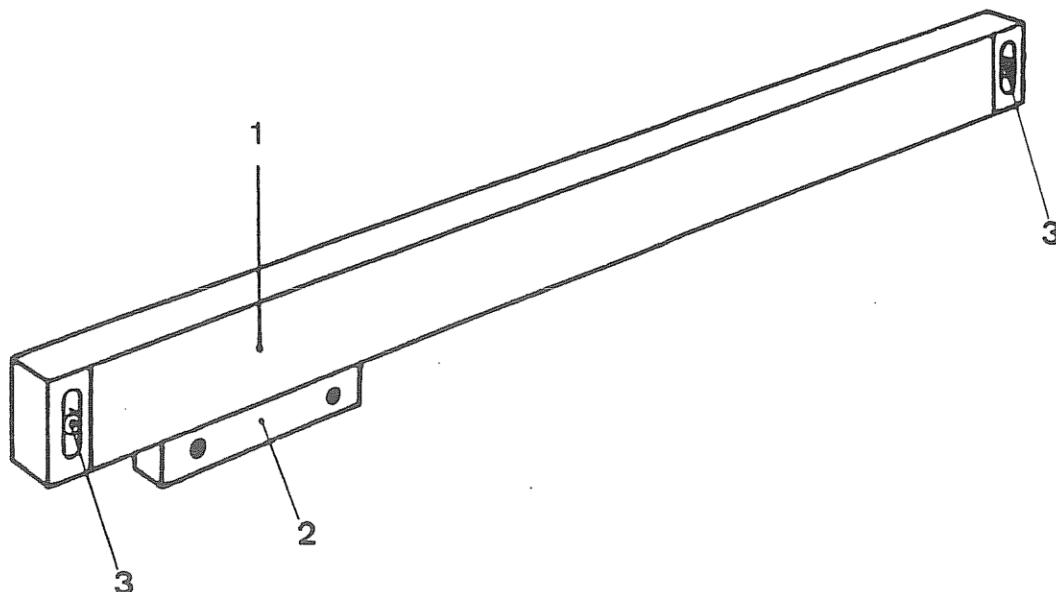
- The X-axis measuring system is built into the cross support at the top.
- The Y-axis measuring system is located on the left side of the stand.
- The Z-axis measuring system is mounted on the left side of the headstock.
- Functional description, see chapter 5.

Measuring system Z-axis

1 Housing with scale.

2 measuring head

3 mounting screws



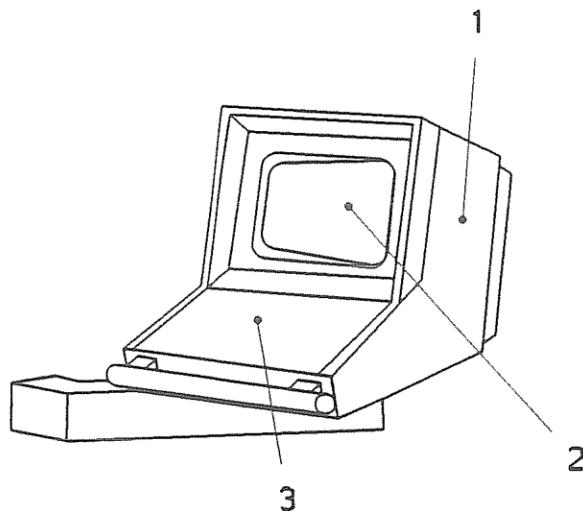
CNC Control

Structure, function and programming of the control are described in the CNC operating instructions and CNC programming instructions.

1 controller

2 Screen

3 control panel

Electrical system

9 control cabinet

10 main switch

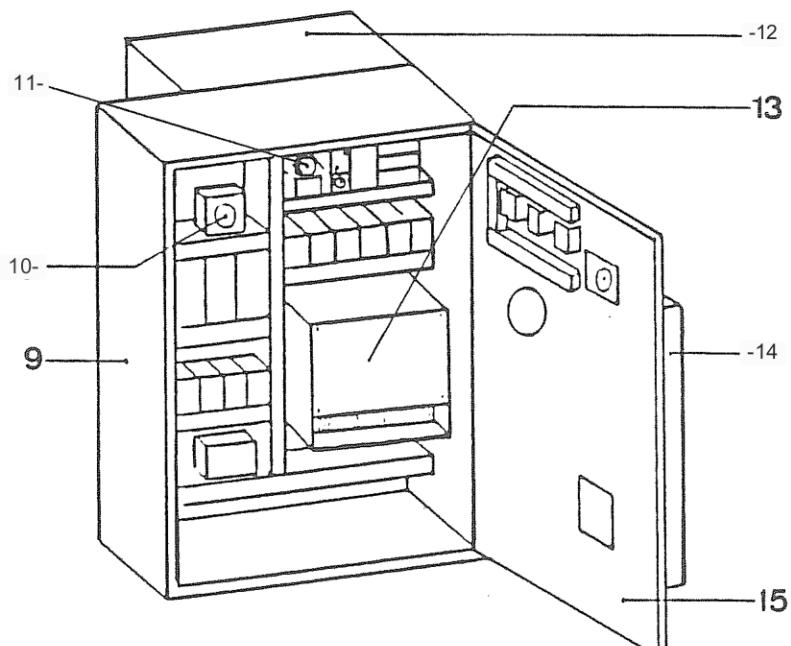
11 pressure switch (752) a)

12 Traforaum

13 thyristor controller

14 heat exchanger (option)

15 control cabinet door



A NOTICE: The information in brackets corresponds to the designations in the circuit diagram.

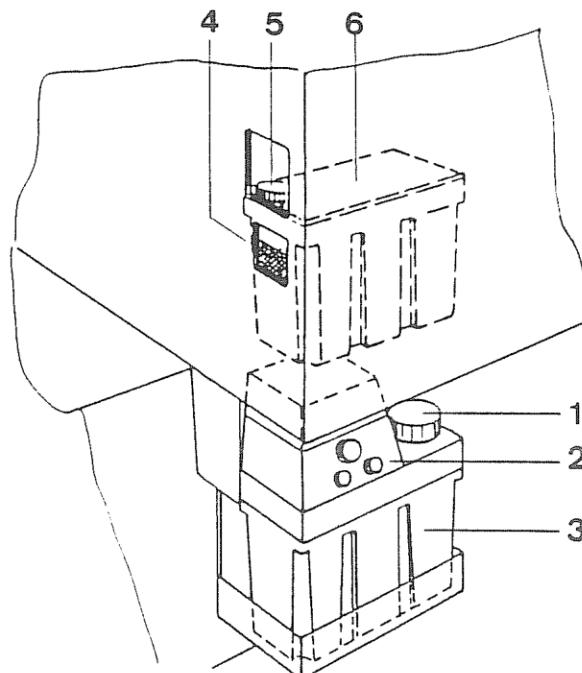
- a) Pressure switch (752) "EMERGENCY STOP limit switch bypass".

central lubrication system

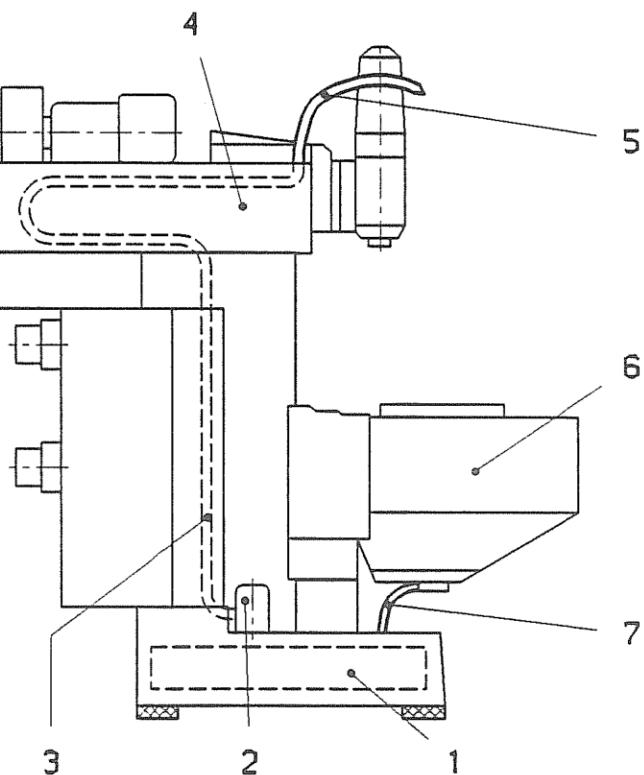
- 1 oil filler plug
- 2 central lubrication unit
- 3 Oil level check

Hydraulikaggregat

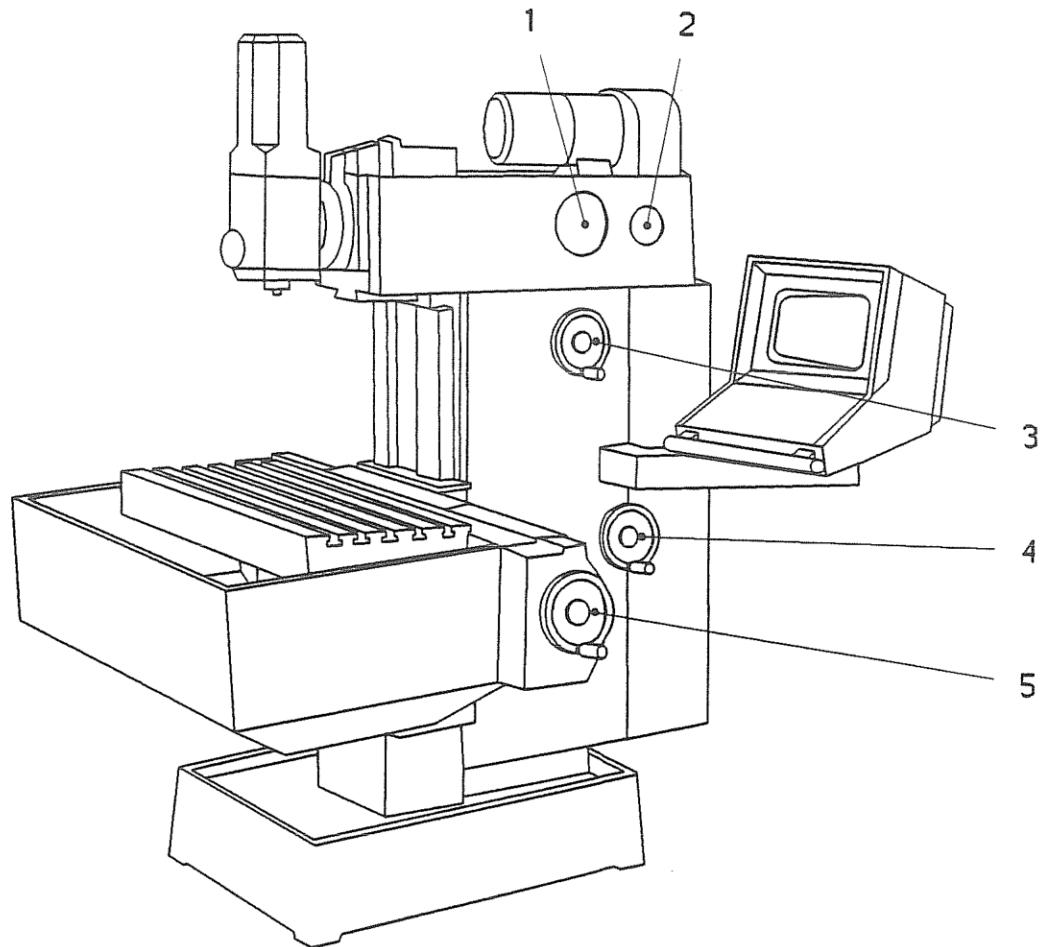
- 4 Oil level check
- 5 oil filler neck
- 6 compact hydraulic unit

Coolant system / splash guard

- 1 cooling lubricant container
- 2 coolant pump
- 3 coolant line
- 4 headstock
- 5 Adjustable nozzle, tool cooling.
- 6 chip tray
- 7 return line



Detailed functional and operating instructions for these systems can be found in Chapter 3, Sections 18, 20 and 22.

Mechanical controls

- 1 Grip wheel for continuously adjusting the speed.
  - White scale: range 63 - 500 rpm.
  - Green scale: range 500 - 4000 rpm.
- 2 Switch button for setting the speed range of the work
  - spindle. Syllable marker: range 63 - 500
  - rpm. Blue marker dot: idle position.
  - Green marker point: range 500 - 4000 rpm.
- 3 Handwheel for adjusting the headstock in the horizontal transverse axis (Z-axis).
- 4 Handwheel for adjusting the cross support in the vertical axis (Y-axis).
- 5 Hand wheel for adjusting the cross support in the horizontal longitudinal axis (X-axis).

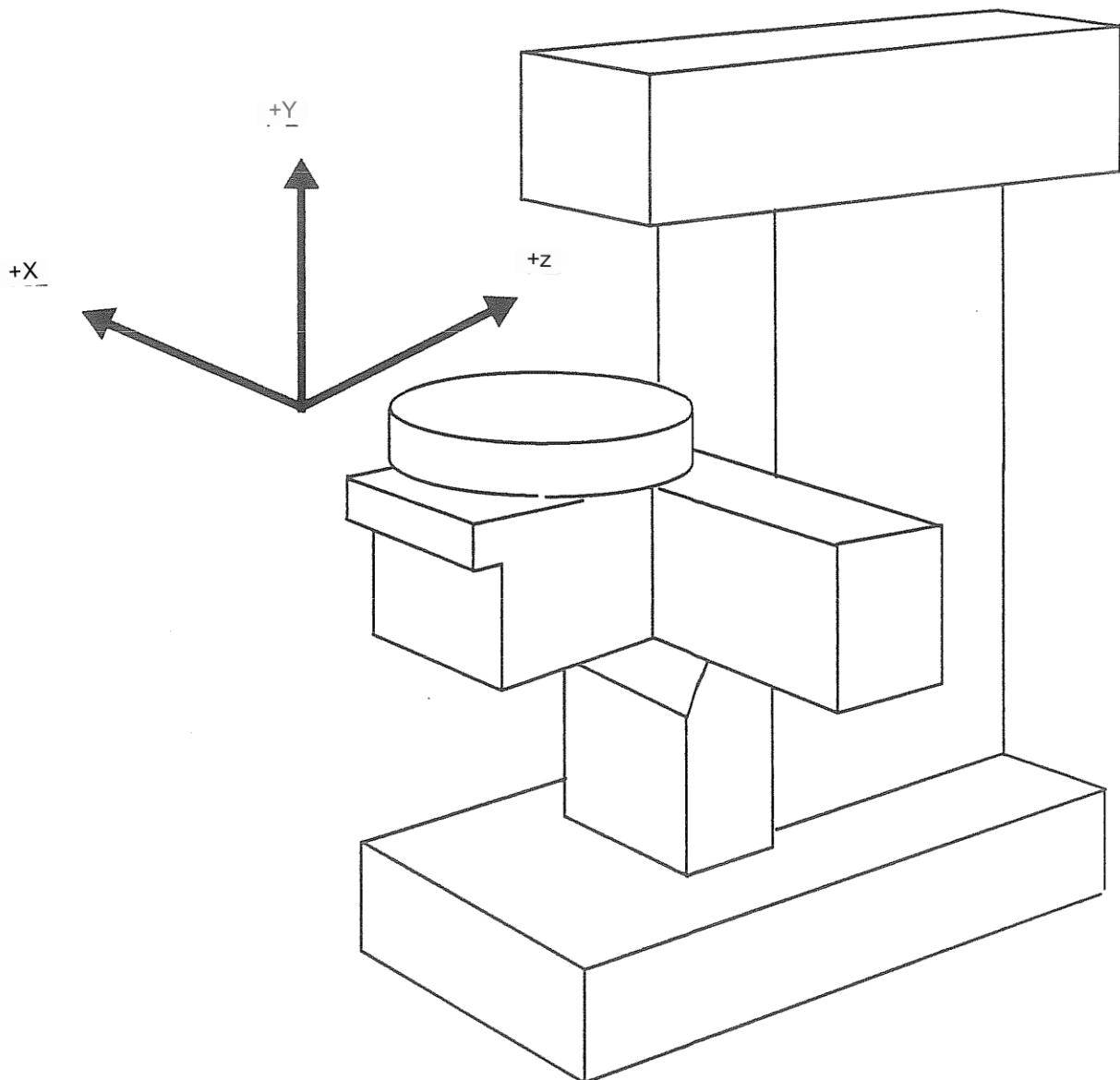
**A NOTICE:** For a description of the controls for the horizontal work spindle and the vertical milling head, see Section 3 of the operator's manual.

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### THE DIRECTIONS OF MOVEMENT

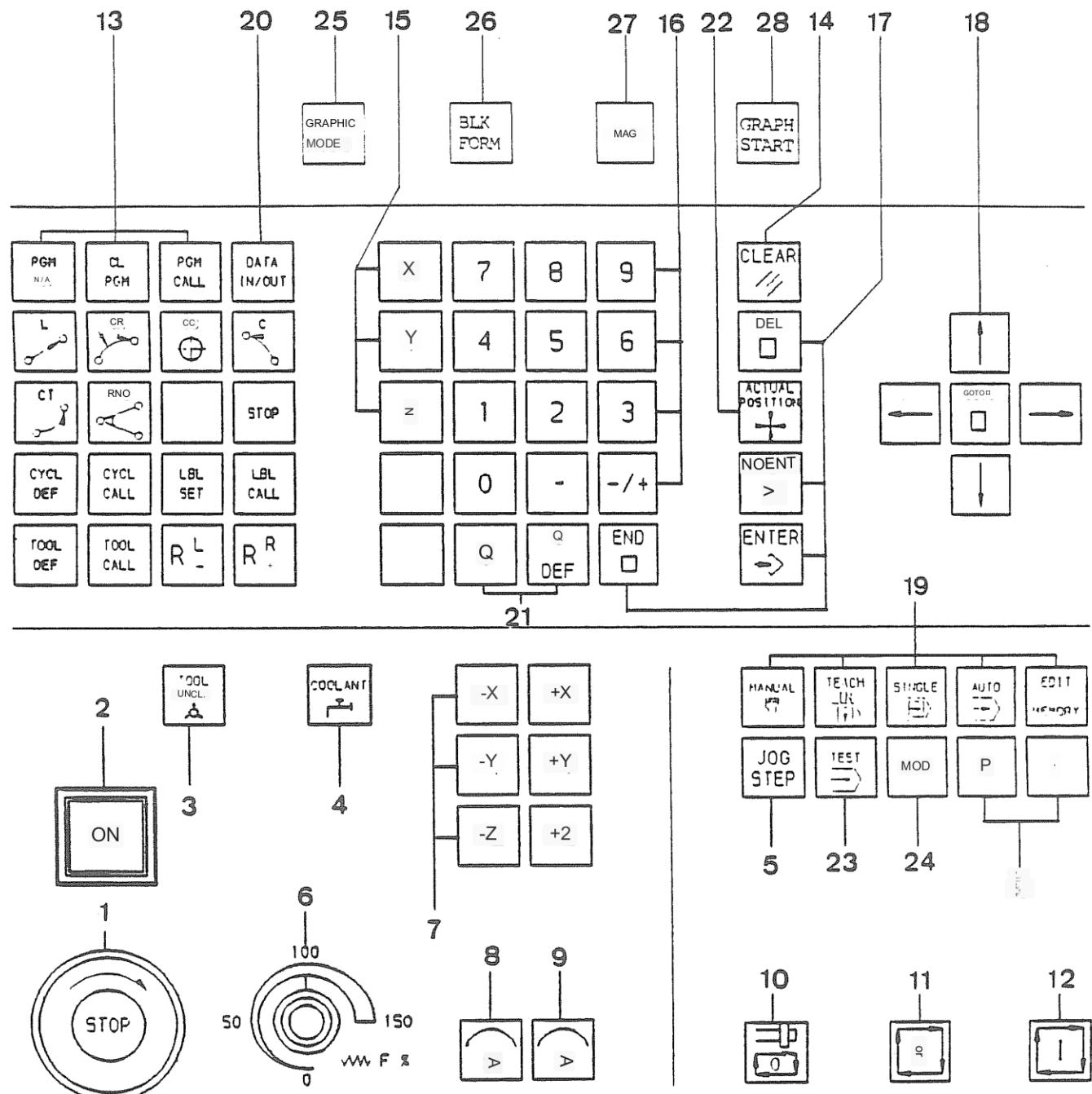
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The coordinate system of the machine is designed in accordance with DIN 66 217, i.e. the designations: "front, rear, left, right, top and bottom" can be seen in the direction of view from the headstock to the workpiece.



## COMMAND STATION (machine)

## controls



## Function of the controls

No.	controls	function
1	Mushroom button -S1-	EMERGENCY STOP SWITCH All of the machine's motors are immediately shut down.
2	Illuminated pushbutton -3SH1-	Machine on.
3	push button	RELEASE/CLAMP tool.
4	push button	Cooling lubricant pump ON/OFF.
5	push button	increment procedure.
6	Potentiometer	Correction of the programmed feed (0-150%).
7	push buttons	Manual movement of the axes in jog mode.
8	push button	Work spindle anti-clockwise rotation ON.
9	push button	Work spindle clockwise rotation ON.
10	push button	Feed work spindle STOP.
11	push button	Feed STOP.
12	push button	Feed (program) START.
13	push buttons	programming commands.
14	push buttons	axis keys.
15	push buttons	numeric keypad.
16	push button	Delete the last entry.
17	push buttons	programming/editing.
18	push buttons	Cursor Control Search.
19	push buttons	operating modes.
20	push button	data transmission.
21	push buttons	parameter programming.
22	push buttons	playback programming.

No.	controls	function
23	push button	test mode.
24	pushbutton menu	User parameters, key numbers.
25	push button	graphics modes.
26	push button	Definition of the blank or reset.
27	push button	magnifying glass
28	push button	Graphics ON.

---

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**OPERATION OF THE MACHINE**

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## FUNCTIONAL TEST / TEST RUN

### Control CNC 232:

**DANGER!** When starting up the machine for the first time, this work may only be carried out by a MAHO specialist personnel are carried out.

After the machine has been set up and connected to the electrical network, a functional test of the machine must be carried out.

Machine-related manual operations are listed in this section. The operation of the control is only partially explained. Detailed information can be found in the CNC 232 operating manual.

#### turning on the machine

- Switch on the main switch on the control cabinet and wait until the MEMORY TEST for identifying hardware errors has expired on the screen. If this function test does not result in an error, the message POWER INTERRUPTION appears on the screen.
- Unlock the EMERGENCY STOP button by turning it.
- Press the CLEAR button (14).
- The error message POWER INTERRUPT disappears from the screen, new message "NO CONTROL VOLTAGE FOR RELAY".
- Press the illuminated pushbutton (2). Indicator lamp -3H1- must light up, the display shows: OPERATE LUBRICATION PUMP DAILY.
- Approach the reference points of the individual axes in accordance with the CNC 232 operating manual. Once the reference point has been reached, the request to approach the reference point of the corresponding axis disappears from the screen.

#### A NOTICE:

The axis display does not flash! A static request to start the reference point displayed on the screen.

- The machine is now ready for operation.

#### Start work spindle

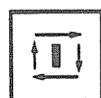
- Press the MANUAL button.
- Switch on the desired direction of rotation by pressing the buttons (8 or 9). The direction of rotation can also be entered via "M03" from the MANUAL or TEACH IN operating mode.

#### A NOTICE:

The work spindle only turns after entering the direction of rotation "M03" = clockwise rotation, "M04" = counterclockwise rotation of the work spindle.

- Enter the direction of rotation under address "M" according to the CNC 232 operating manual using the STOP button.

- START-Taste



press.

A NOTICE:

The work spindle rotates according to the direction of rotation entered. If one of the control commands is not executed correctly, MAHO's service department must be informed.

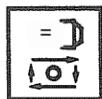
- Press button (10) to stop the working spindle.

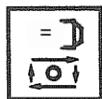
Feed movement in jog mode

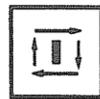
- Press the MANUAL button.
- Start the "-" or "+" direction of an axis by pressing the button (7).

**DANGER!** It can only be traversed in 1 axis at a time!

Shut down the work spindle with the function key



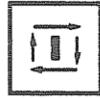
- Taste  Press (work spindle stops immediately). If you then press the button, the work spindle starts up again. This procedure is only possible in the operating modes TEACH IN and SINGLE AUTO.



pressed,

Shut down the work spindle via control command "M5"

- Enter the stop command "M5" according to the CNC 232 operating manual. The working spindle stops with the key.



press,

Turn off the system

The entire system is switched off with the main switch on the machine's control cabinet.

Switch off via EMERGENCY STOP button

The machine can be shut down in any operating state by pressing an EMERGENCY STOP button.

Unlock the EMERGENCY STOP button

**DANGER!** The fault that has occurred must be remedied before unlocking.

- Unlock the relevant EMERGENCY STOP button by turning it.
- Switch the machine on again.

EMERGENCY STOP limitation of the machine slides

If the software limitation fails, a mechanical switch with two cams takes over the EMERGENCY STOP function. The respective slide is braked and an alarm is displayed on the screen.

## ADJUSTING THE WORK SPINDLE SPEED

The work spindle speed can be infinitely adjusted within two ranges via a variator. This infinitely variable control is carried out using the ratchet wheel (7) while the work spindle

is running! The ranges are preselected by turning the switch button (8) with the work spindle stopped!

To do this, the work spindle must be turned slightly to facilitate the engagement of the spur gears.

- Prepare the machine for operation according to the description on Sheet 3.01-1.

- Indicator light  dostonation see shines. Arrangement and function of the controls on the command sheet 2.04-1.

- With the work spindle stopped, set the required speed range using the switch button (8) on the headstock.

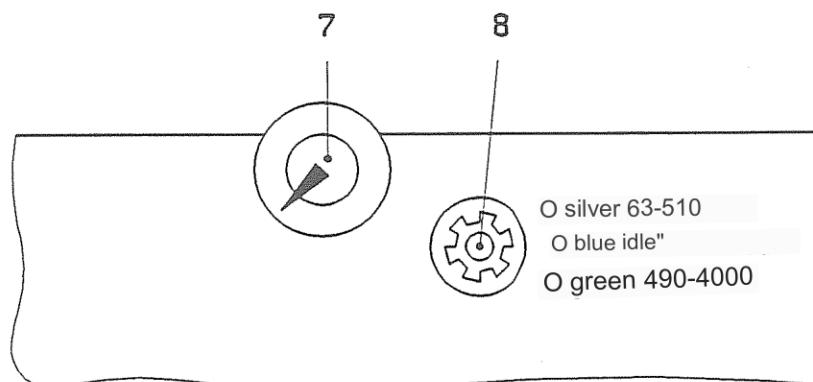
- Switch on the work spindle by pressing the  button. on the  or control panel of the CNC 232

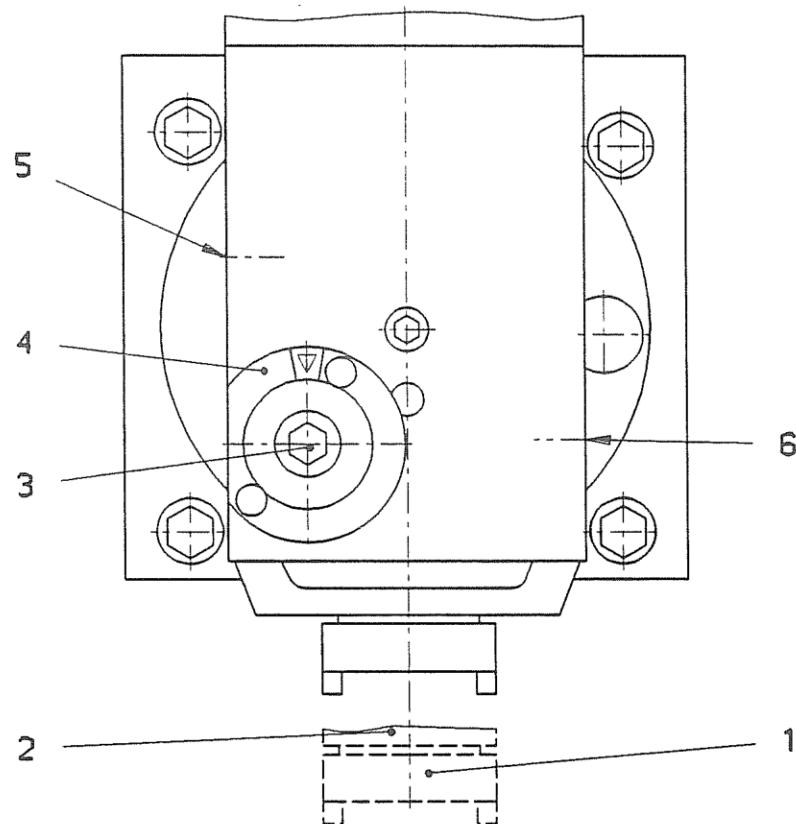
- With the work spindle running, set the required speed using the grip wheel (7) on the headstock.  
If

**A NOTICE:** the speed range has to be changed, the work spindle must first be shut down.

Zen

In the operating modes TEACH IN, SINGLE and AUTO, the speed that was switched must also be programmed.



MILLING HEAD

1 vertical work spindle

2 quill (maximum stroke = 50 mm).

3 Pinion shaft with hexagon socket for adjusting the quill.

4 scale ring for reading the quill adjustment (1 division line = 1 mm).

5 Locking screw to fix the quill.

6 clamping screw for clamping the quill - Allen key: 8 mm SW.

**A NOTICE:** The spindle bearing of the work spindle has lifetime lubrication and is therefore maintenance-free.

In addition to normal clamping, the quill can also be fixed. This is done using a toothed clamping block, which is pressed into the toothed rack of the quill (2) by turning the blocking screw (5) to the right.

**DANGER!** Only possible in the range 0-18.5 mm stroke, in intervals of 3.125 mm.

---

Conversion from horizontal to vertical processing

- Jog headstock to "ZO", table down to "Y350" and horizontal to "X300".
- Set the working spindle idling "SO".
- Remove the tool from the horizontal work spindle. Remove
- the protective cap (1.1) from the coupling part (1).
- Turn the coupling parts (1 and 2) so that the markings are aligned one above the other.
- Press the milling head intermediate flange (6) onto the centering bolts (3) and screw to the headstock using hexagon screws (4).

Pivoting the milling head

- Loosen the hexagon head screws (5) on the intermediate flange (6).
- Bring the milling head into the required angular position according to the scale (7).
- Tighten hexagon head screws (5).

Conversion of horizontal work

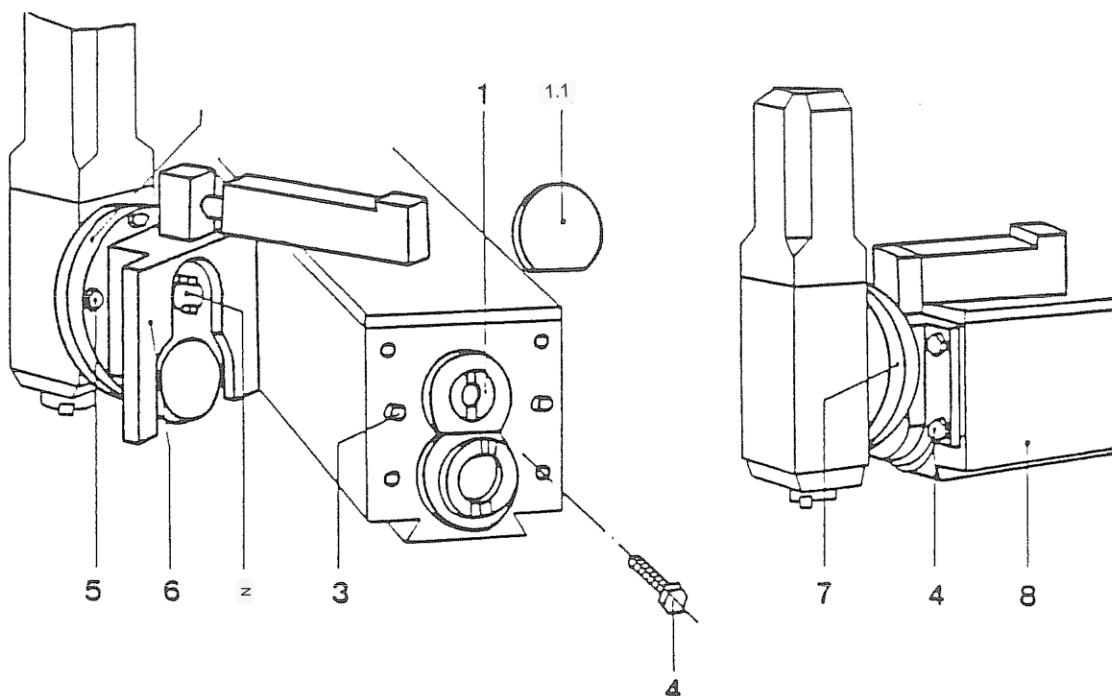
Proceed in reverse order.

- Press the milling head off the headstock (8).
- Swivel the milling head sideways into its rear rest position.

Align the milling head to 0° (see figure on sheet 3.07-1).

- Shut down the machine.
- Turn switch (8) to "idle position" (see sheet 3.03-1).
- Place the test mandrel (200 mm long, only with a rigid table) in the work spindle.
- When using the 320 mm long test mandrel, the universal table must be moved to its left or right end position for reasons of space and then the table top rotated by 90°.
- Loosen the hexagon head screws (5) on the intermediate flange (6) and swivel the milling head to the 0° angular position. Only tighten the hexagon screws lightly.
- Attach the fine probe to the work table using a magnet holder and position it on the circumference of the test mandrel.
- Turn the mandrel to the middle position of the concentricity error.

- Adjust the cross support in the vertical axis (Y-axis). Observe the deflection of the fine feeler. Correct deviations from the exact vertical position ( $0^\circ$  position) by lightly tapping the milling head with a rubber mallet.
- The milling head is aligned when the error measured on the adjustment path in the Y-axis is less than 0.01 mm.
- Tighten hexagon head screws (5). Repeat measurements to check.



**AUTOMATIC TOOL CLAMPING**

Automatic tool clamping is built into both work spindles of the machine.

The tool is permanently clamped in the work spindle by spring assemblies and released hydraulically.

A collet is used to hold the tool in the work spindle, which engages in a headed bolt that is screwed into the tool shank.

**Tool clamping force ISO40**

ISO type B chucking spigot .....	CN	9.5
MAHO/OTT clamping groove .....	CN	11
Time for loosening / clamping .....	s	3

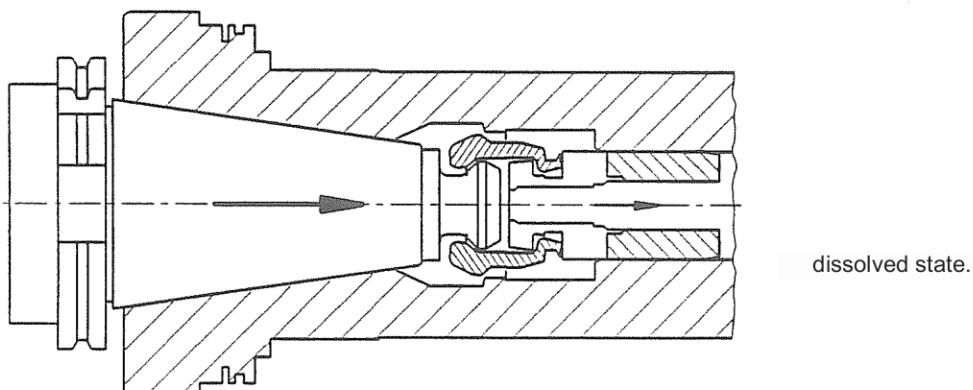
**tool change**

- Stop the work spindle by pressing the button on the command station.
- Press and hold the TOOL UNCL button for the duration of the tool change.
- Remove the old tool from the work spindle.

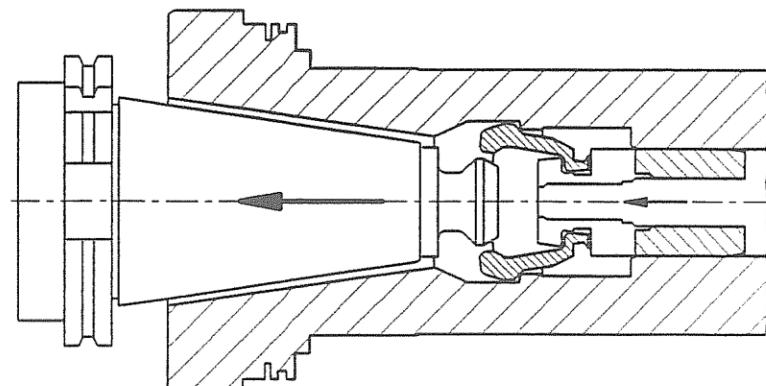


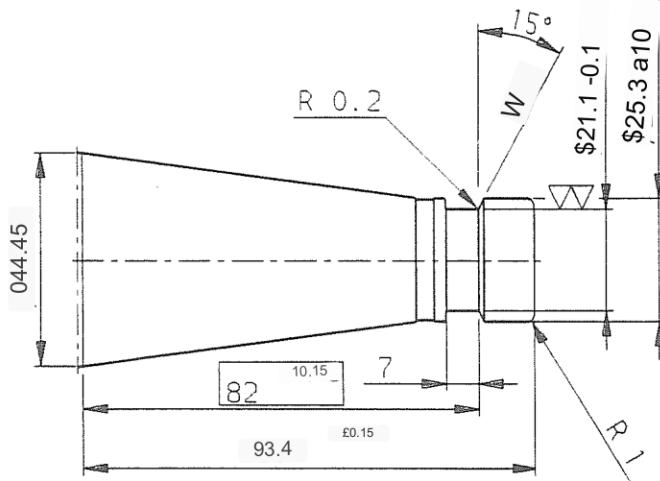
Spindle/feed stop button on control panel

**DANGER!** The tool must be pushed in until the clamping process is complete, as otherwise the collet could be damaged.

**tense state.**

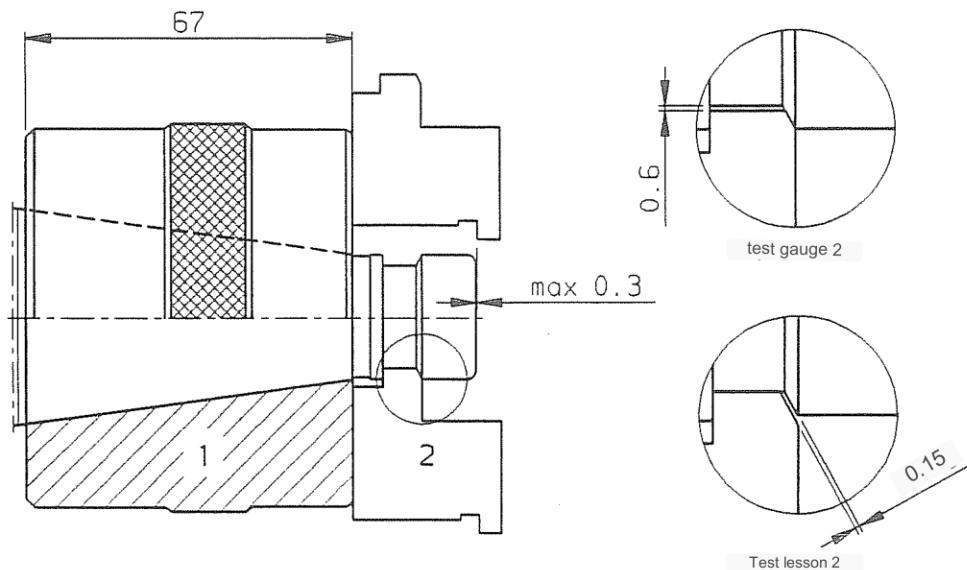
dissolved state.



**TOOL STATION / TOOLS****Reworking the shank of standard MAHO/OTT tools, ISO 40****Attaching the annular groove to the shank of a standard tool:****Checking the ring groove using a MAHO measuring device:**

- 1 Test gauge locating
- 2 socket

See also sheet 3.12-1 "AUTOMATIC TOOL CLAMPING".

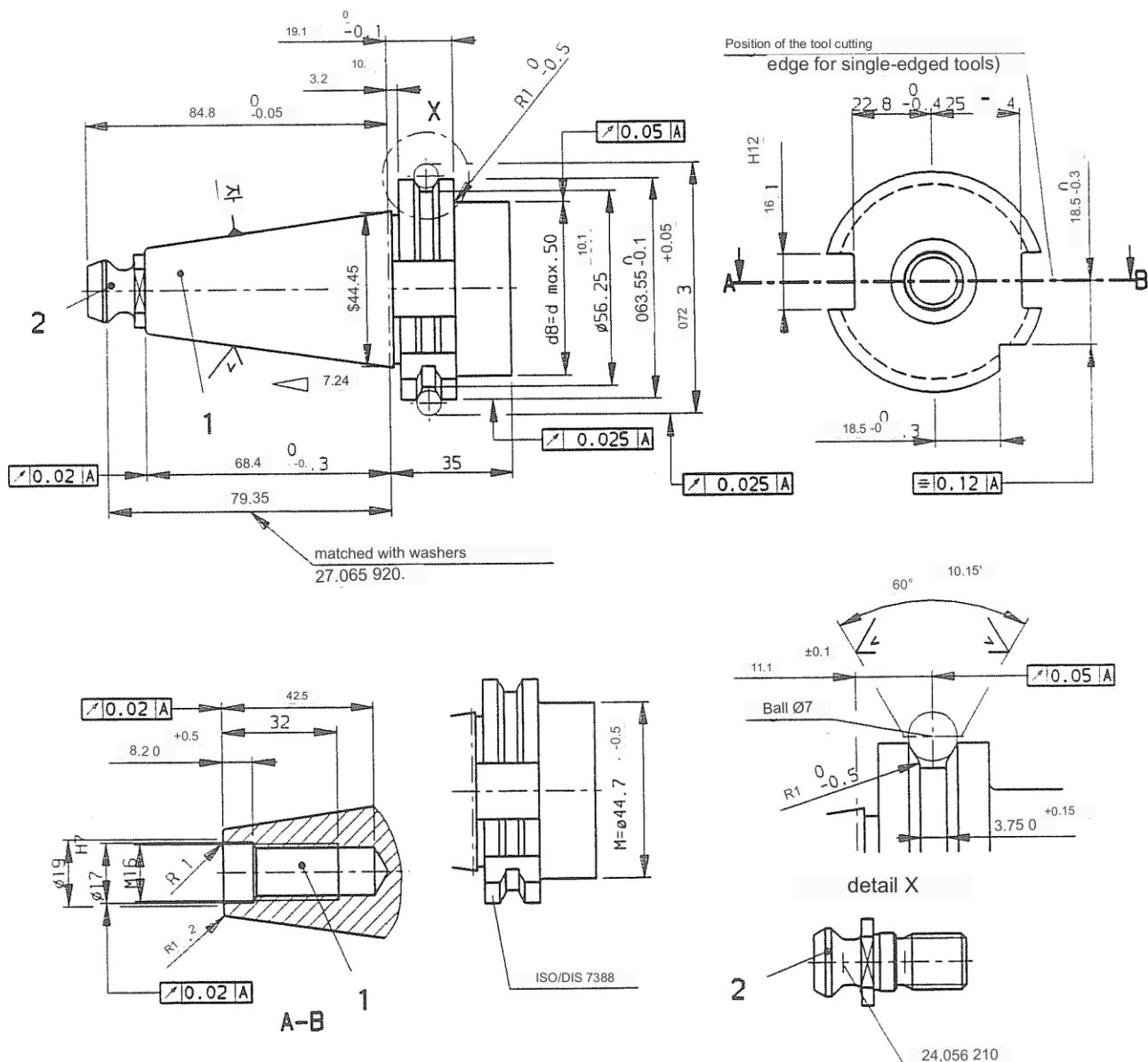


## Tool shank dimensions with ISO type B pull studs

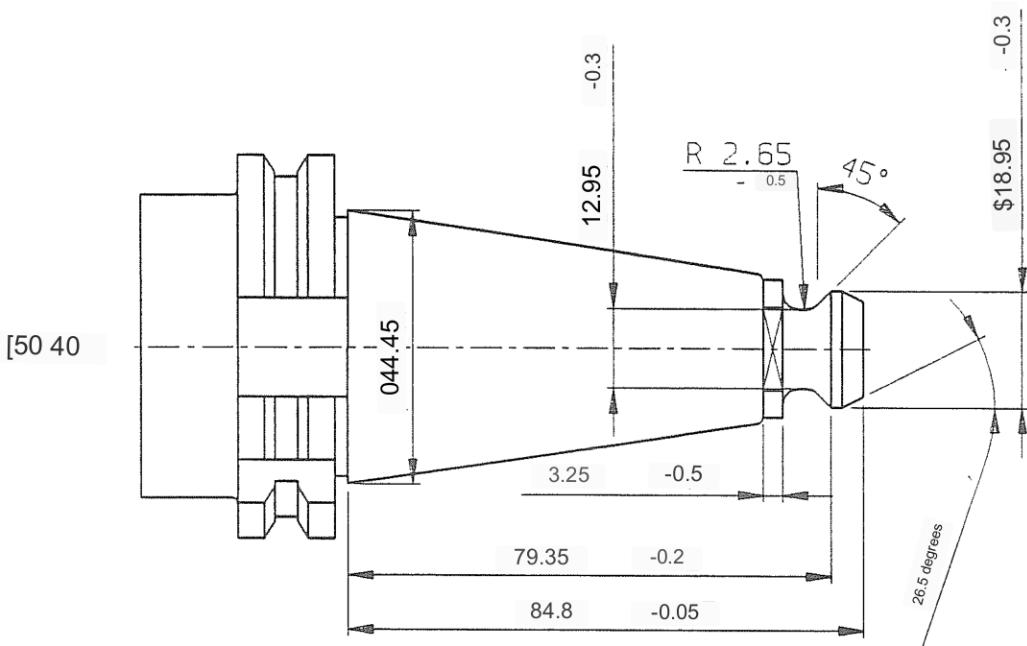
**A NOTICE:** On machines with a tool changer, tools with a steep taper (AT 4) must be used, see DIN 69871.

Steep taper DIN 69871 Part 1 and ISO/DIS 7388 differ in the dimension  $d_8 = 50$  mm or  $M = 44.7$  mm.

With MAHO machines, tools according to ISO/DIS 7388 with pull studs ISO type B be used.



## Tool shank dimensions with pull stud ISO 7388 type B, ISO 40



Before inserting a tool in the work spindle or magazine, check the setting of the pull stud as follows:

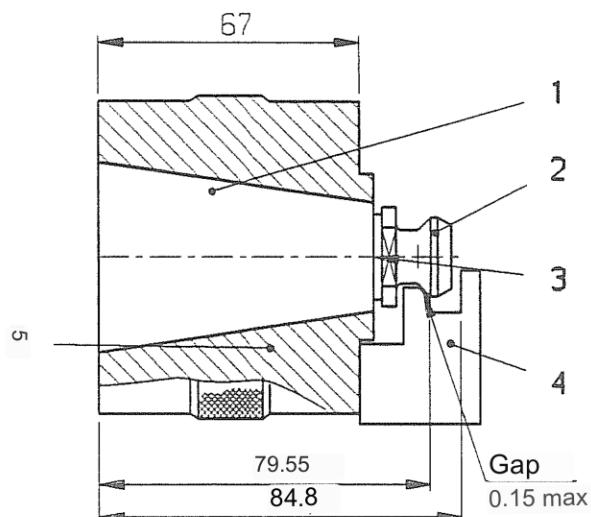
1 clamping cone

2 tightening bolts

3 shim

4 MAHO-Prüflehre

5 test block

A NOTICE:

Test gauge see in the MAHO accessories and shims in the MAHO tool catalog

log.

- Insert the clamping cone of the tool (1) into the test block (5) and check the ring groove of the tightening bolt (2) with the MAHO test gauge (4).
- There may be a maximum clearance of 0.15 mm between the test gauge and the tightening bolt. If necessary, shims (3) (27.065920) should be used between the clamping cone and the tightening bolt.

---

MANUAL ADJUSTMENT OF THE MACHINE CARRIAGE

---

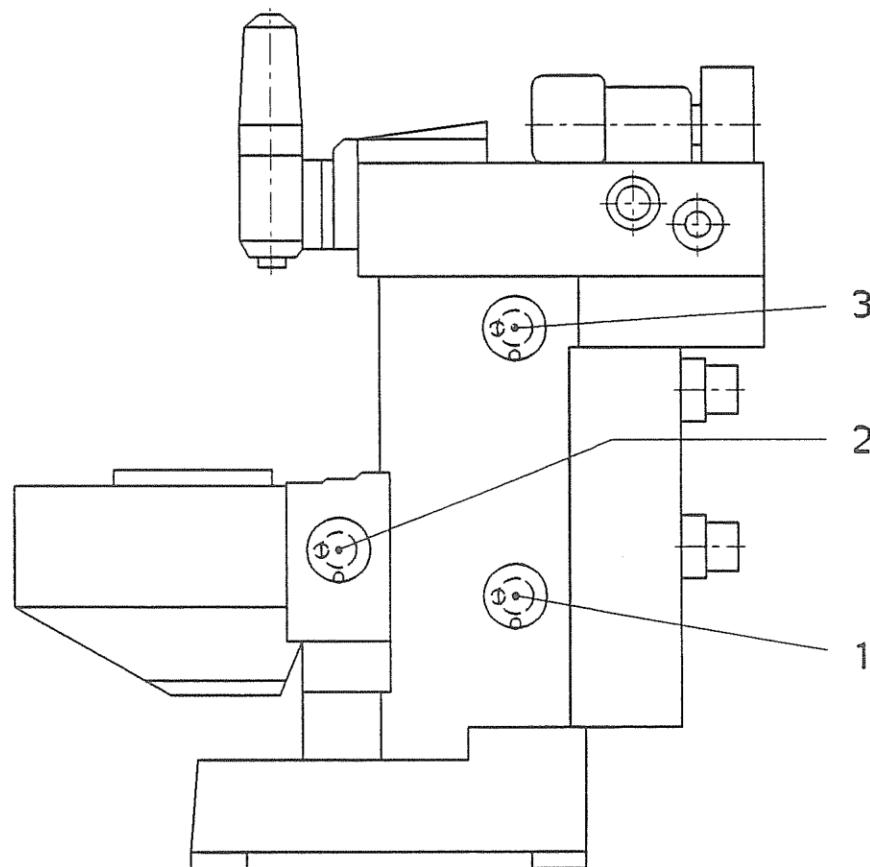
X axis: Pull out the safety handwheel (2) and manually move the vertical clamping table to the left or to the right in the horizontal longitudinal axis. a)

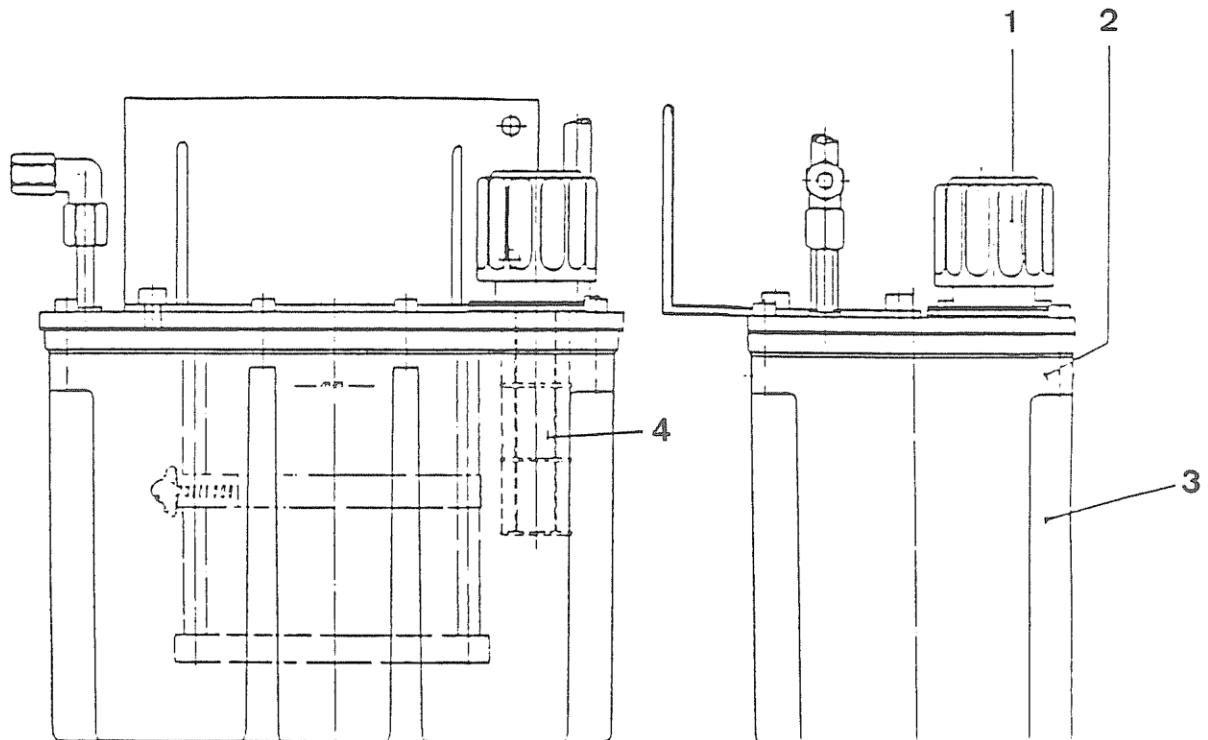
Y axis: Pull out the safety hand wheel (1) and manually move the cross support up or down in the vertical axis. a)

Z axis: Pull out the safety handwheel (3) and manually move the headstock forwards or backwards in the horizontal transverse axis. a)

a) In the X and Z axes: 1 revolution = 5 mm, 1 division 0.02 mm.

b) In the Y axis: 1 revolution = 1 mm, 1 graduation 0.02 mm.



HYDRAULICS

1 filler neck a)

2 Hydraulikaggregat

3 Transparent container.

4 oil strainer

**DANGER!** When topping up with oils, care must be taken to ensure maximum cleanliness. An oil strainer must be used!

Mode of operation (hydraulic diagram see sheet 9.02-1)

When the TOOL UNCL button is pressed on the control panel of the command station, the pump of the hydraulic unit starts up and in a few seconds builds up the operating pressure of approx. 115 bar required to release the tool clamp. b)

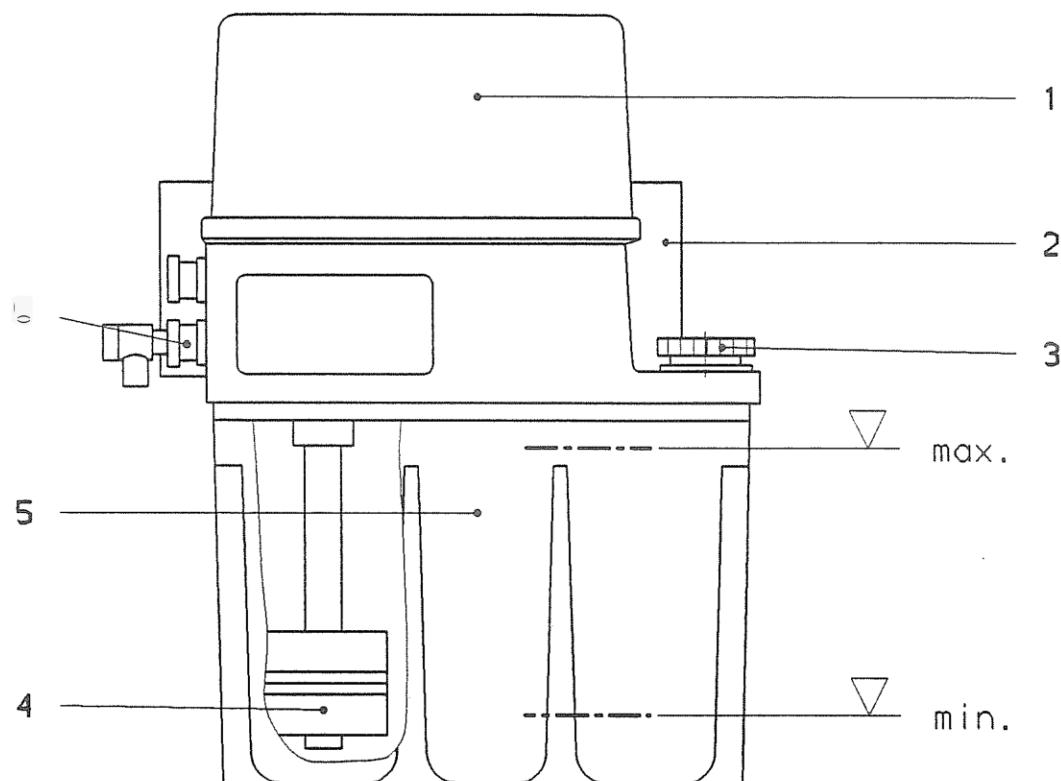
a) See sheet 7.06-1 "LUBRICATION RECOMMENDATIONS".

b) See also Sheet 3.12-1 "AUTOMATIC TOOL CLAMPING".

---

AUTOMATIC CENTRAL LUBRICATION

---



1 central lubrication unit

2 mounting plate

3 Oil filler opening with built-in strainer

4 float switches

5 Transparent container.

6 Pressure connection R 1/4".

**DANGER!** The set interval should not be changed!

A fault message is issued if the pressure does not build up 60 seconds after the pump start-up time.

## mode of action:

The movement-dependent automatic central lubrication ensures an even supply of oil to all sliding surfaces and moving elements of the machine.

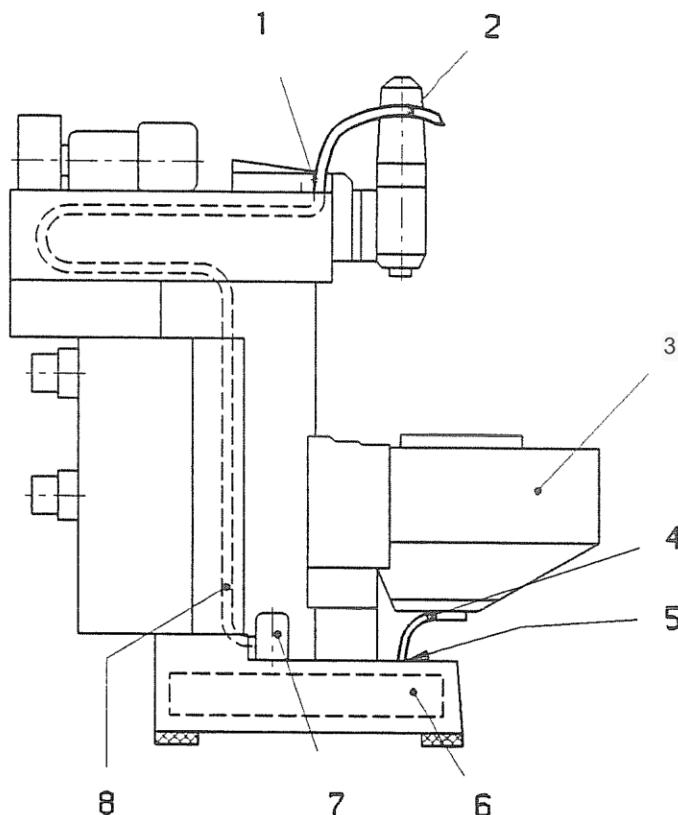
The pump of the central lubrication unit (1) starts up with a lubricating pulse and feeds oil into the line system until the pressure required for the oil supply has built up. After reaching this pressure, an oil pressure monitor switches the pump off again.

## Lubrication pulses are triggered:

1. With every engine start, when the illuminated pushbutton -3SH1- on the command station is pressed. Arrangement and function of the controls on the command station, see Sheet 2.04-1.
2. With the machine started and without any axis movement, after every 8 hours.
3. If the movement of one or more axes, with or without interruption, lasts longer than 16 min. lasts.
4. If an axis movement starts and the last lubrication pulse was more than 32 minutes ago. If the lubrication fails, the oil pressure monitor switches off the work spindle and pre-thrust drive. The screen shows: "INTERVENTION".

After restarting, the error display "I 35" appears (spindle and feed stop). In the fault the error is displayed.

- See chapter 10 for restarting.

COOLANT LUBRICATION DEVICE

1 tap for adjusting the coolant supply.

2 adjustable nozzles for supplying cooling lubricant to the tool. a)

3 chip tray.

4 return line.

5 Removable cover plate.

6<sup>67</sup> cooling lubricant containers (capacity approx. 351) b)

7 Cooling lubricant pump

c) 8 Connection line between pump and headstock

A NOTICE:

a) Cooling lubricant see Sheet 7.07-1.

b) To avoid foaming, the cooling lubricant tank should be kept as full as possible.

c) The cooling lubricant pump is switched on and off with the "COOLANT" button on the control panel of the CNC 232.

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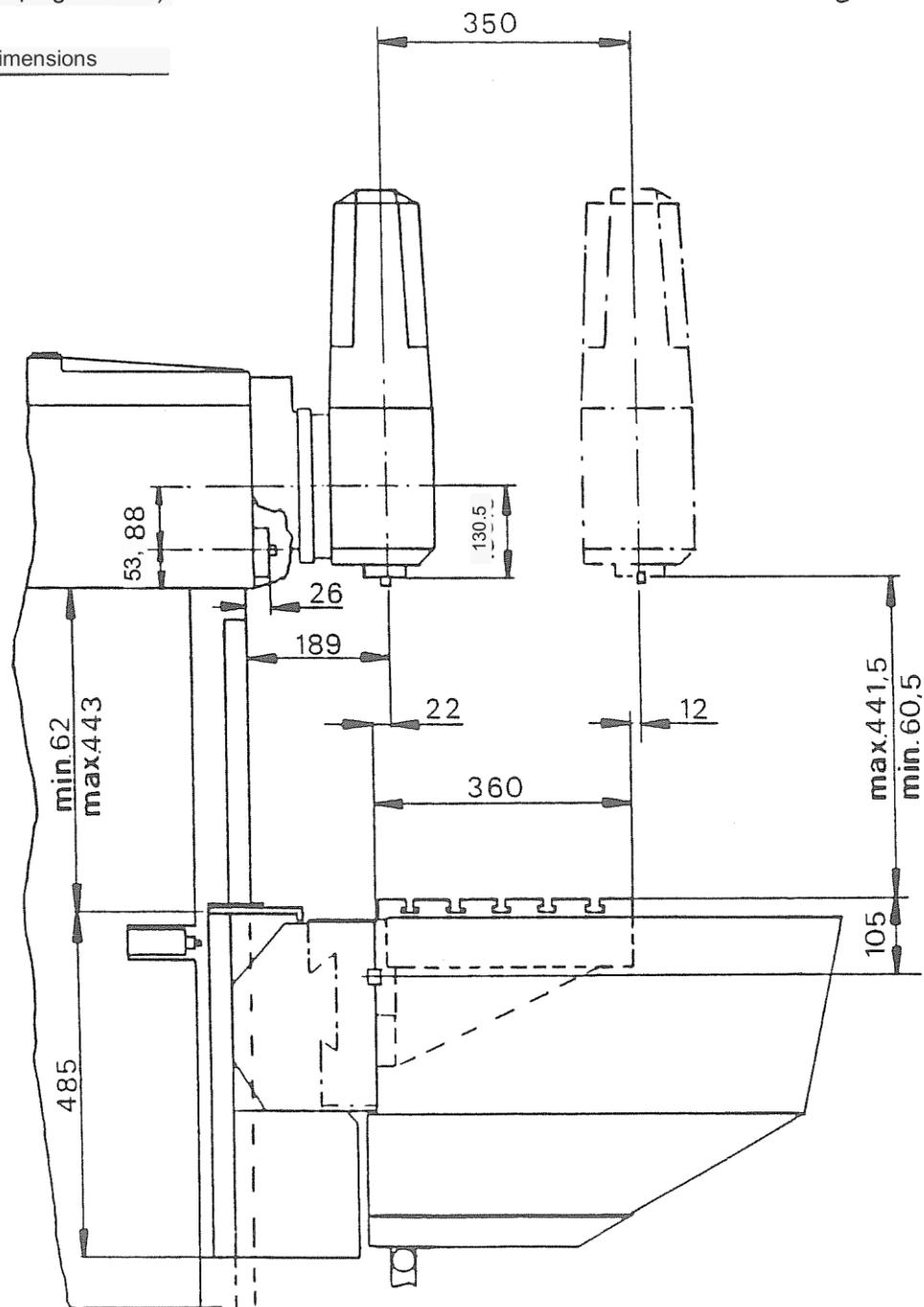
Sheet

## WORK TABLES

Rigid angle table.	.....	4.01-1
universal table	.....	4.02-1
Data	.....	4.02-2
		to 4.02-4
- Working space dimensions	.....	4.02-5

RIGID ANGLE TABLETechnical data 81.178 991

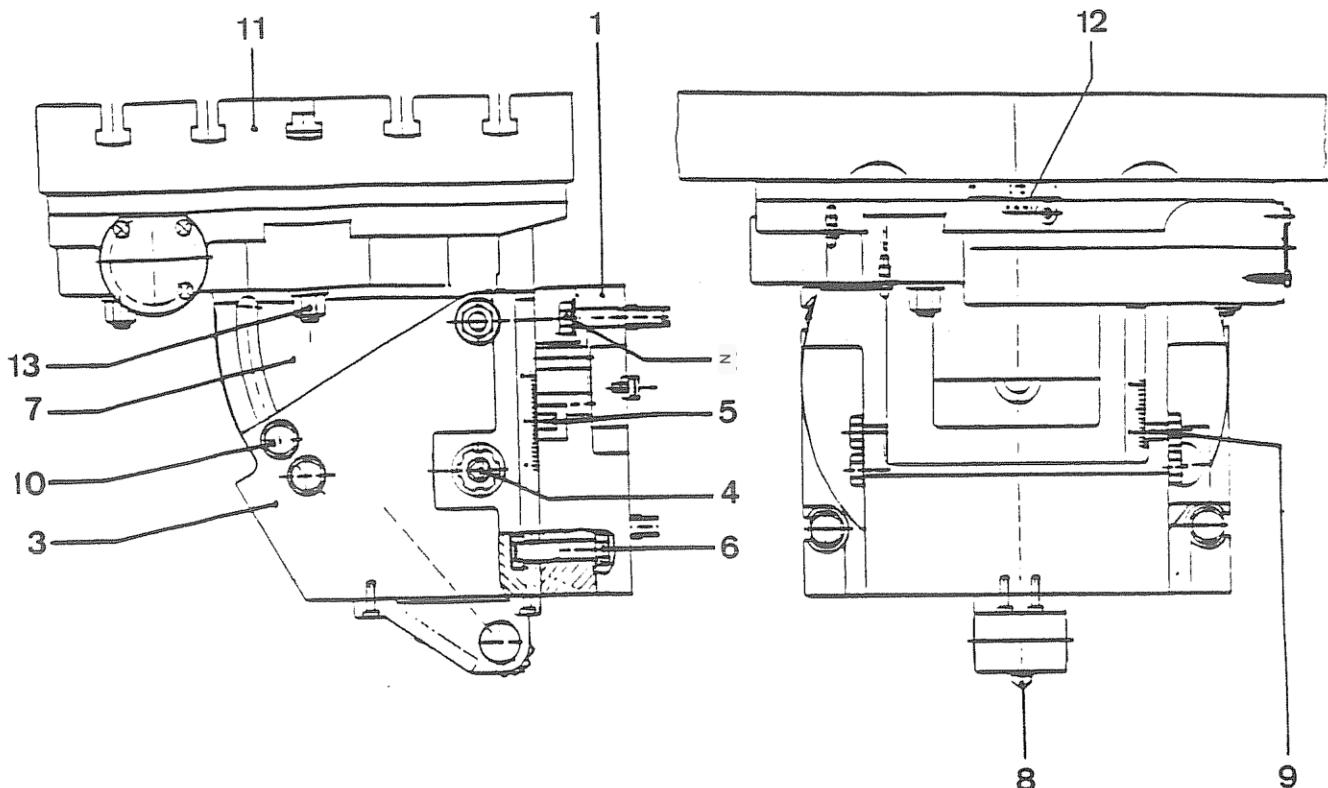
clamping surface .....	mm	800 x 360
Number of T-slots .....	.14H7	5
Spacing of the T-slots .....	mm	63
weight .....	...approx. kg	150
Maximum table load (weight of workpiece and clamping devices) .....	ca. kg	250

workspace dimensions

**UNIVERSAL TABLE****Technical data 81.176 301 - 2**

Clamping surface.....	mm	650 x 350
Center hole..	mm	30H7
Number of T-slots .....	14H7	5
Spacing of the T-slots .....	mm	63
Pivoting around the table transverse axis .....	°	+30
Pivoting around the longitudinal axis of the table .....	°	±30
Rotatability of the table top .....	°	±360
Weight .....	approx.kg	120
Maximum table load (weight of workpiece and clamping device) .....	approx.kg	150

■ The table top is clamped mechanically.



1 clamping plate

2 hexagonal screws and slot nuts for attachment to the machine's vertical clamping table.

3 console

4 spindles for swiveling the console around the table's transverse axis.

5 Console angle adjustment scale (1 division = 20').

6 clamping screws for clamping the console on the clamping plate.

7 swivel part

8 Spindle for swiveling the swiveling part around the longitudinal axis of the table.

9 Scale for the angle setting of the swiveling part (1 division line = 1°).

10 clamping screws for clamping the swivel part in the console.

11 Table top can be rotated 360°.

12 Scale for setting the angle of rotation of the tabletop (1 division = 20').

13 hex nuts for clamping the table top on the swivel part

Working with the universal table

**DANGER!** Before each swiveling of the table around its horizontal transverse axis, all clamping screws (6) are loosened.

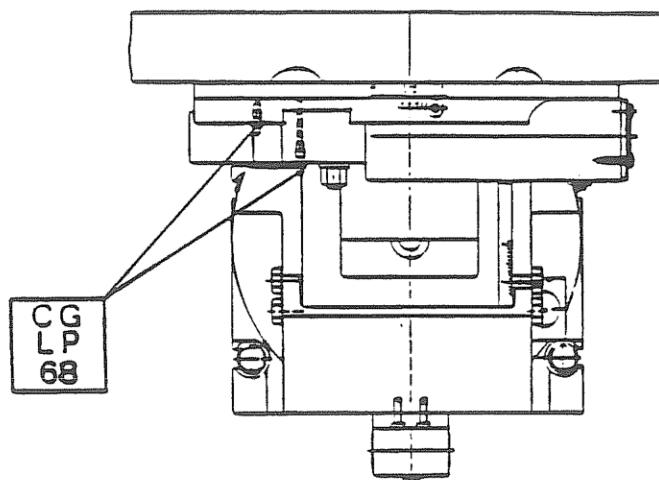
Before swiveling the table around its horizontal longitudinal axis, all clamping screws (10) on both sides of the console must be loosened.

Shut down the work spindle before each indexing process.

After each dividing process, the table top (11) must be secured again with hexagon nuts (13).  
become stuck.

Lubrication/Maintenance

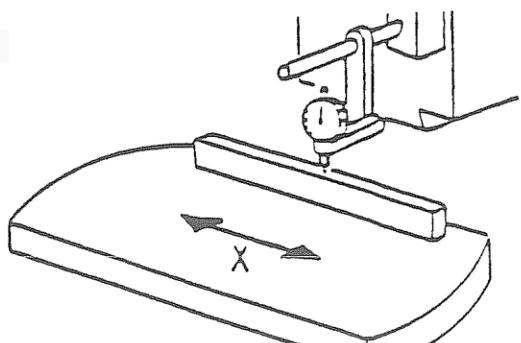
The 2 lubricating nipples must be lubricated with slideway oil ("CGLP 68") after every 200 operating hours.



Aligning the table in the horizontal plane (item no. according to figure on sheet 4.02-2).

Long axis X

- Set the universal table to "0" according to the scales (5, 9 and 12).
- Clamp table top (11) with screws (13).
- Clamp swivel part (7) with screws (10).
- Tighten the clamping screws (6) only slightly.
- Attach the fine feeler to the headstock using a magnet holder.
- Place the ruler on the table surface and turn on the fine feeler.

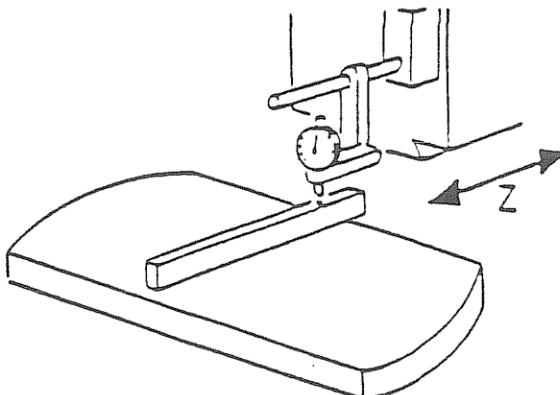


Aligning the table in the horizontal plane Move

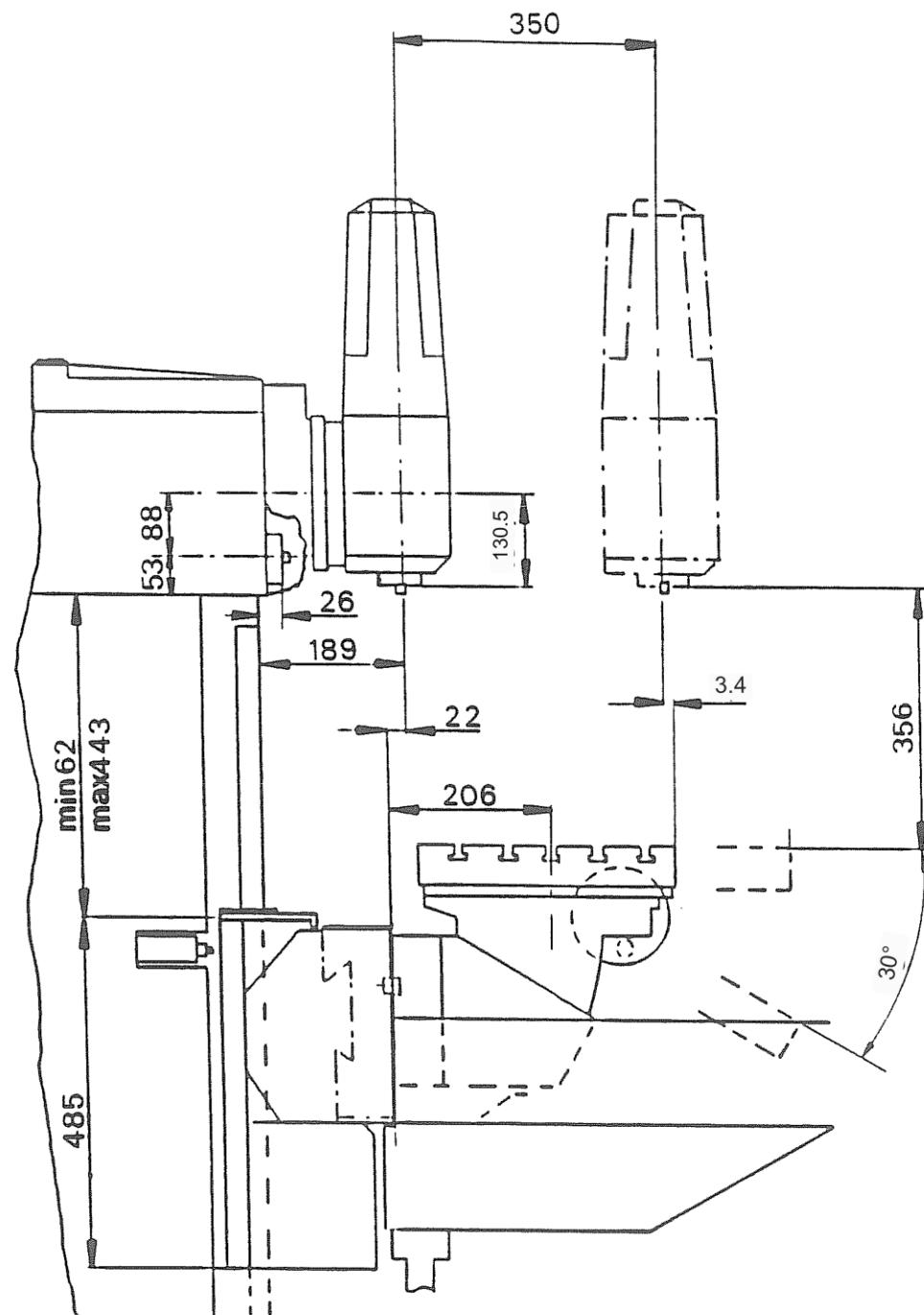
- the table in the horizontal longitudinal axis (X-axis) to both end positions, thereby deflecting the Watch fine feelers.
- Deviations from the exact horizontal position can be determined by tapping lightly with a rubber mallet. correct the table surface.
- The table is aligned when the measured error on the total travel in the X-axis is less than 0.01 mm.
- Tighten the clamping screws (6). Repeat measurements to check.

Querachse Z

- Slightly loosen the clamping screws (10).
- Place the ruler on the table surface and turn on the fine feeler.



- Adjust the headstock (Z-axis in both end positions, while observing the deflection of the fine feeler.
- Observe deviations of the fine feeler. Correct deviations from the exact horizontal position by lightly tapping the table surface with a rubber mallet.
- The table is aligned when the measured error on the total travel in the Z-axis is less than 0.01 mm.
- Tighten the clamping screws (10). Repeat measurements to check.

workspace dimensions

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Sheet

## CNC CONTROL

Linear-Wegmeßsysteme .....	5.01-1
CNC 232 operating manual .....	76.000631

A NOTICE:

The data of the machine constants that are binding for the machine are strips and plain text included. Machine constants and error lists are located in the electrical circuit diagrams in the control cabinet.

## LINEAR-WEGMESSYSTEM

The machine is equipped with 3 digital incremental linear measuring systems for precise positioning in the X, Y and Z axes.

The resolution of these measuring systems, i.e. the smallest absolute distance unit that can still be recorded, is 0.001 mm.

The linear measuring systems are fully encapsulated and arranged directly on the linear guides of the machine slides. This ensures that the measured values are between the actual positions Tool and workpiece correspond.

The machine's linear displacement encoders do not require maintenance.

### Mode of operation of the linear measuring systems:

A precision glass scale, which serves as a measuring standard, moves when the machine slide is moved relative to a photoelectric scanning head with a light source located opposite. Periodic light fluctuations occur at this scanning head, which are converted into sinusoidal signals by silicon photo elements.

The sinusoidal signals are formed into square-wave pulses and electronically evaluated in such a way that machine displacement by 0.005 mm, i.e. by 1 increment of the linear measuring system, each 1 forward Counting pulse or 1 down counting pulse is generated. Correct counting of these by means of a forward sign Impulses, starting from any definable reference point, the respective traverse path is determined.

In addition, the precision glass scale has a reference mark that serves as the absolute reference point for the linear displacement encoder. For a detailed description, see the separate operating instructions for the digital display (Heidenhain).

### The measured value displays:

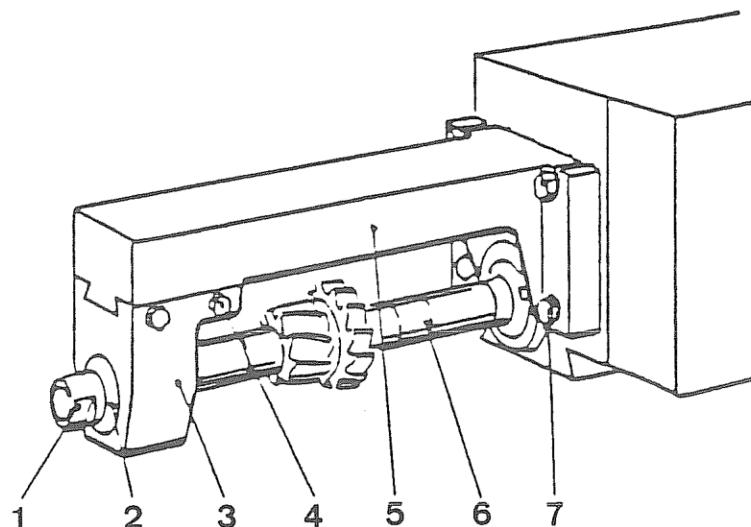
The measured value displays are electronic counters with 8 decades on the screen on the control panel.

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## ACCESSORIES / EXPANSION LEVEL

counter holder .....	6.00-1
angle milling head .....	6.01-1
	6.01-2

COUNTERHOLDER

- Remove the tool from the vertical work spindle (see sheet 3.08-3).
- Bring the milling head from the working position to the rest position (see sheet 3.07-3).
- Fasten the counterholder (5) to the headstock with hexagonal screws (7). Insert
- the milling cutter arbor (6), equipped with the milling cutter and rings, into the horizontal work spindle and to.

A NOTICE: Do not attach the guide bush (2) yet!

- Slide the milling arbor counter bearing (3) into the dovetail guide of the counter holder (5).
- Insert the guide bushing (2) into the cutter arbor counter bearing (3) and push onto the cutter arbor (6).
- Screw on and tighten the clamping nut (1).
- Clamp the cutter arbor counter bearing (3) with screws (4).

The counterholder is dismantled in reverse order.

Max. cutter arbor length .....	mm	315
Max. clampable cutter diameter .....	mm	200

ANGLE MILLING HEADApplication

The angle milling head is used in conjunction with the milling head for milling and drilling work on work pieces that are difficult to access.

Technical specifications

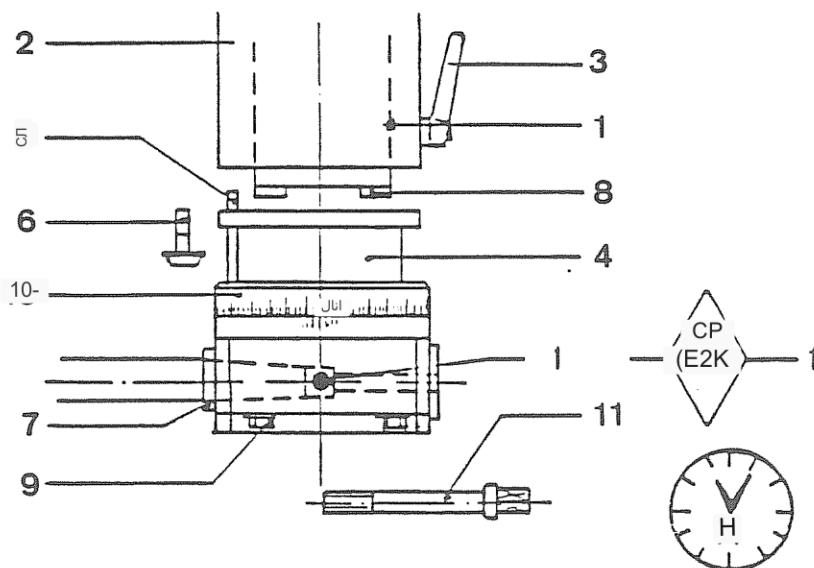
Order no.	Milling spindle interior shot	Milling spindle exterior shot
C 03.01	MK 1	----

## Pivotability of the angle milling head

around its vertical axis ..... ° 360

Smallest disc milling cutter that can be used  
diameter ..... mm 80

DANGER! When using the angle milling head, the maximum permissible speed is limited to 2000 rpm.



cultivation

- Extend the quill (1) of the milling head (2) approx. 7 mm and lightly clamp with the clamping lever (3).
- Align the angle milling head (4) with the dowel pin (5) on the milling head and screw tight with hexagon screws (9).
- Continue to slowly extend the quill (1) while turning the milling spindle (7) slightly by hand until the driving stones (8) of the vertical working spindle engage in the driving flange of the angle milling head (4).
- Carefully advance the quill (1) as far as it will go, move back about 1 mm and clamp with the clamping lever (3).

recording of the tool

- Use a long tightening screw (11) to clamp side milling cutters in the spindle cone (7).

Setting the solid angle

- Swivel the milling head (2) into the required angular position. Pivoting the milling head, see sheet 3.07-1.
- Slightly loosen the clamping screws (9).
- Swivel the angle milling head (4) to the required angular position according to the scale (10) (adjustment accuracy 6').
- Tighten the clamping screws (9).

Lubrication / Maintenance

- After every 500 hours of operation, the spindle bearing and bevel gears must be relubricated with the special grease "Klüber-Isolfex NBU 15" through the grease nipple (12).
- After every 1000 operating hours, check the spindle cone (7) and the driving blocks for damage to consider.

## TABLE OF CONTENTS Series 561

Sheet

## MAINTENANCE

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## MAINTENANCE

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## IMPORTANT INSTRUCTIONS

### lubrication of the machine

- Lubrication and cooling lubrication of the machine are summarized on the following sheets of the operator's manual:

7.02-1 MACHINE LUBRICATION SCHEDULE

7.03-1 LUBRICATION REGULATION

7.06-1 LUBRICANT RECOMMENDATIONS

7.07-1 COOLING LUBRICANTS

- The designation of the lubricants and the identification of the lubrication points in the operator Manual are made according to DIN 51
- 502. The designation of the liquid lubricants is based on the ISO viscosity classification according to the based on the mean point viscosity at 40°C, which is specified in DIN 51 519.
- Machine lubrication plan (sheet 7.02-1) and lubrication instructions (sheet 7.03-1) are based on DIN 8659.
- The oil lubrication nipples on the machine are marked red, the grease lubrication nipples yellow. marked with washers. In addition, there are markings on the lubricating nipples and filling points according to DIN 51 502.

### lubricants

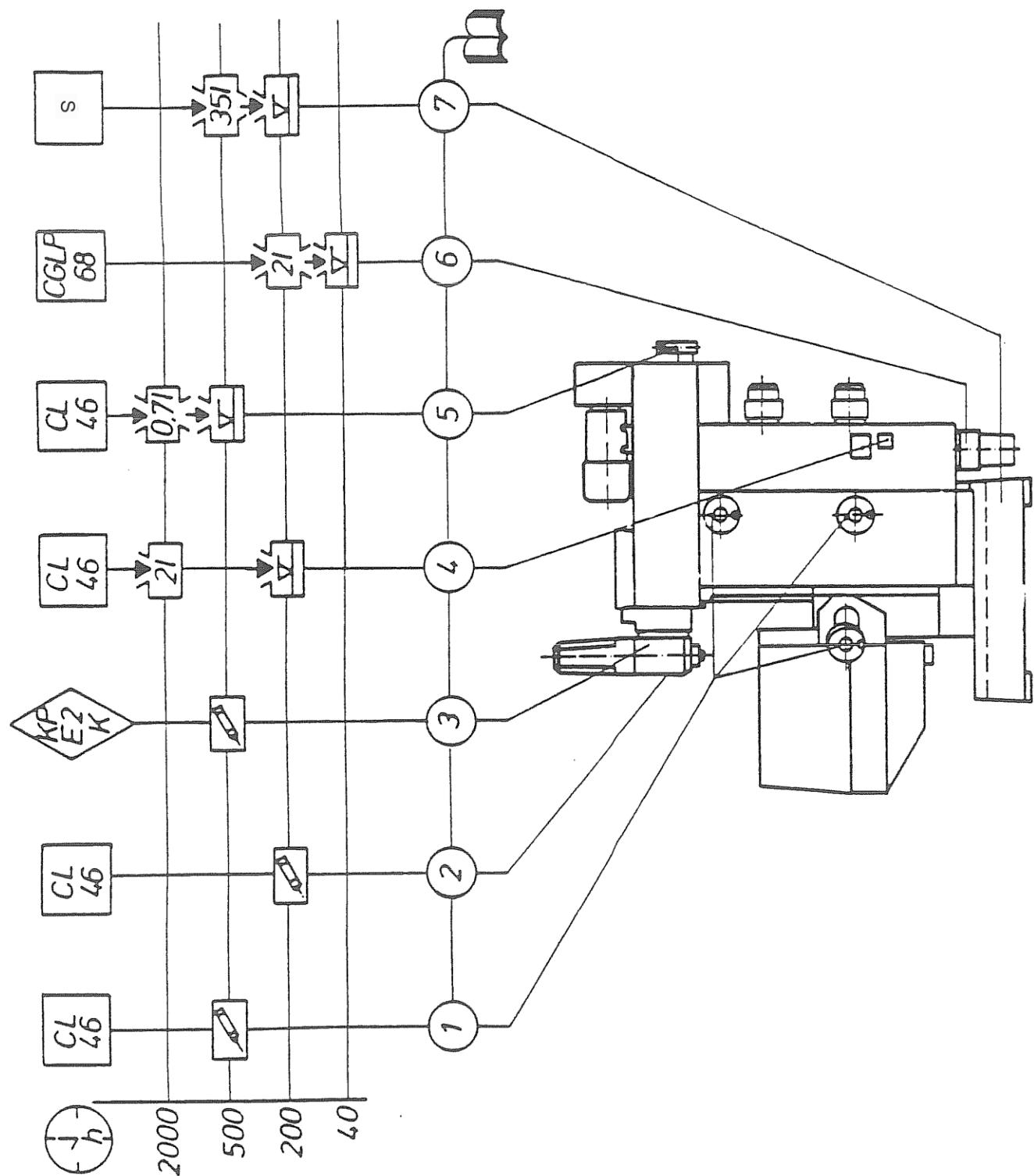
- The use of suitable lubricants is an important prerequisite for operational safety and the service life of the machine.
- The machine is delivered filled.

The lubricants from the initial filling (see Sheet 7.06-1) should definitely continue to be used. If this is not possible for organizational reasons, only products according to the lubricant selection table, Sheet 7.06-3, may be used.

### Maintenance work

- Separately from lubrication and cooling lubrication, all other maintenance work is summarized from sheet 7.20-1 of the operator's manual.
- The maintenance work must be carried out conscientiously at the specified intervals.
- The intervals are complementary, i.e. if the work is due for 1000 hours, the work must be carried out for 40 hours. The same applies to the other intervals.
- Chapter 8 of the operator's manual contains removal instructions for major components.

## MACHINE LUBRICATION SCHEDULE



LUBRICATION REGULATION

Interval in operating hours	No in plan	activity icon	work to be done	Crowd
40	6		Check the oil level in the central lubrication unit trolley.	----
200	2		Lubricate the quill in the milling head with oil   2-3 strokes (1 nipple, red marking).	
	4		Check the oil level in the hydraulic unit.	----
	6		Top up oil in the central lubrication pump.	max. 2 l
	7		Check the fill level in the coolant reservoir (keep as full as possible).	----
500	1		Lubricate the lubricating nipples in the hubs of the handwheels with 2-3 strokes of oil.	
	3		Lubricate the bevel drive in the milling head with grease (1 nipple marked yellow).	2-3 strokes
	5		Oil level in the headstock (at standstill) Check, top up at (10) if necessary. len.	----
	7		Change cooling lubricant. Container re-ca 351 ing.	
2000	4		Change hydraulic oil, clean screen.	max. 2 l
	5		Renew the oil bath in the headstock.	about 0.7 l

See sheets 7.01-1 "IMPORTANT NOTES" and 7.02-1 "MACHINE LUBRICATION CHART".

**LUBRICANT RECOMMENDATIONS**

lubrication point		Lubricant overview			a)
Plan	No in wording	First fill/ lubricant	Stoffart	Designation/ Viscosity range in cSt at 40°C Analysis data	Symbol
2	Quill of the milling head	Aral Sumurol CM 46	lubricating oil	CL 46 / 41,4 - 50,6	CL 46
5	Headstock oil bath	Klüber-Isoflex NBU 15	grease	KPE2K / Worked penetration 265-295 dropping point approx. 180°C.	CP E2K
4	hydraulics	Aral-Vitam DE 46	hydraulic oil	HLP 46/ 41.4 -50.6	HLP 46
6	central lubrication unit ----- universal table	Esso-Febis K 68	track oil	CGLP 68/61.2 - 74.8	CGLP 68
7	cooling lubricant device	See Sheet 7.07-1	cooling lubricant stoff	---- / ----	S

a) See Sheet 7.01-1 "IMPORTANT NOTES".

Safe operation of the machine can only be guaranteed if these types of lubricant are used. We recommend sticking with the type of lubricant used for the first filling, or an equivalent type selected based on the operating requirements.

**LIABILITY IN CONNECTION WITH THE LUBRICANTS**  
**RECOMMENDED IN THE FOLLOWING TABLE CANNOT BE**  
**ASSUMED!**

Each of the lubricant manufacturers listed below maintains a technical lubrication service that can provide information and advice on all lubrication issues.

If cooling lubricant is used intensively - in the form of an emulsion - its compatibility with the slideway oils used on the machine must be taken into account, see sheet 7.07-1 to 7.07-3.5.

## LUBRICANT REGULATION

The lubricants to be used must be resistant to emulsions and aging. They must not attack the materials of the wipers and seals or the paintwork.

Machine type, MAHO.....	Lubricant - identification, DIN 51 502				
	f. gear or circulating lubricant	1) f. Pneumatics	f. Hy- draulik	track oil	roller bearing grease
MH500 M			-----	CGLP 68	
MH500 W					
MH 500 W4					
MH 500 E2		-----			
MH 600 E2					
MH 800 E2					
MH 600C	CL 46		HLPD 46 (HLP 46)		KPE2K
MH 800C				CGLP 220	
MH 1000C					
MH 700 S		HLPD 22			
MH 1000S					
MH 1200S					
MH 1600S					
MAHOMAT					
MC 50					
MC 50 S					
LASERCAV®	-----	-----			

- 1) Minimum requirements for hydraulic oil in accordance with DIN 51 524 and DIN 51 525.  
 Detergent hydraulic oils that also meet the requirements of DIN 51 525 are to be preferred.

## LUBRICANT SELECTION CHART

W, series

Edition: 10/1989

Safe operation of the machine can only be guaranteed if these types of lubricant are used.

We recommend sticking with the first filling type or an equivalent type chosen based on operational requirements.

**ANY LIABILITY IN CONNECTION WITH THE THINGS RECOMMENDED IN THIS TABLE  
LENEN LUBRICANTS CANNOT BE ACCEPTED!**

Each of the lubricant manufacturers listed below maintains a technical lubrication service that can provide information and advice on all lubrication issues.

Type of initial filling = bold and underlined

Lubricant identification according to DIN 51 502				
oil type Manufacturer	<b>CL</b> <b>46</b>	HLP 46	CGLP 220 68	CP E2K
ARAL	Aral - Sumurol CM 46	Aral - Vitam DE 46	Aral - Deganit BW 220 68	----
AVIA	AVILUB RL 46 AVILUB HLP 46	AVILUB RSL 46 AVILUB HLPD 46220 - SU	AVILUB RSL 68	----
blower	<b>BLASOL 158</b>	<b>BLASOL 158</b>	<b>BLASOL 749</b>	<b>BLASOLUBE 301</b>
bp	Energol HL 46 Energol HLP 46	Energol HLP 46 (HLP-D)	Maccurat 220D68 68	----
Castrol	Vario HDX HYSPIN AWS 46	Vario HDX HYSPIN AWS 46	MAGNA CTN 220 68	Product 783
DEA	Rando 46 Regal Oil R&O 46	Rando HD - B 46 Rando HD - Z 46 ALcor DD - 46	Way Lubricant 220 68	Starfak B - EP2
ESSO	NUTO H 46 TERESSO 46	NUTO H 46	FEBIS K 220 68	BEACON 325
Fimitol			Staroil D220 68	

Lubricant identification according to DIN 51 502				
oil type Manufacturer	CL 46	1) HLP 46	CGLP 220	CP E2K
Fox	RENOLIN MR 15	RENOLIN MR 15	RENEP 220K 68	RENOLIT S2
	RENOLIN B 15	RENOLIN B 15		
Klüber	LAMORA 46	LAMORA 46	LAMORA 220 68	<u>Klüber - Isoflex</u> <u>NBU 15</u>
Mobile	DTE - Oil Medium	Hydraulic oil HLPD 46	Slideway oil 220 68	Mobil Temp SMC 32
	Mobile DTE 25			
Shell	Shell Tellus Oil C 46	Shell Tellus Oil 46	Tonna - Oil TX 220 68	Airo Shell grease 7
	Shell Tellus Oil 46 Hydrol DO 46			
Winters- hall	Wiolan CN 46	Wiolan HS 46	Wiolan TH 220 68	
		Wiolan HX 46		
Wisura	Dynax 46	Tempo 46	Bettbahnöl 220 EP 68	
Zeller + Gemelin	GWA 2 ISO 46	HLP 46 ISO	T 12 EP ISO 220 68	
	DHG 46 ISO	DHG 46 ISO		

## COOLING LUBRICANTS

a)

Only cooling lubricants that are water-miscible and contain mineral oil (according to DIN 51 385) should be used on our milling machines and machining centers. When making your selection, make sure that the cooling lubricant does not have the following disadvantageous properties.

1. Sticking and resinification of machine and control parts, not even where the cooling lubricant can penetrate in small quantities.
2. Incompatibility with the slideway oils used, which manifests itself as the lubricants decomposing, hardening
3. The anti-corrosion effect must not diminish even after prolonged use of the cooling lubricant.

or rinsing off. 4. The agents used on the machines for seals and wipers etc. must not be attacked. -

### 5. Requirements for the cooling lubricant:

- Good emulsification and service life even with harder water over 15° d.H. (5.4m equivalent).  
No damaging effects on machine elements (metals, paints, elastomers).
- Good lubricating properties and effects for the sliding machine elements.
- Great resistance to decay and bacteria or resistance to bacterial attack.
- No harmful effects on humans.
- test results and reports on skin compatibility must be presented.
- No toxic additives such as nitrites or phenols.
- Must at least comply with the Technical Rules for Hazardous Materials (TRgA 900).
- Used cooling lubricant emulsion must be able to be split using standard separation processes.

a) DIN 51 385:

Term 2.1 = Emulsifiable cooling lubricant (concentrate)

Term 3.1 = Cooling lubricant emulsion (oil-in-water), ready-to-use mixture

## COOLING LUBRICANTS - DATA SHEET

Selection criteria based on VKIS work sheet 3 - Sept. 1983

## PHYSICAL-CHEMICAL GUIDELINES

## 6.1 of the cooling lubricant concentrate

Characteristic	measurand	test method	benchmarks
Total mineral oil content	Vol. %	DIN 51 471 E	> 35
water content	Vol. %	DIN 51 582	is to be stated
density	g/cm <sup>3</sup> /20°C	DIN 51 757	0.93 - 1.06
Kinematic viscosity at 40°C	mm <sup>2</sup> /s (cSt)	DIN 51 366	20 - 120
20°C	mm <sup>2</sup> /s (cSt)	DIN 51 562 DIN 53 015	50-300
refractive index	nD 20°C	DIN 51 423	is to be stated
flash point	+° C	DIN 51 376	> 130
pour point	-° C	DIN 51 583	10-15
EP additives by mass %  SCI CI	Mass. % P	DIN 51 363 DIN 51 400 DIN 51 577	is to be stated
sulfated ash	Mass. %	DIN 51 575	
preservatives mittel			Type and quantity are to be stated
silicones	%		is to be stated
boron content			is to be stated
IR spectrum			is to be stated

## 6.2 of the water-mixed cooling lubricant (emulsion):

Characteristic	Use concentration	measurand	test method	benchmarks
pH value m.NW 12 a) (12° d.H.) b)	2% 10%		DIN 51 369	8.5 - 9.4
thermal conductivity keit	5%	kcal/mh° C		> 0.45
electr conductivity keit	5%	uS/cm	DIN 38 404	is to be stated
anti-corrosion ability	5%		DIN 51 360/1	R0, S0 c)
corr degree	5%		DIN 51 360/2	0
corros. effect. on copper - discoloration	2.5%	(DIN 51 759) mg/dm <sup>3</sup>	VKIS worksheet no. 7	no
- deposit formation				no
- CU ion content				max. 50
Resistance (m.3g NaC1/1)	5%		DIN 51 367	<95%
Foam behavior at NW 12	5%			Agree with manufacturer
Adhesive and residue behavior	5%		VKIS test sheet 521-01 (DIN E 53 538/3)	not adhesive
resolubility				easily soluble

Characteristic	Use concentration	measurand	test method	benchmarks
Behavior towards elastomers, standard bar S2 according to DIN 53 504: test material: SRE-WBR 28	2% 10%	volume change in % (vol.) Change.d. Shore A hardness unit (SHA) after 100h/70° C	VDA test sheet 521-01 (DIN E 53 538/3)	Vol. Sh-A- + 0.5%
(CFW 88 NBR/ 101)	2% 10%			+ 0.15%
Content of acid separable fractions Ien	2%	Mass.	DIN 51 368	is to be stated
	10%			is to be stated
EP effect			VKIS worksheet no.6	
Friction wear according to Reichert	5%	N7 cm <sup>2</sup>		

Explanations:

- a) pH is a measure of alkalinity. pH value 7.0=neutral, e.g. B. pure drinking water. Emulsions with a lower pH value than 7.0 are referred to as "acidic" and the rust protection effect is then very low. Higher pH values (max. 10.0) improve the rust protection effect. A pH value greater than 9.4 already leads to washing out of the sliding machine elements and skin damage to the operating personnel.
- b) With "NW 12" "normal water" of 12° d.H. (4.3 meq.) x) denoted. 10° i.e. means: . 10 g of calcium oxide per 100 liters of water.  
 i.e. is the abbreviation for "German water hardness",  
 e.g. E.g.: soft water less than 6°d.H. x)  
 medium-hard water 6° 12° i.e.  
 hard water - more than 12° d.H.
- The hardness of the tap water can be obtained from the responsible waterworks.
- c) RO = no  
 rust SO = no black spot
- x) International designation is "mval." (Total of all dissolved minerals)  
 Conversion i.e.

## COOLING LUBRICANT - RECOMMENDATIONS

Stand: August 1989

The cooling lubricants listed below (with the exception of those marked with ") were tested in the laboratory in accordance with DIN 51 599 - Determination of the demulsibility using the stirring method - and evaluated positively.

Trouble-free operation of the machine can only be guaranteed if these products are used in accordance with the recommendations for use specified by the respective manufacturer.

MAHO does not assume any guarantee for consequential damage if other than the cooling lubricants are used!

Manufacturer	Designation	percentage of mineral oil	suitable mixing ratio	
			Conc.: water	in %
ACMOS	ACMOSIT 64-02	30	1:20 - 1:30	5 - 3
	ACMOSIT 64-20	39	1:20 - 1:40	5 - 2.5
Aral	Emulsol 230 EP	72	1:20 - 1:50	5 - 2
	Sarol 460 EP	50	1:10 - 1:30	10 - 3
	Sarol 445 EP	50	1:10 - 1:50	10 - 2
	Sarol 340	45	1:12 - 1:50	8 - 2
AVIA	AVILUB-Metacon 300 EP	40	1:10 - 1:40	10 - 2.5
	AVILUB-Metacon UV 18	40	1:20 - 1:50	5 - 2
	AVILUB-Metacon Synt 100 EP	--	1:10 - 1:40	10 - 2.5
Bantleon	Metacon BSBF	50	1:10 - 1:40	10 - 2.5
	Metacon BCF	50	1:10 - 1:40	10 - 2.5
Bellucco & Co.	Sintolin E1/MH	70	1:20 - 1:30	5 - 3
	Sintolin CB1/MH		1:20 - 1:30	5 - 3
blower	Blasocut 2000 Universal	62	1:3 - 1:20	33 - 5
	Blasocut 4000 Strong	43	1:3 - 1:20	33 - 5
bp	Olex SB 5580 CF	40	1:20 - 1:40	5 - 2.5
	Fedaro M	75	1:5 - 1:30	5 - 3
	Cutora HX	--	1:20 - 1:30	5 - 3
Castrol	Clearedge EP 2840	44	1:20 - 1:40	5 - 2.5
	Cooledge 267 NF	55	1:20 - 1:25	10 - 4

Manufacturer	Designation	Mineral oil- portion %	suitable mixing ratio	
			Conc.: water	in %
Castrol	Hysol CB	48	1:25 - 1:50	4 - 2
	Syntilo R "High Speed" ( TLS 984 in USA)	44	1:20 - 1:40	5 - 2.5
Chemie Linz AG	Hardocor S 305	--	1:14 - 1:30	7 - 3
Cincinnati-Milacron	Cimcool MB 702	60	1:10 - 1:25	10 - 4
	Cimcool MB 703	42	1:10 - 1:25	10 - 4
	Cimcool MB 602	37	1:10 - 1:25	10 - 4
	Cimcool MB 603	32	1:14 - 1:30	7 - 3
CMT-Raunheim	Aquasol 5-58 BO	52	1:20 - 1:50	5 - 2
	Universal 6-58	36	1:10 - 1:40	10 - 2.5
Consulta-Chemie	Rondocor 8320	63	1:10 - 1:30	10 - 3
	Rondocut M-AL	45	1:10 - 1:25	10 - 4
	Rondocor Compact	44	1:20 - 1:50	5 - 2
	Rondocor 6459	21	1:10 - 1:30	10 - 3
DEA	Texol E	66	1:10 - 1:30	10 - 3
	Texol EX-EP	60	1:10 - 1:30	10 - 3
	Texol BS	36	1:10 - 1:30	10 - 3
	Texol BSX-EP	30	1:10 - 1:30	10 - 3
eleven	Sarelf E P34	30	1:20 - 1:30	5 - 3
	Elf XTD 86009		1:10 - 1:30	10 - 3
esso	Kuttwell 40	83	1:10 - 1:30	10 - 3
	Drilling oil BS 30	65	1:12 - 1:30	8 - 3
	Drilling oil BS EP 50	55	1:10 - 1:30	10 - 3
	Drilling oil BS 60	20	1:16 - 1:50	6 - 2
Fimitol	AVANTIN 550	about 70	1:16 - 1:30	66 - 3
	AVANTIN 720	about 60	1:16 - 1:30	5 - 3
	AVANTIN 700 (B,AF,EP)	about 55	1:6.5 - 1:20	15 - 5
	AVANTIN 800	about 40	1:20 - 1:50	5 - 2
	AVANTIN 740	about 35	1:10 - 1:30	10 - 3
fina	VULSOL BST	40	1:20 - 1:50	5 - 2
Fox	RATAK DURANT 20CF	49	1:10 - 1:40	10 - 2.5

Manufacturer	Designation	percentage of mineral oil	suitable mixing ratio concentrate: water	in %
Fox	RATAK RESTIT ALU CF	41	1:10 - 1:40	10 - 2.5
	RATAK RESIST 68 CF	33	1:10 - 1:40	10 - 2.5
hebro chemistry	KSM 300 clorfrei	about 50	1:20 - 1:30	1 - 3
	KSM 210 clorfrei	about 35	1:20 - 1:30	5 - 3
HANDLE	P3 multane 86-1	about 60	1:10 - 1:25	10 - 4
	P3 multane 82-3	about 40	1:16 - 1:30	6 - 3
	P3-multan 74-3	about 40	1:12 - 1:25	8 - 2
	P3 multane 759	about 40	1:16 - 1:30	6 - 3
	P3 multane 65-2	approx. 33 (E)	1:12 - 1:25	8 - 2
Houghton ■ Chemie	ISOCUT 100	approx. 50	1:10 - 1:40	10 - 2.5
	ISOCUT Special	about 45	1:20	5
	ISOPAL S 55	about 50	1:20 - 1:30	5 - 3
Industry- requires STORM	ASSULAN HD 37	38	1:10 - 1:25	10 - 4
	ASSULAN HD 6	50	1:10 - 1:30	10 - 3
Jokisch ■	W2 OP	32	1:7 - 1:20	14 - 5
	Compact W3 F	39	1:10 - 1:20	10 - 5
Klüber ■ Lbrication	ZELIOT MS 250	20	1:5 - 1:20	20 - 5
Stove	Cooker - F 14	55	1:20 - 1:30	5 - 3
	Cooker - F 17	48	1:20 - 1:30	5 - 3
	Cooker - F 100	60	1:20 - 1:30	5 - 3
	Cooker - PKT 5	56	1:10 - 1:30	10 - 3
Lubricor ■	M 724			
	M 735	50	1:10 - 1:20	10 - 5
	B 421	20	1:20 - 1:30	5 - 3
MECANOIL S.A.	MECANOIL S 100	60	1:10 - 1:20	10 - 5
	MECANOIL S 124	55	1:10 - 1:20	10 - 5
	MECANOIL S 2000	55	1:10 - 1:20	10 - 5
MENZEL	MF 50	--	1:20 - 1:40	5 - 2.5
Mobile	Mobilmet 120	30	1:10 - 1:50	10 - 2
	Mobilmet 150	33	1:10 - 1:20	10 - 5

Manufacturer	Designation	percentage of mineral oil	suitable mixing ratio concentrate: water	in %
Mobile	Mobilmet 220	25	1:10 - 1:30	10 - 3
MCU	Betronol EPV 1533	54	1:14 - 1:30	7 - 3
Oemeta	Suprament	42	1:10 - 1:40	10 - 2,5
	NOVAMET	30	1:10 - 1:25	10 - 4
	NOVAMET EP	24	1:10 - 1:25	10 - 4
	NOVAMETS	--	1:10 - 1:25	10 - 4
	Oemeta S 33 (ESTRAMET)	--	1:10 - 1:25	10 - 4
	CUTO W 200	78	1:10 - 1:30	10 - 3
Petrat	PRIMOL PE 62 EP chlorine-free	62	1:14 - 1:30	7 - 3
	PRIMOL BK 84 chlorine-free	60	1:10 - 1:30	10 - 3
	PRIMOL BK 601 EP chlorine-free	60	1:10 - 1:25	10 - 4
	PRIMOL HS 4010 chlorine-free	40	1:14 - 1:30	7 - 3
	MW 028 B			
ROCOL Ltd.	Ultracut 260			
Shell	Shell-KS Fluid O	70	1:20 - 1:30	5 - 3
	Shell-KS Fluid O 300	44.5 (E)	for aluminum: 1:10 - 1:20	10 - 5
	Shell-KS Fluid O 700	43	1:20 - 1:30	5 - 3
	Shell-KS Fluid D	40	1:10 - 1:30	10 - 3
	Shell-KS Fluid O 200	37	1:10 - 1:30	10 - 3
TTV	Trim SOL	45	1:10 - 1:30	10 - 3
	Trim SOL Silicone free	45	1:10 - 1:30	10 - 3
Weko	Curtis S-6	53	1:5 - 1:20	20 - 5
	Curtis S-7	40	1:10 - 1:20	10 - 5
	Curtis S-21	25	1:10 - 1:20	10 - 5
WISURA	WM 3052	about 55	1:10 - 1:20	10 - 5
	Tralustar	about 44	1:10 - 1:20	10 - 5

Manufacturer	Designation	percentage of mineral oil	suitable mixing ratio		in %
			Concentration:	Water	
WISURA	World Cup 2998	about .40	1:20	1:30	5 - 3
Wynn's	Wynn's V-008				
Zeller + Gmelin	Zubora 200 XP	about 58	1:10	- 1:40	10 - 2.5
	Zubora 722 EP	approx. 33.5	1:10	- 1:30	10 - 3
	Zubora SM	approx. 73	1:10	- 1:30	10 - 3

(E) = ester oil

## APPLICATION INSTRUCTIONS FOR WATER-MISCIBLE COOLANTS

FILL ONLY READY MIXED EMULSION INTO THE CONTAINER!

### Mix:

- Fill cold tap water into a clean container and add the appropriate amount of concentrate to the water in a thin stream while stirring constantly. Never vice versa!
- Do not use softened water. Ideal water hardness: 7-20° i.e.
- Do not store emulsion in galvanized containers. Never mix prepared emulsion with other brands.

Mixing temperature: concentrate min. + 10°C  
water max. + 30°C

### Monitoring:

- Periodic control of the concentration using a hand refractometer or acid separation.  
Factor refractometer reading: 1.0
- If the concentration is too high, lean it by adding a very lean emulsion/solution.  
Never add pure water!
- Measurement of the pH value with indicator paper or electrometrically.  
Target value: pH 8.5 - 9.5.
- Continuous or periodic removal of floating leak oil.
- Dirty emulsion can be filtered or decanted and reused.
- If the level of contamination is correspondingly high (depending on bacterial resistance), change the cooling lubricant and clean the system.
- Additives such as bactericides, rust inhibitors, antifoams, etc. must not be used.

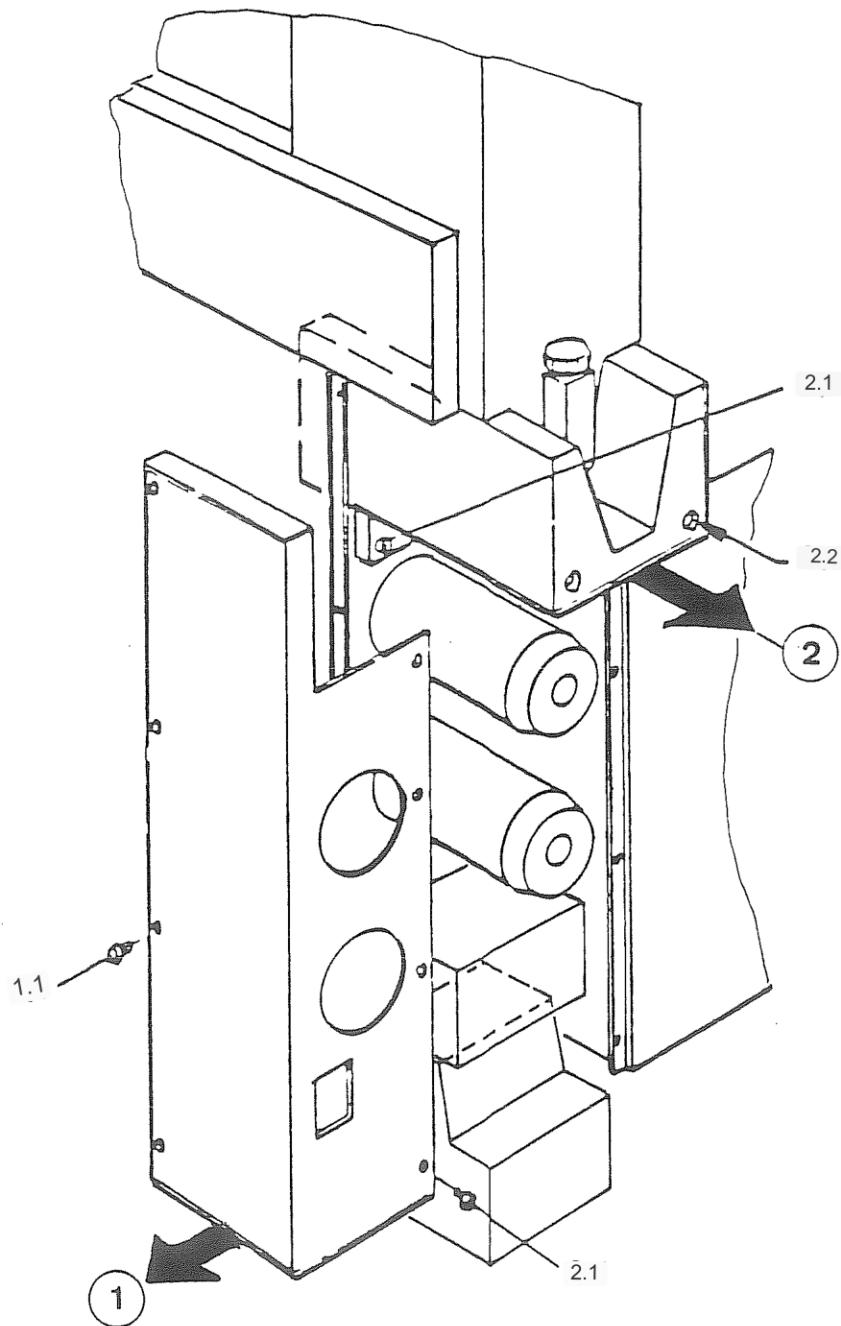
### Filling when changing the lubricant:

- Completely remove the previous cooling lubricant from the system.
- Clear the container and machine of chip sludge and deposits.
- Rinse with hot soda water (2 kg in 50 l of water).
- Remove soda water and rinse with clean tap water.
- Use system cleaner only on heavily contaminated systems.

---

REMOVING THE MACHINE PANELS

---



To carry out maintenance and adjustment work, it is sometimes necessary to remove the machine casing  
ments required.

This is done for disguise (1) and M hood (2) after unscrewing the screws:

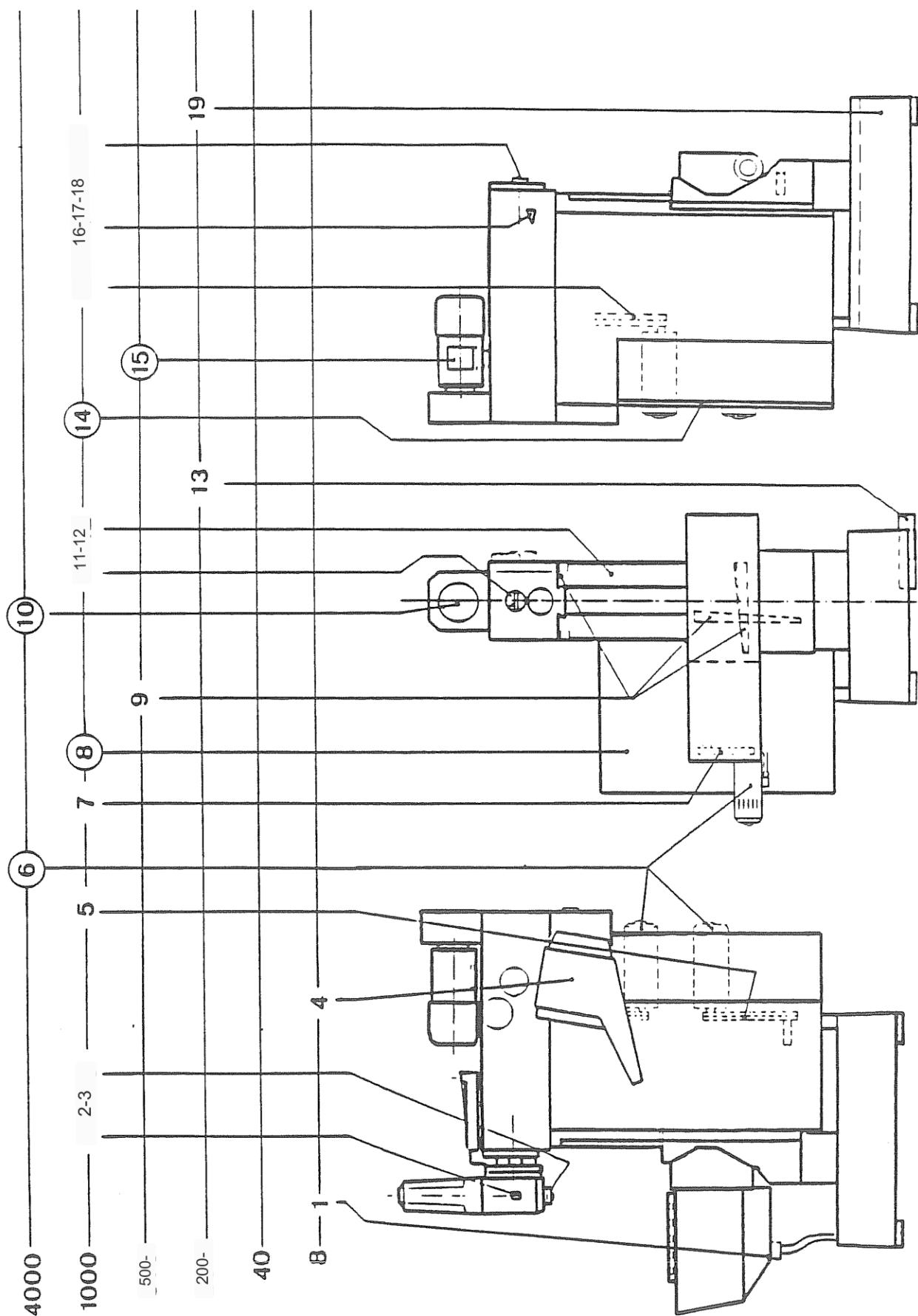
(1.1-1.2-2.1 - 2.2 x) using a 4 mm Allen key.

A NOTICE:

x) To remove the M hood

(2) Move the headstock to Z160!

## MAINTENANCE SCHEDULE



## OVERVIEW OF THE MAINTENANCE WORK

On mechanics and hydraulics

Interv. in re Std.	No.im Plan	work to be done	See sheet
8	1	Clean the screen filter for the cooling lubricant return in the chip tray.	3.24-1
40	----	Clean the entire machine. Clean limit switches and all parts of the covers of moving machine elements with particular care. DO NOT USE COMPRESSED AIR!	----
	19	Remove chip sludge from cooling lubricant container. check the condition of the cooling lubricant.	----
200	13	Empty the leakage oil container in the stand foot.	----
500	9	Check the play on the headstock and cross support guides. 7.30-1 Adjust V-ledges.	7.30-1
	----	Check all hose connections of the hydraulics and the cooling lubricant device for leaks. Tighten screw connections and replace defective hoses.	3.18-1 3.22-1
1000	2, 17	Check the setting dimension of the collet of the automatic tool clamping of both work spindles, readjust.	7.35-1
	3, 18	Check the taper of both work spindles for damage.	----
	5.7, 16	Determine wear on the toothed belts on the feed drives. Er-7.33-1 correct belt tension if necessary.	Er-7.33-1
	11	Check the coupling parts on the face of the headstock and the milling head for damage.	----
	12	Check the guideways on the headstock, column and cross support, as well as the guideway wipers for damage.	7.31-1

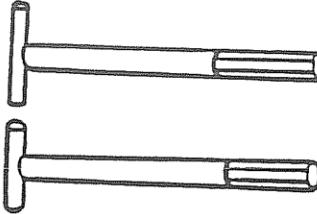
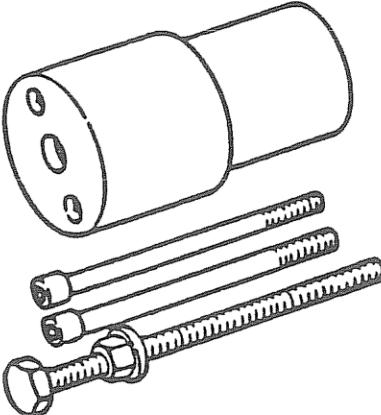
## OVERVIEW OF THE MAINTENANCE WORK

On electrics and electronics

A NOTICE: Pos. numbers in the maintenance plan 7.20-1 are circled.

Interv. in re hours	No.im Plan	work to be done	See sheet
8	13	Clean the outside of the command station. Do not use compressed air! Do not use harsh cleaning agents. Recommended: e.g. "Ethanol".	----
200	----	Check the function of the EMERGENCY STOP button.	-----
1000	8	Clean the inside of the control cabinet. No compressed air turn around!	----
	14	Check the control cabinet door seal for damage.	----
4000	6	Carbon brushes on DC motors -7M1- and tachogenerators for feed drive check for wear, replace if necessary.	----
	10	Check main motor brake for wear, adjust.	----

## SPECIAL TOOLS FOR MAINTENANCE AND REPAIR

Consecutive no.	Depiction	designation	remark
1		Trigger bar with thread "M5"	Page 7.35-1
2		Socket wrenches 5mm and 6mm	Page 7.35-1
3		Puller, speedometer anchor	Page 7.60-1

CHECK / ADJUST GEAR PLAY

The guide play on the X, Y and Z axes (cross slide, vertical worktable and headstock) is factory-set to 0.003 - 0.005

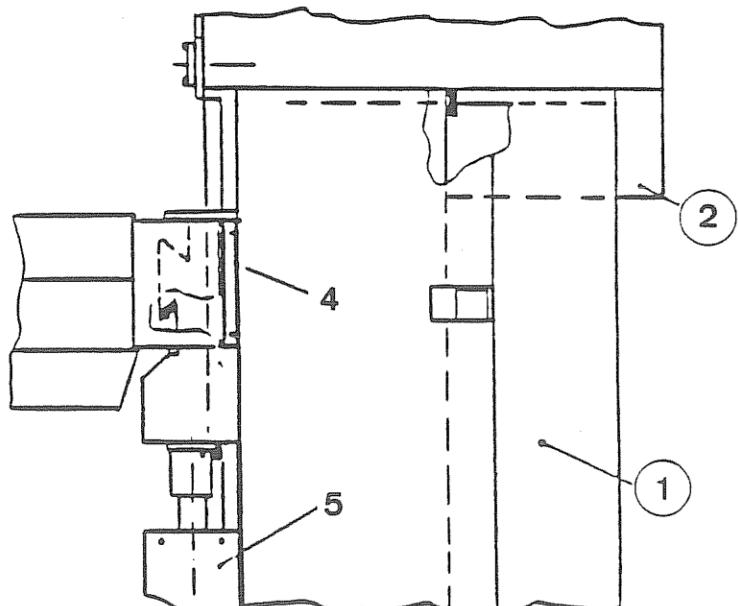
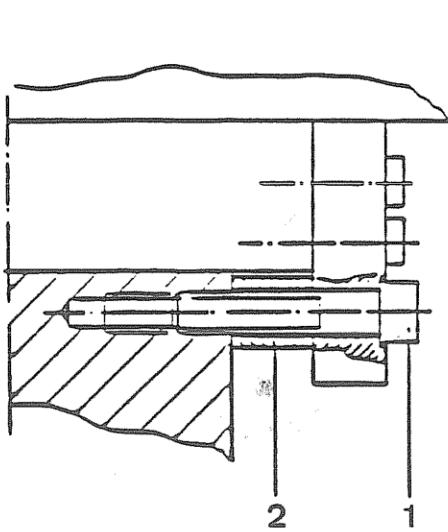
mm. If, after a reasonable run-in period, these values have increased significantly, a readjustment is necessary.

The play on the straight guides is set and readjusted using V-ledges with a pitch of 1:130.5. Here, shortening the tuning bush by 0.13 mm causes a play change of 0.001 mm. a)

The V-ledges must not be set too tight. After readjustment, the cross support, vertical clamping table and headstock must be able to be moved evenly and without jerks.

adjustment process

- Unscrew the Allen screw (1).
- Take out the tuning bush (2).
- Shorten the tuning bush (2) by the required amount and reinsert it.
- Screw in and tighten the Allen screw (1).



The V-ledges are accessible:

X-axis after removing the right bellows (4) on the cross support.

Y axis, after removing the telescopic cover (5) at the bottom of the cross support.

Z-axis, after removing the machine cover

1 , 2 (see sheet 7.10-1).

a) Coordinate axes and directions of movement see Sheet 2.03-1.

## GUIDEWAY WIPER MAINTENANCE

The wipers must be checked for their function at 1000 hour intervals.

### Checking the scrapers

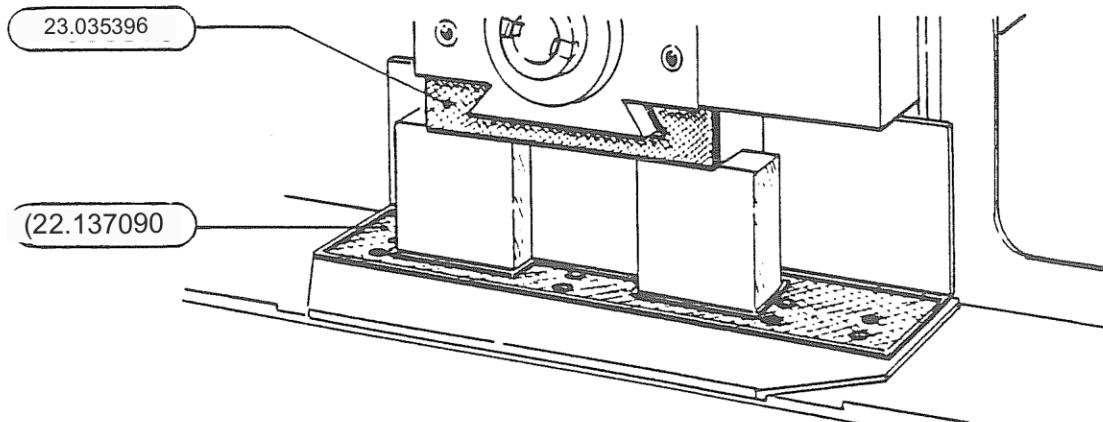
- Dismantle wipers.
- Clean wipers.

**A NOTICE:** If chips are pressed in under the wiper lip, the wiper must be replaced.

- Install new or cleaned wipers, pressing firmly against the tracks.
- Apply a thin layer of slideway oil to the guideway, approx. 50 mm wide. Oil film due to slide movement strip off approx. 30 mm. The wiper is OK if it wipes the oil off the entire guideway.

**NOTES:** The oil used in the central lubrication must be used, see sheet 7.06-1 "LUBRICATION RECOMMENDATIONS".

It is essential to avoid mixing oils.



---

TIMING BELTS CHECK

---

maintenance

Toothed belts do not require any special maintenance.

Since there is no permanent elongation during operation of the toothed belt drive, a correctly tensioned toothed belt no longer needs to be retensioned.

NEVER USE MAINTENANCE AGENTS SUCH AS GREASE OR WAX!

After every 1000 operating hours:

- Check the wear of the belt.

operational disruptions

identifying feature	Caused	fix
Excessive wear on the tooth flanks of the belt.	Too little or too much belt tension	Increase or decrease voltage.
Excessive wear on the tooth root of the belt.	Too much belt tension.	reduce tension.
Shearing of belt teeth	Belt tension too low.	increase tension.
Excessive running noise	Too much belt tension.	reduce tension.
Strong heating.	Belt tension too low.	increase tension.

## REPLACING THE TOOTH BELTS FOR THE FEED DRIVE

### Feed drive X-axis

- Turn off the main switch -Q1- on the switch cabinet.

**A NOTICE:** The main fuses in the control cabinet can be removed to protect against accidental switching on again.

- Remove screws (1) and remove hood (2).

Loosen the bellows on the right-hand side and move them inwards.

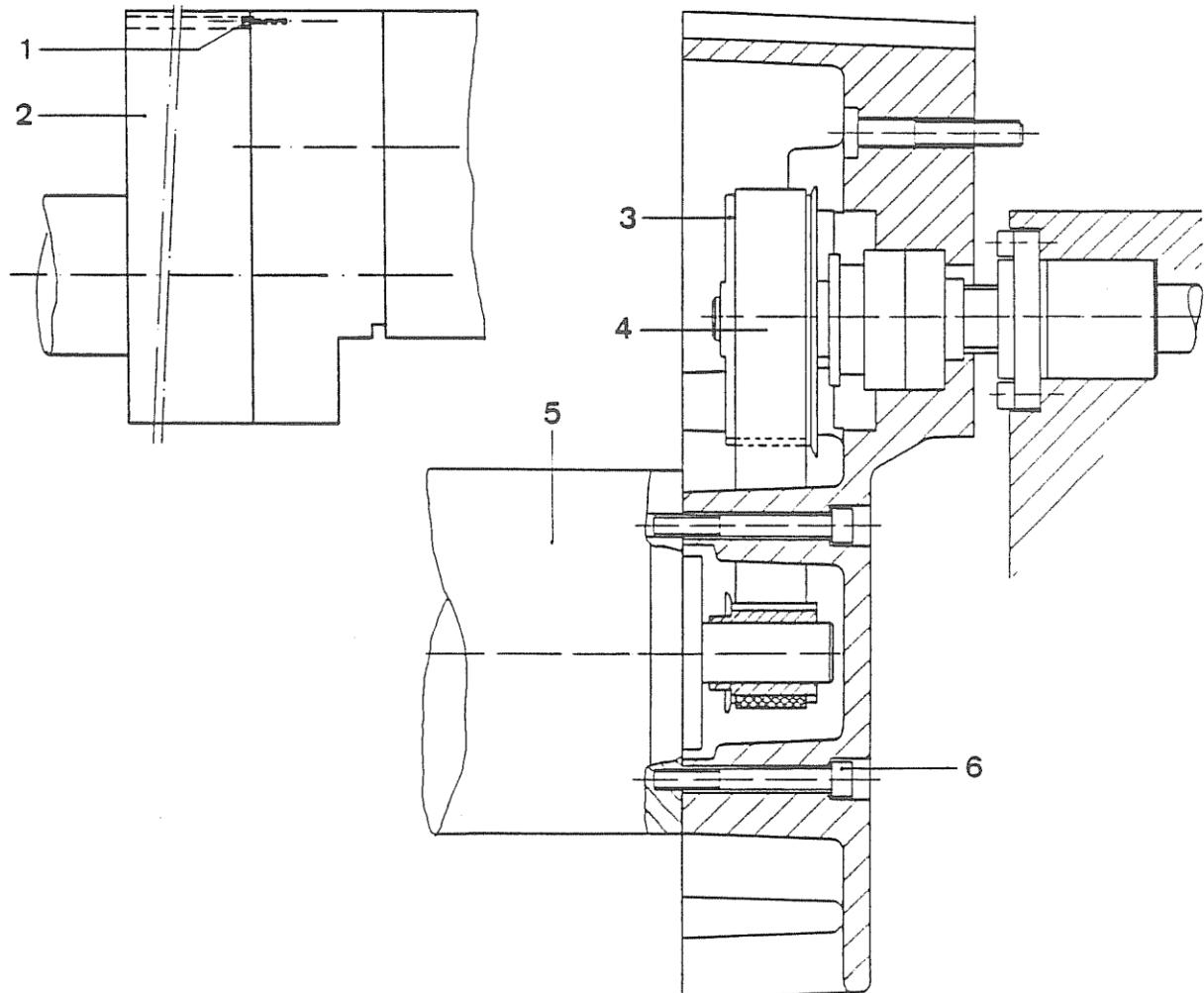
- Loosen the hexagon socket screws (6).

- Remove the motor (5), lift the toothed belt (4) off the drive wheel (3).

- Put on a new toothed belt (4), insert the motor (5) and move it so that the toothed belt is moderately tensioned.

- Tighten the hexagon socket screws (6).

- Reattach the bellows and cover (2).

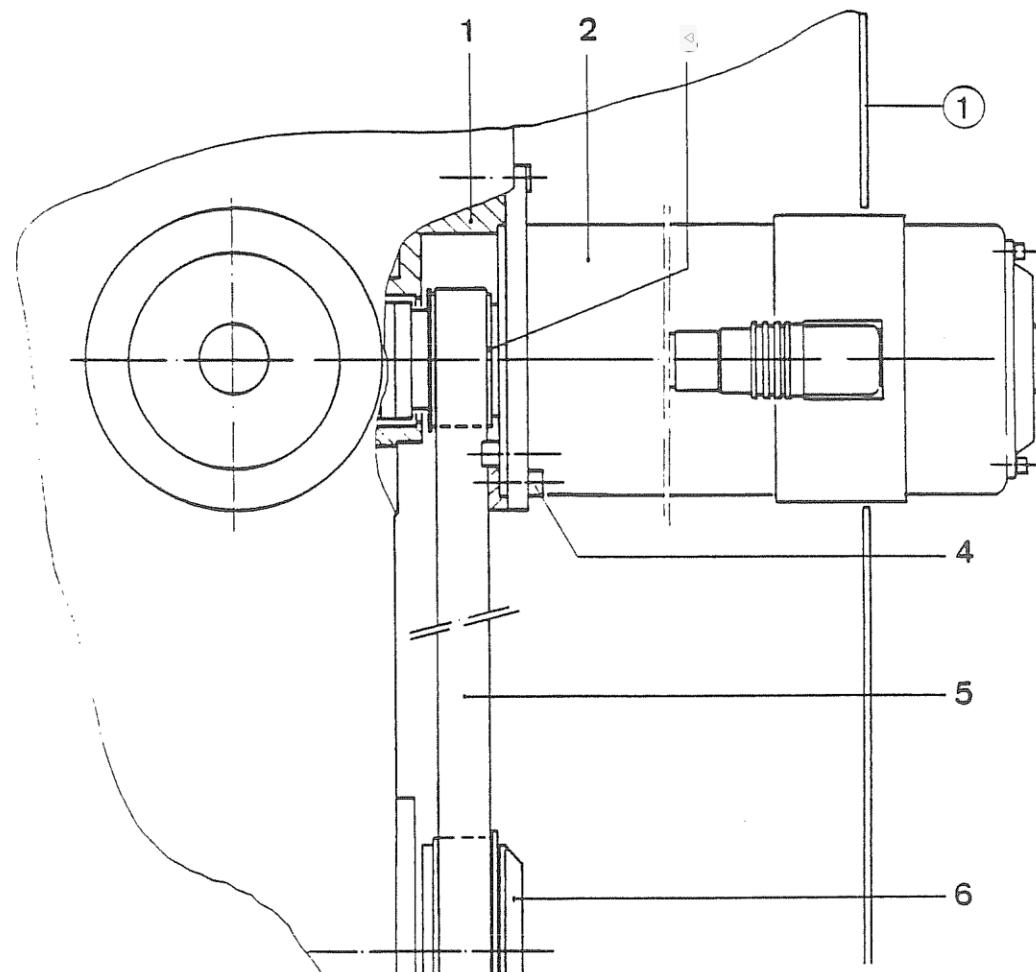


Feed drive Y-axis

- Move the cross support to the upper end position and support it.
- Turn off the main switch -Q1- on the switch cabinet.

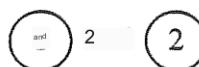
A NOTICE: The main fuses in the control cabinet can be removed to protect against accidental switching on again.

- disguise (1) from the back of the stand, see Sheet 7.10-1.
- Loosen the hexagon nuts (4) on the motor flange (1) and slide the motor (2) down.
- Remove toothed belt (5) from toothed belt pulley (3) and slipping clutch (6).
- Place new toothed belt on toothed belt pulley (3) and slipping clutch (6).
- By moving the motor (2) upwards, moderately tension the toothed belt (5).
- Tighten nuts (4) on motor flange (1) and machine cover (1) attach.





Feed drive Z-axis

- Machine covers 1  remove, see sheet 7.10-1.

- Move the headstock to "Z 200".

- Turn off the main switch -Q1- on the switch cabinet.

A NOTICE: The main fuses in the control cabinet can be removed to protect against accidental switching on again.

- Unscrew the screws and taper (5) and turn the spindle backwards until the taper (3) is accessible.

- Remove the taper pin (3) and pull the flange (4) off the spindle.

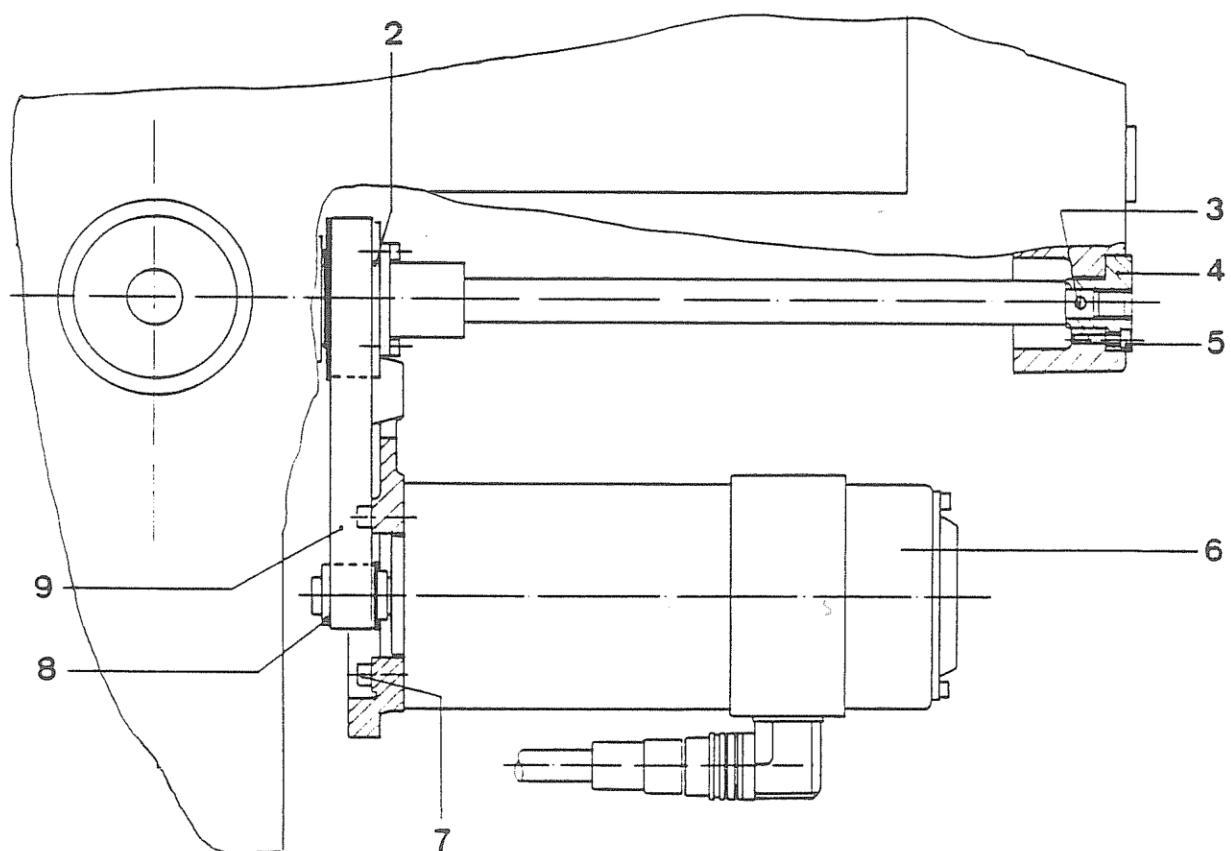
- Turn the spindle approx. 200 mm into the spindle nut.

- Loosen the Allen screws (7), tilt the motor (6) and remove the toothed belt (9).

- Place the new toothed belt on the two toothed belt pulleys (2 and 8).

- Slightly tighten the Allen screws (7) after checking the belt tension.

- The assembly is done in reverse order.



ADJUSTING THE COLLETS OF THE AUTOMATIC TOOLCLAMPING

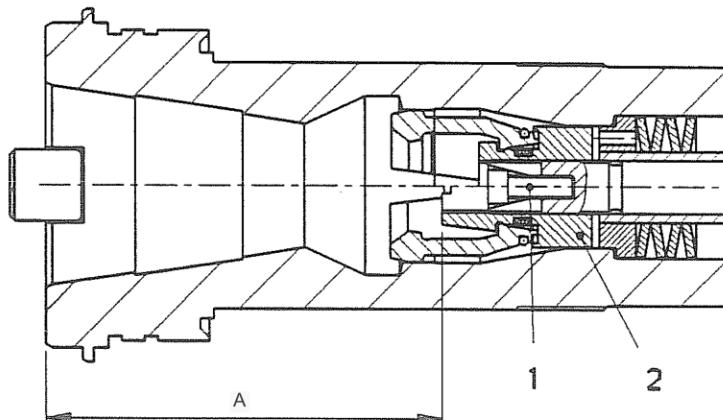
The adjustment process is different for vertical and horizontal work spindles. The setting dimension may only be measured in the "release position", resp. to be set.

Pre-condition:

1. Illuminated pushbutton -3SH1- on the command station actuated (machine ON). a)
2. TOOL UNCL button on control panel pressed (tool clamp released). b)
3. Remove the tool from the work spindle.

adjustment process

- Loosen the threaded pin (1).
- Screw the collet holder (2) in or out using a screwdriver until the setting dimension "A" is reached.
- Secure the collet holder (2) with the threaded pin (1).



dissolved state.

A			
collet	MAHO/OTT	ISO 7388 Type B	Type A
ISO 40	91.4	82.6-0.05	92.9

- Insert the tool in the work spindle and press the TOOL UNCL key (the tool is clamped).
- Press the TOOL UNCL key (the tool clamp is released) and remove the tool from the work spindle.

A NOTICE:

If the tool touches the collet when it is removed from the work spindle, the collet holder (2) must be unscrewed further. In this case, the setting dimension "A" may deviate by a maximum of 0.5 mm.

## MAINTENANCE OF THE DC MOTORS FOR THE FEED DRIVE

Indramat MDC 10

### Removal and installation instructions for speedometer anchor

#### DANGER!

Whenever you work on the speedometer anchor, make sure that the winding is not damaged. Furthermore, it is not permissible to loosen the field magnets of the speedometer in the yoke, since this causes a shift in the neutral zone that cannot be easily corrected.

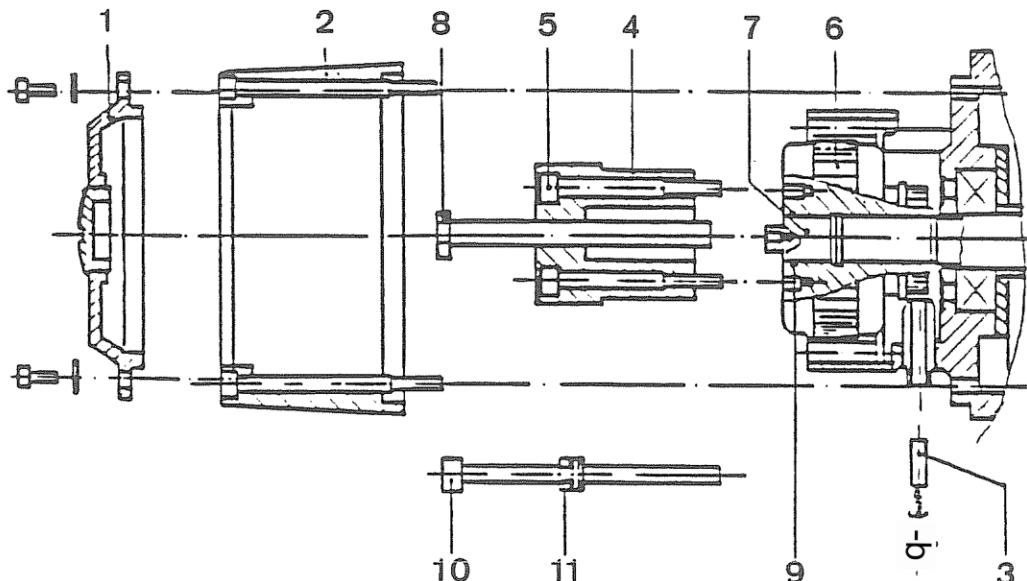
If speedometer anchors with an embossed serial no. from 3051 with speedometers of serial no. to 3050, the red and blue connection wires on the printed circuit board on the side have to be swapped due to the changed speedometer polarity.

### Removal of the speedometer anchor

- Remove cover (1), pull off hood (2).
- Remove the speedometer carbon brush (3) and mark it individually so that it can be installed later in the same holder and in the same installation position, see Sheet 7.60-2.
- Fasten puller (4) to speedometer anchor (6) using screws (5).
- Pull the speedometer anchor (6) off the motor shaft (7) while supporting it (turn the screw (8) clockwise).

### Installation of the speedometer anchor

- Slide a new (!) tolerance ring (9) onto the motor shaft (7). (Each tolerance ring can only be used once).
- Attach the device (4) to the new speedometer anchor without the screw (8) and push this onto the motor shaft. Turn the screw (10) in the motor shaft.
- Pull the anchor up to the stop by turning the nut (11) to the right. Reinsert the carbon brushes (3) observing the instructions on Sheet 7.60-2.



### Checking and replacing carbon brushes

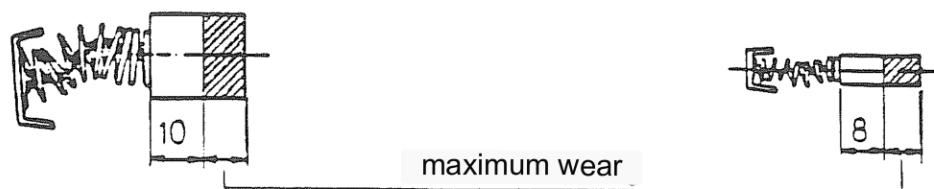
The carbon brushes on the motor and speedometer are subject to wear. They must therefore be checked regularly for ease of movement, wear and spring tension all round, and replaced when the wear limits shown below are approached. Deposits of brush dust in the collector area are to be blown out with dry compressed air after all carbon brushes have been removed. However, this may only be done on the removed engine!

It should be noted that each carbon brush that is removed must always be reinstalled in the same holder and in the same position.

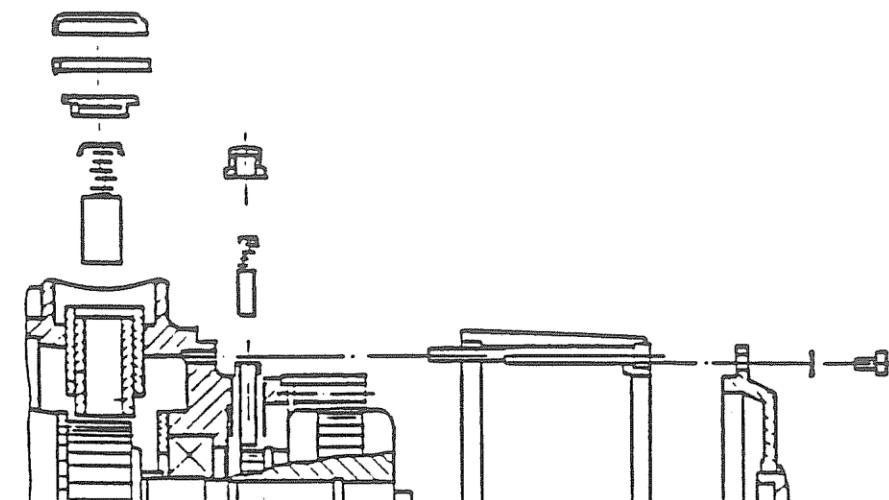
It is important to ensure that the caps are firmly and properly seated on the quiver to ensure perfect contact between the spring plate and the quiver. The carbon brushes may only be replaced in sets. Only the original quality may be used.

Motor carbon brushes 106-57-42155  
(4 pieces / set)

Tacho carbon brushes 105-251-4207  
(4 pieces/set)



Maintenance period when operating on:	motor carbon brushes	Tachokohlebürsten
machine tools	6 months	6 months



## MAINTENANCE OF THREE-PHASE MOTORS (MAIN MOTOR)

- The three-phase motors do not require any special maintenance.
- The roller bearings are lubricated for life and do not need to be relubricated.
- Maintenance is limited to cleaning the motor housing and adjusting the brakes.

### Cleaning the motor housing

- Clean the cooling air passages, especially the gaps at the base of the cooling fins.
- Any accumulation of dust and other residues prevents the free passage of cooling air and encourages excessive heating.
- It is best to remove dust and dirt with a vacuum cleaner.

### Adjusting the brake

The wear of the brake pads must be checked after 1000 operating hours. If necessary, the air gap must be readjusted.

- Remove fan cover (1) and circlip (2).
- Detach fan (3). Remove dust protection ring (4).
- Check the air gap "a" (see table) with a feeler gauge at at least 3 points around the circumference.
- Loosen the hexagon socket screws (5) by approx. 1/2 turn.
- Adjust the adjusting sleeves (6) approx. 1/3 turn and screw into the bobbin housing (7) turning clockwise. Tighten the Allen screws (5), check the air gap "a". If necessary, reset fetch.
- Reattach the removed parts (4, 3, 2, 1).

Motor stopped air gap	
"a" min.	0,3 mm
"a" max.	1,1 mm

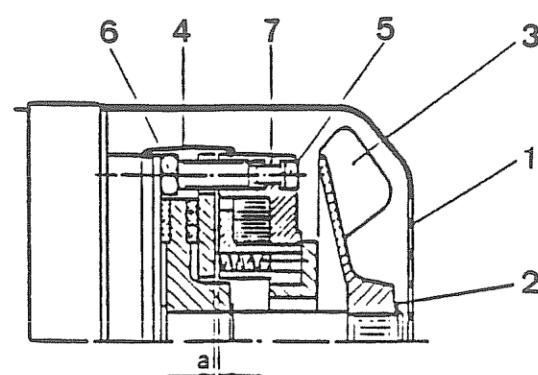
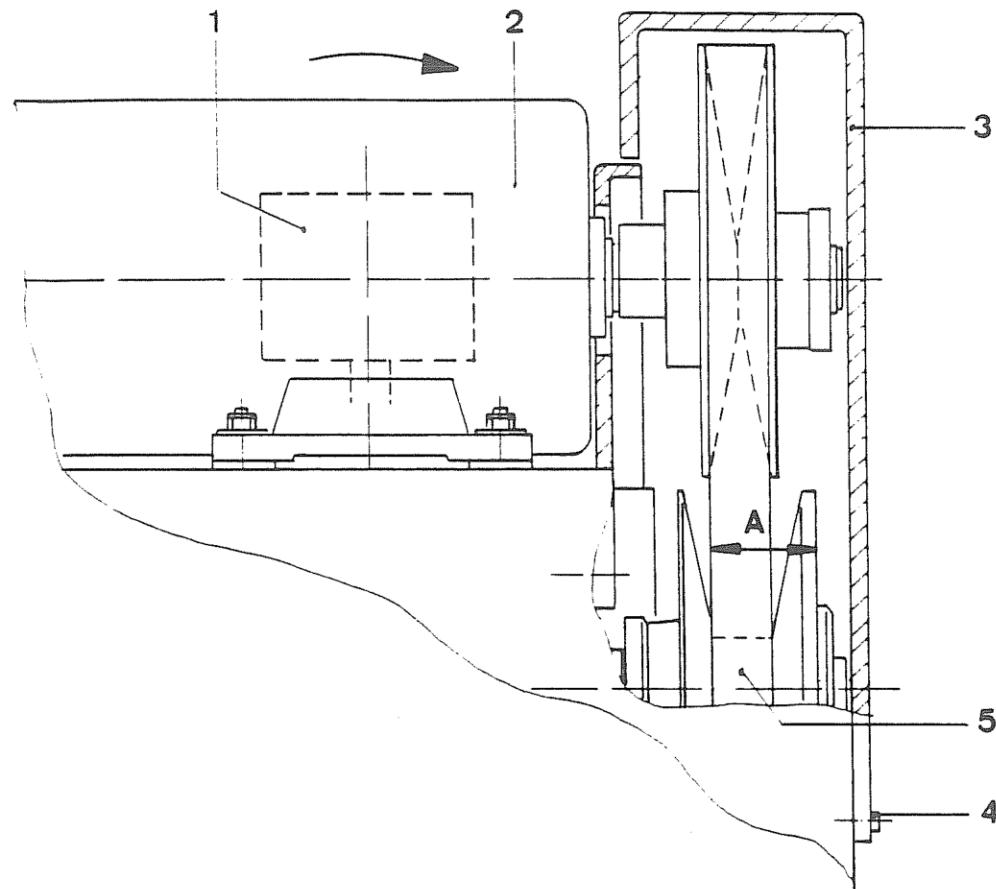


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## REMOVAL INSTRUCTIONS

main engine .....	8.01-1
Removal of the motors for the feed drive .....	8.08-1
until 8.08-3	
Adjusting the safety clutch .....	8.09-1
until 8.09-3	

MAIN ENGINERemoval of the main engine

- Turn off the main switch -Q1- on the switch cabinet.
- Disconnect connection cable (1) from engine
- (2). Remove screws (4) and remove protective hood (3).
- Determine and note dimension "A".
- Unscrew nuts (6).
- Tilt the engine in the direction of the arrow and remove the belt (5).
- Lift motor off headstock.

A NOTICE:

When reassembling, dimension "A" must be strictly adhered to! The motor must be screwed exactly parallel to the headstock!

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REPLACING THE FEED MOTOR

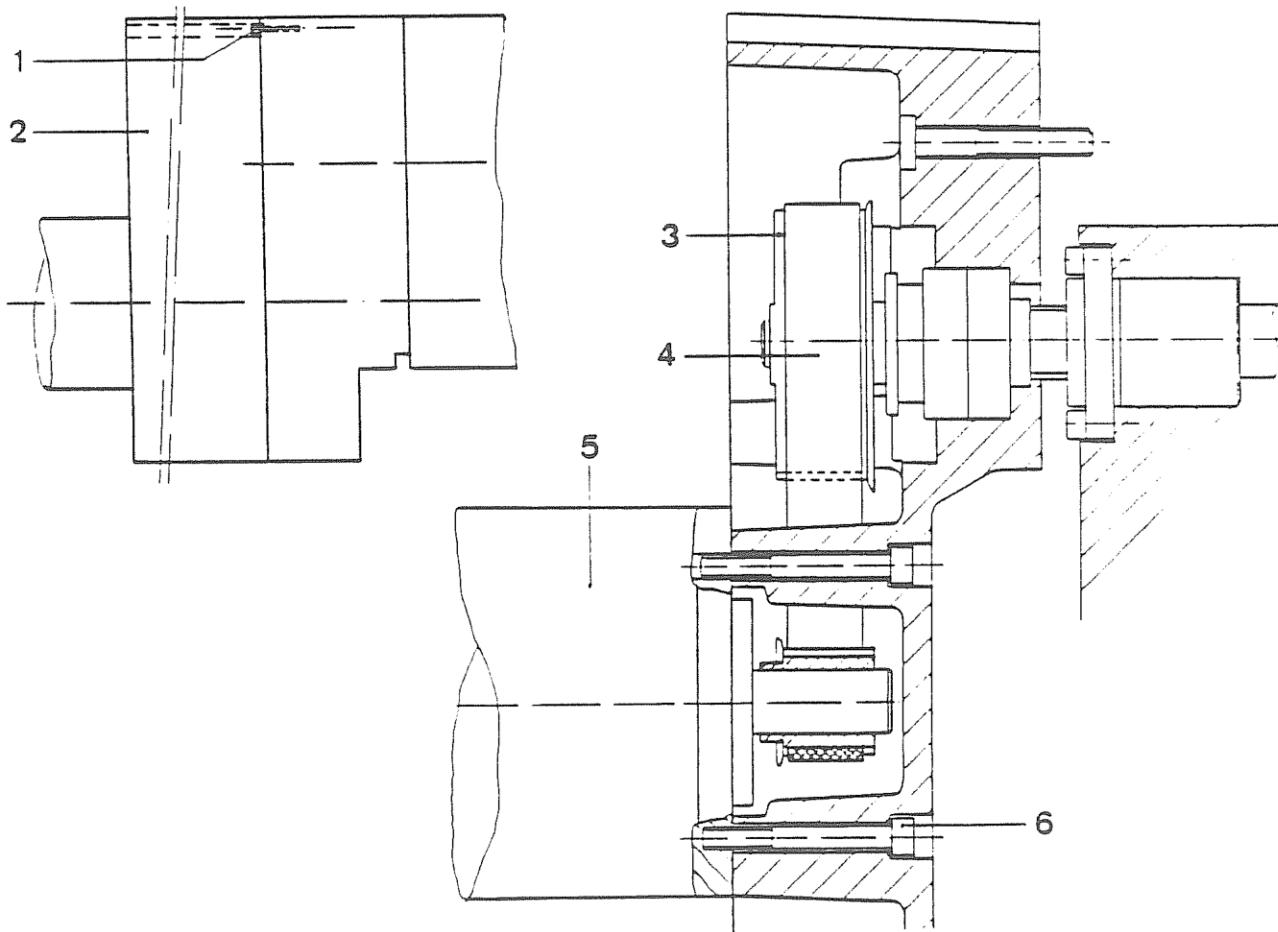
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## Feed drive X-axis

- Turn off the main switch -Q1- on the switch cabinet.

**A NOTICE:** The main fuses in the control cabinet can be removed to protect against accidental switching on again.

- Release the bellows on the right-hand side and push inwards.
- Pull off connector (4).
- Loosen the hexagon socket screws (1).
- Shift the motor (4) backwards slightly and let the toothed belt (2) slide off the toothed belt pulley (3).
- Remove motor (4).
  - Attach new motor, pick up toothed belt (2) with toothed belt pulley (3).
- Slightly tighten the Allen screws (1), after checking the belt tension, tighten the screws (1).
- Plug in the connector and reattach the bellows.



Feed drive Y-axis

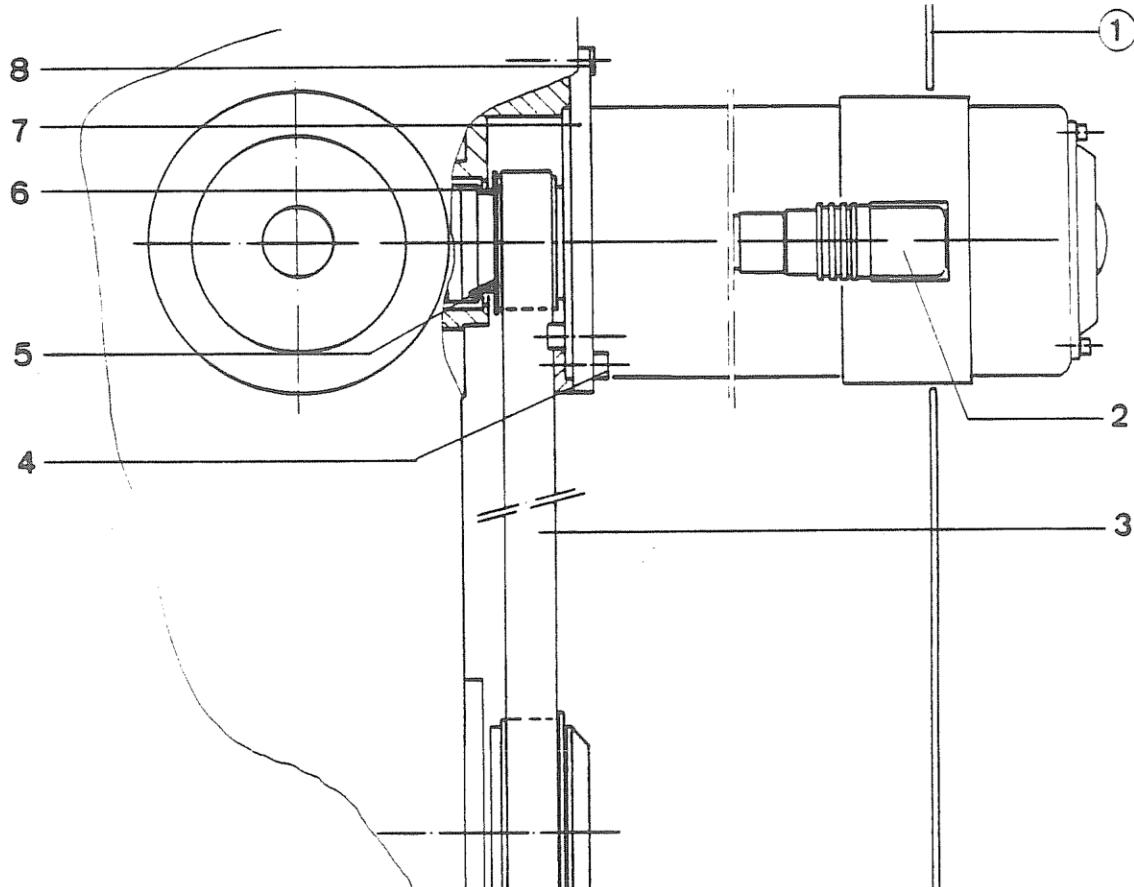
- Move the cross support to the upper end position and support it.
- Turn off the main switch -Q1- on the switch cabinet.

**A NOTICE:** The main fuses in the control cabinet can be removed to protect against accidental switching on again.

- disguise  1) Remove from the back of the stand (see Sheet 7.10-1).
- Loosen and pull off the cable gland (2) on the motor.
- Loosen the hexagon nuts (4) so that the toothed belt (3) relaxes. Remove the toothed belt from the pulley. Assembly and maintenance of the V-belts see sheet 7.33-1.
- Unscrew hexagon nuts (4) and remove motor together with flange (8) and pulley (6).
- Unscrew the hexagon screw (5) and pull the belt pulley (6) off the motor shaft.
- Unscrew the screws (7) and remove the flange (8).

replanting

Reinstallation is in reverse order.



Feed drive Z-axis

- machine casing  and  remove, see sheet 7.10-1.

- Move the headstock to "Z 350".

- Turn off the main switch -Q1- on the switch cabinet.

A NOTICE: The main fuses in the control cabinet can be removed to protect against accidental switching on again.

- Pull off the connector (6.1).

- Loosen the hexagon socket screws (7).

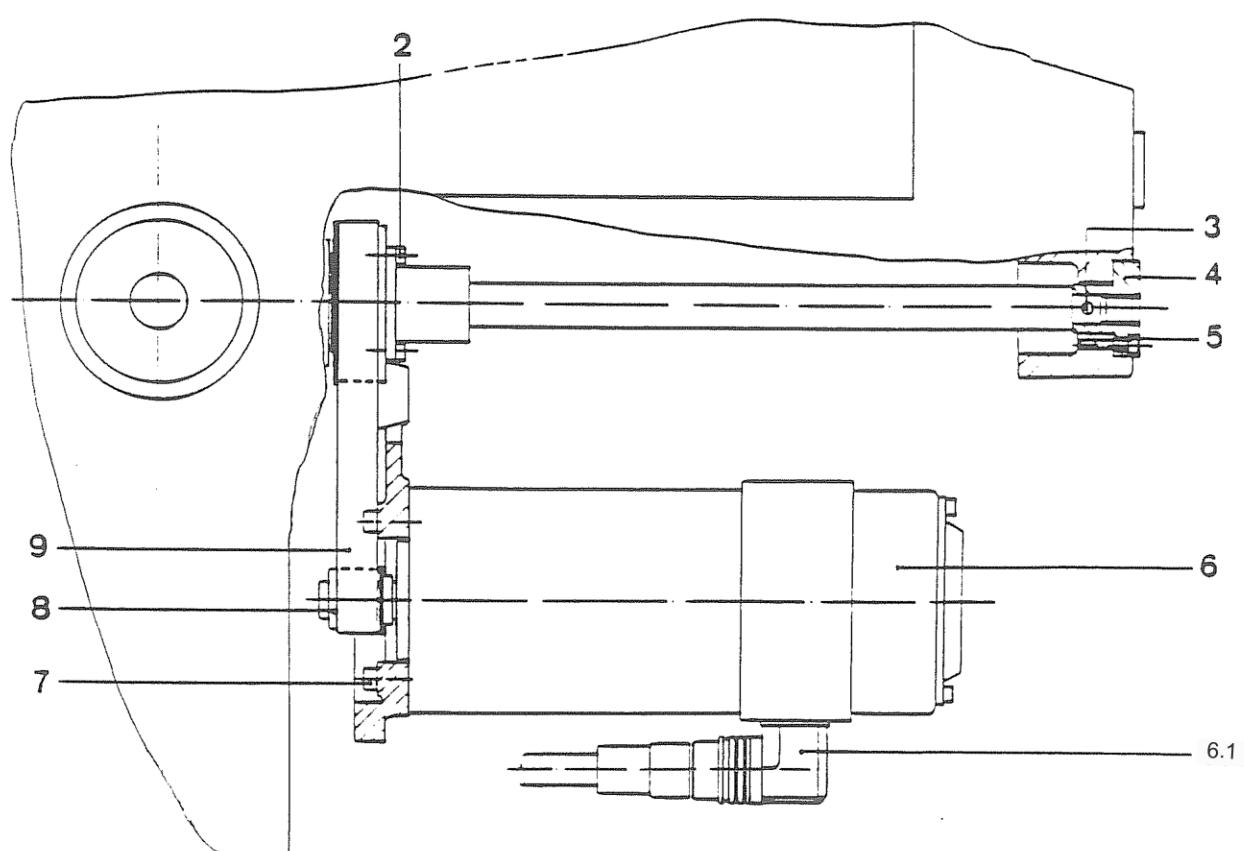
- Slightly tilt the motor (6) and remove the toothed belt (9) from the toothed belt pulley (8).

- Remove motor (6).

- Attach new motor, pick up toothed belt (9) with toothed belt pulley (8).

- Screw in the Allen head screws (7) and tighten slightly, tighten after checking the belt tension.

- Plug in connector (6.1), machine paneling  and  reattach.



## ADJUSTING THE SAFETY CLUTCHES

### functionality

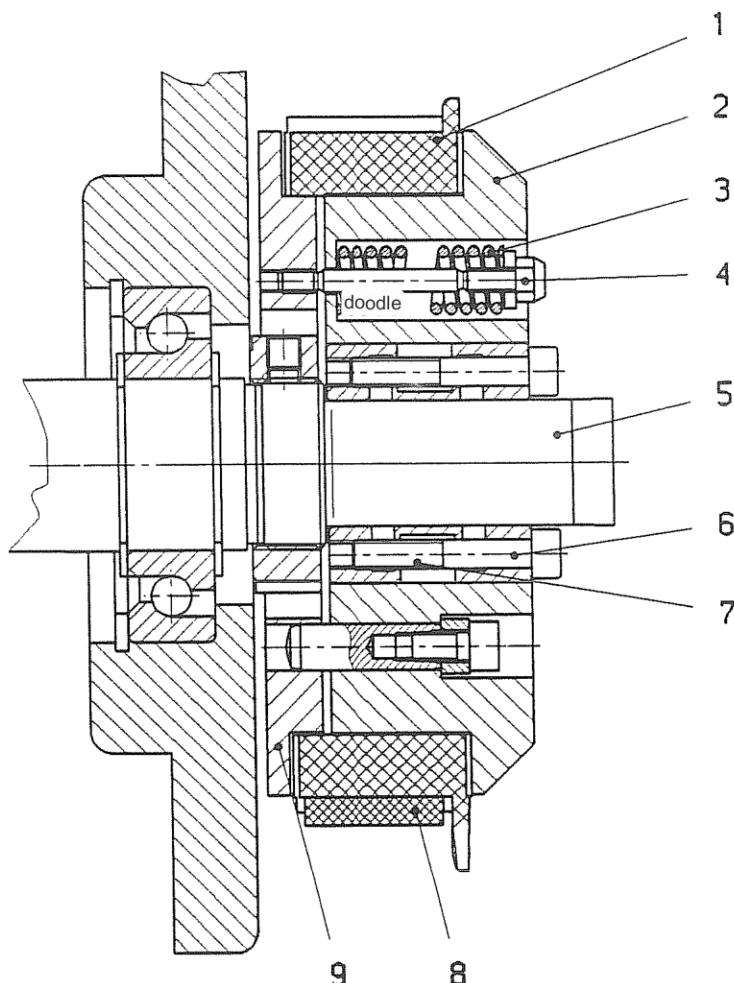
During normal operation of the machine, the torque is transmitted from the toothed belt pulley (friction element) to the hub by means of frictional force with absolutely no slippage. The hub is force-fitted to the ball screw by the pressure sleeve.

In the event of an overload, the toothed disc twists in relation to the hub and the thrust washer. The result of this "Following error" caused by twisting is immediately recognized by the machine's measuring system. After that will the machine is immediately shut down by the EMERGENCY STOP system (see CNC error list).

Once the cause of the fault has been eliminated, the safety coupling is functional again.

The safety clutch is basically maintenance-free, but after repeated responses, the setting of the response torque should be checked and adjusted if necessary.

## Y-axis clutch removal



1 toothed washer (friction element)

6 pressure element

2 hub

7 socket head screw

3 compression spring

8 toothed belts

4 adjustment screw

9 thrust washer

5 ball screw

- Move the cross support to the upper end position and support it.

- Remove toothed belt as described on Sheet 7.33-3.

- Loosen the fastening screws (7), pull the clutch backwards and remove it.

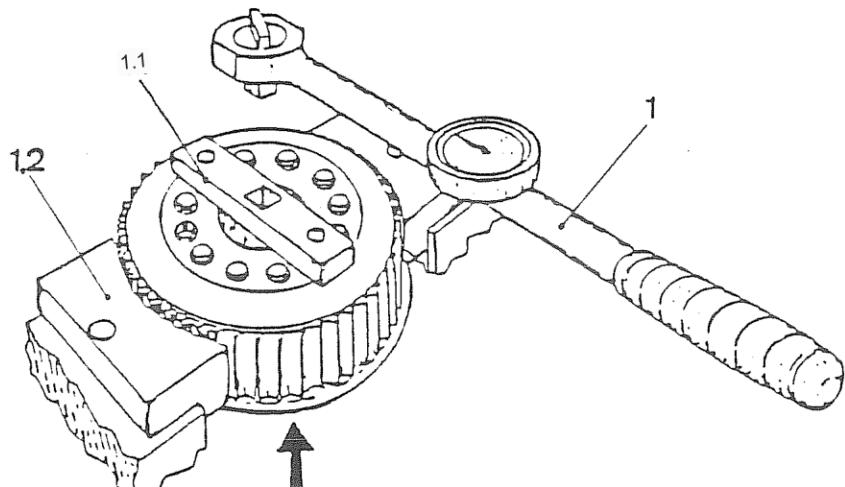
- Adjust the safety clutch (see sheet 8.09-3).

- Installation takes place in reverse order.

**Setting the slip torque**

Tools required: special tool

- 1 = torque wrench  
1.1 = adjustment bracket  
1.2 = special mounting jaws



Support

- Place the safety coupling in the vise using the special mounting jaws (1.2) as shown in the illustration.

**DANGER!**

Do not pinch!

Secure against slipping out!

Insert the bracket (1.1) into two opposite holes in the slip clutch hub.

- Insert the torque wrench with dial gauge in the square hole of the bracket (1.1) and tighten or loosen the adjusting screws (11) evenly until the safety clutch slips at the required torque (see table).

**A NOTICE:**

The adjusting screws (11) should have the same screw-in depth after the adjustment has been made exhibit.

	Y axis
Torque setting value (Nm)	16

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Transmission plan - main transmission .....	9.01-2
hydraulic plan .....	9.02-1
Automatic central lubrication - plan .....	9.05-1

## SPARE PARTS PLANS AND LISTS

Instructions for ordering spare parts .....	.9.10-1
Spare and wearing parts list (EDP printout)	
rolling bearing plan .....	9.30-1
Stock list (computer printout)	

## TRANSMISSION SCHEDULE

Feed drive 13.137 048

**Motor MDC 10 20F 1444-0**  
Md nominal 3.7Nm  
Rapid traverse =  
Lmin feed = 1-2000 mm/min

Melange 420 Heidenhain LS 403 C (W3)  
LS 403 (WL)  
420

**Z-Axis**  
**127063 2071**  
Md nominal 3.7Nm

**Normalweg**

Software gunkl

10Emergency stop

6=fixed stop

362 emergency stop

362 fixed stop

**Y-Axis**

**12 : Normalweg**

Software run Y1

0

0.3

OM = 2000 rpm

Rapid

traverse =

Lmin

feed =

1-2000

mm/min

500.6

software point

500

Normalweg

7

0.3

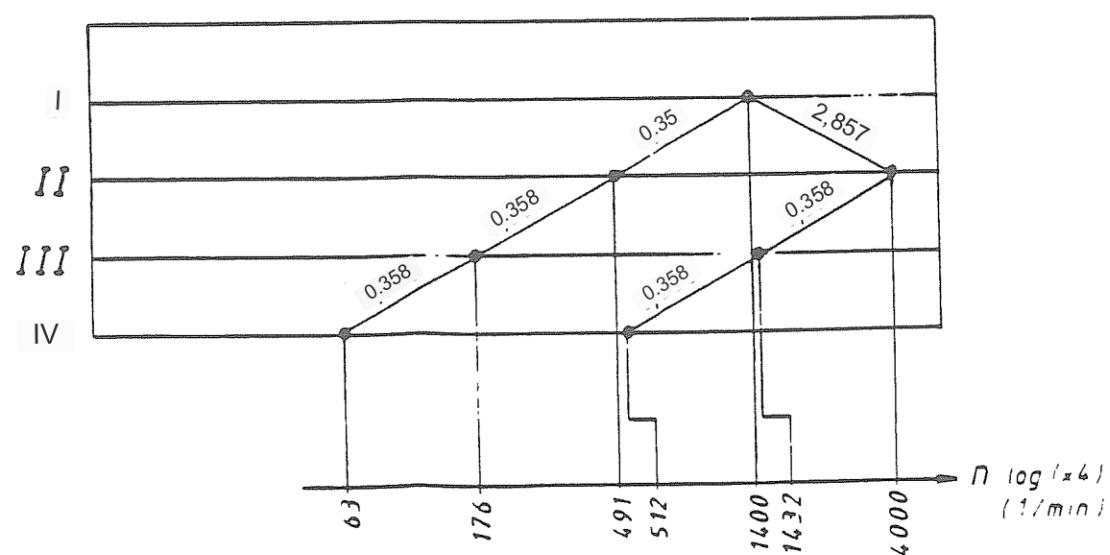
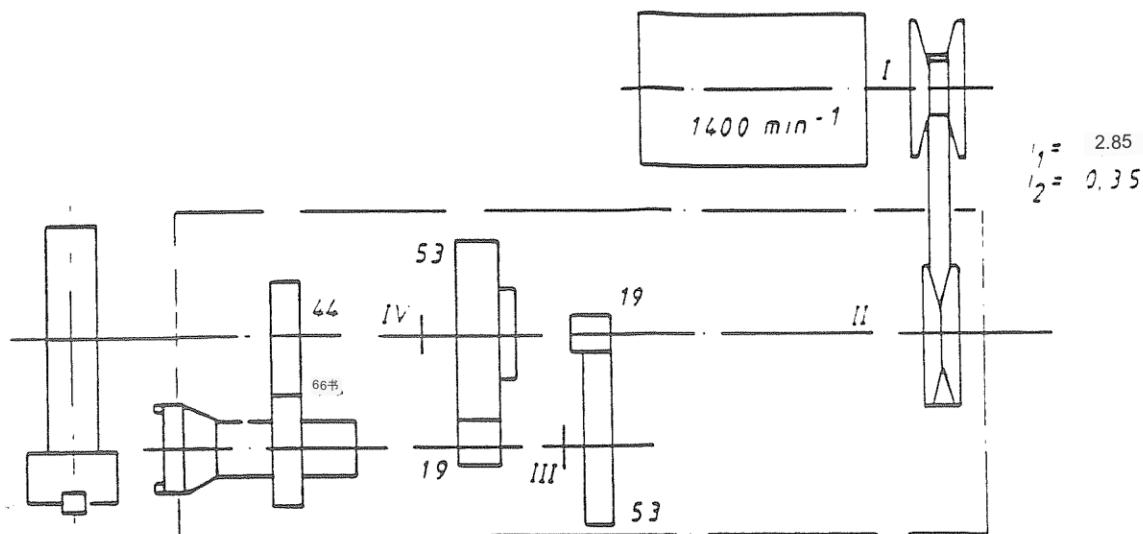
500.6

software point

500

Normalweg

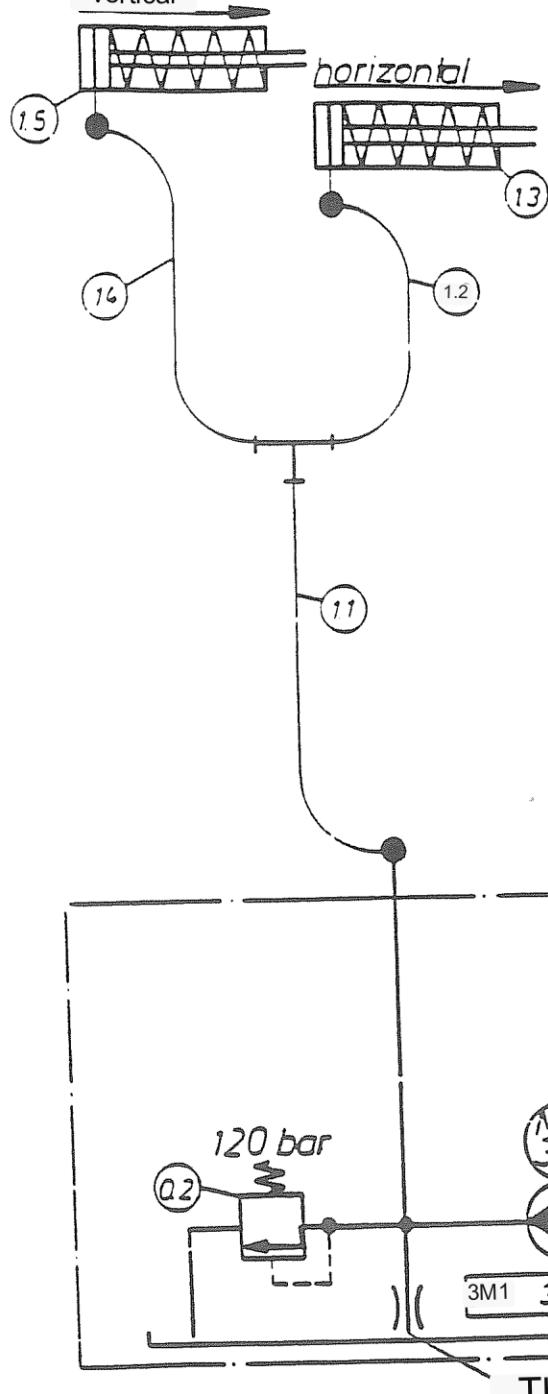
main gear 13,035 401



## HYDRAULIC PLAN 14.049 897

Tool tension - loosen

vertical



Total oil volume 2.01

Usable oil volume 1.3 l

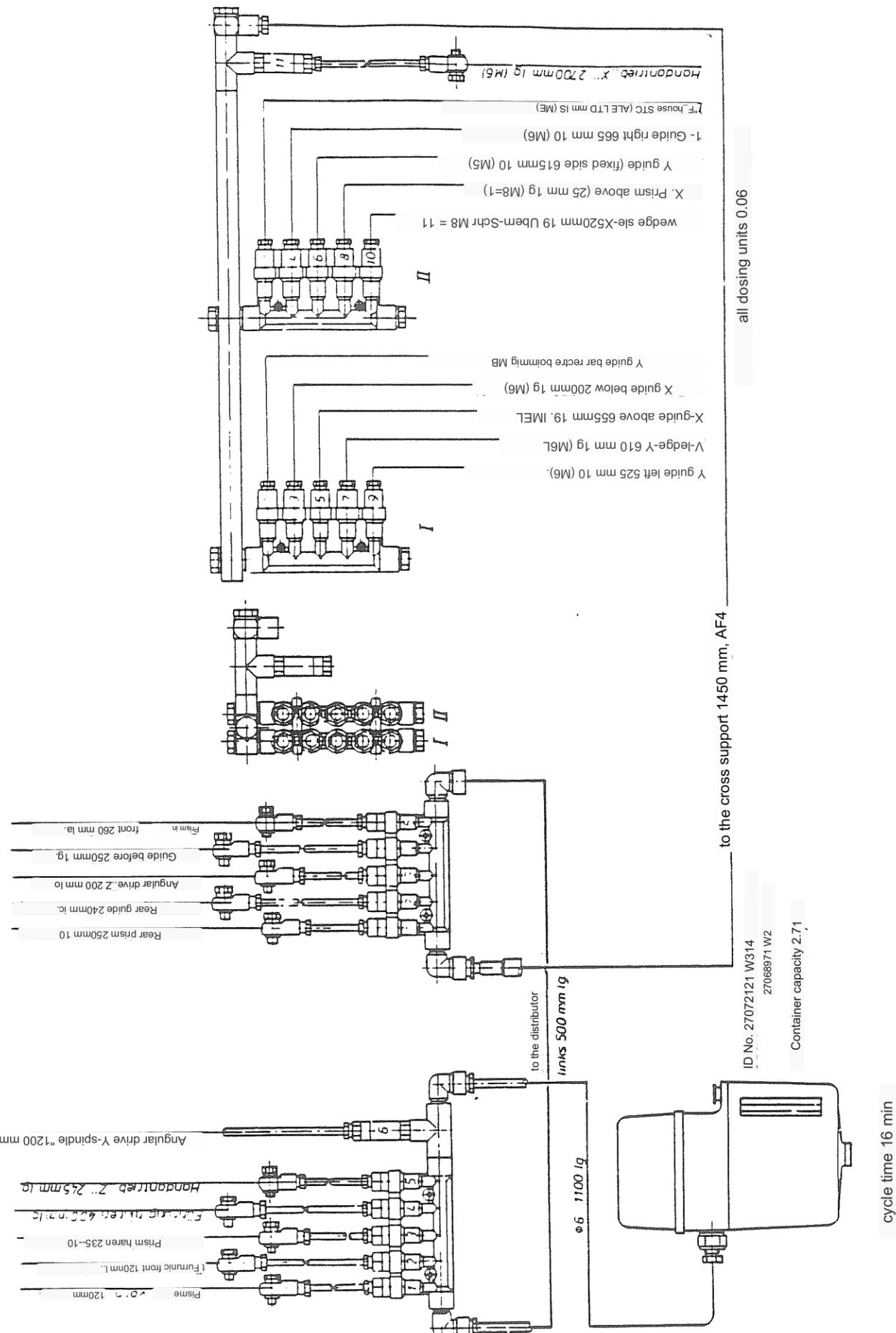
Oil CL 46 DIN 51502

$$Q = 1,8 \text{ l/min}$$

F: 0.37KW

$$n = 2810 \text{ min}^{-1}$$

## CENTRAL LUBRICATION SYSTEM - PLAN 12.138 607



## INSTRUCTIONS FOR ORDERING SPARE PARTS

### Wear and spare parts list

Wear and spare parts - assigned to the individual main assemblies - are listed on the following sheets. The abbreviations in the "Material/Remarks" column mean in detail:

MISC	wearing part	(no guarantee)	a)
ET-1	spare part	(normal wear and tear)	
ET-2	spare part	(max gear pack)	
roller bearing list	EDP printout of all rolling bearings, assigned to the individual main assemblies, see "ROLLER BEARING SCHEDULE".		

### parts catalogue

Mechanical spare parts are summarized in a separate parts catalogue, which is supplied once for each machine. This parts catalog contains:

ASSEMBLY DRAWINGS      these are reduced but otherwise unchanged assembly drawings  
gene.

Spare parts for the electrical equipment are shown in the device layout plans and provided with a function group number.      b)

- The circuit diagram device list contains the designation and the ID number of the spare part for each function group number.      b)

Fast and flawless delivery of spare parts is only possible if the order contains the following information:

- machine type
- Factory number of the machine.
- ID number or Function group number and position number of the spare part.
- Color (only for painted parts).

a) Workshop drawings of the "quick-wear parts" are provided for special cases.

b) The version that is binding for the machine is the "wiring diagram" - in the control cabinet of the machine refer to.

MAHO			Stücklistenart	
	creation date	ID number	ME	Layout/IMG
Production level position	ID number	Happen	strategisch/AMO	
	99.056005			
	27.068207	4 ST		
	23.035396	1 ST		
	22.137090	1 ST		
	22.035177	2 ST		
	81.184385	1 ST		
	82.136759	1 ST		
	27.056965	1 ST		
	27.065935	3200 NM		
	27.059899	1 ST		
	27.071707	1 ST		
	81.175300	1 ST		
	27.061614	1 ST		
	27.072549	1 ST		
	27.059596	1 ST		
	27.072154	1 ST		
	27.073089	1 ST		
	27.073090	1 ST		
	27.067926	3 ST		
	27.067803	2 ST		
	91.184364	1 ST		
	27.051610	1 ST		
	27.051583	1 ST		
	27.051903	1 ST		
	27.064203	1 ST		
	25.0006082	1 ST		
	13.001646	1 ST		
	27.955656	1 ST		
	27.064632	3 ST		
	27.059916	3 ST		
	27.067423	1 ST		
	27.059037	2 ST		
	27.066327	1 ST		
	27.059754	3 ST		

parts list

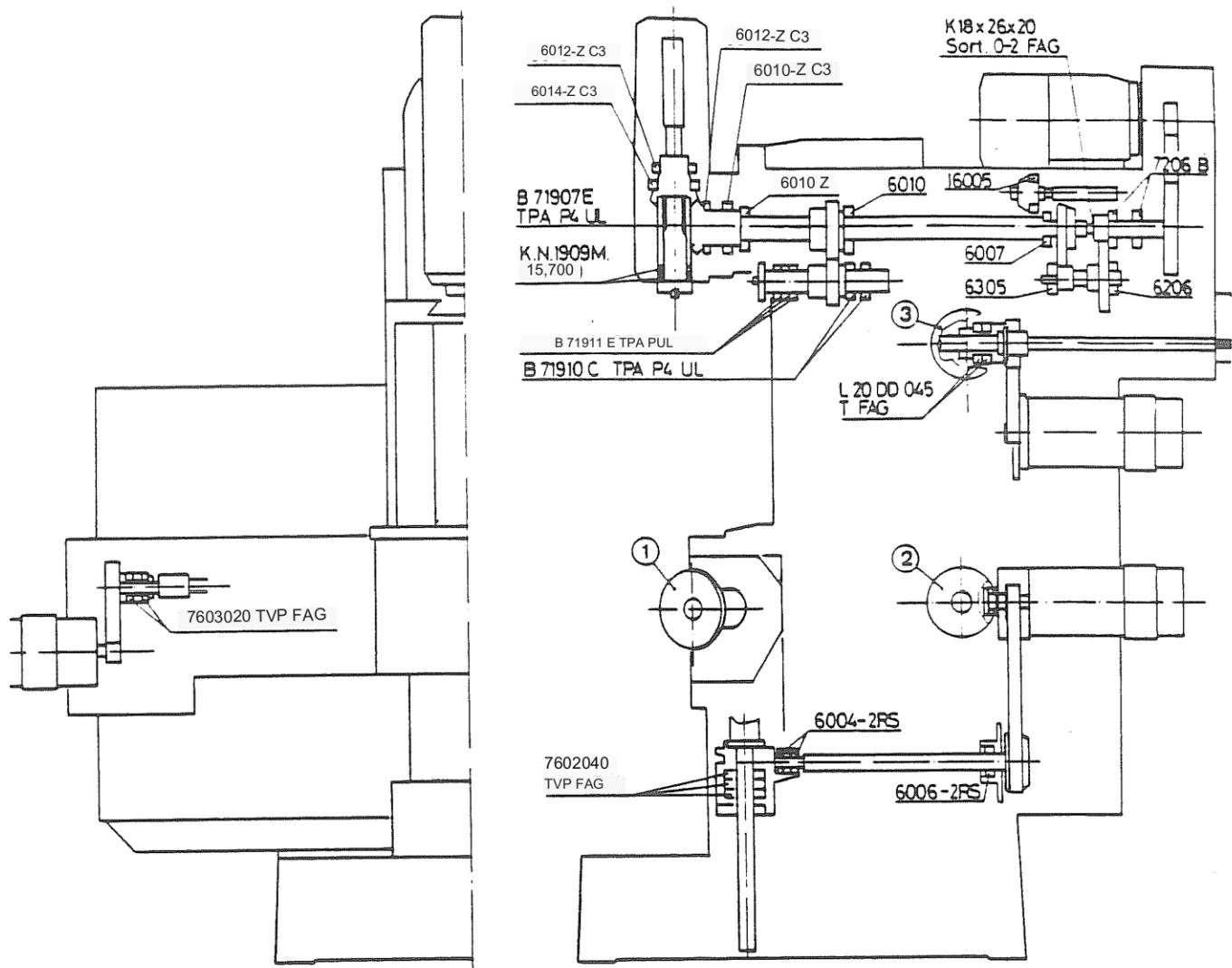
parts list	drawing no	gross requirements	Designation 1	Designation 2	order quantity	Order number
						sheet
						Materials/Remarks
CRSPÄRE PARTS						1
	Drawing N					
	gross requirements					
1	1		MACHINE COMPLETION			
			COMPRESSION SPRING D -030 A GOOD D=0.32 DH= 4.0 LO= 19.8			
1	1		STRIPPER			
1	1		STRIPPER			
1	1		BELLOWS HORIZONTAL			
1	1		HYDRAULIC LINE			
1	1		HYDRAULIC LINE			
1	1		COOLANT LINE WITH INJECTION			
3290	1		D. PLASTIC HOSE RAUFILAN			
			KREUZ SUPPORT			
			GEAR COUPLING			
	1		ZAHNRICMEN HTD			
	1		MOT.Z.-SCH.SHRUNK			
	1		POWER SUPPLY-BRONZE			
	1		POWER APPROACH YOURSELF.			
	1		HÄADSTOCK			
	1		HÄNDWHEEL 11.POSITION DISPLAY			
	1		DRE CURRENT			
	1		KOLDEN			
	1		DISC SPRING COLUMN			
	1		ANGULAR BALL BEARINGS			
	1		SCHÄEGBALL BEARINGS			
	1		HYDRAULIC LINE			
	1		PILL BALL BEARING			
	1		GROOVE BALL BEARING			
	1		PIAD LKRANZ			
	1		BELT WIDTH			
	1		COMPRESSSION			
	1		SPRING PINION SHAFT			
	1		COOLANT PUMP			
	1		COOL. PUMP 290-420V			
	1		CONTROL CABINET/ELECTRICAL			
	1		AIR CONTACTOR 110V 50/60HZ			
	1		LO CIRCUIT			
	1		SWITCHING PELAIS 24V GS 10A RL 900 512 SCHRACK			
	1		AIR CONTACTOR 110V 50/60HZ 3TB 4017 0AG1			
	1		AIR CONTACTOR 110V 50/60HZ			
	1		LIMIT SWITCH TYPE ZS 336			
	1		L C 1 - D 2 5 (0) / 4 F 7 T F L F M E C .			
			RC-SC1/220/110/220V URR			
			SIEMENS			
			112 SPEZ.1257 SCHMERSAL			

MAHO		creation date	Stücklistenart	Lageplan/MG
	ID number	ME		
Production level position	ID number	Happen		Lageplan/MG
	99.056005			
	27.069155	1 ST		
	27.071933	3 ST		
	27.057603	3 ST		
	27.063190	1 ST		
	27.059419	3 ST		
	23.060370	2 ST		
	23.059048	1 ST		
	27.071529	1 ST		
	27.062432	1 ST		
	27.066428	2 ST		
	13.047178	1 ST		
	27.073095	1 ST		
	27.073094	1 ST		
	14.057535	2 ST		
	27.073091	1 ST		
	23.056043	1 ST		
	27.072121	1 ST		
	27.073285	1 ST		
	27.072924	1 ST		
	27.074170	1 ST		
	27.070463	1 ST		
	27.051620	4 ST		
	27.070136	4 ST		
	81.017461	1 ST		
	27.071737	1 ST		
	26.061225	13 ST		
	27.063041	1 ST		

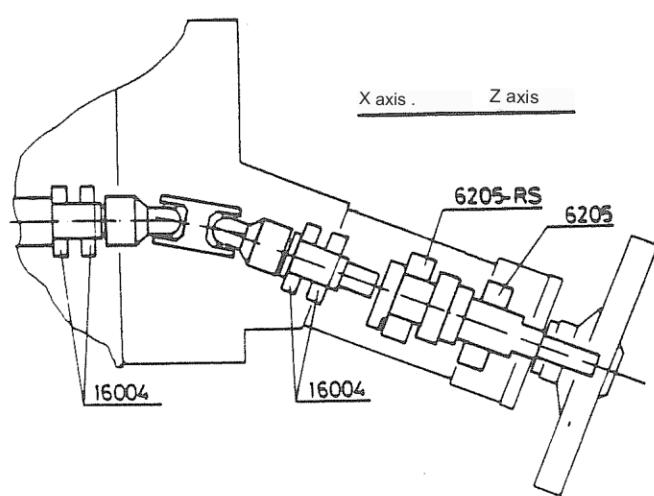
parts list

parts list		order quantity	Order number
SPARE PARTS	Designation 1	Designation 2	Painterly/Remarks
	THYRISTOR SERVER ST. 2TR142 THYRISTOR AMPLIFIER MODULE SMOOTHING REACTOR	G11-WÖ+ZES INDRAMAT TSS13/047 F.3TRM2 INDRAMAT GLD 2 INDRAMAT	
	CONVERTER TRANSFORMER RESISTANCE WITH STOP. 1 ohms	LTT 5.0-3 380V GRV 20165S DANOTHERM 250VA SEC.3X19V	2X140V
	CONTROL TRANSFORMER 220/380V CONTROL TRANSFORMER 320V	50/60HZ 750VA SEC110/220	
	RELAY BOARD EK 10/ S RESISTOR VITROHM KH	ART.NR.90002 MURR 5 WATT 1K TYPE PAT05 25A EDI	BUERKL
	RECTIFIER TABLE		
	STRIPPER MILLING HEAD TURNING		
	PISTONS DRIVE STICK DISC	95.100.290.4.2 OTT 95.100.393.4.2 OTT	
	SPRING COLUMN FAN WHEEL	25.100.144.4.2 OTT DUROGER INTEGRAL HARDSCH.	
	CENTRAL LUBRICATION GEAR PUMP AGGR. MACHINE CONSTRUCTION	049 310 110 / 220V 50/60Hz	
	TONGS SPRING BATTERY HOLDER F. 132/232	95.102.436.2.1 95.102.435.4.1 332/NR 239 609 01AUST.HDH	OTT
	HYDRAULICS HYDR KOMPAGGR.SK 7611 FEED DRIVE		
	GROOVE BALL BEARING COMPRESSION SPRING D -263 V-04 BALL SCREWS	160.06 D = 2,75 D1 = 10,0 L2 = 38,0 25X 5X 2+2 5XBX 374 Li	
	TOOTHING HTD ELL SPRING	L.TOLZ.+ 550 5M-25 310X5/2X0.4 CIN2993	
	ELFICHE STRONG ARM TIE D	1DC10.20F/111-1	IND

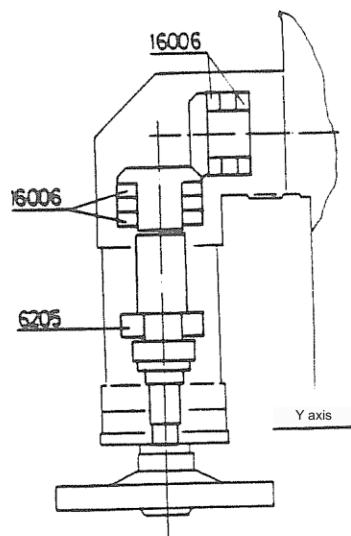
## BEARING PLAN



① + ③



②



## MAHO

	creation date	Stücklistenart		
	ID number	ME	Lapout/Mfg	drawing no.
	99.056005			

## parts list

Production level position	ID number	Happen	Lapout/Mfg	Gross requirement drawing no.	Designation 1		Maturity Date	order quantity	Order number
					Designation 1	Designation 2			
<b>DEVICE LIST WAREHOUSE</b>									
	27.065745	2 ST	2	KREUZ SUPPORT	17603020 TVP	FAG		2	
	27.051609	1 ST	1	AXIAL - SCHRAEGKUGELLAGER	6205				
	27.051617	4 ST	1	GROOVE BALL BEARING	16004				
	27.055641	1 ST	1	ISOLATED BALL BEARING	6205-R S				
				ISOLATED BALL BEARING					
				PENDULUM					
	27.067926	3 ST	3	SCHRAEGKUGELLAGER	971911 E TPA P4 UL				
	27.051618	1 ST	2	ILLUMINATED BEARING	16005				
	27.0677803	2 ST	1	INCLINED BALL BEARING	B71910 C TPA P4 UL				
	27.051590	1 ST	4	ILLUMINATED BEARING	6010				
	27.057457	1 ST	1	GROOVE BALL BEARING	6010-Z				
	27.051610	1 ST	1	PILL BALL BEARING	6206				
	27.051583	1 ST	1	ILLUSTRATED BALL BEARING	6007				
	27.054153	1 ST	1	ILLUSTRATED BALL BEARING	6305				
	27.051908	1 ST	1	WREATH	K18X26X20 SORT 0-2	FAG			
	27.061375	2 ST	2	SCHRAEGKUGELLAGER	7206 B UNIV. PAIRED				
				MILLING HEAD					
					6010-Z C3				
					6014-2C3				
					6012-ZC3				
	27.070870	1 ST	1	GROOVE BALL BEARING	6012-ZC3				
	27.070872	1 ST	1	GROOVE BALL BEARING					
	27.070371	1 ST	1	GROOVE BALL BEARING					
	27.070871	1 ST	1	GROSS BALL BEARING					
	27.067677	2 ST	2	CYLINDER ROLLER BEARING					
	27.067678	4 ST	4	SCHRAEGKUGELLAGER					
				FEED DRIVE					
	27.051620	4 ST	4	GROOVE BALL BEARING	16006				
	27.054597	1 ST	1	GROOVE BALL BEARING	6206-2RS				
	27.065322	3 ST	3	AXIAL - SCHRAEGKUGELLAGER	7602040 TVP FAG				
	27.051609	1 ST	1	GROOVE BALL BEARING	6205				
	27.055641	1 ST	1	GROOVE BALL BEARING	6205-R S				
	27.072595	2 ST	2	AXIAL - SCHRAEGKUGELLAGER	L20 DD 045 T FAG				
	27.054362	2 ST	2	GROOVE BALL BEARING	6004-2RS				
	27.051617	2 ST	2	GROOVE BALLACER	16004				
	27.061464	1 ST	1	RIESELSENFREI LAUF	HF 2015 INA				

## CAPTURE COMMISSIONING DATA

## PART 1

KZ/MASCH.-NO.	N 53566	A 53566 *
PROJECT NO.	D 9418830	*
CONTROL NO.	3813937A	
WIRING DIAGRAM NO.	200084	E *
SW-STAND B.	DELIVERED / CPU NO.	NC24294005PLC25013403
CONNECTION VOLTAGE (VOLT/HZ) :	380/50	
ID NO. TABLE		
WANTED AXIS? X		Y *
SOLLW. NC GOO (VOLTS)	9.01	#9.07 *
TOW DEP. GOO (MM)	4225	#
CIRCUIT CURRENT (VOLT)	9,11	#9.07 *
CURRENT LIMIT (VOLT)	2.5	\$2.5 *
NO LOAD CURRENT 5%		
OF GOO (A) (A)	5.4	5.5 1.1 #4.6 *
60% OF GOO (A)	6.0	5.6 #2.4 *5.6 *
100% OF GOO (A)	6.2	5.6 13.1 *5.7 *
CURRENT CONSUMPTION, LOADED WITH KP	250.00	: 250.00 *
5% OF GOO (A)	5.9	5.8 10.7 #5.6 *
60% OF GOO (A)	6.4	6.1 #1.3 *6.6 *
100% OF GOO (A)	6.3	6.1 #1.7 *6.7 *
FAKTOR B. AC-ANTR. (MV/AMP)	0,00	*

## CAPTURE COMMISSIONING DATA

## PART 1

KZ/MASCH.-NO.	S 53566	# *
PROJECT NO.	D 9418830	*
STEERVERUNG NO.	3813937A	
WIRING DIAGRAM NO.	200084	E *
SW VERSION B. DISCONTINUED. / CPU NO.	NC24294005PLC25013403	*
CONNECTION VOLTAGE (VOLT/HZ)	380/50	#
IDENT NO. TABLE		#
WANTED AXIS? Z		#
REFERENCE GOO (VOLT)	: 9.05	*
NC TOW DEP. GOO (MM)	4275	#
CIRCUIT CURRENT (VOLT)	#9.04	#
CURRENT LIMIT (VOLT)	: 2.5	*
CURRENT DRAWING, NO LOAD		
5% OF GOO (A)	3.9	4,0 # *
60% OF GOO (A)	5.0	5,0 *
100% OF GOO (A)	5.2	5,2 *
CURRENT CONSUMPTION, LOADED WITH KP	250.00	#
5% OF GOO (A)	0.0	0,0 *
60% OF GOO (A)	0.0	0,0 *
100% OF GOO (A)	0.0	0,0 *
FACTOR B. AC DRIVE. (MV/AMP)	0,00	#

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TABLE OF CONTENTS Series 561

Sheet

## TROUBLESHOOTING

Response to malfunctions .....	10.01-1
Manual resetting of the machine slides after the EMERGENCY STOP cam has been approached .....	10.03-1
Failure of the central lubrication .....	10.06-1

## RESPONSE TO MALFUNCTIONS

In the event of faults whose cause cannot be clarified or which indicate a defect, the nearest MAHO machine service should be notified immediately.

The following customer service stations are responsible for Germany:

Customer Service Pfronten:	mechanics	08363-89302
	371	
	electronics	08363-89301
	341	
	Installation	08363-89281
	Teletex-Telex	836382
	Fax	08363-89444
Customer Service Emstal/Kassel:	mechanics and	
	electronics	05624-50150
	Telex	094613
	fax	05624-50199
Customer service VZ-Hilden:	headquarters	02103-57010
	mechanics and	
	electronics	02103-570123
	fax	02103-570140
Customer service VZ Kornwestheim:	Central	07154-13290
	mechanics and	
	electronics	07154-132921
	Telex	715413
	fax	07154-132945

External faults, e.g. caused by a power failure, can usually be remedied by the customer himself.

In the event of a power failure, the machine must be switched off immediately at the main switch.

After the voltage has returned, the machine is switched on as described on sheet 3.01-1 and set to the starting position in the appropriate operating mode.

If (e.g. during setup) the headstock collides with the table or the workpiece, the feed STOP or EMERGENCY STOP button must be pressed.

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## MANUAL RESETTING OF THE MACHINE SLIDES AFTER DRIVING THE EMERGENCY STOP CAM

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When overrunning the EMERGENCY STOP cam

If the normal traversing range of the X, Y and Z axes is exceeded as a result of a contouring error, the machine is shut down by the "EMERGENCY STOP" limit button. The following appears on the screen:  
MAJOR POSITIONING ERROR.

In order to start again afterwards, a switch to bypass the EMERGENCY STOP circuit must be actuated.

The slides of the relevant axes must be reset manually as described below and errors on the screen must be deleted.

A NOTICE: Two people are required for this.

- Press push button -752- in switch cabinet.
- Ensure that mushroom button -S1- on control panel is not pressed.
- Press illuminated pushbutton -3SH1- "Machine ON".
- Press the "MOD" button.
- Select the MOD function "key number".
- Enter code number 84159 and press "ENTER".
- Move the axes in such a way that the reference points can be reached without collision.
- Release pushbutton -7S2- again.
- Approach reference points. continue program run.

## CENTRAL LUBRICATION FAILURE

### Restarting the machine after a lubrication failure

#### A NOTICE:

Positions in brackets see figure on sheet 3.20-1 "AUTOMATIC CENTRAL LUBRICATION".

- Check the oil level in the transparent container (5) and top up if necessary through the filler opening (3). see sheet 7.06-1 "LUBRICATION RECOMMENDATIONS".
- Press the illuminated pushbutton -3SH1- on the command station. Indicator light -3H1- lights up. a)
- Check the main lines between the central lubrication unit (1) and the oil distributor for leaks, eliminate any leaks.

#### After eliminating the cause of the fault

- Unlock EMERGENCY STOP button -S1- by turning.
- Press the illuminated pushbutton -3SH1- on the command station. Indicator light -3H1- lights up. a)
  - a) Arrangement and function of the operating elements on the command station see Sheet 2.04-1.

# MAHO

AKTIENGESELLSCHAFT

REPAIR CARD

MH-	Machine no.	Order no.																								
customer	Control unit manuf.	Project no.																								
designation i.e. defective part		ID No.																								
Error Description:																										
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	sporadically				consequential error																					
	repeated																									
Exhibitor	office	Date																								
ID no. 78.004.697																										

# MAHO

AKTIENGESELLSCHAFT

REPAIR CARD

MH-	Machine no.	Order no.																								
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